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EDUCATIO ARTIS GYMNASTICAE

1/2017

STUDIA
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EDUCATIO ARTIS GYMNASTICAE

1/2017

March 2017

DOI:10.24193/subbeag.62(1)

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YEAR
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ISSUE

Volume 62 (LXII) 2017
MARCH
1

STUDIA

UNIVERSITATIS BABEȘ-BOLYAI EDUCATIO ARTIS GYMNASTICAE

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STUDIA UBB EDITORIAL OFFICE: B.P. Hasdeu no. 51, 400371 Cluj-Napoca, Romania,
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GENDER DIFFERENCES IN PHYSICAL ACTIVITY AMONG THE UNIVERSITY STUDENTS IN THE VISEGRAD (V4) COUNTRIES

PONGRÁC ÁCS^{1*}, JÓZEF BERGIER², FERDINAND SALONNA³,
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ZSANETT WELKER¹, ALEXANDRA MAKAI¹

ABSTRACT. Introduction. Sedentary way of life has become a global phenomenon in the past decades. Therefore, the number of people with excess weight has doubled in the past 30 years. Besides this fact, it has been justified that more than half of the population is overweight. Even young adults are affected by the problem. It is an important issue because 60% of the overweight young people keep their excess body weight in later adulthood increasing the risk of different diseases.

Material and method. Our study aims at assessing the differences between the health status and the physical activity among young people (secondary school and university students) in the Visegrad (V4) countries. Our current research examines the differences in the physical activity among university students regarding their sexes (n=2237). SPSS 22.00 software was used for statistical analysis.

Results. According to the results, we found significant differences ($p<0.001$) both in the extent of physical activity values, except for moderate activities between sexes. Significant differences were observed between the countries concerning the examined parameters ($p<0.001$). Among Polish university students, we found significant differences in sexes in the total, vigorous, moderate and walking MET/week values ($p<0.05$). Almost identical results were found in the Czech Republic and the other V4 countries compared to Poland. There were no significant gender differences in the rate of walking activities regarding the Czech respondents ($p=0.426$). The results of the Hungarian respondents approximated

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those of the Slovak ones; no differences were found in the physical activity category of the vigorous and moderate activity values ($p>0.05$). In Slovakia, we found significant differences between sexes in total MET/week and walking activities (MET/week) ($p<0.001$), thus, female students were found to be more active than males caused by the higher rates of walking activities of women.

Conclusion. The V4 countries are not in an advantageous situation concerning physical activity in the European framework because only 21-35% of the population does sports once a week. According to our results, university students show a more positive picture on physical activity than the adult population. However, there are some specific risk groups. 43.8% of female and 57.3% male students can be considered as persons with high physical activity. Our findings may play a major role in the development of intervention programs targeting young people and in the concern of the differences between sexes. Furthermore, these results may call young people's attention to health maintenance to preserve their fitness for getting better activity figures.

Keywords: *physical activity, V4, gender differences, university students*

Introduction

Changes in economic and social patterns of life have altered people's way of life significantly. A sedentary lifestyle has become a global phenomenon in the past decades and is associated with the development of various diseases, such as obesity, Type II diabetes, and cardiovascular disorders. Therefore, active physical life has a great significance nowadays (Biernat & Tomaszewski, 2015; Apor, 2012). According to statistics, the number of people with excess weight has doubled in the past 30 years. Besides this fact, it has been justified that more than half of the population is overweight. Even young adults are affected by the problem. It is an important issue because 60% of the overweight young people keep their excess body weight in later adulthood increasing the risk of different diseases (Herzig et al., 2012). Physical activity is an important factor in the prevention of diseases and health maintenance in which sports have a key role (Ács et al., 2011; Cselik et al., 2015; Jaromi et al., 2012; Babocsay et al., 2014). Doing mainstream sports should start in childhood as it determines health maintenance to a great extent. Moreover, athletes may feel to belong to a community (Bergier et al., 2014).

Unfortunately, most of the young people choose a sedentary lifestyle during their university studies. They spend a lot of time in front of the computer or television. For transportation, they take the public vehicle or cars opposite to

walking (Pavlik, 2015). Therefore, today's lifestyle does not require physical activity but everyone's conscious decision should be to do sports to preserve a good health status.

Inactivity has an adverse effect on people's health status, and also on their nervous, cardiovascular, musculoskeletal system (Apor, 2012).

Furthermore, nutrition and weight management also have an important role in health. With a healthy lifestyle three-quarter of cardiovascular illnesses could be preventable (Bergier et al., 2014).

Obesity is a serious problem worldwide, and a reason for several chronic diseases. According to the European Health and Life Expectancy study, more than half of the adult population is obese or overweight and this rate is also increasing among the young people in Europe (Martos et al., 2012; Központi Statisztikai Hivatal, 2010).

Besides the health risk of obesity, inactivity reduces the working capacity of the population. People are getting far away from physical activities, physical work or sports activities. In their leisure time, they choose sedentary activities different from active recreation (Pavlik, 2015).

Sports activities have some rules fixed in guidelines where the age groups can find the recommended weekly level of physical activities. For young people, 6-7 hours vigorous activities are recommended weekly (Pavlik, 2015). Furthermore, a research from Harvard University proved that 2000 kcal of physical activity/ week reduces the risk of heart attack by 64% (Shaper & Wannamethee, 1991). However, the personal guideline is essential, due to different personal health status, or age. The aim of sports activity is an important factor in physical and recreational activities (Pavlik, 2015). For people aged between 18-64 years, the WHO recommends 150 minutes of moderate physical activity/week equally distributed during individual days. It can be 75 minutes of intensive physical activity/ week or an equivalent volume of intensive and moderate physical activity/week including recreational activity, or exercise related to transport, relocation, occupational activity, household activities, and sports (Pavlik, 2015).

Bergier et al. showed that low physical activity was observed among 20.84% of students. According to the IPAQ, analysis of the physical activity level indicated that it was lower among females compared to males. The Median for weekly physical activity was 1,554.00 MET*min/week among women, and 2,611.00 MET*min/week among men ($p < 0.000$) (Bergier et al., 2012).

In 2012, a national study called "ENERGY" was carried out with the participation of Sweden and seven other European countries. They examined the activity and leisure time habits of students aged between 10-12 years. The aim of the research was to compare the students' anthropometric data, nutrition habits, and physical activities with the participation of 546 students in Sweden

and the other countries. According to the results in Switzerland, there are fewer obese or overweight students than in other countries. Walking and cycling activities are higher represented in Switzerland. However, no significant differences were found in the consumption of sugary soft drinks among the eight European countries. Thus, these are age-related habits that we can change together but there are several other reasons for inactivity due to environmental differences. Obesity and inactivity of students can be considered as a combined problem which needs complex prevention to improve the proportion of healthy and active students in the European population (Michael et al., 2012).

Our research was conducted in the four Visegrad countries (V4): Poland, Hungary, Czech Republic, and Slovakia in 2015. The aim of the study was to examine the university students' physical activity, nutrition habits, and sports preferences to find the differences and similarities among the four countries and to find a better prevention strategy to improve the in-group's health status.

Material and Method

Physical activity

“Physical activity is defined as any bodily movement, produced by skeletal muscles, that requires energy. It is associated with health and life quality. It involves sports and other activities undertaken while working, carrying out household chores or engaging in recreational pursuits.” American and European guidelines follow different ways (<http://www.eufic.org/article/hu/>). Americans suggest moderate intensity exercise with 150 min/week, while Europeans recommend 30 min. moderate exercise for 5 days a week at least. The importance of physical activity becomes a priority for the decision makers. It is affected by the inconvenient fact that only 41% of the European population does sports once a week at least (<http://ec.europa.eu/citizenship/>). Furthermore, Ács et al. (2011) justified that inactivity burdens the economy of a country (Ács et al., 2011).

Quantitative, cross-sectional survey research.

Objective: To assess the health status, physical activity, nutrition habits of young people (university students) in the V4 countries. The survey assesses the activities of young people, the basis of their nutrition, and their relation to sports. The study aims to learn if they do any sports or what sports they prefer.

Participants: Young population in the V4 countries (age: 19.5 (SD:2.95). Participant countries were the Czech Republic (Palacky University, Olomouc) Poland (*Pope John Paul II State School of Higher Education in Biala Podlaska*),

Slovakia (The *University of Presov in Presov, Faculty of Sport*) and Hungary (The *University of Pécs, Faculty of Health Sciences, Pécs*). The number of participants in each country accounted for 1200 persons from the secondary school and university population at the beginning of the research. The sample consisted of 600 secondary school and 600 university students on average in each country. The gender distribution was equal and the distribution per year was proportional. For statistical analysis, the research comprised of 2237 university students as a total. The university sample comprised of 1st-year and 3rd-year students at the Faculty of Humanities, the Faculty of Engineering, and the Faculty of Health Sciences.

Survey: Interviewing was carried out from April to June, 2015 at the same time in each country. IPAQ extended questionnaire and a self-administered questionnaire were used to assess nutritional and activity habits (www.ipaq.ki.se). In order to evaluate data, INDARES software and a paper-based questionnaire were used. Ethical principles of the Helsinki Declaration were taken into consideration. Participation was voluntary and anonymous for young people. Interviewing was carried out online and in a paper-based form with the help of research assistants.

Measuring physical activity

Checking physical activity is possible only with reliable and valid methods. These methods include questionnaires, indirect calorimetric, direct observation, pulse telemetry, and sensors measuring different motions. Despite the limitations of these methods, there is no perfect standardized measurement for physical activity. Several measuring instruments are available, but access to these gadgets has financial limits. Therefore, it has become a crucial issue to elaborate a method to measure the extent and quality of physical activity entirely and be purchased quickly. Hence, the International Physical Activity Questionnaire was construed (IPAQ) in 1998. IPAQ gives an opportunity to assess the individual's physical activity, but at the same time, it seems to be a subjective tool to determine the extent of physical activity. Therefore, the most accurate data can be gained by the objective and subjective measurements of physical activity in a combined way. Evaluation of IPAQ separates three activity groups, namely low, medium, and high categories. The physical activity categories are as follows: low with 600/MET/week activity level; medium with 600-1500/MET/week; and high with above 1500/MET/week. IPAQ differentiates sedentary, moderate, and vigorous activities to which different MET values are associated, such as sports or household chores. The individual's physical activity per week equals with the MET value multiplied with the duration of the activity (MET/week) (Lachat et al., 2008; Lee et al., 2011).

Dependent and independent variables

Independent variables: sex, age, domicile, body height, body mass (self-reported), education

Dependent variables: According to IPAQ extended data measuring physical activity, three physical activity categories were differentiated in agreement with international standards: low, moderate, and high physical activities.

Statistical analysis: Data analysis was carried out by SPSS 22.00 statistical software. Besides descriptive statistics, chi-square test, Mann-Whitney U test, and Kruskal-Wallis tests were used for analysis of the differences between countries. Data distribution was tested by Kolgomorov-Smirnov test. As data distribution was not considered as normal, we applied non-parametric tests. The significance level was determined by $p < 0.05$.

Results

Descriptive statistics

Table 1. Descriptive statistics

	Hungary		Poland		Slovakia		Chech Republic		Total	
Sample size (n)	495		727		512		503		2237	
Gender	<i>Male</i>	<i>Female</i>	<i>Male</i>	<i>Female</i>	<i>Male</i>	<i>Female</i>	<i>Male</i>	<i>Female</i>	<i>Male</i>	<i>Female</i>
	231 (46.67%)	264 (53.33%)	356 (48.97%)	371 (51.03%)	262 (48.97%)	250 (48.83%)	219 (43.54%)	284 (56.46%)	1068 (47.74%)	1169 (52.26%)
Mean (SD)										
Age	23.04 (2.05)	22.75 (1.86)	21.39 (1.64)	21.15 (1.45)	21.87 (1.46)	21.19 (1.29)	21.92 (1.89)	21.35 (1.82)	21.97 (1.85)	21.57 (1.74)
BMI	23.15 (3.69)	21.74 (3.45)	24.19 (3.33)	21.60 (3.13)	24.37 (3.13)	21.31 (3.16)	24.64 (3.43)	21.51 (2.86)	24.13 (3.40)	21.55 (3.14)
Body weight (kg)	73.77 (14.44)	60.18 (10.60)	79.16 (13.03)	60.13 (9.95)	79.56 (12.13)	58.96 (9.70)	81.32 (13.73)	60.20 (9.41)	78.53 (13.52)	59.91 (9.92)
Body height (cm)	177.17 (9.38)	167.28 (6.09)	180.72 (7.24)	166.71 (6.21)	180.49 (7.70)	166.23 (6.01)	181.46 (7.40)	167.13 (6.29)	180.15 (7.96)	166.83 (6.16)

The research was realized by the cooperation of four Visegrad countries (Poland, Slovakia, the Czech Republic and Hungary). The physical activity and the nutritional habits of 2237 university students were assessed with the help of an international research group.

Table 2. Gender differences in physical activity level among the V4 countries

	Slovakia				Poland				Czech Republic				Hungary				Total			
	Male		Female		Male		Female		Male		Female		Male		Female		Male		Female	
PA	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Low	21	9.59	11	4.4	25	7.02	26	7.01	21	9.59	31	10.92	34	14.72	33	12.5	101	9.46	101	8.64
Medium	87	33.79	91	36.4	111	31.18	199	53.64	74	33.79	150	52.82	83	33.93	116	43.94	355	33.24	556	47.56
High	154	56.62	148	59.2	220	61.8	146	39.35	124	56.62	103	36.27	114	49.35	115	43.56	612	57.3	512	43.8
Gender differences:	p=0.217 (0.077)				p<0.001 (0.234)				p<0.001 (0.207)				p=0.193 (3.306)				p<0.001 (0.148)			
Total MET/week	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
	5382.11	5366.7	7075.89	5815.33	7477.54	6479.81	5049.28	4848.03	7165.74	5951.12	5144.46	4700.67	3429.27	3038.71	3653.49	3543.79	6023.95	5727.01	5190.6	4913.07
Gender differences:	p<0.001 (Z=-4.140)				p<0.001				p<0.001 (Z=-3.972)				p=0.967 (Z=-0.041)				p=0.006 (Z=-2.750)			
Total vigorous activity MET/week	1694.5	2215.81	1914.4	2367.36	2390.45	2841.63	1024.04	1899.91	2327.85	2507.92	1139.3	1954.05	1215.24	1725.23	1028.33	1576.36	1952.7	2457.87	1243.42	1985.06
Gender differences:	p=0.334 (Z=-0.965)				p<0.001				p<0.001 (Z=-6.475)				p=0.404 (Z=-0.834)				p<0.001 (Z=-7.942)			
Total moderate activity MET/week	2327.11	2635.29	2393.85	2569.7	2938.43	3157.11	2273.17	2678.78	2806.43	2896.53	2208.47	2457.76	1434.09	1497.19	1713.91	2015.84	2436.02	1746.81	2156.96	2474.37
Gender differences:	p=0.388 (Z=-0.864)				p=0.010 (Z=-7.937)				p=0.029 (Z=-2.177)				p=0.533 (Z=-0.624)				p=0.085 (Z=-1.725)			
Total walking MET/week	1360.49	1665.48	2767.64	2527.23	2148.66	2288.48	1752.07	1978.33	2031.46	2134.03	1796.7	1867.88	779.94	1149.32	911.25	1148.69	1635.23	1982.82	1790.21	2030.01
Gender differences:	p<0.001 (Z=-7.871)				p=0.035 (Z=-2.108)				p=0.426 (Z=-0.796)				p=0.189 (Z=-1.314)				p=0.009 (Z=-2.623)			

The present study examines the responses of the 1st-year and the 3rd-year university students from four countries (495 Hungarian, 727 Polish, 512 Slovakian, and 503 Czech students) studying arts, engineering, health sciences, and medicine. The sex ratio follows a 50%-50% distribution. Their mean age was 21.76 (SD:1.80). Mean height: 173.15 cm's (SD: 9.71). Mean body weight: 68.81 kg's (SD: 15.01). BMI: 22.77 (SD: 3.51). Their BMI is in the center line of the average category, 22.92% of students was overweight or obese based on the self-reported measurements (Table 1).

Gender differences in physical activity among the Visegrad countries (V4)

9.46% of male students and 8.64% of female students have low physical activity that equals with fewer than 600 MET physical activities at school, at home, or in free time activities. Differences were observed between the countries

in the MET/week values for total activities and the MET/week values for vigorous, moderate and walking activities.

The aim of our study was to assess the physical activity among university students in the V4 countries within the framework of gender differences. In our analysis, physical activity was compared to IPAQ questionnaire in three categories (low, moderate, vigorous) and to the MET/week values of the total activities concerning sex differences in four countries.

It was confirmed by the total MET/week (TMET) and the vigorous activity MET/week (VMET) values were higher in males (TMET: 6023.95 (SD: 5727.01), VMET: 1952.7 (SD: 2457.87)), than in females (TMET: 5190.6 (SD: 4913.07), 1243.42 (SD: 1985.06)). As a conclusion, there was a significant difference ($p < 0.05$) concerning the four parameters in the V4 countries. In the four V4 countries, there were no significant differences in moderate (MET/week) activities, and we found inverse result in walking activities according to the gender differences, as in walking activities (WMET). Female students (WMET: 1790.21 (SD: 2030.01)) had significantly higher MET/week values than males (WMET: 1635.23 (SD: 1982.82)).

A significant difference ($p < 0.001$) was found between the physical activity categories in the light of sexes. We found a lower rate of low physical activity category (8.64%) in female students than in males (9.46%). However, male students were presented mostly in the high physical activity group. 57.3% of the male students took part in the high category opposite to females. Only 43.8% of the latter group was found in the high physical activity category.

Besides the gender differences of physical activity values in the V4 countries, we examined the differences among the four countries.

Similar results to those of the V4 countries resulted from Poland. 7% of both males (7.02%) and females (7.01%) belonged to the low physical activity category, thus, they did fewer than 600 MET/week physical activity. At the same time, the difference was significant between sexes in the high physical category. In this category, 61.8% of males and 39.35% of females did 1500 Met/week physical activity at least. This physical activity could be carried out at school, at home, or during leisure time. Similarly, there were significant differences in the sexes in total. The vigorous, moderate and walking MET/week values showed significant differences ($p < 0.05$).

Almost identical results were found in the Czech Republic and other V4 countries compared to Poland. There was a significant difference in both sexes concerning the physical activity ($p < 0.001$). We highlight the three activity categories in which 56.62% of males and 36.27% of females were the only respondents in the high physical activity category. In the Czech respondents, there were no significant gender differences between the rate of walking activities ($p = 0.426$).

The results of the Hungarian respondents approximated those of the Slovak ones; no differences were found in the physical activity category, or in the vigorous and moderate activity values ($p>0.05$).

In Slovakia, we found significant differences between sexes in total MET/week and walking activities (MET/week) ($p<0.001$). We found that female students were more active than males caused by higher rates of walking activities of females.

The results of the Hungarian respondents were much lower in the total MET/week and vigorous MET/week values. It is worth mentioning, that the ratio of the respondents in the high activity category accounted for 49.35% of males and 43.56% of females. However, it was moderate but similar to the ratio of other countries. (Table 2). At the same time, the ratio of the respondents in the low category varied between 14.72 % and 12.5% (Figure 1).

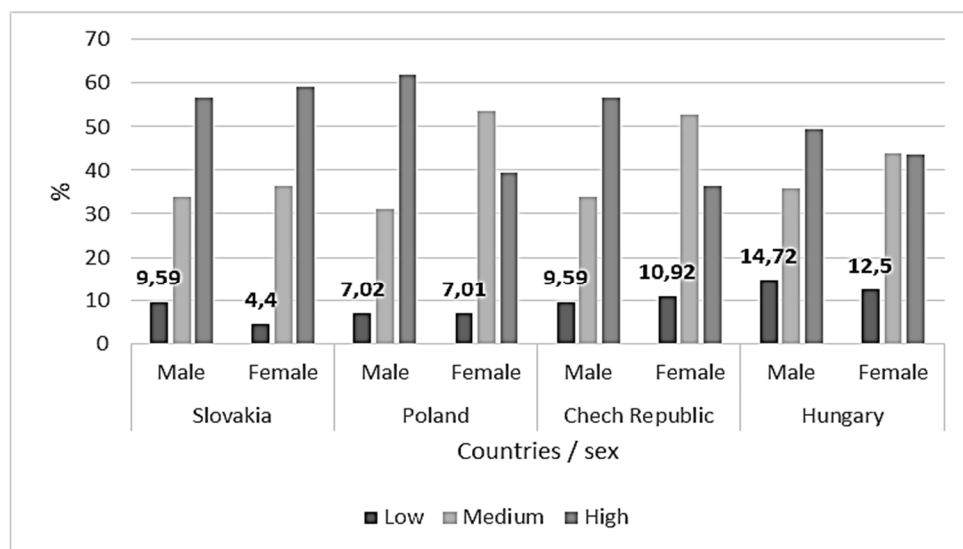


Fig. 1. Gender differences in the rates of low physical activity in the V4 countries

We also examined the differences between countries, and found significant differences among them ($p<0.001$). It was caused by the worse MET/week values of physical activity of Slovakia and especially Hungary. However, a higher proportion of low physical activity group was found for Hungary (Figure 2) where 12.5% of female students, and 14.72% of male students belonged to this category opposite to the other countries where this ratio was under 10% (except for Czech females).

Discussion

Considering health status, the subjective evaluation is different between males and females. Females regard themselves as being less fit than males do (Tesch-Römer et al., 2008; Hosseinpoor et al., 2012; Vöörmann & Helemaee, 2013). Ansari (2014) et al. examined the five forms of physical activity related to sex distribution in a cross-sectional study. The five forms are as follows: moderate, increased, vigorous, intense, and workout physical activities. The representative sample comprised of 1300 university students. Issues in the self-administered questionnaire compiled by the American Heart Association concerned the duration and frequency of the physical activity per week. Regarding sex distribution, the activity level of female students was lower than that of their male counterparts (Ansari et al., 2014). Bergier et al. (2012) justified the activity in young people using IPAQ in their research. According to their results, 25.27% of the respondents had low physical activity. Regarding sex differences, there was a high ratio for those with vigorous physical activity (males:48.77% and females: 31.35%). Our results support these above findings that 12% of the university students have low physical activity that may increase the risk of getting into the inactive category. It may involve several health risks and the increase of the chance of diseases (Bergier et al., 2012).

At the same time, 43.8% of the female students, and 57.3% of males belong to the high physical activity category, that fact may serve as a guideline for the students to be an exemplar for other people. With the help of intervention, the physical activity of young people can be improved and incorporated into their everyday lives.

Teresa M Bianchini de Quadros et al. had similar results (2009) in their survey research in which they reported the socio-demographic factors of physical activity among university students in Brazil with the help of a logistic regression model. According to their results, females and part-time students had higher inactivity ($p < 0,05$) (Bianchini de Quadros et al., 2009).

The above findings were confirmed by Galan et al. in which the sample with the total of 21188 persons justified boys' appropriate health status associated with higher life quality and satisfaction (Galán, 2013).

According to our results, differences in physical activity related to sexes were found among university students in the V4 countries except for moderate physical activities. Female university students have fewer appropriate physical activity indicators than male university students. However, female students had favorable results in walking activities than males. Regarding the country differences, Slovakia and Hungary need more effective changes in the improvement of physical activity among the university students. Furthermore, it should be noted

that there is no compulsory physical education at universities and colleges in Hungary. Students from the faculties examined take part in the physical education classes in an optional form. Therefore, willingness for participation is rather low despite that exercising should improve their health status. However, research proved that regularity in sports activities is crucial. It should be ideal for young people to do sports every day (Pavlik, 2015).

The research strengths are as follows: high sample size, international database supported by the partnership of the V4 countries. At the same time, it is worth mentioning that self-evaluation of physical activity results means subjective data for the researchers. An objective measurement technique would mean a useful option to confirm data and define new directions in research.

Conclusions

Within a European framework, the V4 countries are not in an advantageous situation regarding physical activity. At the same time, our findings have justified that university students in these countries have more positive data on overweight and inactivity within the socio-demographic parameters than the adult population. Several differences regarding inactivity were found in our study. These results may play a crucial role in the development of intervention programs for different target groups. They may call young people's attention to further physical activities to maintain and sustain their health and fitness in all their life.

Acknowledgments

We would like to express our appreciation to the Visegrad-Fund for providing a chance to carry on the study, the leaderships of the partner universities, and the colleagues participating in the research.

A special acknowledgement goes to József Bergier, the leader of the project.

REFERENCES

- Ács, P., Hécz, R., Paár, D., & Stocker, M. (2011). The ratio/value of fitness- the economic burden of physical inactivity nation Hungary. *HungarianEconomicReview* 58. 7-8. 689-708. (Ács P, Hécz R, Paár, D., & Stocker M. A fittség (m) értéke – A fizikai inaktivitás nemzetgazdasági terhei Magyarországon. *Közgazdasági Szemle*, 58. évfolyam/ 7-8. szám, pp. 689-708., 2011)

- Apor, P. (2012). Body workout again stillness's. *Hungarian Sciences* 173.12. 1470-1477. (Apor P. Testedzéssel a megbetegedések ellen In: Magyar Tudomány. 2012. 173. évf. 12. sz., p. 1470-1477.)
- Babocsay, B., Kovács, B., & Járomi, M. (2014). Egészségügyi dolgozó gerinciskola programja, *Egészség-Akadémia* 5: (3):153-164.
- Bergier, B., Bergier, J., & Paprzycki, P. (2014). Level and determinants of physical activity among school adolescents in Poland. *Ann Agric Environ Med.* 21(1):75-78.
- Bergier, J., Kapka-Skrzypczak, L., Biliński, P., Paprzycki, P., & Wojtyła, A. (2012). Physical activity of Polish adolescents and young adults according to IPAQ: a population based study. *Ann Agric Environ Med.* 19(1):109-115.
- Bianchini de Quadros, T. M., Petroski, E. L., Santos-Silva, D. A., & Pinheiro-Gordia, A. (2009). The prevalence of physical inactivity amongst Brazilian university students: it's association with sociodemographic variables. *Revista De Salud Pública.* 11(5), Octubre: 724.
- Biernat, E., & Tomaszewski, P. (2015). Association of socio-economic and demographic factors with physical activity of males and females aged 20-69 years. *Annals of Agricultural and Environmental Medicine.* 22 (1): 118-123.
- Cselik, B., Szmodis, M., Szóts, G., & Ács, P. (2015). Hungarian Dimensions of Physical Activity Based on Studies at School Ages. *Practice and Theory in Systems of Education.* 10 (2).
- E. Ansari, W., Khalil, K., Crone, D., & Stock, C. (2014). Physical activity and gender differences: correlates of compliance with recommended levels of five forms of physical activity among students at nine universities in Libya. *Central European Journal of public health.* 22(2):98-105.
- Galán, I., et al. (2013). Physical activity and self-reported health status among adolescents: a cross-sectional population-based study. *BMJ Open* 3:e002644.
- Herzig, M., et al. (2012). Differences in weight status and energy-balance related behaviors among schoolchildren in German-speaking Switzerland compared to seven countries in Europe. *Int J Behav Nutr Phys Act.* Nov.29; 9:139.
- Hosseinpoor, A.R., et al. (2012). Social determinants of self-reported health in women and men: understanding the role of gender in population health. *PLoSOne.* 7(4):e34799.
http://ec.europa.eu/citizenship/pdf/spring_eurobarometer_july_2014.pdf (15/09/2015)
<http://www.eufic.org/article/hu/egeszseg-es-eletmod/Fizikai-aktivitas/artid/Iranyelvek-fizikai-aktivitashoz/> (15/09/2015)
- Jaromi, M., Nemeth, A., Kranicz, J., Laczko, T., & Betlehem, J. (2012). Treatment and ergonomics training of work-related lower back pain and body posture problems for nurses. *Journal Of Clinical Nursing* 21: (11-12):1776-1784.
- Központi Statisztikai Hivatal (2010.) Egészség felmérés (ELEF) 2009. Statisztikai Tükör IV. 50 1-7., Retrieved from: <http://www.ksh.hu/elef> (11/01/2015).
- Lachat, C.K., et al. (2008). Validity of two physical activity questionnaires (IPAQ and PAQA) for Vietnamese adolescents in rural and urban areas. *Int J Behav Nutr Phys Act.* Jul 10; 5:37.

- Lee, P. H., Macfarlane, D. J., Lam, T. H., & Stewart, S. M. (2011). Validity of the international physical activity questionnaire short form (IPAQ-SF): A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 8:115.
- Martos, É., et al. (2012). The National Nutrition and Nutritional Status of tests OTÁP 2009 IV. - entering the Hungarian population. *Medical Journal* 153 (29): 1132–1141. (Martos É, Bakacs M, Sarkadi-Nagy E, Ráczkevy T, Zentai A, BaldaufZs, Illés É, Lugasi A Országos Táplálkozás és Tápláltsági Állapot Vizsgálata- OTÁP 2009- IV. A magyar lakosság makroelem- bevitele, Orvosi Hetilap 153. évfolyam, 29. szám, 1132–1141.)
- Michael, H., et al. (2012) Differences in weight status and energy-balance related behaviors among schoolchildren in German-speaking Switzerland compared to seven countries in Europe. *International Journal of Behavioral Nutrition and Physical Activity*, 9:139.
- Pavlik, G. (2015). The role of the regular physical activity in the prevention of different diseases and in the preservation of health. *Health Sciences* LIX. (2):1-16.
- Vöörmann, R., & Helemaee, J. (2013). A comparative analysis of gender differences in self-rated health: is the Baltic Sea a frontier of the East–West Health Divide in Europe? *FilosoFija. sociologija*, 62-70.
- Shaper, A.G., & Wannamethee, G. (1991). Physical activity and ischemic heart disease in middle-aged British men. *BrHeart J*. 66: 384-394.
- Tesch-Römer, C., Motel-Klingebiel, A., & Tomasik, M. J. (2008). Gender differences in subjective well-being: comparing societies with respect to gender equality. *Social Indicators Research*. 82(2): 329-349.
- www.ipaq.ki.se (15/09/2015).

REPETITION SPEED INFLUENCE ON INCREASING TENDENCY FOR HEART RATE IN WEIGHT TRAINING

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ABSTRACT. The benefits of weight training are consequences of the workout. A weight training program is a composite of several variables that can be combined in a multitude of options to achieve the desired effects (Ratamess, 2012). Identifying these variables and their correct planning is essential to anticipate a beneficial purpose of weight training program (American College of Sports Medicine, 2007). Our research took place between February 9 and April 19, 2015, in the gym of the Faculty of Physical Education and Sports of the Babeș-Bolyai University of Cluj-Napoca. The research objective was to analyse the trend of increase in heart rate (HR) at different speeds of execution for repetitions of the weight training exercises. The results obtained suggest that the tempo of execution influence the increasing tendency for heart rate in weight training. In general, we noticed that as the speed of execution decreases the growing trend of HR is lower. But those conditions apply only at specific speed of execution for repetitions and they are influenced by the specific of muscle involved in exercise.

Key words: *weight training, tempo, heart rate, increasing tendency.*

REZUMAT. Influența vitezei de execuție a repetărilor asupra tendinței de creștere a frecvenței cardiace în antrenamentul cu greutate. Beneficiile antrenamentului cu greutate sunt consecințe ale programului de antrenament. Un program de antrenament cu greutate este un compozit de mai multe variabile care pot fi combinate într-o multitudine de variante pentru a obține efectele scontate (Ratamess, 2012). Identificarea acestor variabile, precum și planificarea corectă a lor, este esențială pentru a anticipa o finalitate benefică a programului de antrenament cu greutate (American College of Sports Medicine, 2007). Cercetarea s-a desfășurat în perioada 9 februarie - 19 aprilie 2015, în sala de fitness a Facultății de Educație Fizică și Sport din cadrul Universității

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Babeș-Bolyai Cluj-Napoca. Obiectivul cercetării a constat în analiza tendinței de creștere a frecvenței cardiace la diferite viteze de execuție a repetărilor din cadrul exercițiului. Rezultatele obținute sugerează că tempoul de execuție al repetărilor influențează tendința de creștere a FC. În general, am observat că pe măsură ce viteza de execuție scade tendința de creștere a FC este mai mică. Dar aceste condiționări nu se aplică tot timpul și sunt influențate de specificul grupei musculare implicate în exercițiu.

Cuvinte cheie: *antrenament cu greutate, viteză de execuție, frecvență cardiacă, tendință de creștere.*

Objective

The research objective was to analyse the trend of increase in heart rate (HR) at different speeds of execution for repetitions of the weight training exercises.

Material and methods

The research took place between February 9 and April 19, 2015, in the gym of Faculty of Physical Education and Sports of the Babeș-Bolyai University of Cluj-Napoca.

The research was applied to 11 subjects, students of Physical Education and Sports Faculty of the Babeș-Bolyai University. All subjects enrolled in the study were male, with a minimum of 6 months experience in weight training. Age of participants was between 19 and 25 years (for details see Table 1).

Muscle groups included in our research were:

- Latissimus Dorsi with the exercise "Back Lat Pull-Downs";
- Pectoralis Major with the exercise "Horizontal Bench Press".

Tempo of execution used in our research was:

- 1010 (1 second for eccentric, 0 seconds for isometric after eccentric, 1 second for concentric, 0 seconds for isometric after concentric);
- 3030 (3 seconds for eccentric, 0 seconds for isometric after eccentric, 3 seconds for concentric, 0 seconds for isometric after concentric);
- 6060 (6 seconds for eccentric, 0 seconds for isometric after eccentric, 6 seconds for concentric, 0 seconds for isometric after concentric).

Table 1. Details of subjects included in research

Nº	Code	Age (years)	Bodyweight (kg)	Height (m)	Body mass index IMC
1	005	22	78	1.80	24.07
2	006	21	80	1.85	23.37
3	007	21	74	1.75	24.16
4	008	22	80	1.76	25.83
5	009	21	67	1.77	21.39
6	011	22	69	1.72	23.46
7	012	20	82.6	1.75	26.97
8	013	19	83.5	1.79	26.06
9	014	21	67.8	1.72	22.92
10	015	25	83.2	1.80	25.68
11	016	19	64.9	1.69	22.72

The workload used in our experiment was 60% of one repetition maximum (1RM). Heart rate was recorded using our own protocol (Văidăhăzan, Hanțiu, Pop, & Pătrașcu, 2015). Heart rate values were analyzed and extracted from each record with SportTracks 3 (Zone Five Software LLC, 2013).

Each subject participated at 6 sessions interspersed with days of rest. Sessions included in the research were:

- Session 1, 1RM test for Latissimus Dorsi;
- Session 2, 1RM test for Pectoralis Major;
- Session 3, training session with 3 particular tempo (60% of 1RM);
- Session 4, research session with tempo 1010 (60% of 1RM);
- Session 5, research session with tempo 3030 (60% of 1RM);
- Session 6, research session with tempo 6060 (60% of 1RM).

The sequence of research sessions was conducted according to the following design:

- 1RM testing session for Latissimus Dorsi;
- 1RM testing session for Pectoralis Major;
- Rest day;
- One session with execution of 3 tempo;
- Rest day;

- Research session for 1010 tempo;
- Rest day;
- Research session for 3030 tempo;
- Rest day;
- Research session for 6060 tempo.

1RM testing protocol is different between researchers. There are many proposed programs that comply with some main rules regarding the length of the pause between test sets but there is no standardized model. Thus, our protocol was built based on several papers (Kraemer, Fleck, & Deschenes, 2012; Ratamess, 2012; Schwellnus, 2008).

The 1RM session, used by us, was as follows:

- Warm-up;
- Rest for 1 minute;
- Set No. 1 with 50% of predicted 1RM (10 repetitions);
- Rest for 3 minutes;
- Set No. 2 with 70% of predicted 1RM (5 repetitions);
- Rest for 5 minutes;
- Set No. 3 with 100% of predicted 1RM (1 repetition);
- Rest for 5 minutes;
- Set No. 4 with 100% of predicted 1RM (1 repetition);
- Rest for 5 minutes;
- Set No. 5 (if necessary) with 100% of predicted 1RM (1 repetition);
- Rest for 1 minute;
- Cool-down.

All research sessions were led by a scientist helped by an assistant. The exercises included in our research were recorded on camera to analyse the form of repetitions. In order to achieve the desired tempo we used an audio system connected to a digital metronome (Paul Girsas, n.d.). Centralization of data was performed with Microsoft Excel.

Encodings used for research sessions are:

- Research session with 1010 tempo, MD_T1 codes (for Latissimus Dorsi) and PM_T1 (for Pectoralis Major);
- Research session with 3030 tempo, MD_T2 codes (for Latissimus Dorsi) and PM_T2 (for Pectoralis Major);
- Research session with 6060 tempo, MD_T3 codes (for Latissimus Dorsi) and PM_T3 (for Pectoralis Major).

Centralization of data was done with Microsoft Excel and statistical analysis was performed with SPSS Statistics using linear regression to calculate the upward trend in HR. The growth trend for HR was analysed by growth step, expressed in beats / minute. A paired-samples t-test was conducted to compare the dynamic of HR between tempos of execution.

Results

The increasing tendency for HR, for every exercise recorded, is presented in Table 2.

Table 2. Increasing tendency for HR for exercises recorded

Nº	Code	Increasing tendency	Increasing tendency	Increasing tendency	Increasing tendency	Increasing tendency	Increasing tendency
		(beats/min.) MD_T1	(beats/min.) MD_T2	(beats/min.) MD_T3	(beats/min.) PM_T1	(beats/min.) PM_T2	(beats/min.) PM_T3
1	005	0.914	1.125	0.571	0.877	0.858	0.839
2	006	1.495	0.557	0.657	1.265	0.861	0.961
3	007	2.421	0.626	0.766	1.807	0.659	0.385
4	008	0.829	0.506	0.141	0.696	0.223	0.367
5	009	1.630	0.739	0.544	0.495	0.424	0.636
6	011	1.121	0.257	0.434	0.506	0.094 *	0.116
7	012	0.801	0.815	0.446	0.929	0.440	0.195
8	013	1.022	0.736	0.291	1.209	0.656	1.429
9	014	0.668	0.245	0.161	0.590	0.291	0.350
10	015	0.763	0.246	0.143	0.618	0.162 *	0.344
11	016	1.626	0.417	0.483	1.051	0.358	0.289

* Data recorded for these sets are not statistically significant and they haven't been used in our analysis.

The statistical index of HR increase, for Latissimus Dorsi, on the 3 tempo included in our research are found in Table 3.

There was a significant difference in the scores for increasing tendency of heart rate for MD_T1 (M=1.21, SD=0.53) and increasing tendency of heart rate for MD_T2 (M=0.57, SD=0.28); $t(10)= 3.69, p=0.05$. These results suggest that tempo of execution has an influence on HR tendency growth. In particular, our data shows that as the speed of execution decreases the growing trend of HR is lower.

Table 3. Statistical index of HR increase for Latissimus Dorsi

Pair	Tempo	Mean	N	Std. Deviation	Std. Error Mean
Pair 1	MD_T1	1.20818	11	0.532359	0.160512
	MD_T2	0.56991	11	0.276324	0.083315
Pair 2	MD_T1	1.20818	11	0.532359	0.160512
	MD_T3	0.42155	11	0.213815	0.064468
Pair 3	MD_T2	0.56991	11	0.276324	0.083315
	MD_T3	0.42155	11	0.213815	0.064468

A significant difference we observed, also, in the scores for increasing tendency of heart rate for MD_T1 (M=1.21, SD=0.53) and increasing tendency of heart rate for MD_T3 (M=0.42, SD=0.21); $t(10)= 6.77$, $p=0.05$. These results suggest that the tempo of execution has an influence on HR tendency growth. In particular, our data shows that as the speed of execution decreases the growing trend of HR is lower.

There was no difference in the scores for increasing tendency of heart rate for MD_T2 and increasing tendency of heart rate for MD_T3, $p=0.05$.

Table 4. Paired Samples Test for Latissimus Dorsi

Pair	Tempo	Paired Differences			t	df	p
		Mean	Std. Deviation	Std. Error Mean			
Pair 1	MD_T1 - MD_T2	0.638273	0.574428	0.173197	3.685	10	0.004
Pair 2	MD_T1 - MD_T3	0.786636	0.385376	0.116195	6.770	10	0.000
Pair 3	MD_T2 - MD_T3	0.148364	0.255572	0.077058	1.925	10	0.083

The statistical index of HR increase, for Pectoralis Major, on the 3 tempo included in our research are found in Table 5.

Table 5. Statistical index of HR increase for Pectoralis Major

Pair	Tempo	Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PM_T1	0.99100	9	0.403537	0.134512
	PM_T2	0.53000	9	0.237158	0.079053
Pair 2	PM_T1	0.91300	11	0.401269	0.120987
	PM_T3	0.53736	11	0.394509	0.118949
Pair 3	PM_T2	0.53000	9	0.237158	0.079053
	PM_T3	0.60567	9	0.403028	0.134343

There was a significant difference in the scores for increasing tendency of heart rate for PM_T1 (M=0.99, SD=0.40) and increasing tendency of heart rate for PM_T2 (M=0.53, SD=0.24); $t(8)=4.10$, $p=0.05$. These results suggest that tempo of execution has an influence on HR tendency growth. In particular, our data shows that as the speed of execution decreases the growing trend of HR is lower.

A significant difference we observed, also, in the scores for increasing tendency of heart rate for PM_T1 (M=0.91, SD=0.40) and increasing tendency of heart rate for PM_T3 (M=0.54, SD=0.39); $t(10)= 2.69$, $p=0.05$. These results suggest that the tempo of execution has an influence on HR tendency growth. In particular, our data shows that as the speed of execution decreases the growing trend of HR is lower.

There was no difference in the scores for increasing tendency of heart rate for PM_T2 and increasing tendency of heart rate for PM_T3, $p=0.05$.

Table 6. Paired Samples Test for Pectoralis Major

Pair	Tempo	Paired Differences			t	df	p
		Mean	Std. Deviation	Std. Error Mean			
Pair 1	PM_T1 - PM_T2	0.461000	0.337665	0.112555	4.096	8	0.003
Pair 2	PM_T1 - PM_T3	0.375636	0.463089	0.139627	2.690	10	0.023
Pair 3	PM_T2 - PM_T3	-0.075667	0.309311	0.103104	-0.734	8	0.484

Statistical index of HR increase for both muscles included in our research are found in Table 7.

Table 7. Statistical index of HR increase for Latissimus Dorsi and Pectoralis Major

Pair	Tempo	Mean	N	Std. Deviation	Std. Error Mean
Pair 1	MD_T1	1.20818	11	0.532359	0.160512
	PM_T1	0.91300	11	0.401269	0.120987
Pair 2	MD_T2	0.64067	9	0.253884	0.084628
	PM_T2	0.53000	9	0.237158	0.079053
Pair 3	MD_T3	0.42155	11	0.213815	0.064468
	PM_T3	0.53736	11	0.394509	0.118949

In Table 8 we observe a significant difference in the scores for increasing tendency of heart rate for MD_T1 (M=1.21, SD=0.53) and increasing tendency of heart rate for PM_T1 (M=0.91, SD=0.40); $t(10)=2.47$, $p=0.05$. These

results suggest that muscle specificity influence the growing trend of HR. In particular, our data show that the increasing tendency of heart rate differs depending on the muscle group involved, on 1010 tempo.

There was no difference in the scores for increasing tendency of heart rate for MD_T2 and increasing tendency of heart rate for PM_T2, $p=0.05$. We have seen no difference, also, in the scores for increasing tendency of heart rate for MD_T3 and increasing tendency of heart rate for PM_T3, $p=0.05$. These results suggest that muscle group involved in exercise does not influence the increasing tendency of heart rate for 3030 and 6060 tempo.

Table 8. Paired Samples Test for both muscles, on all 3 tempo of execution

Pair	Tempo	Paired Differences			t	df	p
		Mean	Std. Deviation	Std. Error Mean			
Pair 1	MD_T1 - PM_T1	0.295182	0.395732	0.119318	2.474	10	0.033
Pair 2	MD_T2 - PM_T2	0.110667	0.219803	0.073268	1.510	8	0.169
Pair 3	MD_T3 - PM_T3	-0.115818	0.423594	0.127718	-0.907	10	0.386

Discussions

The biggest increasing tendency for heart rate was recorded for Latissimus Dorsi on the 1010 tempo. Compared with this, the trend of growth on 3030 tempo had lower values. The increasing tendency for heart rate for 6060 tempo was lower than 1010 tempo, also. As a result, we can say that as the speed of execution for repetitions decreases the tendency to increase of HR is lower.

The same model of response regarding the growth trend of HR we observed with Pectoralis Major. The increasing tendencies for HR recorded on 3030 and 6060 tempo are lower when compared to 1010 tempo.

A comparison between muscles shows that HR increasing tendency is lower for Pectoralis Major than Latissimus Dorsi, on 1010 tempo. But on 3030 and 6060 tempo this difference is uncertain because the data did not show statistical significance. We can only assume that as we execute our reps with lower speed the differences in growth trend for HR is cancelled by physiological factors.

Since the growth trends of HR are lower at lower speeds of execution, we recommend using lower speeds execution (almost 6 seconds) for beginners' workouts. The results obtained by us support ACSM recommendations that

suggest for beginners moderate speeds of about 3 seconds on the eccentric contraction and 3 seconds on the concentric contraction (American College of Sports Medicine, 2005).

Conclusions

The biggest increasing tendency for heart rate was recorded at two-second execution speed (1010 tempo) for both muscles, the Latissimus Dorsi and Pectoralis Major. Comparing the growth trends between the two muscles at 1010 tempo, we observed that the Latissimus Dorsi trend growth is higher than the Pectoralis Major.

For 3030 and 6060 tempo we didn't find significant differences between the two muscles regarding the increasing tendency for heart rate.

Acknowledgment

The content of this article is part of the PhD research conducted in Sport Science.

REFERENCES

- American College of Sports Medicine. (2005). *ACSM's Guidelines for Exercise Testing and Prescription - Seventh Edition*. Statele Unite ale Americii: Lippincott Williams & Wilkins.
- American College of Sports Medicine. (2007). *ACSM's Resources for the Personal Trainer - Second Edition*. Statele Unite ale Americii: Lippincott Williams & Wilkins.
- Buitrago, S., Wirtz, N., Yue, Z., Kleinoder, H., & Mester, J. (2011). Effects of load and training modes on physiological and metabolic responses in resistance exercise. *Eur J Appl Physiol*, 112(7), 2739-2748. doi:10.1007/s00421-011-2249-9.
- Coulson, M., & Archer, D. (2009). *Practical fitness testing*. Marea Britanie: A. & C. Black.
- Diniz, R.C., Martins-Costa, H.C., Machado, S.C., Lima, F.V., & Chagas, M.H. (2014). Repetition duration influences ratings of perceived exertion. *Perceptual and Motor Skills*, 118(1), 261-273.
- Honeybourne, J., Hill, M., & Moors, H. (2004). *Advanced PE & sport*. Marea Britanie: Nelson Thornes.
- Ide, B.N., Leme, T.C., Lopes, C.R., Moreira, A., Dechechi, C.J., Sarraipa, M.F., ... Macedo, D.V. (2011). Time Course of Strength and Power Recovery After Resistance Training With Different Movement Velocities. *Journal of Strength and Conditioning Research*, 25(7), 2025-2033. doi:10.1519/jsc.0b013e3181e7393f.

- Kraemer, W. J., Fleck, S. J., & Deschenes, M. R. (2012). *Exercise physiology*. Statele Unite ale Americii: Wolters Kluwer Health/Lippincott Williams & Wilkins.
- Paul Girsas. (no date). *Easy Metronome*. Retrieved from play.google.com: <https://play.google.com/store/apps/details?id=girsas.metronome>.
- Ratamess Jr., N. (2012). *ACSM's Foundations of Strength Training and Conditioning*. Statele Unite ale Americii: Lippincott Williams & Wilkins.
- Schweltnus, M. (2008). *The Olympic textbook of medicine in sport*. Marea Britanie: Wiley-Blackwell.
- Văidăhăzan, R.-C., Hanțiu, I., Pop, N.H., & Pătrașcu, A. (2015). Heart rate recording system for participants to weight training in Cluj-Napoca's fitness gyms (compatibilities between Android and Windows 7). *Studia Universitatis Babeș-Bolyai, Educatio Artis Gymnasticae*, 60(1), 29-40.
- Zone Five Software LLC. (2013, February 12). *SportTracks*. Retrieved from zonefivesoftware.com: <http://www.zonefivesoftware.com/sporttracks/>

STUDY OF THE BASKETBALL AND VOLLEYBALL THEMATIC UNIT BASED ON THE STUDENTS' PERFORMANCE

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ABSTRACT. The aim of our research is to assess the students' performance within the teaching units can be found in the syllabus. The benefit of the new method modeled by us is to give a detailed and comprehensive picture about the students' load ability, endurance (individually), as well as make the students' evaluation easier. At the same time it facilitates to confirm the efficiency of the educational system and the teacher's successfulness. In Physical Education, we are demonstrating a new method in our research to make differentiation. The students' lesson activity can determine the conditions how to form the certain groups. No students are those that adapt the tasks unified by everybody but after the group formation (based on measuring), the students perform the tasks correlated to the group abilities. Therefore, the load ability will be unified for everybody according to their capacity by doing the various exercises. The research showed the efficacy of the method as well as we can get an accurate picture about the same loading rate of the students' performance who can be loaded or less loaded by comparing two teaching units after performing the exercises controlled by measuring. The WHO (2010) offer a medium and high intensity physical activity for the individuals aged at 5-17 in minimum 60 minutes. The objective is to develop the skeletal, joint and musculoskeletal system as well as the cardiorespiratory endurance with aerobic exercises. This measuring method helps to test whether the medium or high intensity load, prescribed by the WHO, can be accomplished or cannot, measuring the effectiveness of the program. PE lesson plays a major role in this.

Keywords: *Differentiation, Measuring of Pulse Rate, Motivation*

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Introduction

The WHO (2010) offer a medium and high intensity physical activity for the individuals aged at 5-17 in minimum 60 minutes. The objective is to develop the skeletal, joint and musculoskeletal system as well as the cardiorespiratory endurance with aerobic exercises.

Numerous Hungarian and foreign researchers emphasize the significance and role of a healthy lifestyle especially in connection with sport and exercise for different target groups (Bendíková 2014, Dobay 2014, Bíró 2015, Bujdosó at all 2013, Dávid at all 2010, Herpainé 2014, Herpainé at all 2016, Herpainé 2007, Herpainé at all 2015, Madarász-Bácsné 2016, Molnár at all 2014, Olvasztóné at all 2007, Ráthonyi at all 2015, Simon 2004, Simon 2015/A, Simon 2015/B, Simon at all 2012, Simon-Kajtár, 2011).

Supported with previous studies we stated that being aware of the pulse zones had *raison d'être* (Müller, Rácz, 2011, www.tka.hu).

In our research the load capacity of the students with different abilities was studied in the same conditions within a certain class taking the other factors influencing the load capacity into account.

They got instructions for their out-of-class sporting activities with specifying the proper pulse interval which could also be employed during their own training.

Two teaching units were chosen, volleyball and basketball. The teaching units were divided in three measurable parts.

The diagnostic evaluation lesson (1st lesson), the practicing lesson (building up soft coordination) and the summative evaluation lesson were the used phases. The educational lessons were divided into four parts where the measures were carried out: measuring pulse in the 1st minute, after the warming-up phase, the pulse after the main phase and the pulse measured 5 minutes after the main phase (resting pulse).

From these measures we could realize the thematic unit. Comparing the two teaching units, we could get a comprehensive picture about the students' load ability in the starting phase of the two ballgames (Figure 1.).

During the second teaching unit in the same thematic unit students worked in groups attending to data where the central factor was the load ability. Forming the three groups, the load ability was given by degrees therefore we could reach the same load for each student. The 80% intensity aimed at the beginning of the lesson was successful at every tested lesson so the measuring method can be said to be efficient at the basketball and volleyball lesson.

It can be planned in the next thematic unit how high the load should be generated so that the students can make out appropriate performance besides learning to move in a proper way.

Hypothesis

With the new method it can be possible to assess the students' deficiencies and their continuous development. With individual measurement within a given time period under a thematic unit for everybody.

This method demonstrates the ratio to the load of the thematic units.

To identify the efficiency of the thematic units can make the curriculum built from these units and the educational method as well as the methodological substantiation of the learning organization and the learning material processing easier.

Materials and Methods

16-year-old schoolboys were studied in the research at Újpest Bilingual Technological Technical and Grammar School in Budapest in 2016/17 school term. The pulse measuring took place on the neck area for 10 sec and multiplied by 6. After that feedback analysis was calculated from the data then some conclusions were drawn about the load, the proportion of the load and the educational -organizational methods. Finally differentiation was made based on the given data.

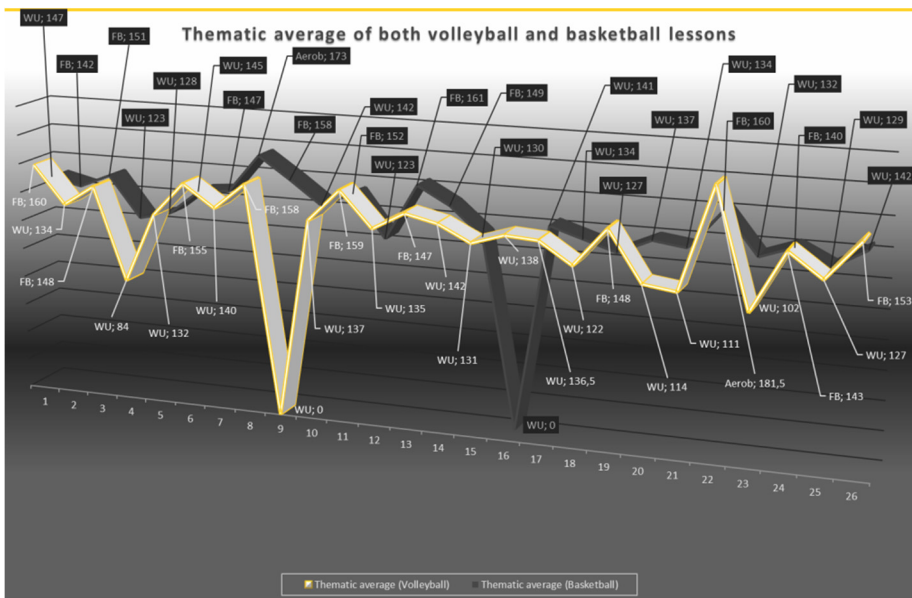


Fig. 1. Thematic average of both volleyball and basketball lessons

The average within the three lessons formed the thematic average which also gave a comprehensive picture about the class performance. The student's HR reserve-HRR % (the students' heart rate reserve percentage) - was counted from this. The HRR is the difference between the studied individuals' resting and maximum HR.

The HRmax is the highest pulse rate per minute (bpm) that a person can reach with his max performance. This value depends on the person, the age, the physical conditions and the fitness level.

The HRmax value can be used to determine the training intensity, usually given in percentage of the HRmax value (Figure 2.).

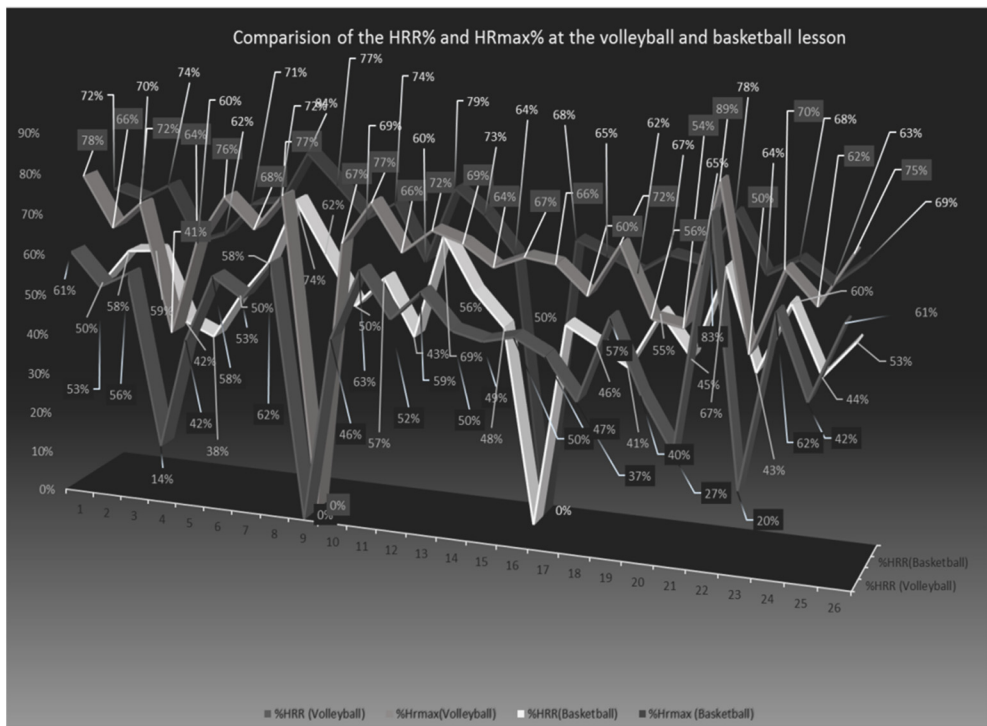


Fig. 2. Comparison of the HRR% and HRmax% at the volleyball and basketball lesson

Three groups were formed considering the activity and the resting HR (Table 1.).

Table 1. Group work considering activity and resting HR

Group work considering activity and resting HR		
1 st group	2 nd group	3 rd group
Number 1	Number 4	Number 8
Number 2	Number 5	Number 9
Number 3	Number 6	Number 10

Results

Three devices were at our disposal so three students were measured per group and the others only manually.

A student was selected from each group and the working procedure of the system was demonstrated by him.

The 1st group (the least loaded students) was shown at the Figure 3. and Figure 4.

Training Session Report

2016.10.28. - Rolabda 7:43-8:31

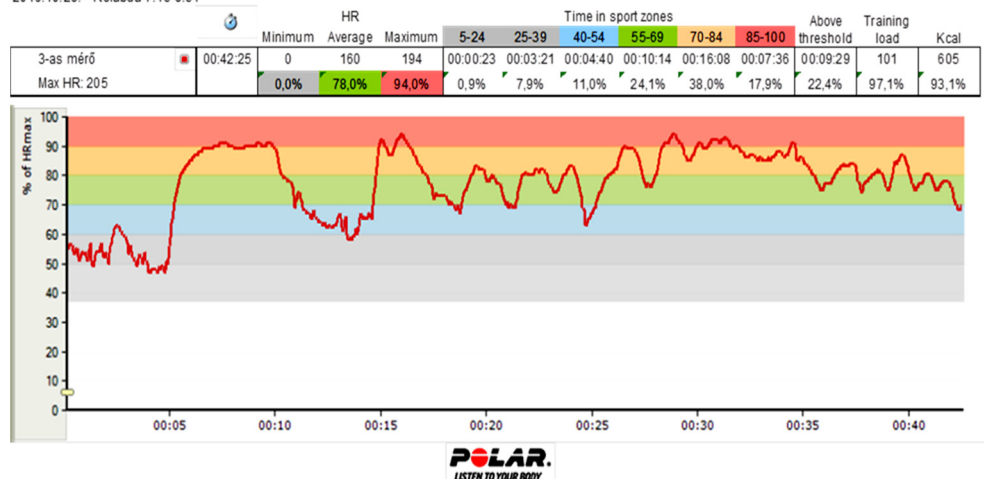


Fig. 3. Student's- belonged to the 1st group with measurement numbered 3- performance based on the HRR% during the volleyball second thematic unit

Training Session Report

2016.10.28. - Ropplabda 7:43-8:31

	00:42:24	HR			Time in sport zones						Above threshold	Training load	Kcal
		Minimum	Average	Maximum	5-24	25-39	40-54	55-69	70-84	85-100			
3-as mérő	00:42:24	0	160	194	00:00:23	00:03:32	00:04:40	00:10:03	00:16:08	00:07:36	00:09:29	101	604
Max HR: 205		0,0%	68,0%	92,0%	0,9%	8,3%	11,0%	23,7%	38,1%	17,9%	22,4%	97,1%	92,9%

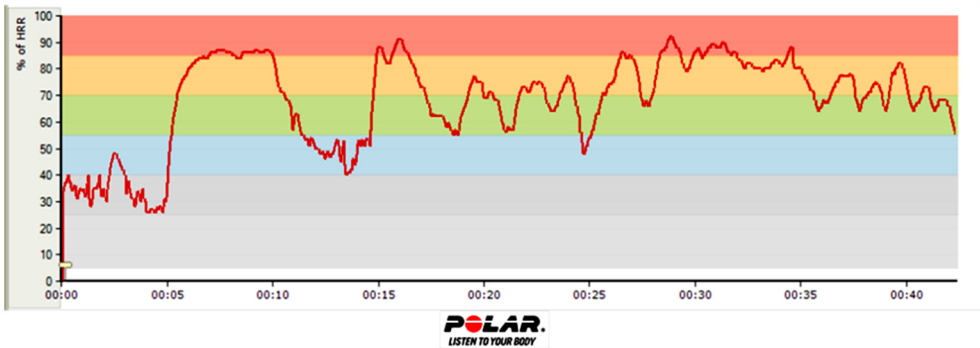


Fig. 4. Student's- belonged to the 1st group with measurement numbered 3- performance based on the HRmax% during the volleyball second thematic unit

We can allocate that above 85% zone of the student's maximum output the student spent 7:36 minutes and he/she provided 60-84% achievement in most of the lesson (26 min). In this group the load choice is very significant so that the intensity should not influence the task fulfilment.

The students belonged to the group numbered 2 are those who claim the higher load than the 1st group but less one than the 3rd group (Figure 5., Figure 6.).

Training Session Report

2016.10.28. - Volleyball 7:44-8:31

	00:43:03	HR			Time in sport zones						Above threshold	Training load	Kcal
		Minimum	Average	Maximum	5-24	25-39	40-54	55-69	70-84	85-100			
Number 5	00:43:03	0	152	193	00:00:06	00:03:58	00:07:40	00:15:55	00:13:08	00:02:13	00:03:16	84	498
Max HR: 205		0,0%	63,0%	91,0%	0,3%	9,2%	17,8%	37,0%	30,5%	5,2%	7,6%	97,7%	93,4%

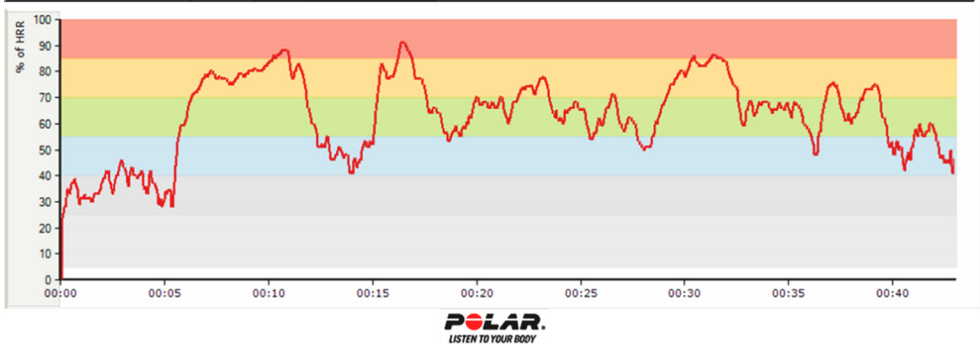


Fig. 5. Student's- belonged to the 2nd group with measurement numbered 5- performance based on the HRR% during the volleyball second thematic unit

Training Session Report

2016.10.28. - Volleyball 7:44-8:31

Number 5	00:43:03	HR			Time in sport zones						Above threshold	Training load	Kcal
		Minimum	Average	Maximum	5-24	25-39	40-54	55-69	70-84	85-100			
Max HR: 205		0	152	193	00:00:06	00:03:58	00:07:40	00:15:55	00:13:08	00:02:13	00:03:16	84	498
		0,0%	74,0%	94,0%	0,3%	9,2%	17,8%	37,0%	30,5%	5,2%	7,6%	97,7%	93,4%

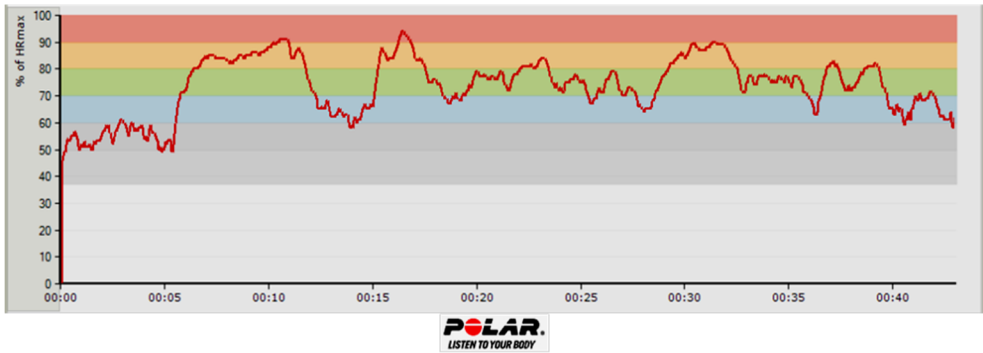


Fig. 6. Student's- belonged to the 2nd group with measurement numbered 5- performance based on the HRmax% during the volleyball second thematic unit

The 2nd group students spent 60-84% performance zone under the predetermined load in the majority of the lesson (29 minutes and 2 minutes above 85%). The time out included explanations, discipline and fall-in was only 10 minutes.

The 3rd group is one that can be loaded at the highest (Figure 7., Figure 8.).

Training Session Report

2016.10.28. - Volleyball 7:45-8:30

Number 10	00:41:08	HR			Time in sport zones						Above threshold	Training load	Kcal
		Minimum	Average	Maximum	5-24	25-39	40-54	55-69	70-84	85-100			
Max HR: 205		0	154	187	00:00:22	00:02:17	00:07:48	00:12:39	00:17:11	00:00:49	00:01:58	85	496
		0,0%	64,0%	87,0%	0,9%	5,6%	19,0%	30,8%	41,8%	2,0%	4,8%	96,6%	93,1%

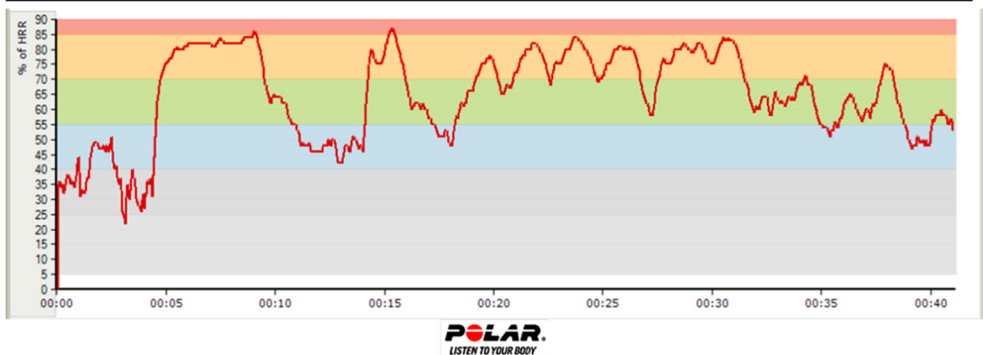


Fig. 7. Student's- belonged to the 3rd group with measurement numbered 10- performance based on the HRR% during the volleyball second thematic unit

Training Session Report

2016.10.28. - Volleyball 7:45-8:30

Number 10	00:41:08	HR			Time in sport zones						Above threshold	Training load	Kcal
		Minimum	Average	Maximum	5-24	25-39	40-54	55-69	70-84	85-100			
Max HR: 205		0	154	187	00:00:22	00:02:17	00:07:48	00:12:39	00:17:11	00:00:49	00:01:58	85	496
		0,0%	75,0%	91,0%	0,9%	5,6%	19,0%	30,8%	41,8%	2,0%	4,8%	96,6%	93,1%

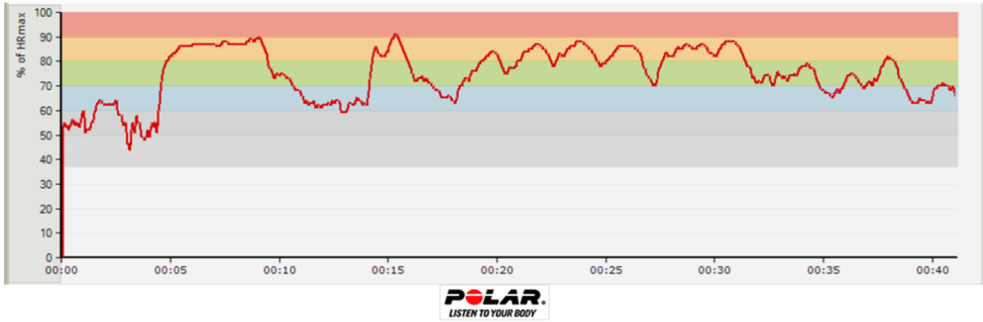


Fig. 8. Student's- belonged to the 3rd group with measurement numbered 10- performance based on the HRmax% during the volleyball second thematic unit

The students in the 3rd group spent fewer than 1 minute (most of them) in the zone above 85% and they spent more than 29 minutes in the 60-84% zone proportionally HRmax%.

We can allocate that the students in each group correlating to individuals got nearly the same load by different exercises.

Similar performance can be diagnosed during the basketball thematic unit.

In case of the first group the result shows similar values to the volleyball teaching unit after less intensity and carrying out easier exercises (Figure 9, Figure 10.).

Training Session Report

2016.11.11. - Basketball 7:48-8:35

Number 2	00:47:03	HR			Time in sport zones						Above threshold	Training load	Kcal
		Minimum	Average	Maximum	5-24	25-39	40-54	55-69	70-84	85-100			
Max HR: 205		0	154	197	00:00:28	00:03:21	00:08:45	00:15:17	00:14:54	00:04:16	00:06:17	96	593
		0,0%	75,0%	96,0%	1,0%	7,1%	18,6%	32,5%	31,7%	9,1%	13,4%	100,0%	100,0%

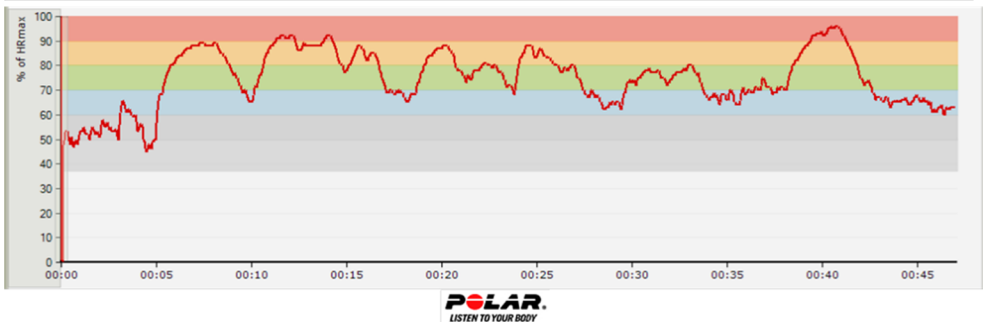


Fig. 9. Student's- belonged to the 1st group with measurement numbered 2- performance based on the HRmax% during the basketball second thematic unit

Training Session Report

2016.11.11. - Basketball 7:48-8:35

Minimum	HR			Time in sport zones					Above threshold	Training load	Kcal
	Average	Maximum	5-24	25-39	40-54	55-69	70-84	85-100			
0	154	197	00:00:28	00:03:21	00:08:45	00:15:17	00:14:54	00:04:16	00:06:17	96	593
0,0%	64,0%	94,0%	1,0%	7,1%	18,6%	32,5%	31,7%	9,1%	13,4%	100,0%	100,0%

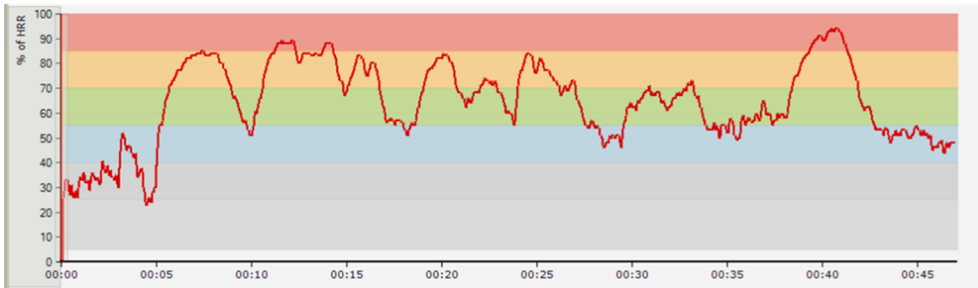


Fig. 10. Student's- belonged to the 1st group with measurement numbered 2- performance based on the HRR% during the basketball second thematic unit

The students spent 30 minutes in the 60-84% zone. The participated student correlating to his own maximum HR worked with 75% intensity and the highest HR at the lesson correlating to his/her normal healthy HR was 96% namely 197.

The output of the students belonged to the 2nd group verifies the efficiency of the method (Figure 11., Figure 12.).

Training Session Report

2016.11.11. - Basketball 7:46-8:35

Minimum	HR			Time in sport zones					Above threshold	Training load	Kcal
	Average	Maximum	5-24	25-39	40-54	55-69	70-84	85-100			
0	148	197	00:00:31	00:04:49	00:11:33	00:15:59	00:12:24	00:02:10	00:02:42	85	518
0,0%	72,0%	96,0%	1,1%	10,2%	24,3%	33,7%	26,1%	4,6%	5,7%	100,0%	100,0%

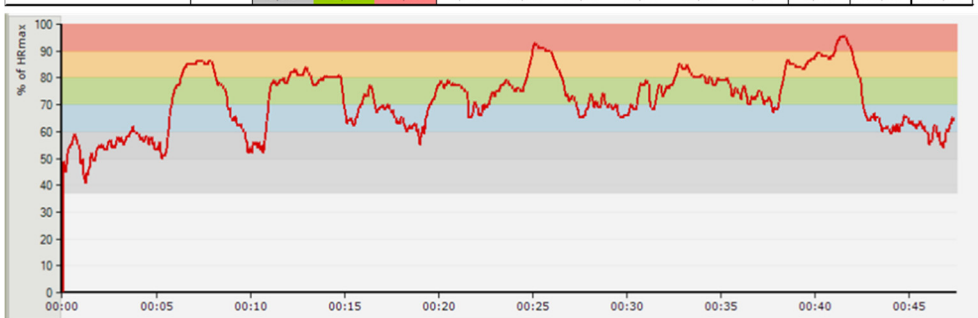


Fig. 11. Student's- belonged to the 2nd group with measurement numbered 4- performance based on the HRmax% during the basketball second thematic unit

Training Session Report

2016.11.11. - Basketball 7:46-8:35

Number 4	00:47:29	HR			Time in sport zones						Above threshold	Training load	Kcal
		Minimum	Average	Maximum	5-24	25-39	40-54	55-69	70-84	85-100			
Max HR: 205		0	148	197	00:00:31	00:04:49	00:11:33	00:15:59	00:12:24	00:02:10	00:02:42	85	518
		0,0%	60,0%	94,0%	1,1%	10,2%	24,3%	33,7%	26,1%	4,6%	5,7%	100,0%	100,0%

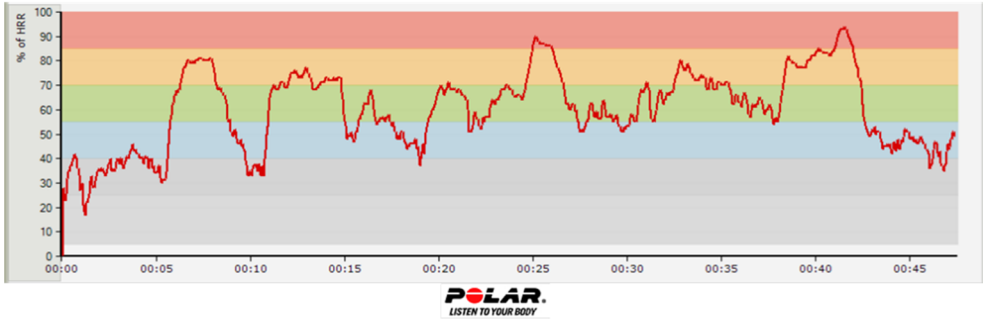


Fig. 12. Student's- belonged to the 2nd group with measurement numbered 4- performance based on the HRR% during the basketball second thematic unit

Most of the students in group 2- as seen the chosen student's diagram – spent the most time i.e. more than 28 minutes in the 60-84% zone and in the 85% zone almost 2 minutes.

The members of the 3rd group that could be loaded in the highest degree considering their age, sex and lesson type, the following results were obtained (Figure 13., Figure 14.).

Training Session Report

2016.11.11. - Basketball 7:46-8:34

Number 10	00:48:07	HR			Time in sport zones						Above threshold	Training load	Kcal
		Minimum	Average	Maximum	5-24	25-39	40-54	55-69	70-84	85-100			
Max HR: 205		0	148	194	00:02:04	00:04:18	00:11:09	00:12:23	00:15:09	00:03:01	00:03:28	87	540
		0,0%	72,0%	94,0%	4,3%	9,0%	23,2%	25,7%	31,5%	6,3%	7,2%	100,0%	100,0%

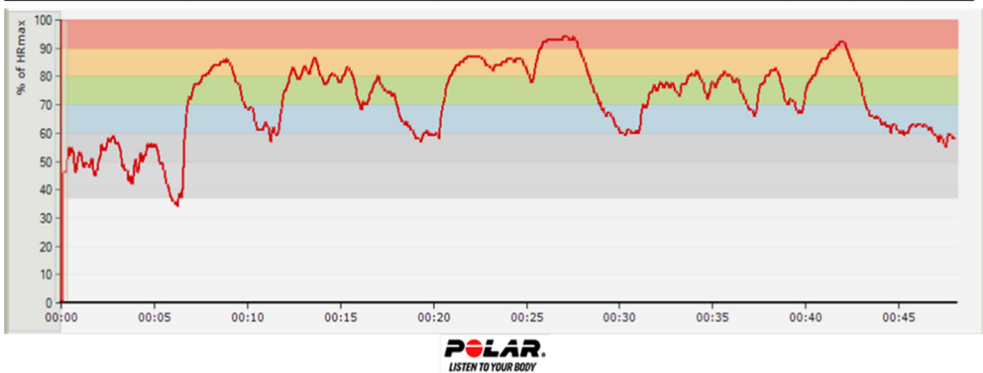


Fig. 13. Student's- belonged to the 3rd group with measurement numbered 10- performance based on the HRmax% during the basketball second thematic unit

Training Session Report

2016.11.11. - Basketball 7:46-8:34

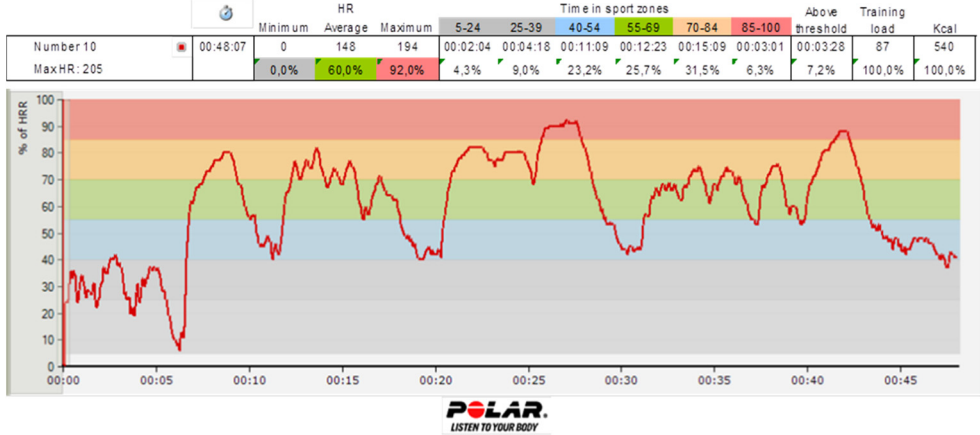


Fig. 14. Student's- belonged to the 3rd group with measurement numbered 10- performance based on the HRR% during the basketball second thematic unit

Students in group 3 and the student with measurement 10 worked 27 minutes in the 60-84% zone and 3 minutes in the zone above 85%.

The objective measurement of the three groups makes possible to ascertain and adopt adequate load ability for the teacher. It can be practiced in every teaching unit (except gymnastics). It requires continuous checking and interoperability between the groups. Increasing the students' interest and visualizing the developmental diagram are rudimentary to the efficient work. In addition to the measurement of the students' work, it can serve as the measurement of the teacher's preparation, professional knowledge as well as the support of the evaluation. This method can play a major role to predict and prevent the students' diseases.

Conclusions

This method can contribute to evolve a new objective measuring method that can change the subjective evaluating system of the teaching units and the incompetent people's conviction according to which PE has to be evaluated in a subjective way. PE can be measured and can be made measurable.

The usage of this system can make possible to eventuate a crucial change in the approach in the field of this profession, too where the foundation of the judgment will not depend on the short-term humanity but the development achieved with long-term and hard work.

REFERENCES

- Bendíková, E. (2014). Lifestyle, physical and sport education and health benefit sophisticated activity. *European researcher: international multidisciplinary journal. Sochi: Academic publishing house Researcher, 2014, 69, 2-2, 343-348.*
- Bíró, M. (2015). A testnevelés aktuális kérdései. In Révész, L. & Csányi, T. (Ed.), *Tudományos alapok a testnevelés tanításához. I. kötet: Szemelvények a testnevelés, a testmozgás és az iskolai sport tárgyköréből. Társadalom-tervezés- és orvostudományi nézőpontok* (pp.105-136.). Budapest: Magyar Diáksport Szövetség.
- Bujdosó, Z., & Dávid, L.(2013). Extreme sports and other activities in tourism with special regard to the Mátra Mountain. *Journal Of Physical Education And Sport, 13,1, 39-45.*
- Dávid, L., Lontai – Szilágyi, Zs., & Baros, Z. (2010). The Impact of Tourism and Sports Activities In: Szabó, J., Dávid, L., & Lóczy, D. (Ed.), *Anthropogenic Geomorphology: A Guide to Man-Made Landforms.* (pp. 233-254.). Dordrecht: Springer.
- Dobay, B. (2014). A Selye János Egyetem óvopedagógus hallgatói körében végzett felmérés a testmozgás tükrében. In „Oktatás és tudomány a XXI. század elején“ – Nemzetközi Tudományos Konferencia tanulmánykötete (pp. 69-71.). Komarno: Selye János Egyetem.
- Herpainé Lakó, J., & Olvasztóné Balogh, Zs. (2007). Nagyszülők és unokák testedzésének aktuális kérdései az egészségfejlesztés tükrében. *Egészségfejlesztés, 48, 1-2, 14-16.*
- Herpainé Lakó, J. (2014). The Issues of The Relationship of Grandparents and Grandchildren in the Light of Physical Activity. *European Journal Of Mental Health, 9, 2, 178-194.*
- Herpainé Lakó, J., & Balogh Olvasztóné, Zs., (2015). Recreational activities in the different kind of generation in connection with physical activity. In E. Bendíková (Ed.), *Health and physical activities in lifestyle among children and youth Banská Bystrica, Szlovákia, 2015.06.06, 2015.* (pp. 10-21.). Banská Bystrica: Matej Bel University.
- Herpainé Lakó, J., Boda, E., Olvasztóné Balogh, Zs., & Hidvégi, P. (2016). Generációk értékközvetítő szerepe a testnevelés és sport területén. In Juhász, Gy., Orsovics, I., & Nagy, M. (Ed.), *Korszerű szemlélet a tudományban és az oktatásban SJE Nemzetközi Tudományos Konferencia. Komárno, Szlovákia, 2016.09.13-2016.09.14.* (pp. 334-241.). Komárno: Selye János Egyetem.
- Madarász, T., & Bácsné Bába, É. (2016): Survey on the Employees' Fitness Condition and the Employers' Health Preservation Possibilities in Case of Small and Medium-sized Enterprises. *Sea: Practical Application of Science, IV, 2, 11, 205-212.*
- Molnár, C., Dávid, L., & Vasa, L. (2014). Health tourism in Hungary: history, its revaluation and tendencies. In Laskowski, M, Sauer, P. (Ed.), *Innovations and sustainable development: actual research problems in Eastern Europe* (pp. 137-153.). Lublin: Technical University of Lublin.
- Müller, A., & Rácz, I. (2011). *Aerobic és Fitness irányzatok.* Budapest: Pécs Dialóg Campus Kiadó.
- Nagy, Zs., & Müller, A. (2016). The Role of the Pulse Measurement in the Students' Differentiated Education Applied in PE. In E., Bendíková, P., Mičko (Ed.), *Physical Activity, Health and Prevention: International Scientific Conference: Conference Textbook of Invited Lectures* (pp. 5-14.). Banská Bystrica: Matej Bel University Faculty of Arts, Department of Physical Education and Sports.

- Olvasztóné Balogh, Zs., Gaálné Balogh, B., & Herpainé Lakó, J. (2007). Az egészségnevelés lehetőségei az óvodában egy társasjáték tükrében. *Egészségfejlesztés*, 48, 1-2, 17-20.
- Ráthonyi-Odor, K., Bácsné Bába, É., Keresztesi, K., & Borbély, A. (2015). Sportszervező képzés jelene, jövője – előtanulmány a Debreceni Egyetem végzős sportszervező hallgatóinak véleménye alapján. *Magyar Sporttudományi Szemle*, 16, 4, 37-43.
- Simon, I. (2004). Komplex prevenció mozgásprogram hatása a légúti- és mozgásszervi beteg gyerekek egészségállapotának megváltoztatására. *Sportorvosi Szemle*, 45, 1, 86.
- Simon, I.Á. (2015/A). Bölcsődei testnevelés módszertana. In Simon, I. Á. (Ed.), *A kisgyermekkorú nevelés módszertana* (pp. 59-79.) Szombathely: Nyugat-magyarországi Egyetem Regionális Pedagógiai Szolgáltató és Kutató Központ.
- Simon, I.Á.(2015/B). *A gyógytestnevelés elmélete és módszertana*. Szombathely: Nyugat-magyarországi Egyetem Savaria Egyetemi Központ.
- Simon, I.Á., Baloghné Bakk, A., & Kajtár, G. (2012): Soproni utánpótlás korú versenyzők táplálkozási-és étkezési szokásainak vizsgálata. *Magyar Sporttudományi Szemle*, 13, 50, 62.
- Simon, I.Á., & Kajtár, G.(2011). A Sopronban úszásterápián részt vevő mozgás- és légzőszervi beteg gyermekek és szüleik egészségmagatartásának vizsgálata. *Magyar Sporttudományi Szemle*, 12, 70, 46.
- World Health Organization (2010): *Global recommendations on physical activity for health*, Printed in Switzerland, retrieved from:
http://apps.who.int/iris/bitstream/10665/44399/1/9789241599979_eng.pdf
<http://www.tka.hu/tudastar/dm/104/a-testnevelés-feedbackje-ikt-n-keresztul>

REPETITION SPEED IN THE CONTEXT OF SPECIFIC PHYSICAL TRAINING PERIOD FOR JUDO ATHLETES

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ABSTRACT. Introduction: Muscles are the main driving force in the locomotive system. Moreover, their activity is crucial for athletic performance. The repetition speed they generate allows for higher performance. Maintaining a positive average for repetition speed is essential for constant performance. **Hypothesis:** A specific physical training period influences the evolution repetition speed. **Methods and Materials:** Seventeen female subjects from Romania's Junior Olympic Judo Team took part in our study with the age between 14 and 20 years old. The MGM-15 Jump Carpet was used for the repetition speed test. **Results:** There was no significant statistical difference between the initial and final repetition speed measurement but there was a strong difference between the test's values for both feet and each single ones. **Conclusions:** The physical training period the subjects undergone had no impact over the way repetition speed behaves. Even though this element showed significant differences between various jumping positions this was not enough to confirm the hypothesis. This being the case, there may be another factor that influences the repetition speed's evolution.

Key words: *judo, MGM-15, repetition speed, physical training*

REZUMAT. Viteza de repetiție în contextul unui program de antrenament fizic specific al sportivilor de judo. Introducere: Mușchii sunt principalul motor în cadrul sistemului locomotor. Activitatea lor este crucial pentru performanța sportivă. Viteza de repetiție generată de aceștia permite atingerea unei performanțe ridicate. Menținerea unei viteze de repetiție ridicată este esențială pentru performanță constantă. **Ipoteză:** O perioadă de antrenament fizic specific influențează viteza de repetiție. **Metode și Materiale:** 17 subiecți de gen feminin din cadrul Lotului Olimpic al României de Judo categoria Juniori cu vârsta cuprinsă între 14 și 20 de ani au participat la studiul nostru. Covorul de sărituri MGM-15 a fost

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folosit pentru măsurarea vitezei de repetiție. **Rezultate:** Nu a fost identificată o diferență semnificativ statistică între valoarea inițială și finală a variabilei măsurate. S-a identificat o diferență semnificativ statistică între valorile acesteia între săriturile pe ambele picioare și pentru fiecare dintre ele în parte. **Concluzii:** Perioada de antrenament fizic în care au fost integrați subiecții nu a avut un impact asupra modului în care evoluează viteza de repetiție. Deși la acest capitol este prezentă o diferență semnificativă între valorile variabilei pentru săriturile pe ambele picioare și pentru ele individual acest lucru nu a fost îndeajuns pentru confirmarea ipotezei. Aceasta fiind starea de fapt, putem presupune că există o variabilă neidentificată care influențează evoluția vitezei de repetiție.

Cuvinte cheie: *judo, MGM-15, viteza de repetiție, antrenament fizic*

Introduction

Your body constantly adapts to the stresses under which you place it. Exercise is one such stress. Over time, your body will physiologically adapt to aerobic training. These physiological adaptations will decrease muscle soreness and make your heart more efficient so you can exercise more easily and at a higher intensity than when you first start a workout routine. More importantly, your overall health will improve (Dudley, 1982).

Your muscles can be comprised of Type I or Type II fibers. Type I fibers are suitable for endurance exercise because they do not contract as quickly, but they also do not fatigue as quickly. By contrast, Type II fibers are suitable for sprinting exercise because they contract rapidly, but also fatigue rapidly. With aerobic training, Type I muscle fibers increase in size. This means your muscle fibers are able to contract for a longer period of time (Trappe, 2006).

Judo is characterized by high-intensity intermittent efforts, resulting in high physiological demand (Franchini, 2011). Judo athletes typically take part in seven to eight competitions, either regionally or internationally (Julio, 2013).

Thus, the training schedule is important to provide judo athletes a better chance to qualify in these tournaments (Crnogorac, 2010; Fukada, 2013; Stojanovic, 2009).

There are three elements involved for attaining the desired speed: the mental quickness and the physical approach combined with the appropriate technique. Physical speed is normally defined as the quickness of movement of a limb, whether this is the legs or the arms of a judoka. Physical speed as an integral part of the judo performance is influenced by: the judoka's quick mental response, the choice of the target, his mobility, his endurance, his basic strength

and by the technique he chooses. We normally develop the physical speed through the application of various techniques of sprinting first rehearsed at slow speeds and then transferred to runs at maximum speed over set distances and times. This chosen gradation ensures proper warm up of the muscles and joints groups, increase endurance, provide opportunities to correct the running technique and influence the stride length needed to reach an upper speed level.

Hypothesis

A specific physical training period influences the evolution of repetition speed of judo athletes.

One of the aims of this study was to identify if an intensive training period would affect the repetition speed of judo athletes. The physical training period was expected to prepare the athletes for the upcoming national and international competitions.

Materials and Methods

Seventeen female subjects took part in our study with the age between 14 and 20 years old. All the subjects were athletes that compete in national and international judo competitions and are part of the Romania's Junior Olympic Judo Team. During the specific physical training period, all subjects underwent the same routine at the same location. The test's protocol was explained to the participants and written informed consent was obtained from them.

All the subjects were briefed beforehand regarding what the experiment consisted of and what they were required to do. The subjects were assured that any personal information would not be made public and their personal data recorded will be analysed under the cover of anonymity. Moreover the subjects were instructed how to control social and routine aspects of their lives so that those variables would not interfere with the experiment's results. Also, after the briefing, the subjects were asked to confirm their understanding of what was required on a premade consent form.

The study was conducted between May and July of 2016. The 17 subjects underwent an intensive physical training period that aimed to prepare them for the upcoming competitions. The main aspects that the training period was concern with were strength improvement, endurance and muscle fitness. All of these were intertwined with specific training for judo techniques. Overall this intensive and specific training period was a vigorous shock for the subject's physical performance.

For the measurements we've used the MGM-15 jumping carpet that offers data regarding the force-speed asymmetry and also the structural consistency of a subject's movement control. The carpet is used in the Miron Georgescu Modified Test that requires the subject to perform 1 set of 15 consecutive jumps on both legs, on left and on the right leg each. The data recorded is then analyzed by the instrument's software and final coefficients are offered.

We've conducted 2 measurements for the whole research. One was done before and one was after the physical training period. This schedule allowed us to identify as accurately as possible the effects of the training over the force-speed asymmetry.

The protocol for each measurement was as follows:

- The subjects were accommodated with the instrument;
- The subjects were informed with regards to the test's requirements;
- The subjects had 10-15 minutes for warm-up;
- The subjects could dry-test a few jumps;
- The subject started the test with 3 sets of 15 jumps (both feet (BF), right foot (RF), left foot (LF)) with 15 seconds pause between the sets.

We've focused our attention on one coefficient offered by the software: repetition speed. The repetition speed refers to the speed at which the subject can repeat a sport related technique on a loop. The value of the coefficient relates to the average value of the time spent on the ground and it offers data regarding the relation between force and speed. The quality and level of the speed for each subject is directly correlated to the value of the coefficient registered:

- High: speed values between 0.16-0.165 s;
- Average: normal speed values between 0.17-0.18 s;
- Very poor: speed values over 0.200 s.

The data we collected were analyzed using Excel Office software.

Results

A paired-samples t-test was conducted to compare the value of the initial repetition speed (V_{rep} at T1) and the value of the final repetition speed (V_{rep} at T2) for the judo athletes. There was no significant difference in the scores of the initial test and of the final test conditions no matter which indicator was tested. These results suggest that the training program the subjects undergone did not affect either positive or negative the repetition speed. (Table No. 1)

An independent t-test was conducted to compare the value of the repetition speed registered for each indicator (BF, RF, and LF) at the beginning and at the end of the study period. Significant statistical differences were observed for the pair BF-RF and BF-LF at both beginning and end of the study. (Table No. 1)

Table 1. Statistical analysis of the data for BF, RF and LF at the two measurement moments (T1 and T2).

Moment/ Indicator	Mean	Std. dev.	Min	Max	Statistical significance (p)				
T1	BF	0,18	0,0186	0,14	0,2	< 0,0001	BF-RF BF-LF RF-LF	1,67 x 10 ⁻¹¹ < 0,0001 0,6128	BF 0,1302 RF
	RF	0,27	0,0281	0,22	0,31				
	LF	0,27	0,0386	0,22	0,35				
T2	BF	0,19	0,0267	0,14	0,24	2,88 x 10⁻¹¹	BF-RF BF-LF RF-LF	2,1 x 10 ⁻¹⁰ 5,87 x 10 ⁻⁸ 0,2586	T1-T2 0,1387 PS 0,5791
	RF	0,28	0,0318	0,20	0,34				
	LF	0,27	0,0366	0,20	0,36				

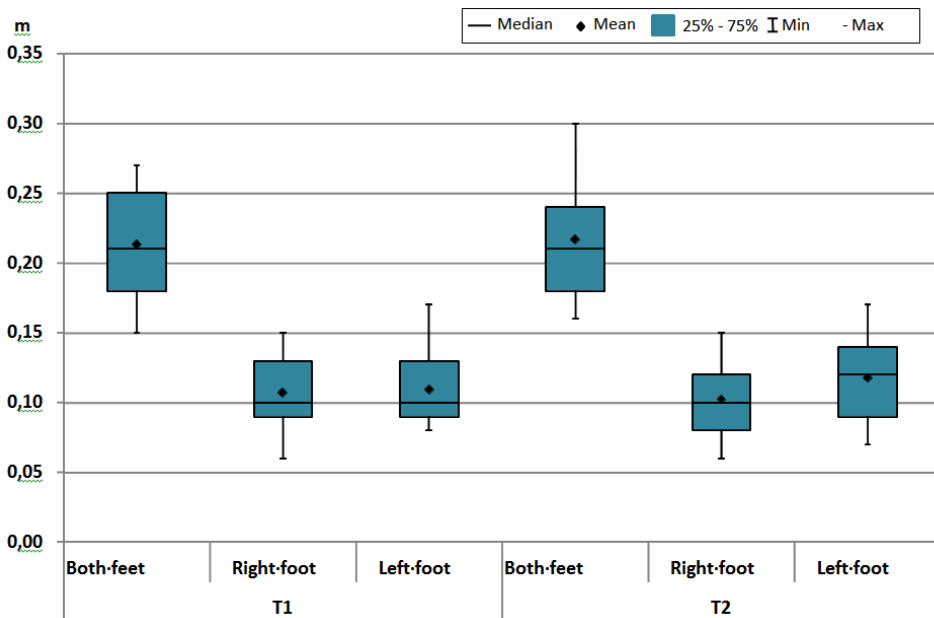


Fig. 1. Graphic representing the statistical results of the analysis of data

Discussion

An important aspect of this study that must be taken into account is the fact that the MGM-15 equipment offers a numeric value for the repetition speed of a subject without including the subject's technique specific to judo. The value for this index is raw due to the way the test is conducted. This study aimed to identify if this value can be affected by an intensive physical training. The value offered to us by the equipment does refer to the speed of repetition from a neuromuscular point of view, in other words it gives us the level at which the subject is able to perform a movement over and over again. This movement can be a judo technique or not. The study conducted by Almansba investigated the execution speed of judo athletes for a specific judo technique. Their study focused on the actual execution speed between different weight categories in judo. In the end they identified that there was an important factor that was discovered between the weight categories: the repetition speed of that particular technique. Our findings show that the actual repetition speed in judo may not be a major factor due to its raw origins. There might be many other more important factors such as actual muscle speed and not repetition speed that can determine the outcome of a judo competition.

Conclusions

One part of this study aimed at identifying if a specific physical training period influences the repetition speed of judo athletes. The lack of a statistical significance for any of the jump sets at the beginning and the end of the study may mean that the physical training period was not aiming to improve speed repetition its role being to improve the overall physical fitness of the athletes. Also, this result may suggest that the content of the training period might not be suited if the aim would be the increase in speed repetition.

On the other hand the fact that there is a significant difference between the data recorded for both feet and right foot and left foot at both the start and end of the study, suggests that both feet jumps offer a higher repetition speed than one foot ones.

REFERENCES

- Almansba, R., Franchini, E., Sterkowicz, S., Imamura, R. T., Calmet, M., Ahmadi, S. (2008) A comparative study of speed expressed by the number of throws between heavier and lighter categories in judo, *Science & Sports*, Volume 23, Issues 3-4, p. 186-188.
- Crnogorac, B., Mekić, A., Kajmović H. (2010) Deffects of basic preparation period at motor and functional abilities of Bosnia and Herzegovina female judokas *Homo Sporticus*, 1, pp. 17–20.
- Dudley G., Abraham W., Terjung R.. (1982) Influence of exercise intensity and duration on biochemical adaptations in skeletal muscle *J. Appl. Physiol*, 53(4), 844-850.
- Franchini, E., Del Vecchio, F.B .I, Matsushigue, K.A., Artioli G.G. (2011) Physiological profiles of elite judo athletes *Sports Med*, 41, pp. 147–166.
- Fukuda, D.H., Stout, J.R., Kendall, K.L., Smith, A.E., Wray, M.E., Hetrick, R.P. (2013) The effects of tournament preparation on anthropometric and sport-specific performance measures in youth judo athletes *J Strength Cond Res*, 27, pp. 331–339.
- Julio, U.F., Panissa, V.L.G., Miarka, B., Takito, M.Y., Franchini E. (2013) Home advantage in judo: a study of the world ranking list *J Sports Sci*, 31, pp. 212–218.
- Stojanovic, M., Ostojic, S., Patrick, D., Milosevic, Z. (2009) Physiological adaptations to 8-week precompetitive training period in elite female judokas *Med Sport*, 4, pp. 415–424.
- Trappe S, Harber M, Creer A, Gallagher P, Slivka D, Minchev K, Whitsett D., (2006) Single muscle fiber adaptations with marathon training, *J Appl Physiol*, 101: 721-727.

CORRELATIVE STUDY BETWEEN THE FAIR PLAY DISPLAYED IN COMPETITIONS AND THE ATHLETES' BEHAVIOUR

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ABSTRACT. Introduction. Fair play represents an ensemble of displayed moral qualities and attitudes, in order to perform sports activities in a climate favourable for sports performances, competition, supporters and athletes. Sport, by its purpose, represents the athletes' capacity of winning honestly, by respecting their opponents, teammates, supporters, etc. Education in the spirit of fair play is done by the coach in collaboration with the athlete, based on the moral knowledge and values taught by family and school. The athletes with an adequate level of fair play displayed in trainings and competitions determine a proper behaviour and an easier social integration, starting from the observation that "well-raised persons" are significantly easier to accept than persons situated at the other extreme, from the perspective of behaviour in this case. The objective of our investigation consists of identifying the correlations between fair play in competitions and fair play displayed in the society. The research methods used within the study were the method of bibliographic study, the observation method, the survey method, (within which we applied the questionnaire for fair play) and the SPSS method of analysis and interpreting the results. **Results and discussions.** Results have demonstrated that the athletes displaying fair play behaviour in competitions have proper behaviour, by respecting the moral norms and values imposed by the society. **Conclusions.** The study confirms that fair play conduct is based on the moral dimension that must be controlled and learnt (as the case may be) in trainings, competitions and in social relationships outside arenas and gymnasiums. Thus, the athlete will represent a model for young people, for the future athletes, and he will integrate easily in the society, both while practicing sport and mostly after wrapping up the sports career and integrating in various fields of activity.

Keywords: *Sport; fair play; competition; moral conduct; social integration*

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REZUMAT. Studiu corelativ dintre fair-play-ul manifestat în competiții și conduita sportivilor. Introducere. Fair-play-ul reprezintă un cumul de calități morale și atitudini manifestate, în vederea desfășurării activităților sportive într-un climat favorabil performanțelor sportive, competiției, suporterilor și sportivilor. Sportul, în funcție de finalitatea sa, reprezintă capacitatea sportivilor de a câștiga în mod cinstit, respectând adversarii, coechipierii, suporterii, etc. Educația în spiritul fair-play-ului se face de antrenor în colaborare cu sportivul, având la bază un fundament al cunoștințelor și valorilor morale din familie și din școală. Sportivii care dețin un nivel adecvat al fair-play-ului și îl manifestă în competiții și antrenamente, determină o conduită adecvată și o integrare socială mai bună și mai facilă pentru acesta, plecând de la considerentul că „oamenii binecrescuți” sunt mult mai ușor de acceptat decât cei care se află la polul opus, din punct de vedere al conduitei în acest caz. Obiectivului investigației noastre constă în identificarea corelațiilor dintre fair-play în competiții și fair-play-ul manifestat în societate. Metodele de cercetare utilizate în cadrul studiului au fost metoda studiului bibliografic, metoda observației, metoda anchetei în cadrul căreia am aplicat chestionarul pentru fair-play și metoda de analiza și interpretare a rezultatelor (SPSS). **Rezultate și discuții.** În urma rezultatelor s-a demonstrat că sportivii care manifestă o conduită fair-play în competiții, manifestă o conduită adecvată, respectând normele și valorile morale impuse de societate. **Concluzii.** Studiul confirmă că la baza unei conduite fair-play, sta o bună fundamentare a dimensiunii morale care trebuie să fie controlată și învățată (după caz) în antrenamente, competiții și în relațiile sociale dinafara stadioanelor și a sălilor de sport. Astfel, sportivul va reprezenta un model pentru tineri, pentru viitorii sportivi și se va integra cu ușurință în societate, atât pe parcursul practicării sportului cât, mai ales după încheierea carierei sportive și integrare în diverse domenii de activitate.

Cuvinte cheie: *Sport – fair-play – competiție - conduită morală - integrare socială*

Introduction

The issue of sports training made it necessary to systematize and interpret data on the practical, methodical, organizational and prospective aspects. Gradually, a set of knowledge, notions, concepts, principles, methods and rules specific to performance athletes was established. Hence, sporting training has become an instructive and educative process with particular physical and mental formative valences; its objective is to value the human aptitudes as much as possible in order to obtain sports performance, which involves high moral and intellectual features. The sports competition includes the behaviour of athletes and it embodies the biopsychosocial unit of the personality as an expression of the individual in competitive conditions.

Sport is an activity with social character; its institutionally organized unfolding brings us in the presence of others. Hence, it invites us to communication, interaction, thus determining us to develop social relating skills (sport is an important means of socialization), as well as specific attitudes. Sport is in theory an ideal activity for “training” social behaviour. It represents a defined social field, governed by relatively strict rules and by regulatory norms for sanctioning deviations and for punishing deviant behaviour. Unlike the acquisition of abstract rules in other fields, sport provides a learning method with more experiential, applicative focus.

The athlete's training must be understood as a preparation for life, not only for the sports branch practiced, because education is the action of forming the individual for himself, by developing a many-sided interest (Herbart, 1976). At the same time, education is integration: integration of life forces in the harmonious body function, integration of social aptitudes in order to adapt to groups, integration of spiritual energies, through the social and corporal being, for the complete development of individual personality (Hubert, 1965).

Moral conscience and conduct are acquired based on the continuity in forming moral notions, beliefs and behaviour, by respecting the action unit of emotional factors (school, family, cultural units), as well as the unity between the instructive and the educative process. The behavioural manifestations of the athlete during his training (practice, competitions, social life) reflect his level of education/ moral-volitional training. We refer here to the moral component within the fair play spirit of the athlete, to the perception and application of this concept promoted and supported by all competent bodies in the field. Research had underscored those athletes *exceeding* the average level display tenacity, responsibility, attitude stability and action. *Below* the average level, psychological manifestations include a narrow sphere of interests with a realistic, practical and formal character.

Sport and sports competition are submitted to the moral values of fair play, consisting of respect for the opponent, regardless of religion, ethnic group, race, political colour, etc. Moral education is understood as a passage from morals to morality, as an interiorization of moral norms, rules and – it involves not only a cognitive dimension, but also an affective and a practical dimension (Grigoraş, Stan, 1994). Hence, the optimization of the athlete's training process requires the transformation of training into a constructive process meant to ensure the continuity of its formation; it focuses on mobilizing and properly empowering human resources (Tüdös, 2000). Sports performance does not belong only to the strong, fast or skilful. Without strong will, perseverance, character strength, (i.e. without the moral qualities of personality) an athlete cannot become a champion; moreover, he cannot become a true athlete and a genuine human being.

Fair play represents a whole set of morals, a psychology, a code of unwritten, chivalrous and traditional laws and it constitutes a notion with multiple meanings; it expresses fair fight, observation of written and unwritten rules, respect for the opponent and sportsmanship. In the opinion of Țopescu, sport is not really sport without fair play. There are however factors that influence it negatively, such as the desire to win at all costs, the unleashed passion, the exacerbated prestige, the tendency of being surrounded by the worship aura, the fear of failure, the tempting perspective of material or other types of advantages. All of these aspects make sport turn towards wrong paths and athletes forget about the laws of morals, about the fact that one should be modest after winning and graceful after losing (Țopescu, 2003). The model of educated athlete is characterized by simplicity, modesty and balance. The first meaning of sport is sportsmanship. It accompanies the athlete throughout the active years on the arena and then over his lifetime.

Hemingway contended that sport teaches us how to win honestly and how to lose gracefully; sport teaches us life. But we do not always win. This is why a great athlete knows how to accept defeat with the head up. Beyond victory and participation, there is something more valuable from an ethical and philosophical perspective: the victory upon us.

At the other extreme, the British writer George Orwell wrote as early as in 1948, "Serious sport has nothing to do with fair play. It is bound up with hatred, jealousy, boastfulness, disregard of all rules." There are many examples in this respect. Let us examine the first-league player who aims near the goal, while the referee says it was a goal. His error can be corrected rapidly if the author admits his own fault, but he does not intend to do so. Another example is the array of athletes who choose all types of substance abuse to boost their exercise and focus capacity, to the detriment of athletes who compete in all honesty.

Years ago, the philosopher Hans Lenk and the sports sociologist Gunter A. Pilz noted that education in the spirit of fair play must not be neglected in a society that tends to become exclusively success-oriented. Education for fair play encourages people to learn how to be calmer and more relaxed, fairer. Most of the times, sport is like life. The painter Vincent Van Gogh said, *look for a glimpse of the sun without pushing the other into the shadow* (Hans-Albrecht Pfisterer, 6 / 2000).

Fair play means respecting the rules, giving up wrongfully obtained advantages, providing equal opportunities, displaying preventive behaviour, respecting the opponents and accepting the others. However, fair play as a fundamental sports and moral attitude is threatened nowadays – not only in sport, but also in other fields of social living. Notwithstanding, we must take into account that fair play provides genuine possibilities for a better orientation in a world full of competitive elements.

The objective of the study consists of identifying the correlations between fair play in competitions and fair play displayed in the society. This objective is meant to assess the instrument we have designed, by highlighting the possible correlations between the two subscales and between them and the fair play scale as a whole.

Hence, we propose here to demonstrate that *there is a direct correlation between the variables fair play in competitions and fair play in general, namely that a higher score for the dimension of fair play in competitions entails higher scores in the dimension of fair play in the society.*

Material and method

The research methods used within the study were the method of bibliographic study, the observation method, the survey method, (within which we applied the questionnaire for fair play) and the SPSS method of analysis and interpreting the results.

Research methodology

The research had an exploratory character and it began in February 2016 by collecting information regarding the elaboration and application of the fair play questionnaire; the research ended in August 2016. It was pre-tested on 60 subjects and subsequently applied to 150 subjects. The subjects were athletes, selected according to the following criteria: studies, gender, sports branch, age and sports ranking.

The fair play questionnaire is meant to measure the way athletes think and act in competitions and in social life from the perspective of the aforementioned concept of fair play. The questionnaire comprises a number of 28 items structured on two 14-item subscales: fair play in competitions and fair play in general. The subject chose a number within a five-point Likert scale, which showed the degree to which the subject agreed with that statement. The scoring is done for each subscale or for the scale as a whole, with the mention that some items are reversed.

While pre-testing this instrument on the same sample of 60 subjects, we obtained a 0.87 Cronbach's alpha coefficients of internal consistency overall, while 0.79 for *fair play in competitions* and 0.77 for *fair play in general*. Similarly, a test-retest correlation was not possible in order to assess the stability of results. Cronbach's alpha coefficients show good, high fidelity of the instruments, thus proving that the scale items measure various aspects of the same variables.

Results and discussions

The analysis and interpretation of results was conducted using the specialized psychological statistics software SPSS. Within the statistical analysis, we determined the bivariate Pearson's correlation between the variables fair play in competitions and fair play in the society, in general.

Table 1. Pearson's correlations between fair-play in competitions and general fair-play: descriptiv statistics.

Descriptive Statistics

	Mean	Std. Deviation	N
General fair play	107,8267	14,95665	150
Fair play in competitions	53,1733	9,00168	150

Table 2. Pearson's correlations between fair-play in competitions and general fair-play:correlations.

Correlations

		Fair-play general	Fair-play in competitii
Fair-play general	Pearson Correlation	1	,934 **
	Sig. (2-tailed)	,	,000
	N	150	150
Fair-play in competitii	Pearson Correlation	,934 **	1
	Sig. (2-tailed)	,000	,
	N	150	150

** . Correlation is significant at the 0.01 level (2-tailed).

In order to assess the hypothesis, we calculated the bivariate Pearson's correlation between the variable *fair play in competitions*, on one hand, and the variable *fair play in general*. The hypothesis was confirmed for the analyzed variables.

There is a direct significant positive correlation between the variables *fair play in competitions* and *fair play in general* ($r = 0.934$, $p = 0.000$). Namely, athletes with high fair play behaviour in competitions tend to have high fair play behaviour in general and the other way around, (athletes with low fair play behaviour in competitions tend to have low fair play behaviour in general).

Table 3. Bivariate Pearson's correlation between the variables
fair play in competitions and *fair play in general*

	<i>Fair play in general</i>
<i>Fair play in competitions</i>	N = 150 r = 0,934 p = 0,000

From a qualitative perspective, for the correlations found between the variables fair play in competitions and fair play in general, it can be stated that athletes displaying fair play behaviour in sports competitions will display the same type of behaviour in social life, too. The sports norms, rules and regulations, as well as social norms and social living rules mark the behaviour of athletes who interiorize them and behave according to the same spirit of fair play. It is equally true that when these rules and norms are respected to a lesser extent, the behaviour of athletes is less fair play than that of athletes who respect these rules and norms, both in competitions and in social life. The respect for the others, for the opponents and for the teammates, the acquisition and observation of game rules and social norms lead to the construction of sports conduct in the spirit of fair play, displayed in all life situations.

Conclusions

The correlations found between the variables fair play in competitions, fair play in the society and fair play in general allow us to state that athletes displaying fair play behaviour in sports competitions will display the same type of behaviour in social life, too. The sports norms, rules and regulations, as well as social norms and social living rules mark the behaviour of athletes interiorizing them and behave in the spirit of fair play.

The attitude and value related structures of personality are constituted within and based on the way an individual related to his environment and they are displayed in his activity and behaviour. The athlete's orientations towards moral values ensure the basis for displaying fair play behaviour regardless of the situation.

The athletes displaying high fair play spirit are more aware of their own feelings and they have a better consolidated sense of the Self. They live and perceive their own feeling of choice regarding their own behaviour, compared to athletes who display low fair play behaviour.

The interiorization of social norms and rules (related to sports and social living) determine the athletes to manifest more autonomous behaviour than those who only know about the existence of these norms and rules, (such behaviour originates in the individuals' intentionality, which is self-determined).

A sports education in the spirit of fair play leads to the construction of the athlete's autonomous personality, to the manifestation of their self-development capacity according to the spirit of fair play.

In sports, conducts determined by the sports branch regulation are learnt and imposed; subsequently, they become abilities and customs in the athlete's conduct, adapted to the moral training of athletes and to the reflection of this training in their conduct. The sports environment provides the possibility of finishing this type of education, thus contributing to a high extent to the construct of morality through the objective proposed – the development of human personality.

REFERENCES

- Grigoraș, I., Stan, L. (1994). Educația moral-civică (Formarea moralității și civismului). In A., Neculau, T., Cozma (Eds). *Psihopedagogie* (p. 70), Iași: Spiru Haret.
- Hans-Albrecht Pflasterer (2000). *Olympisches Feuer*, 6/2000, p. 30-31.
- Herbart, J.H. (1976). *Prelegeri pedagogice*, Bucharest: Didactic.
- Hubert, R. (1965). *Traité de pédagogie générale*, Paris: PUF.
- Tüdös, Șt. (2000). *Criterii psihologice în fundamentarea și structurarea pregătirii sportive*. Bucharest: Paideia.
- Țopescu, C. (2003). *Fair play*, p. 10, Bucharest: Humanitas.
- William H. Willimon & Thomas H. Naylor (1995). *The Abandoned Generation: Rethinking Higher Education* (William B. Eerdmans).
www.fairplayinternational.org/start.
www.psihologie.esential.ro/links.
www.thesportjournal.org/2004Journal/Vol7No3/bohnstedtMiller.asp.
www.tigger.uic.edu/MoralEd/articles.

GENDER DIFFERENCES IN TECHNICAL FEATURES OF ELITE JUNIOR TENNIS PLAYERS AND IN THE TECHNOLOGICAL CHARACTERISTICS OF THEIR RACKETS

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ABSTRACT. Introduction: The more precise observation of tennis players is essential to reach the best competitive performance in junior level as well. **Objective:** The aim of the research was to test the hypothesis that the majority of elite junior tennis players are right-handed and most of them use the two-handed backhand stroke and modern forehand and backhand grips. Furthermore the technical characteristics of the rackets used well reflect the differences in gender. **Method:** 40 elite male (15.92 age) and 40 elite female (16.34 age) tennis players participated in our research. Testing was carried out with calibrated means and equipment based on standard protocols. **Results:** 92.5% of the males and 95% of the females are right-handed. 65% of the females and 72.5% of the males use the modern semi-western forehand grip. As far as backhand groundstrokes are concerned, the frequency of the two-handed backhand stroke is 95% for females and 80% for males. 40% of the males and females used the modern two-handed backhand grip. The males used a significantly longer and heavier racket of greater swing weight than the females ($p < 0.05$). On the other hand, females tennis players used a significantly bigger head size with a stiffer and wider frame racket than the males ($p < 0.05$). **Conclusions:** The results draw attention to that the dominant arm, grips, backhand type and used rackets' characteristic give useful information for the trends in the preparation of the elite junior tennis players.

Key words: tennis, dominant and non-dominant hand, grip, backhand stroke, technological changes

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Introduction – Objective

Elite junior tennis players have to play against excellently-trained opponents who are increasing in number both at the national and international levels. Thanks to modern equipment, court surfaces and modern training methods, play is becoming faster in the junior level as well. Furthermore, one can talk about a whole-year competition period already at the junior level, not to mention the fact that these age-category players will provide the future generation of tennis players. To have a better competition performance, more precise observation and preparation is essential, part of which consists of gathering data and analysing the dominant hand, different racket grips, technical elements, height of the player and technical characteristics of the racket used.

Smooth, powerful and accurate strokes are based on proper racket grips (Levey, 2005, 2012). This is especially true for the junior tennis players. The racket grip has an effect on the angle of the racket surface at the contact point, thus influencing the speed of the ball, its spin and direction. The selection of a proper racket grip is difficult as certain racket grips are more favourable than other ones in terms of different technical elements and game situations (Levey, 2005, 2012). Furthermore, the dominant hand (the more skilful one) has an influence on the technical, tactical and conditional preparation of the junior tennis player as well as on the formation of his/her game style. Modern rackets are lighter, have a wider frame, have bigger heads size, are stiffer and have longer duration than the older, wooden and metal rackets (Bolettieri, 2001; Dobos, 2013; Crespo & Reid, 2009; Miller & Cross, 2003). These technological changes have revolutionised changes in stroke technique, even at the junior level. Modern grips (semi-western, western grip), footworks (split-step, gravity step), new hitting stances (open, half-open), the two-handed backhand stroke, and faster spins and strokes have appeared. As a result of these, the trends in preparing elite junior players have gone through great changes.

The role of height is also not negligible in junior tennis, but there are some other significant factors of successful performance. It is obvious that taller players have longer arm extension than their partners. Taller professional tennis players have much better biomechanical conditions for faster service speed than their shorter partners (Martin, Kulpa, Delamarche & Bideau, 2013). Furthermore, in professional players a significant relationship can be observed between height and the average speed of the first and second serves (Cross & Pollard, 2009; Vaverka & Cernosek, 2013, 2016). In our opinion these facts are true for junior tennis players as well, thus, their height provides an advantage, mainly in the longer extension of the arm. Height also has an effect on racket selection, playing style and player footwork.

Based on all these, the aim of this research is to examine the hypothesis, according to which the majority of the under-16 and -18 elite junior Hungarian tennis players are right-handed, most of them apply modern forehand and backhand grips, a majority of them use two-handed backhand strokes, the males are generally taller, and the technological characteristics of their rackets well reflect the difference in gender. A further aim of this study is to help in the more effective preparation of junior tennis players based on the information obtained.

Methods

Participants

The best Hungarian tennis players from the under-16 and -18 age group (the first 40 players) participated in the research. The stratified random sampling method was used; 20 boys and 20 girls from each age category were tested (altogether, 80 people). In addition, 30% of the investigated tennis players had ETA or ITF rankings besides the Hungarian one, and 10% were among the top hundred. The selected sample represented the total male and female population of the best Hungarian under-16 and -18 age-category tennis players: they had 3-7 years of competition experience and played 40-90 stake matches a year on average. From the point of view of the research, two groups were formed: 1) male tennis players; 2) female tennis players. Their average chronological age was: 15.92 and 16.34, respectively, for the males and females.

The ethical norms (Harriss & Atkinson, 2011) of the research were in harmony with the principles formulated in the Helsinki declaration. Also, professional-ethical permission was granted for the research (7878/2014), issued by the Public Health Organization of the Budapest Government Office.

Experimental procedures

The determination of the subjects' calendar age, height and racket grip and the main parameters of their rackets were carried out based on a standard protocol (Mészáros, 1990a,b; Levey, 2005, 2012; Bollettieri, 2001).

Examined variables

The dominant hand: is the more skilled upper extremity of tennis players which holds the racket and drives it during the different executions of the stroke.

Racket grip: position of the hand of the player on the grip.

One-handed backhand groundstroke: this is the technical element which is initiated with one hand from the left side of the body (in the case of a right-handed player), and after contact the ball finishes on the right side of the body.

Two-handed backhand groundstroke: this is the technical element which is launched with two hands from the left side of the body (in the case of a right-handed player) and finishes on the right side of the body after contact with the ball.

Height: (m): This is the difference between the plane of the sole and the highest point of the top of the head in metres (Mészáros, 1990a).

Parameters of the racket used:

Weight (g): full mass of the racket without the strings in grams.

Length (cm): distance between the two ends of the racket in cm.

Stiffness (RA): is the number that shows to what extent the racket bends as a result of the given force (Bollettieri, 2001).

Swing weight (kg·cm²): character of the racket manifested in the dynamic movement of the racket, which is nothing more than the manoeuvrability of the racket.

Head size (cm²): size of the racket's head in cm²

Frame beam (mm): Thickness of the outer edge of the racket in mm.

Statistical analyses

First, the dispersion of the data was carried out with an investigation of the statistical data, during which the Shapiro-Wilk-W test was used. The data did not meet the demands of normal dispersion, thus, height and the basic statistical indices of the main parameters of the racket used were given by the median and quartile range. The non-parametric Mann-Whitney U test was applied in examining the difference in gender. The significance level was determined at value $p < 0.05$.

The frequency of grips, the type of backhand stroke, the dominant (hitting arm) and non-dominant hand were given as a percentage with the percentile value. The statistical analysis was carried out with SPSS 12.0 software.

Results

92.5% of the males were right-handed, and 7.5% were left-handed. For females, the number of right-handed players was 95%, with 5% being left-handed (Figure 1). 65% of elite junior female tennis players used the semi-western grip, with 35% using the eastern forehand grip for the forehand groundstroke. In the case of males it was 72.5% for the semi-western, 25% for the eastern forehand and 2.5 % for the western forehand grip (Figure 2). As far as the backhand

strokes are concerned, the frequency of the two-handed backhand groundstroke was 95% for the females and 80% for the males. 5% of the females and 20% of the males used a one-hand groundstroke (Figure 3). 55% of the females used the so-called traditional grip, and 40% of the females used the modern two-handed backhand grip in executing backhand groundstrokes. The rate of the traditional and that of the modern two-handed backhand grip was 37.5% and 40%, respectively, in males. Another 2.5% used the extreme two-handed grip. 17.5% of the males used the one-handed eastern grip, and 2.5% used the one-handed semi-western grip, while 2.5% of the females used the eastern grip and 2.5%, the semi-western one-handed backhand grip (Figure 4).

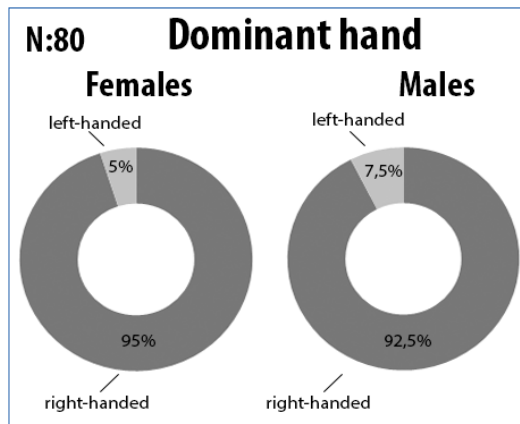


Figure 1. Frequency of dominant and non-dominant hand in elite junior tennis players

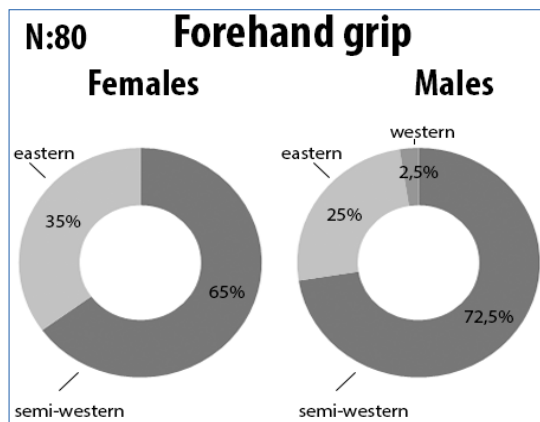


Figure 2. Frequency of forehand grip in elite junior tennis players

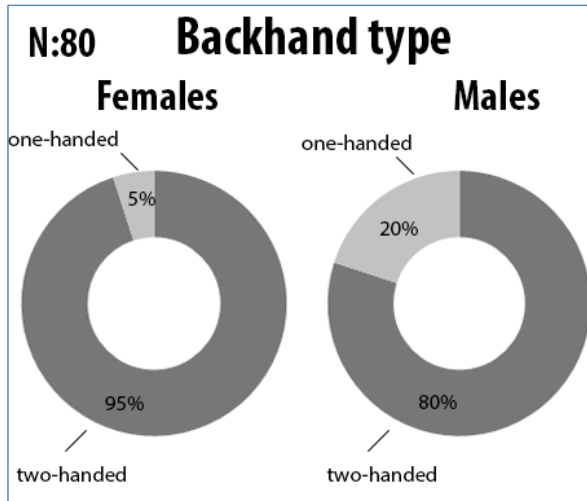


Figure 3. Frequency of backhand stroke in elite junior tennis players

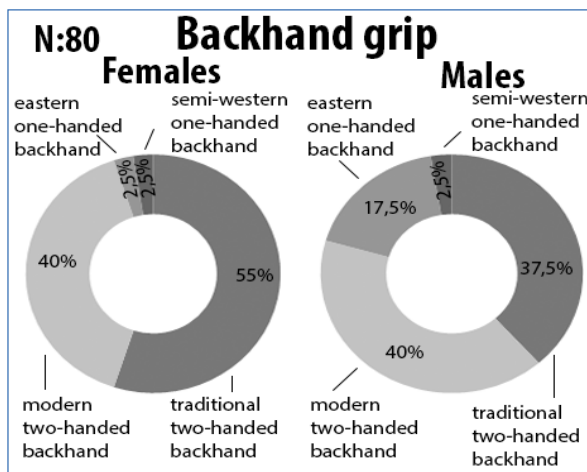


Figure 4. Frequency of backhand grip in elite junior tennis players

The males used significantly longer and heavier rackets of greater swing weight compared to the females ($p < 0.05$). The females used a racket with a significantly larger head size with a stiffer and thicker frame compared to the males ($p < 0.05$) (Table 1). Male tennis players were significantly taller than the females ($p < 0.05$) (Table 1).

Table 1. Basic statistics and differences of used tennis racket and body height in elite junior tennis players. N:80

Variables	Males N:40		Females N:40	
	Median	Quartile Range	Median	Quartile Range
Weight (g)	305.00*	20.00	295.00	10.5
Length (cm)	69.00*	0.42	68.58	0.5
Stiffness (RA)	64.00*	6.00	68.00	11.00
Swing weight (kg·cm ²)	320.00*	12.50	312.50	11.00
Head size (cm ²)	632.00*	15.00	645.00	0.00
Frame beam (mm)	21.41*	0.75	23.66	2.33
Body height (cm)	177.70*	7.9	168.80	9.08

Asterisks indicates significant differences $p < 0.05^*$.

Discussion

Importance of dominant hand and gender differences of its frequency (percentage)

The majority of the tested elite junior tennis players are right-handed (males 92,5%, females 95%). The frequency of left-handed players is insignificant (males 7,5%, females 5%). According to TE, ITF, ATP and WTA official websites the right-handed dominance can be observed in the best junior and professional (best 40) players in the world. The percentages males, 87.5%; and females 95% in the case of professional men it is 80% and for women, 85%.

It can be seen from the data that the percentage frequency of the right-handed players is significantly higher than that of the left-handed ones in both genders, thus, the tennis players play many more matches against the right-handed partners both at the junior and professional levels. So the majority of professional and junior tennis players have more match experience, technical preparedness, tactical plans and repertoires when playing against right-handed players. These mean a kind of advantage for left-handed players. We think this statement is true for the tested elite junior tennis players as well.

Importance of forehand grip and gender differences of its frequency (percentage)

The dominance of the semi-western racket grip can be observed by comparing the frequency of the eastern and western grip in the elite junior males and females tennis players (males, 72.5%; females, 65%). The semi-western forehand grip ensures faster spin and greater control of the execution of spin of forehand groundstrokes and lobs compared to the eastern forehand grip. Furthermore, it can be applied in handling the flat, slightly spinned finishing and defensive forehand stroke, as well as in the case of high-bouncing balls. The highest spin can be generated with the western handgrip (Levey, 2005, 2012). According to our opinion the majority of the tested junior players of both genders possess the modern forehand technique and good physical condition, allowing them to give a spin to the ball while considering the speed as well. The complete lack of western grip use in females can be found in only 2.5% of the males. But it shows that the examined elite junior tennis players hardly or very rarely use high-rising forceful spins. Regarding the eastern forehand grip, 25% of the males and 35% of the females play flat balls with less spin which result from this type of grip.

Backhand strokes and their importance and percentage frequency in different genders

In analysing the frequency of backhand strokes of elite junior male and female tennis players, the considerable dominance of the two-handed backhand stroke can be observed (males, 80%; females, 95%). The frequency of the one-handed backhand stroke was 20% for the males and only 5% for the females. In comparison, according to ETA, ITF, ATP and WTA official websites 95% of elite junior male tennis players (the best 40) and 98% of the females use two-handed backhand strokes 75% of the best male professional tennis players and 90% of the women use a two-handed backhand stroke. The measured data in this research reinforces the international trend which shows a drastic pushing forward of the two-handed backhand stroke in both genders.

During play junior tennis players are able to generate faster and more spinned balls thanks to modern handgrips and equipment. So it is a basic requirement for the players to have such a backhand stroke with which they can handle and generate these faster and more spinned balls. Based on the observations, this double requirement can be fulfilled much easier with the use of the two-handed backhand stroke. The majority of the tested junior players use the two-handed backhand stroke in both genders.

The swing radius of the racket is shorter in a two-handed backhand stroke than in the one-handed one, so the time elapsed between the swing and the contact point is shorter (0.09s) for the former than the latter (0.13s) (Reid, 2001; Reid &

Elliott, 2002). The short backswing makes for easier timing, better control, shorter preparation of the racket and better hiding of the stroke (Reid, 2001). The spin of the two-handed backhand stroke demands less physically and coordination-wise of the tennis player, as the less skilful arm can aid the horizontal and vertical movement of the racket at the contact point. This stroke provides a huge advantage in handling the high-bouncing ball (up to shoulder level) and can ease the handling of balls rising to different heights as well. In the early phases of the teaching-learning process, the two-handed backhand stroke creates less of a challenge in terms of coordination (two hands aid the execution of the stroke), thus learning the basics requires a shorter time. The biomechanical characteristics make the execution possible from various hitting stances. The vibration resulting from the contact point is divided between the two upper extremities in the case of a two-handed backhand stroke, thus decreasing the load on one arm (Elliott, 2003). Tennis elbow in players using the two-handed backhand stroke is less frequent than for players using the one-handed stroke (Roetert, Brody, Dillman, Groppel & Schultheis, 1995).

The one-handed backhand stroke ensures a longer path to the speeding up of the racket. Its contact point is about 20-30 cm ahead, and its distance of extension is greater than that of the two-handed backhand stroke (Reid, 2001). Thus, the reaching and handling of balls hit with the one-handed backhand stroke and bouncing outward can be well solved. Furthermore, the hit does not force the player to hit the ball with spin. The execution of hitting the backhand volley with one hand is not a problem for the player either. It ensures an easier adjustment to the racket grip while running to the net.

Importance of backhand grip and gender differences of its frequency (percentage)

Regarding the two-handed backhand grip, it can be observed that a greater percentage of elite girl tennis players (55%) apply the traditional racket hold instead of the modern one (40%). The percentage of two-handed backhand grip for the males is more equal (traditional, 37.5%; modern, 40%). Of the males, 2.5% used the extreme two-handed grip. The modern two-handed backhand grip (when the dominant hand holds the racket with the eastern backhand grip and the non-dominant hand with eastern or semi-western grip) places the wrist of the dominant and non-dominant arm in such a position that players are aided in generating greater spin than with the traditional backhand grip, without placing a huge load on the wrist of the dominant arm. The handling of high balls is also more comfortable with it. On the other hand, the traditional two-handed backhand grip (when the dominant hand holds the racket with the continental and the non-dominant hand with the eastern or semi-western grip) places a huge load on the dominant arm. It is true that low-bouncing balls are more comfortable to

hit with this grip, which is why a great percentage of the tested players use the modern two-handed backhand stroke. But the use of the traditional two-handed backhand stroke is more significant with the females, although it is not negligible with the males either (females, 55%; males, 37.5%). The reason can be found in the freer movement of the wrist of the dominant arm.

In studying the one-handed backhand stroke of elite junior tennis players, it can be said that a great majority of the males (17.5%) use the eastern grip compared to the semi-western one (2.5%). Use of either the eastern or the semi-western one-handed grip is insignificant with the females (2.5%; 2.5%). The data show that 17.5% of the males use a one-handed backhand grip, allowing the ball to be well spun while considering the speed of the ball as well. A negligible percentage (2.5%) uses the semi-western one-handed backhand grip. As a result of the application of higher trajectory, stronger one-handed backhand spins in the tested group are minimal. Furthermore, we think that only 5% of the tested elite girl tennis players have the kind of training orientation and tactical preparedness and such conditional and coordination abilities which allow one-handed backhand strokes to be applied steadily with the proper effectiveness. Thus, the use of the one-handed backhand grip is insignificant among them.

Differences in gender in the features of the racket used and body height (Table 2)

In analysing the median values of the rackets used, it can be said that the tested elite junior male tennis players used medium-weight (305 g) and medium stiff (64 RA) rackets of normal length (69 cm), a medium head (632 cm²) and relatively high swing weight (320 kg·cm²). These rackets were significantly longer, heavier, have greater swing weight, a smaller head size, a narrower frame and were more flexible than those used by the females. In addition, the males were significantly taller as well. This is why we think that male tennis players, due to their higher level physical abilities, are also able to speed up the heavier and longer rackets properly. Therefore, they are able to reach a greater hitting force, return and receive balls arriving further from the body, have higher contact points at the serves and cover a greater area both on the baseline and at the net than the females. Furthermore according to our opinion the greater swing weight, smaller head, and narrower frame of the racket can show that male tennis players have special coordination features besides their physical abilities which allow them to manoeuvre the tennis racket properly and the more flexible frame ensures a better control and spin of the ball.

The elite females tennis players used medium weight (295 g), normal length (68.58 cm), specifically stiff (68 RA) rackets of a wider frame (23.66) and medium head (645 cm²). Its swing weight (312 kg·cm²) registered a medium

value. These rackets were significantly lighter, stiffer, have a bigger head, a wider frame and a smaller swing weight compared to those used by males. Besides these, their height was significantly shorter compared to the males. According to the author, the technical variables of the rackets used reflect the lower level physical abilities and anthropometric specialities of the female players. This is why they play with wider rackets with a bigger head and thicker frame, which increase the resistance of the racket head rotating along the longitudinal axis. Furthermore, the racket with a larger head ensures a larger sweet spot. All these help them in better controlling the ball and in the execution of successful strokes. The use of a stiffer racket also aids the females in creating a greater hitting force. This way enough ball speed can be obtained with a shorter swing, allowing the return of balls in case of a bad contact point (hits contacting the ball with the edge of the racket). The lighter rackets of smaller swing weight can be well-speeded up.

Finally we think that the shorter extension distance deriving from their lower body height and a shorter racket, the females use a different kind of footwork and playing style than the males. The use of a stiffer racket puts a greater load on their arm, and the controlling and spinning of the ball with a stiffer racket is more difficult for them, but this disadvantage can be compensated for by decreasing the firmness of the strings and using shorter and lighter tennis racket with larger head size.

Conclusions

In conclusion it can be said that the data draw attention to the following facts: the majority of the tested junior elite tennis players are right-handed, play with arched, proper and fast balls with normal spin as a result of modern rackets, modern grips and use the two-handed backhand, which basically determine the trends in the preparation of the players. In addition, gender differences – which are of key importance – also have to be considered in terms of preparation.

REFERENCES

- Bollettieri, N. (2001). *Tennis handbook*. (2nd ed.). Champaign: Human Kinetics.
- Crespo, M., & Reid, M. (2009). *Coaching beginner and intermediate tennis players*. London: International Tennis Federation.
- Cross, R., & Pollard, G. (2009). Grand Slam men's singles tennis 1991-2009 Serve speeds and other related data. *The ITF Coaching & Sport Science Review*, 16, 8-10.

- Dobos, K. (2013). Ideas about some factors determining the performance in modern tennis. *Magyar Sportudományi Szemle*, 14, 19-24.
- Elliott, B. (2003). The development of racquet speed. In B. Elliott, M. Reid, & M. Crespo (Ed.), *Biomechanics of Advanced Tennis* (pp. 33-70). London: International Tennis Federation.
- Emirates ATP ranking (2016 December). Retrieved from:
<http://www.atpworldtour.com/en/rankings/singles>.
- Harriss, D.J., & Atkinson, G. (2011). Ethical standard in sport and exercise science research. *International Journal of Sports Medicine*, 32, 819-821. doi: 10.1055/s-0033-1358756
- ITF junior rankings (2016 December). Retrieved from:
<http://www.itftennis.com/juniors/rankings/player-rankings.aspx>.
- Levey, J. (2005). A grip on your game. *Tennis*, 3, 52-57.
- Levey, J. (2012 August). A grip on your game. Retrieved from:
<http://www.tennis.com/your-game/2012/08/grip-guide-your-game/3775/#vyHplzEpoRO>.
- Martin, C., Kulpa, R., Delamarche, P., & Bideau, B. (2013). Professional tennis players' serve: Correlation between segmental angular momentums and ball velocity. *Sports Biomechanics*, 12, 2-14. doi:10.1080/14763141.2012.734321
- Mészáros, J. (1990a). A fontosabb testméretek és az alkalmazott mérőeszközök. In J. Mészáros (Ed.), *A gyermeksport biológiai alapjai* [Biological basis of child sport. In Hungarian.] (pp.38-45). Budapest: Testnevelési Egyetem.
- Mészáros, J. (1990b). Az életkor. In J. Mészáros (Ed.), *A gyermeksport biológiai alapjai* [Biological basis of child sport. In Hungarian.] (pp. 49-68). Budapest: Testnevelési Egyetem.
- Miller, S., & Cross, R. (2003). Equipment and advanced performance. In B. Elliot, M. Reid, & M. Crespo (Ed.), *Biomechanics of Advanced Tennis* (pp.179-200). London: International Tennis Federation.
- Reid, M. (2001). Biomechanics of the one and two handed backhands. *The ITF Coaching & Sport Science Review*, 9, 8-10.
- Reid, M., & Elliott, B. (2002). The one and two-handed backhands in tennis. *Sports Biomechanics*, 1, 47-68. doi:10.1080/14763140208522786
- Roetert, E.P., Brody, H., Dillman, C.J., Groppe, J.L., & Schultheis, J.M. (1995). The biomechanics of tennis elbow. An integrated approach. *Clinics in Sport Medicine*, 14, 47-57.
- Tennis Europe Ranking (2016 December). Retrieved from:
<http://te.tournamentsoftware.com/ranking/ranking.aspx?rid=79>
- Vaverka, F., & Cernosek, M. (2013). Association between body height and serve speed in elite tennis players. *Sports Biomechanics*, 12, 30-37. doi:10.1080/14763141.2012.670664
- Vaverka, F., & Cernosek, M. (2016). Quantitative assessment of the serve speed in tennis. *Sports Biomechanics*, 15, 48-60. doi:10.1080/14763141.2015.1123763
- Women's WTA tennis rankings (2016 December). Retrieved from:
<http://www.wtatennis.com/rankings>.

STUDY ON IMPROVING THE QUALITY OF DRIVING SKILL BY SIXTH GRADE STUDENTS

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ABSTRACT. Quality motric skill has a complex content because of the relationship they have with other driving qualities and the skills and driving skills. Any voluntary motric action, regardless of the degree of difficulty to be performed requires a certain level of skill and some coordination at the level of the cerebral cortex. The topic discussed is current being the object of study for many specialists of this domain thanks to its importance in getting the performance at any level. Starting from the premise that the sports activity becomes component of daily activities, practicing base appropriation physical exercise are in the organized framework. In the educational process increasingly requesting physical education lesson creative thinking of students, so as to build their capacity to operate with driving actions learned and apply appropriate measures in certain driving situations. Learning and applying skills and driving skills in practice broaden the horizons of knowledge of students from point of view motric. Students become more skilled, more agile and more resistant to easily resolve difficulties that arise in practice. Motor basic education in general and particularly Aimed at skill development of school tasks not so immediate, and especially Subsequent Their use in diversity activities.

Keywords: *development, gymnasium, skill*

REZUMAT. Studiu privind îmbunătățirea îndemânării la elevii de clasa a VI-a. Îndemânarea este o calitate motrică complexă, având profunde interferențe atât cu celelalte calități motrice, cât și cu priceperile și deprinderile motrice. Orice acțiune motrică voluntară, indiferent de gradul de dificultate, pentru a putea fi efectuată necesită un anumit nivel de îndemânare și o anumită coordonare la nivelul scoarței cerebrale. Tema abordată este de actualitate fiind obiect de studiu pentru mulți specialiști ai domeniului datorită importanței ei în obținerea performanțelor la orice nivel. Plecând de la premisa că activitatea sportivă devine componentă a activității cotidiene, baza însușirii practicării exercițiului fizic se

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află în cadru organizat. În procesul instructiv-educativ lecția de educație fizică solicită permanent gândirea creatoare a elevilor, în așa fel încât să le formeze acestora capacitatea de a opera cu acțiunile motrice însușite și de a aplica acte motrice potrivite în anumite situații concrete. Învățarea și aplicarea deprinderilor și priceperilor motrice în practică lărgeste orizontul cunoașterii al elevilor din punct de vedere motric. Elevii devin mai îndemânatici, mai agili și mai rezistenți în rezolvarea cu ușurință a dificultăților ce apar în activitatea practică. Educarea calităților motrice de bază în general și a îndemnării în special vizează nu atât realizarea unor sarcini școlare imediate, cât mai ales utilizarea lor în diversitatea activităților ulterioare.

Cuvinte cheie: *dezvoltare, gimnaziu, îndemânare*

Introduction

Driving skills are directly influenced by the individual's physical and mental condition. These are qualities of the human body with native character whose level depends on the initial manifestation of hereditary genetic background.

One aspect that should be considered in the methodology of teaching physical education is the inter-school skills and motor skills. Such skills cannot improve without input qualities, even as the driving qualities cannot develop without increasing the level of implementation of driving skills.

In the educational process physical education class requesting that creative thinking of students, so as to build their capacity to operate with driving actions learned and apply appropriate measures in certain driving situations.

The opportunity to address this issue is justified by the fact that literature is demonstrated applicability and transfer to the specialized area of practice different sports branches.

Motor ability is central because its development at various specific levels is a fundamental criterion for assessing the effectiveness of the educational process.

“Qualities or skills driving movements in general are an interesting topic for specialists, knowing their role in the ability and motor performance of man” (Dragnea, Bota, 1999).

Quality skill as coordinative capacity is characterized by the sharpest expression of the importance of higher nervous segments in making any voluntary movement, represented by superior quality indices.

The psychometric quality of this quality is the most discussed. In the literature (Cârstea, Tudor, Bota, Sasu, 1995), the skill can also be seen as the coordinative quality is determined by the processes driving directions and

control gestures. It provides the individual the opportunity to coordinate the movements safely, with minimal energy consumption, the possible situations and unusual, to learn relatively quickly sporting gestures.

Starting from the idea that skills means better coordination of the entire body motility, it received very broad and undifferentiated. Attempts to join her prowess or mobility component as a second choice were able to impose partial. Fetz cited Pehoiu, Sabau, Sabau (2001), believes that in parallel we tried assigning notions of coordination and quality coordination similar meaning.

Answering the question, what is coordination? This is the qualitative Psychomotricity, being a multidimensional complex phenomenon, involving many systems aim to solve an optimal control of the movement. The main determinant of sensorimotor-motor coordination is to structure appropriate time, directions and amplitudes, pulse spatial precise dosages.

Skill even if there is no movement is felt in simple but complex structures that require fast driving in the time-space orientation and a way to prompt execution.

There is practically no basic motor skill, or specific utility, without requiring a modicum of skill to be performed rational, economic, and coordinated in the direction intended purpose.

Skill acquisition and improvement of skills driving conditions, ensuring their applicability in the most varied conditions and helps the individual to adapt easily to the constant change of the means used in physical education class. Once formed, the driving skills allow movements to be performed with precision, smoothness and economy of effort, and while perfecting the skill. Consolidation, however, is automated and skills cannot significantly influence skills.

The difficulty of driving action to be performed depends on coordination arrangements in the alleged execution of movements, such as symmetric or asymmetric coordination, coordination of simultaneous or sequential and coordination of two or more segments. In acknowledging the temporary disparity between body segments differences students in performing driving actions there is a clumsily. However availability for skill development is increased when this quality is accompanied by a sense of orientation in space and locomotion development.

In the education process of skill development are given exercises the student to solve unexpected situations using rapid movements, agile and efficient.

Fine motor skills are addressed in quality physical education class and school sports as the theme to link called "developing motor skills or skill speed" after link fearless "selective is influencing the musculoskeletal system." It will always be addressed first lesson theme and a topic addressing skill and speed as the same lesson is not possible.

During a school year can be programmed and skills addressed in any period or semester whether working indoors or outdoors.

Skill, like other driving skills cannot be claimed by any sports games or the gym nor any other branch or sporting events set by the syllabus. This quality, like the others, generally belongs to everyone, but anyone in particular (Cârstea et al., 1995).

Research methods

To conduct this research we started from the following hypothesis: Using games and paths applied in physical education class in middle school contributes to the development of quality driving skills.

Research methods used in this research:

- bibliographical documentation method;
- method experiment;
- observation method;
- statistical and mathematical method;
- graphics method.

The research was conducted at the school no. 11 of Targoviste, in the sixth grade of A, a mixed sample of 24 subjects. Physical education classes were held in the gym and on the sports field inside the school, outdoors.

The experiment debuted in January 2015 when initial testing took place and ended in the month of June 2015 with conducting final testing.

During the experiment in physical education lessons they were used means proposed by us to improve the quality driving skills.

Quality testing driving skills test was performed by applying a literature (Sabau, Sabau, Pehoiu, 2001), because in addition to assessing and valuing complex ability to move by observation method should be during the execution of a measure used for data movement.

The test consists of negotiating a route that contains 12 stations and measuring 25m in length.

The route has been arranged as follows:

Stations 1-2: the starting line running on the distance of 2 m, starting at beep ball's up to the medicinal; is appreciated the speed at which sound stimulus and the ability to orient in space.

Station 3: Running student running around the ball medicines; determining the ability of orientation in space.

Station 4: consists in undertaking a rolling before the squat squatting on a mattress gymnastics; determining the ability of differentiation and orientation in space.

Station 5: the student performs a jump over a box crate gym in the direction of travel; it evaluated the ability of differentiation.

Station 6: student raises handball ball resting on the floor and threw on target from a distance of 3m by gymnastics circle, suspended at a height of 2 m; it evaluated the ability of differentiation and orientation in space.

Station 7: Running the student performs circumventing a sign written on the floor; targeting ability is appreciated in space travel in changing conditions.

Station 8: the student performs a crawl through a box crate gym; verified differentiation capacity;

Station 9: after working the previous station, the student stood up and running, from running, jump on the crate gym whose height is 1,10 m; is determined capacity expansion and differentiation;

Station 10: is still running on the box running the gym, followed by descent by jumping on it; checked force support, balance and ability to differentiate;

Station 11: running to the finish line; it is estimated acceleration capability.

Students argued sample for each test twice, and was rated the best result.

During the research were used as paths and motion gaming applications (1, 2, 4) that have focused on skill development and we describe below:

Route 1. Venue: physical education room or outdoor field; Materials needed: Crate gymnasium, two mattresses. Description: Running 3 m and crate climbing gym; jump ball landing on the mat; Running 4 m and jumping over a partner located in the squat; landing and rolling before the squat squatting on the second mattress; Running 3m. And jumping over three successive crate boxes placed transversely to the direction of the route, parallel and equally spaced; Running 5 m to finish; the best time wins.

Route 2. Venue: hall of physical education and sport; Materials needed: Crate gymnasium, three banks gym. Description: Running 3 m; passage lying face two banks gym and adjacent side creeping along the length thereof; crate climbing gym and slept passage facial gymnastics bench inclined by fixing one end of the box; dragging on this sloping tract arms to end fixed on the ground; lying transverse to the direction of forward and side rolls 3m to a line on the ground; crossing the dorsal and lying about 6m away. Shift face up only hands and feet to the finish line.

Route 3. Place: physical education room or outdoor field; Materials needed: two mattresses two 2 kg medicine ball. Two milestones. Description: Rolling forward the squat; Running 5 m; turning 180 degrees; Running 5m. with the back; turning 180 degrees; driving the ball on a line on the ground by successive touches with his right hand 5 m; Running 3 m to pole; Rod bypass; Running 3 m back; driving the ball with the other hand; Running up to the finish line.

Route 4. Place: physical education room; Materials needed: a medicine ball; two gym mats; a case of gymnastics; a circle of gymnastics; a ball handball; pole height. Description: from the starting line running on the distance of 2m, starting at beep ball's up to the medicinal; Running student running around the ball medicines; performing a rolling before the squat squatting on a mattress gymnastics; jump over a box crate gym in the direction of travel; Handball lifting the ball resting on the floor and throw on target from a distance of 3m by gymnastics circle, suspended at a height of 2 m; Running student performs circumventing a sign written on the floor; crawling through a box crate gym; of running, gymnastics jump on the crate whose height is 1,10 m; Running on chest gym, followed by descent by jumping on it; Running up to the finish line.

“Sowing and harvesting potatoes”

Mark the starting line and 15 m are drawn four rounds for each team. The whole team is divided into four equal teams willing column, one behind the starting line, having placed at the starting line four balls or other objects. At the signal, the first student from each team raises balls and they planted in circles located in front of the team to 15 m, then turn around and touch the palm next student on the team that will travel and collect balls planted, they will bring to the team. A time to plant and reap students' alternate balls. Win the team that finishes first “seedtime and harvest.”

“Cosmonauts”

Players are divided into teams of equal size and sits on the strings behind a line of departure. A placed in front of each team at a distance of 10-15 m circle. At the signal, the first player from each team runs to circle him “dress”, through it before then left foot trunk and head it “undressed” by removing the right foot circle. Sit circle on the ground and returns to the team after passing hand over the tail of the string.

The game continues until all players participating. Team that finishes first wins. Circle will be dressed and undressed as the whole team. Dressing and undressing process circle will be shown before the start of the game.

The game can also be done from the circle lineup for each team. After dressing and undressing circle by the first player, it is passed from hand to hand for the same action for each player. It returns to the circle who started the game ends (the distance between the players on the circle is an arm's length). Team that finishes first wins.

“Roll the ball”

Players are placed on teams like the relay. 10-20 steps away from the starting line snaps turning point.

At the signal, the first player from each team starts rolling on the ground with the touch of your hand every step, a medicine ball to the point of return that it

bypasses and returns to the team in the same manner, with the other hand, gives the following and then move on to the tail of the string. The game continues with each player until last came in his place. Team that finishes first wins.

“Relay”

Students are organized into several teams, arranged in one row and seated behind a line of departure. The first of each team sit in squatting position with his back toward the direction of running. Returning to the starting signal, the line runs drep 5 m a running jump over a ditch two lines distance of 1 m., runs 5 m pass under a rope held by two students travel a distance of 4 m jumping on one foot, marking the completion point bypass route and running straight back to their team, hitting the shoulder next player.

“Builders”

Children are divided into two equal teams placed in the string format. Each team sits beside a box of cubes in front is traced to walk in balance and mark a line that is where they build. The first child of each team take two cubes each, go steady with hands outstretched to the side marked place, let their cubes, returning to running, touching on next and take their places. Children are required to place the cubes so as to build a wall. Top builders are declared members of the team who finished first and fairest building of the wall.

“Obstacle Relay”

The children were divided into two equal teams, placed in band refunded string a line of departure. Before the teams on the track, put in three places by two plastic baskets that support each baton gymnastics.

The distance between obstacles is 2m. To order, the first of each team start in running and jumping over obstacles. In return run to the next team that touch his shoulder. Win the team that finish first and go through the correct route (without break stick).

“Rabbit Race”

Children are divided into teams of equal size arranged in rows return the starting line. 6-8m draw from this is the finish line. The first child of each team expects starting signal squat position. At the signal, they start with rabbit jump up to the finish, running around in a teddy bear which marks running back in place and return to their teams after they reached my hand on the shoulder next colleague. Win the team that finished first race.

“All the flag”

Children are divided into two equal teams, arranged in rows return the starting line. In front of teams is a starting line and a mattress to 5-6m. At the signal, the early start, run, roll on the mat, take in hand a flag waving in support

it, put it back, run to their team for the next touch his shoulders and sits at the bottom string. Finally comes the winning team who finished first and correctly executed movements.

“Touch bell”

Children are divided into two teams put back the starting line. Before each team at 2m distance there are two stumps (benches) perpendicular to the direction of travel. To order, the first of the teams running up to the stump, which escalates, jump on it and runs until the bell suspended touches, return to running, touch his shoulder and sits next to the tail string. The teacher highlights the team who finished faster and more accurately.

“The best marksman”

Children are divided into two teams return the strings placed on a sight. In front of each line is a small buckets of balls. To order, how many children in each team take a ball and throws it into the basket placed at a distance of 2-3m. After throwing, running to the basket, touching it and return bypass to the first team colleague. After that sits at the end of the string. Win the team that has more balls in the basket.

“Race snakes”

Children are divided into groups of equal number. Teams are placed on strings return the starting line. A few meters from the finish line it draws. To order, receive support children sleeping in the abdomen and begin to crawl (helping the abdomen) to the finish line. Rises and running back up to the next waiting lying down, touching them on the shoulder and then move on to the tail string.

“Beware the Bear”

Children are divided into several teams equal in number placed on each end facing the strings of a bank gymnastics. Toys are placed on each bank “teddy bear”. To order, the first of each team climb up the banks and go in balance, stepping over the “teddy bear” so they do not break. Once executed, run and reach the first children who wait in another queue and then sit at rows. Win the team that finished first and has the lowest number of “bears” felled.

“Do not touch the rope”

Children are divided into teams of equal number placed on strings, return the starting line. At a distance of 6-8m it is fixed on two supports a rope at a height of 0,50m. At the signal, the first of each team runs close to where the rope is placed in sleep before and crawl on the forearms (the movement is executed with support only on the forearms), keeping the legs stretched, under the rope without touching it. After they passed it, stand up, turn in running the outside and sits at the bottom string. Next start when touched by colleagues conclude relay. Win team whose last component passes the finish line first.

“Walk in a circle and throw”

Children are divided into two teams sit in front of the starting line drawn on the ground. In front of each team at 2-2.5 m distance you draw one circle. At the signal, a child from each team running with a ball in his hand, enters the circle drawn and throw the ball with both hands first child of his team. Who threw passes behind the string?

Results

Following the proposed new use of resources during the research note an improvement in student performance between the two tests.

Selected means to increase the quality of driving skill indices contributed to this quality education, from an average of 38.3 “initial testing at a value of 34.1” average group investigated in final testing.

Table 1. Results recorded in two tests

No. Crt.	Arithmetic average initial testing	Arithmetic average final testing	Difference between average
Control sample	38,3 seconds	34,1 seconds	4,2 seconds

Conclusion

General driving capacity development of children in the process of growth is conditioned by the functionality of their skills and attitudes, strongly influenced by methodological concept of efficient organization of motor activities in physical education lessons.

The hypothesis that use the routes applied in physical education class skills to develop motor skills was confirmed, citing the improving student outcomes to final testing.

Evolution student achievement during the research demonstrates that an intervention in the educational process to improve quality of driving skill means carefully selected and carefully planned will lead to achieving objectives.

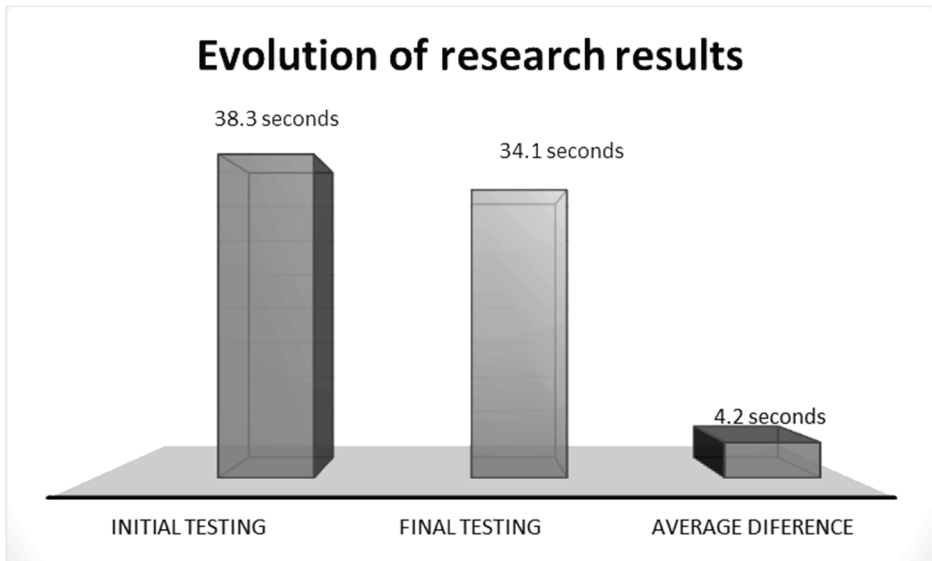


Figure 1. Evolution results following the two tests

By using trails utility-applied, relays and games during the research during lessons of physical education and sport, I noticed that students were actively involved and happy, which led to a higher density of the lesson and also making it more attractive.

REFERENCES

- Cârstea, Ghe., Tudor, V., Bota, A., Sasu, A. (1995). *Metodica educației fizice. Îndrumar pentru lucrările practice*. București: A.N.E.F.S.
- Dragnea, A., Bota, A. (1999). *Teoria activităților motrice*. București: Editura Didactică și pedagogică.
- Dragnea, A., 1991, *Teoria și metodică dezvoltării calităților motrice*. București: MTS.
- Sabău, I., Sabău, E., Pehoiu, C. (2001). *Atletism – tehnică și metodică de învățare rapidă*, Târgoviște: Editura Macarie.
- Tudor, V. (1999). *Capacitățile condiționale, coordinative și intermediare – componente ale capacității motrice*, București: Editura RAI-Coresi.

THE IMPLEMENTATION OF EVERYDAY PHYSICAL EDUCATION AMONG UPPER PRIMARY PUPILS IN THE NORTH GRATE PLAIN

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ABSTRACT. Regarding physical education, significant changes could be detected in the educational policy with the introduction of the everyday physical education in Hungary. Thus the investigation of alteration in the field of Physical education and sport provides the main topic. Firstly, the appreciation of the fact was measured; on the other hand, we were searching the answer how the positive and negative attitudes toward everyday physical education appeared among the students (N=1153), concerning the aims of the National Curriculum 2012. Results show that the outstanding part of the students (95%) like PE lessons. Regarding gender differences in the appreciation, a significant difference can be pointed out as it is remarkably higher among boys ($p=0,000$). The role of PE teachers and their motivating effect can be seen in our study.

Keywords: *primary school students, daily physical education, National Curriculum 2012*

Introduction, the relevance of the topic and its theoretical background

The theoretical background of our paper was based on the implementing researches (Fazekas-Halász, 2012) and the investigations of curriculum theories (Hamar-Ladislav, 2008; Hardman-Marshall, 2009; Hamar, 2012; Rétsági, 2014; Rétsági-Csányi, 2014).

Implementing examinations are searching the answer for the question how the aims can be reached and not for that question what the exact target is. They do not investigate the decision itself but the progress. If the participants or interest

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groups (actors, agents, stakeholders) of the interventions for public education are in the focus, we have to think on the interior characters of the school (leaders, pedagogues and other co-workers), the school users (parents and students) and the guiders of the development (governmental administration, local leaders). The representatives of the organisations supporting the development in the educational sector (pedagogical providers, consultants) can be mentioned in this section too who can have a significant influence on the implementation of the interventions. Measuring the levels of the implementation, it can be stated that macro level can be detected by the extensive level of the society (the role of health awareness in the educational processes in this case) while micro level can be detected by the individuals namely by the students and teachers. Progresses in these levels determine the success of the implementation (Fazekas-Halász, 2012)

The first National Syllabus was accepted by the Government 5 October 1995 which has changed several times since then. More researchers (Rétsági et al., 2011, 2014; Hamar-Derzsy 2002a; 2002b, Hamar, 2012) has investigated the different national curriculums (1995-NAT1, 2003-NAT2, 2007-NAT3, 2012-NAT4), alongside the alterations of public education and the educational law, highlighting the modifications of the content in the field of physical education and sport.

The latest National Syllabus was accepted by the Hungarian Government on the basis of the 110/2012 (VI. 4.) Government Regulation on 4 June 2012. In this, physical and mental health education is detected as a concrete aim. The shift in the education policy has had a mostly favourable effect on the field of Physical education and sport particularly because of the introduction of everyday physical education. § 27 of the law makes the organisation of everyday physical education mandatory for full-time education students which means five lessons per week. From the school year 2012/2013, everyday physical education is mandatory on the 1st, 5th and 9th years, after that on every year in uplink direction. From the school year 2015/2016, the introduction of everyday physical education became complete. It was determined too that the students should have the claim for appropriate nutrition, sport and healthy lifestyle. Proficiency in game and sport culture and the claim for developing a healthy, health-centred system is necessary for the implementation of the principles and aims. This field and school physical education in that has outstanding aims which are knowledge of the sport, development and enlargement of the sport skills, participation in leisure-time and sport competitions, regular physical activity and the formation of the values of healthy lifestyle. Analysing the four aim systems of the National Syllabus, it can be stated that it assumes from the required general values and principles (key competences) which surrounds the whole document and their validation in the system is the main point. Physical education always had an outstanding role in the field of health education. However, the subject has got into a new dimension

with the implementation of the everyday physical education which can create a new quality as the conceived aims make the educators of this field able to more efficient health education and the creation of the bases of the health culture (Rétsági, 2014). According to the National Syllabus 2012, the outstanding aim of the field of Physical education is that sport could have a serious role in the life of every student, socialising them on a lifelong, health-conscious and active lifestyle (Makszin, 2014).

In the light of the studies

In Hungary, physical education is the part of the education from 1867. The idea of everyday physical education already appeared at the juncture of the 20th century (in the 1900s) but examples for it can be seen only from the 1980s. At the beginning of the century, in the 1910s the implementation of everyday physical education was urged. The director of the Physical Education College fought for it from 1925. In 1933, Bálint Hóman, the minister of religion and public education decreed its introduction in five schools in the capital city in 1933. Although the students of three schools in Csongrád county who took part in everyday physical education become more skilled and their concentration and reaction time improved (Szegfű, 1989), only in some schools was it introduced in the 1980s (Ivanics, 1993). In Szeged, the students welcomed enthusiastically the new possibility and regular physical activity became as a claim (Udvarhelyi, 1989). In Kecskemét, the pupils liked everyday physical education and their physical performance became better too (Grosán), however, the contribution of this system to the improvement of health and fitness was only partly confirmed in Hódmezővásárhely. Nevertheless, the subjective points obviously showed the efficiency of the program as it had a motivating effect on motion awareness. The evolvement of the desire for daily sport caused by the regular activity couldn't have been confirmed (Tózsza-Rigóné, 2011), however, the physical education five times per week contributed to the increase of the students' physical performance (Vári et al., 2012).

Hungary is unique in Europe with its physical education which contains five lessons per week thus we try to present some important investigations in international level, which demonstrate the positive effects of the everyday physical education. Its effect was measured in Pennsylvania with the involvement of nine control groups. This kind of active sport program has proved successful as those students who took part in everyday physical education developed in every aspect (regarding health and motion skills) in comparison to other students in whose schools were no everyday physical education (Erflé, 2014). Shepard et al. (2013) highlighted in a longitudinal investigation that daily sport in childhood had a

positive effect for the attitudes toward sport participation in adulthood as well. Barnett et al. (2008) confirmed as well that the value, if it is acquired in childhood, determines the lifestyle in adulthood as well. A Croatian study stated that daily sport develops the children's gymnastic skills (Culjak et al., 2014). 2043 children (between 9 and 13 years) were measured in a Greek representative examination with the assistance of 77 primary schools. It was pointed out that regular physical activity and the appropriate nutrition five times per day contribute to the evolvement and the fixation of the patterns of health behaviour (Moschonis et al., 2013).

Borbély (2014) claimed in a representative national research that more than 70% of the asked population agreed with the necessity of implementation of everyday physical education which means that the adult population (potentially the adults) felt it necessary. According to Rétsági (2015), everyday physical education creates bigger possibilities and the classroom physical education plays the leading role in the socialisation by sport. In particular, Mikulán (2013) elaborates that everyday physical education can provide a positive effect in long term. On the basis of these results we suppose that it is important to examine what pupils consider of this subject.

The liking and the importance of the subject

Bakonyi (1969) investigated whether students like physical education and how many hours they would like to have from it. Regarding gender, no significant differences were detected. At the same time, primary school pupils would have liked to have more PE lessons than secondary school pupils. According to Bíróné (2004), physical education is one of the most favourite subjects. Báthory (1997) states that physical education excels in primary school students regarding the appreciation of the subjects, however, it adds that it decreases with the age and it has a more prominent place among boys rather than among girls. This is confirmed by the investigation of Hamar et al. (2012) who compared Transylvanian and Hungarian students in the school year 2006/2007.

Hamar-Karsai (2008) measured the affectivity to physical education among 11 to 18-year-old students (n=2840) in a cross sectional analysis. In this, boys showed a more accepting attitude and mind-set than girls; furthermore, positive emotional saturation shows a decrease with the age especially among girls. PE teacher has an attitude forming role at school as well. The positive emotions evolved during teaching and learning of the subject can increase the pedagogical efficacy not only in physical education but in the whole education progress. The decreasing of liking was detected with the increase of the age too. The opinion regarding the number of PE lessons was more unfavourable among

those who had only two lessons compared to those who had four lessons per week. Nevertheless, investigating all of the students, it can be seen that 77.8% of them would like to have four or more PE lessons per week. On this basis, it can be laid down that students have a favourable opinion about PE.

The results of another representative investigation measuring the lifestyle and physical education of 8th year students show that less than the half of the responders liked physical education lessons. The main reason of the antipathy was marked in the content of the lessons, then in the teacher itself and the exhausting nature of the lesson (Rétsági-Ács, 2010).

In our previous longitudinal research, we excavated the changes regarding the attitudes toward physical education among 6th year students (n=131) in three small towns in Szabolcs-Szatmár-Bereg County after a year. Concerning the evaluation of the importance of the PE lessons, no significant differences could be detected between the two examinations on the basis of the crosstabs analysis, however, 52.7% of the student had a different statement in 2014 than it had in the previous year. In the biggest ratio, they evaluated the situation of physical education as important as the other subjects. Analysing those who had a different claim during the two examination, it can be detected that the number of the statements of 'it is incomparable with other subjects' decreased in the biggest ratio (to ¼). 75% of them stated that physical education is as important as the other subjects while 16.7% of the evaluated it more important than the others. Regarding those students who evaluated PE more important in the first examination, 71.4% of them thought that PE become as important as other subjects and 14.3% evaluated it more important than the others. It can be stated that the subject conserved its stability and the evaluation of the importance of the physical education lessons did not decrease after one year namely since the students take part in everyday physical education on the basis of our research (Fintor, 2014; Fintor-Szabó, 2013).

Aims and methods

In present study, the primary school pupils' relation to everyday physical education was measured. According to the literature, the researchers are hopeful and expect a positive attitude from the implementation of everyday physical education (NAT, 2012; Mikulán, 2013; Rétsági, 2015); furthermore, previous examinations showed a positive image (the experiences of the 1980s, Tózsa-Rigóné, 2011)

In international destinations it can be stated regarding the literature that everyday physical education has not implemented in other countries except in Hungary, however, many international investigation highlighted the positive effects of daily sport. Some of them were introduced and regular physical activity and

everyday physical activity become comparable on the basis of their results (Shephard et al., 2013; Moschonis et al., 2013; Culjak et al., 2014).

In our investigation, which was examined with a self-made Likert scale questionnaire, the answers replied for the group of questions were analysed which present the opinion of the pupils about the aims and exercises of the everyday physical education lessons, stated in the National Syllabus as well. This group of questions consists of 28 statements where the pupils had to express their agreement or disagreement on a 1-to-4 scale (1 meant absolutely not true, 2 meant rather not true, 3 meant rather true, 4 meant fully true).

Hypotheses

- We hypothesize that significant majority of the respondents has a positive opinion about physical education; however, a significant difference is expected regarding gender, for the boys (H1).
- We hypothesize that significant differences will be pointed out regarding gender and the appreciation of the lesson, in case of the group of questions concerning the implementation of everyday physical education (H2).

Material and methods

From the participants of the implementation, the views of the students are discussed in our investigation. The number of the participants involved into the examination is 1153 which shows a balanced distribution regarding gender as 45.3% of the participants is boy while 52.2% of them is girl. 15.0% of the sample do not play sport, 17.5% of them play some kind of sport once per week, 19.3% of them play sport twice per week and 48.0% of them play sport at least three times per week².

Different sport levels were categorised namely school sport, hobby sport and competitive sport/in sport clubs were separated. Thus 43.5% of the sample play sport as a hobby, 17.4% of them do it in school frames and 23.8% of them do it in organisational frames in a sport club. The distribution of the pupils was balanced regarding the year.

² We asked the participants to mark their choices as motion which takes at least 30 minutes and which is outside the mandatory everyday physical education.

The sampling frame was meant every institute in the North Grate Plain region where the upper primary students are educated in full-time. The sample can be regarded as a representative sample regarding the counties, the type of the settlements and the number of the pupils. The sample is a multi-stage, stratified sample. In the results, the change in the number of the participants is caused by the non-response questions.

Results

To test our first hypothesis, the answers in connection of the appreciation of the physical education subject were analysed (Table 1).

Table 1. The distribution of the appreciation of the physical education subject regarding gender (N=1074)

	Boy	Girl
I like it very much	56.4%	36.2%
I like it	38.7%	53.9%
I dislike it	2.0%	8.1%
I dislike it very much	2.9%	1.9%

It can be stated that the appreciation of the subject is high in both cases as almost 95% of the students like or like very much the physical education subject. Nevertheless, a significant difference can be pointed in the liking out regarding gender ($p=0,000$). 56.4% of the boys signed that they 'like it very much' while among girls the option 'I like it' could be seen in such a high rate (53.9%). Such a difference in liking PE between boys and girls confirms our first hypothesis. Thus it can be seen that the boys' relation to physical education is still outstandingly better in comparison with girls so this relation has not changed since the implementation of everyday physical education, compared to the literature.

Furthermore, the statements of the group of questions are analysed which relate to the implementation of everyday physical education and to the aims and exercises formulated in the National Syllabus 2012. This group of questions contained 28 statements (Table 2).

Table 2. The means of the statements related to the implementation of everyday physical education (N=1153)

How likely are the following statements for the physical education lessons in your school?	Mean
1. We practise only one kind of sport (e. g. handball) in the PE lesson.	1.52
2. The PE teacher is stricter than the other teachers.	1.88
3. We get difficult tasks from the PE teacher.	1.98
4. Because of the PE lesson, I am tired during the day.	2.08
5. The PE teacher has high expectations.	2.16
6. I like sport programs and sport coverages on the television and on the Internet because of the PE lessons.	2.39
7. I listen to the nutrition because of the facts which I heard from the PE teacher.	2.42
8. The PE teacher use to talk about healthy lifestyle as well.	2.68
9. Because of the PE lessons, I do fancy to play some kind of sport after school too.	2.80
10. We play diverse games on the PE lessons.	2.86
11. We regularly get evaluation on PE lessons (the teacher gives oral evaluation, give us red points or marks etc.)	2.88
12. We warm up with interesting gymnastic exercises on PE lessons.	2.89
13. The PE lesson always consists of a warming up, a main part and a finishing part.	3.03
14. I become very tired at the end of the PE lesson.	3.05
15. On the PE lessons, I recognise the competition rules of the different kind of sports.	3.07
16. I became much more skilful while we have PE lesson every day.	3.12
17. We regularly play on the PE lessons.	3.13
18. PE lesson teaches me how to cope with failures (defeats).	3.14
19. The mood is always good on the PE lessons.	3.15
20. We hear a lot of thing about the importance of exercise and sport.	3.17
21. On the PE lesson, I am evaluated on the basis of my individual abilities.	3.19
22. I get on well with my PE teacher.	3.20
23. On the PE lesson, we learn more type of sport.	3.21
24. The PE lesson teaches us to collaborate in a team.	3.21
25. I feel that I can be heathier because of the PE lessons.	3.23
26. Because of the PE lesson, I avoid harmful habits like smoking and alcohol consumption.	3.33
27. The PE teacher wishes that everybody can learn the learning content thus he/she helps to everybody.	3.35
28. On the PE lesson, those students can be successful too who have worse achievement on other lessons.	3.45

The examination of the means of the statements, it could be detected that those statements got the highest means (with the highest agreement) which showed the helpfulness of the PE teacher concerning the learning content and which indicate the own success of the students. It is an important result that they regard this lesson that here everybody can be successful, even those students who achieve worse in other lessons. The statement indicating the recognition of the subject got the lowest mean which confirms that pupils really have the possibility to meet more type of sport on the everyday PE lessons. This is strengthened by the result which shows the high mean of the statement 'On the PE lesson, we learn more type of sport'.

After this, cluster analysis was made to categorise the statements which provided us groups where overlaps were allowed regarding the statements.

Thus three groups were interpreted:

Group 1: 1., 9., 10., 12., 13., 15., 16., 17., 23., Subject knowledge (mean=2.60)

Group 2: 4., 6., 7., 14., 18., 19., 24., 25., 26., Health awareness (mean=2.88)

Group 3: 2., 3., 5., 8., 11., 20., 21., 22., 27., 28. The role of the PE teacher (mean=2.79)

Thus the groups were formed in such a way where the statements could be classified around the aims seen in the National Syllabus 2012 as well. Regarding the first group (Subject knowledge), the didactic and educational aims of the PE lessons could be detected. In the second group (Health awareness), the statements in relation to the students' healthy lifestyle, personality development and health awareness were clustered. In the third group (The role of the PE teachers), the role of the pedagogue can be seen.

It was examined whether any significant differences could be detected in the analysis of the means regarding gender. It can be claimed that no difference can be seen in the groups regarding gender as an agreement could be pointed out.

Regarding the distribution of the appreciation of the subject, a significant difference can be seen in the different clusters ($p=0,000$) (Table 3).

Table 3. The groups of cluster and the distribution of the appreciation of the physical education subject (N=933)

	Subject knowledge	Health awareness	The role of the PE teacher
I like it very much	10,8%	34,3%	54,8%
I like it	31,7%	40,5%	27,8%
I dislike it	80,6%	10,4%	9,0%

Pupils who like the subject very much marked the role of the PE teacher in the highest ratio (54,8%). Probably, the influence of the PE teacher can be detected as the most motivating factor regarding the appreciation of the subject. Concerning pupils who 'only' like the subject, the role of health awareness is outstanding (40.5%). They feel that the importance of this factor is the strongest aim after the implementation of the everyday physical education. Regarding students who dislike the subject, the statements of the subject knowledge can be seen in the biggest ratio (80.6%). They are the biggest most critical participants of the lesson who feels that the amount of the knowledge which it required to acquire is too high.

Discussion and conclusions

A representative investigation was made among upper primary pupils in the North Grate Plain in the fourth year after the implementation of everyday physical education (2012 September). The students' attitude in relation to PE lessons and the appearance of the aims and tasks of the National Syllabus were examined. Rétsági (2014) claimed too that the subject can come into a new dimension with the implementation of everyday physical education. Furthermore, it can create a new quality while the conceived aims can enable the teachers of this field for more efficient health education and for the creation of the basis of the health culture.

Our results show that the liking of the subject is remarkably higher among boys compared to girls and this fact has not changed compared to the results of previous researches. An outstanding part of the students (95%) likes the physical education lessons. On the other hand, our hypothesis that a significant difference can be expected after the categorisation of the statements in relation to the implementation of everyday physical education regarding gender was not confirmed. However, it was confirmed in case of the subject liking means of the groups. Pupils who like the physical education subject very much marked the role of the PE teacher with the highest value, regarding their answers.

It can be claimed that the role of the PE teachers can outstandingly be seen regarding everyday physical education thus the institutional support role of the pedagogues can be highlighted in the examined instituted.

REFERENCES

- Bakonyi, F. (1969). A testnevelés mennyiségének és minőségének befolyása a sportolási igény alakítására. *A testnevelés tanítása*. Budapest, Művelődésügyi minisztérium módszertani folyóirata 5, 3, 75–78.
- Bakonyi, F. (1969). Az iskolai testnevelés hatása a tanulók testneveléssel és sporttal kapcsolatos szemléletére. *A testnevelés tanítása*. Budapest, Művelődésügyi minisztérium módszertani folyóirata 5, 1, 19–30.
- Bakonyi, F. (1969). Szeretik-e a tanulók a testnevelést – hány órát szeretnének? *A testnevelés tanítása*. Budapest, Művelődésügyi minisztérium módszertani folyóirata 5, 2, 35–38.
- Barnett, M.L., Morgan, J.P., Eric van Beurden., Beard, R. John (2008). Perceived sports competence mediates the relationship between childhood motor skill proficiency and adolescent physical activity and fitness: a longitudinal assessment. *International Journal of Behavioral Nutrition and Physical Activity* 5, 40.
<http://www.ijbnpa.org/content/5/1/40/> Utolsó letöltés: 2015.06.20.
- Báthory, Z. (1997). *Tanulók, iskolák, különbségek. Egy differenciális tanításemélet vázlata*. Budapest, Okker Kiadó
- Bíróné, N.E. (2004). *Sportpedagógia. Kézikönyv a testnevelés és a sport pedagógiai kérdéseinek tanulmányozásához*. Budapest-Pécs, Dialóg Campus Kiadó
- Borbély, Sz. (2014). As parents see physical education (PE) from a representative survey's point of view. In Karlovitz János Tibor (szerk.): *Mozgás, környezet, egészség*. International Research Institute. 39–54.
<http://www.irisro.org/health2014dec/14UrbinneBorbelySzilvia.pdf>
Utolsó letöltés: 2015.06.20.
- Culjak, Z., Miletic, D., Kalinski, S. Delas., K., Ana, Z., F. (2014). Fundamental Movement Skills Development under the Influence of a Gymnastics Program and Everyday Physical Activity in Seven-Year-Old Children. *Iranian Journal of Pediatrics*, 24: 2. 124–130.
- Erfle, S. (2014). Analyzing the Effects of Daily Physical Education in Middle Schools on Obesity: Evidence from Pennsylvania's Active Schools Program. In (Ricky Todao ed.): *Handbook of Physical Education Research*. New York: Nova Science Publishers. 91-109. ISBN: 978-1-63321-076-9.
- Fazekas Á., Halász, G. (2012). *Az implementáció világa*. Az európai uniós forrásokból megvalósított magyarországi oktatásfejlesztési beavatkozások empirikus vizsgálatának elméleti megalapozása. Kézirat. Budapest, ELTE PPK Felsőoktatás-menedzsment Intézeti Központ.
<http://www.impala.elte.hu/produktumok-i-munkafazis> Utolsó letöltés: 2015.06.08.
- Fintor, G. (2014). Testmozgás a közösségben, avagy a mindennapos testnevelés jelenléte Szabolcs megyében. In (Juhász Erika szerk.) *Közösségi Művelődés – Közösségi Tanulás*. Debreceni Egyetem TEK BTK Neveléstudományok Intézete. 67–79.
- G. Fintor – J., Szabó (2013). Correlations of Sport Levels and Popularity of Sport Programmes among Elementary School Students. *Recreation, a Közép-Kelet Európai Rekreációs Társaság Tudományos Magazinja*. issue IV/2., 11-16.

- Grosán, P (2001). Ízelítő a mindennapos testnevelés jegyében született iskolai programokból. *Új Pedagógiai Szemle* 51: 11. 149-152.
- Hamar P, Ladislav, P. (2008). Physical education and education through sport in Hungary. (Testnevelés és oktatás sport segítségével Magyarországon). In Gilles, Klein, Ken, Hardman (eds.): *Physical Education and Sport Education in European Union*. Editions Revue EP.S, 11 avenue du Tremblay: Paris.
- Hamar P., Derzsy, B (2002a). Az elmúlt tíz esztendő tantervi változásainak tapasztalatai I. rész. Módszertani lapok. *Testnevelés* 9: 1. 1-7.
- Hamar, P. (2012). MindenNATos testnevelés. *Új Pedagógiai Szemle* 62: 11-12. 87-97.
- Hamar, P., Derzsy, B. (2002b). Az elmúlt tíz esztendő tantervi változásainak tapasztalatai II. rész. Módszertani lapok. *Testnevelés* 9:2. 1-6.
- Hamar, P., Karsai, I. (2008). Az iskolai testnevelés affektív jellemzői 11-18 éves fiúk és lányok körében. *Magyar Pedagógia* 108. 2. 135-147.
- Hardman, K., Marshall, J. (2009). *Second World-wide Survey of School Physical Education. Final Report*. International Council of Sport Science and Physical Education.
- Ivanics, G. (1993). Mindennapos testnevelés. *Fejlesztő pedagógia: pedagógiai szakfolyóirat* 4. 1-2. 11-13.
- Makszin, I. (2014). *A testnevelés elmélete és módszertana*. Budapest-Pécs, Dialóg Campus Kiadó.
- Mikulán, R. (2013). Az iskolai testnevelés szerepe és jelentősége az egészségfejlesztésben. *Új Pedagógiai Szemle* 63: 7-8. 48-69.
- Moschonis, G., Mavrogianni, C., Karatzi, K., Iatridi, V., Chrousos, P. George., L, Christos., Y. M. (2013). Increased physical activity combined with more eating occasions is beneficial against dyslipidemias in children. The Healthy Growth Study. *Eur J Nutr* 52: 1135-1144.
- NAT 2012. *Új Pedagógiai Szemle* 1- 3, 30 -256.
- Rétsági E., Ács, P. (2010). A serdülők életmódja es testneveléssel kapcsolatos véleményük. *Magyar Sporttudományi Szemle* 11. 44. 13-20.
- Rétsági E., Csányi, T. (2014). Nemzeti Alaptanterv 2012 Testnevelés és sport műveltségi terület – az iskolai testnevelés új kihívásai I. *Magyar Sporttudományi Szemle* 15. 59: 3. 32-37.
- Rétsági, E. (2014). Mindennapos testnevelés az iskolában. *Élet és Tudomány* 69: 37. 1166-1167.
- Rétsági, E. (2015). A sport szerepe a szocializációban és a pedagógiában. In. (szerk. Laczkó Tamás- Rétsági Erzsébet): *A sport társadalmi aspektusai*. Pécsi Tudományegyetem Egészségtudományi Kar. Pécs. 51-61. ISBN 978-963-7178-72-6
- Rétsági, E., H. Ekler, J., Nádori, L., Woth, P., Gáspár, M., Gáldi, G., Szegerné Dancs, H. (2011). *Sportelméleti ismeretek*. Budapest, Dialóg Campus.
- Shephard, J.R., Trudeau, F. (2013). *Quality Daily Physical Education for the Primary School Student: A Pruneal Account of the Trois-Rivières Regional Project*, *Quest*, 65: 1. 98-115.
- Szegfű, I. (1989). Történeti áttekintés a mindennapos testedzésről. In. SÜLI József (szerk.) *A mindennapos testedzés kézikönyve*. A Csongrád Megyei Tanács V.B. művelődési osztálya és Pedagógiai Intézete kiadványa. 2-6.

- Tózsá-Rigóné, N., J. (2011). *A mindennapos testnevelés komplex programja Hódmezővásárhelyen 2005-2009-ig: Megvalósulás, hatékonyságvizsgálat, szoftverfejlesztés*. PhD disszertáció. Szegedi Tudományegyetem, Neveléstudományi Doktori Iskola. Szeged. Utolsó letöltés: 2015.06.17. http://doktori.bibl.u-szeged.hu/1488/1/ertekezes_ekezetnelk.pdf
- Udvarhelyi, F. (1989). Ötletek és módszerek a mindennapos testgyakorlás megszervezéséhez. *A mindennapos testedzés kézikönyve*. A Csongrád Megyei Tanács V.B. Művelődési Osztálya és Pedagógiai Intézete kiadványa. 40–63.
- Vári, B., Marton, A., Balogh, L. (2012). A mindennapos testnevelés hatásának követéses vizsgálata 1-4. osztályos tanulók körében. *Magyar Sporttudományi Szemle* 14. 54: 59–60.

UTILIZATION OF PHYSIOTHERAPY SERVICES IN THE WORD

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ABSTRACT. Introduction. Both at the national and international levels, direct access for patients to physical therapy services is currently under debate. Direct access for patients seeking physical therapy care might reduce waiting time and costs, and thus be of benefit for patients and health insurance companies. **Objectives.** The purpose of this study was to assess current evidence and evaluate the impact of physical therapy guideline adherence on subsequent healthcare costs and utilization for patients. **Materials and methods.** Data Sources is from Value in Health (2011-2016) and an electronic search was conducted in PubMed, at the 15th of January 2017. Key words were used independently and in combination including: physical therapy, physiotherapy and utilization. **Results.** The initial search of each database results were as follows: Value in Health (15) and Medline (PubMed) (41). Thus, a total of 56 results were identified. After applying the inclusion criteria and omitting duplicates, 22 articles remained and were included in this review. **Conclusion.** Utilization of physiotherapy in the word is different but where they oft use this therapy the health care costs became reduced.

Key words: *physical therapy, physiotherapy, utilization.*

REZUMAT. Utilizarea serviciului de kinetoterapie/fizioterapie în lume. Introducere. Atât la nivel național cât și internațional, un acces direct la serviciile de fizioterapie/kinetoterapie pentru pacienți este în dezbatere în prezent. Accesul direct pentru pacienții care doresc fizioterapie/kinetoterapie poate reduce costurile și timpul de așteptare, și, prin urmare, o să fie benefică pentru pacienți și pentru societățile de asigurări de sănătate. **Obiective:** Scopul acestui studiu a fost de a evidenția și evalua prin dovezi curente impactul fizioterapiei/ kinetoterapiei cu orientare privind costurile asistenței medicale și utilizarea către pacienți. **Material și metode.** Bazele de date utilizate: Value in Health (2011-2016) și pentru căutare electronică: PubMed, în data de 15 ianuarie 2017. Cuvintele de cheie au fost utilizate în mod independent și în combinație incluzând: fizioterapie, kinetoterapie și

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utilizare. **Rezultate.** Căutarea inițială în baza de date a fiecărui rezultat au fost următoarele: Value in Health (15) și Medline (PubMed) (41). Astfel, un total de 56 rezultate au fost identificate. După aplicarea criteriilor de includere și omiterea duplicatelor, 23 de articolele au fost incluse și rămâneau în această recenzie. **Concluzii:** Utilizarea kinetoterapiei/fizioterapiei în lume este diferit, dar unde se aplică frecvent această terapie și costurile asistenței medicale devin mai reduse.

Cuvinte cheie: *fizioterapie, kinetoterapie, utilizare.*

Introduction

“Physical therapy provides services to individuals and populations to develop, maintain and restore maximum movement and functional ability throughout the lifespan. This includes providing services in circumstances where movement and function are threatened by ageing, injury, pain, diseases, disorders, conditions or environmental factors. Functional movement is central to what it means to be healthy. Physical therapy is concerned with identifying and maximizing quality of life and movement potential within the spheres of promotion, prevention, treatment/intervention, habilitation and rehabilitation. This encompasses physical, psychological, emotional, and social wellbeing. Physical therapy involves the interaction between the physical therapist, patients/clients, other health professionals, families, care givers and communities in a process where movement potential is assessed and goals are agreed upon, using knowledge and skills unique to physical therapists” (World Confederation for Physical Therapy, 2011).

Physiotherapy is a health care profession which provides treatment to individuals in order to develop, maintain and restore maximum movement and functional ability throughout a person’s lifespan (Maruf et al., 2012.)

Physiotherapy services are widely found in health institutions, private practice, schools, sports and work place settings. To provide effective treatment, the physiotherapist must understand the cultural, psychological and social factors that affect the patients. This begins with the assessment of the patient's condition through a medical history review and physical examination. This applies to all patients, irrespective of age and context. Physiotherapy has many specialties such as cardiopulmonary, geriatrics, neurology, orthopedics and pediatrics, to name a few (Maruf et al., 2012).

Both at the national and international levels, direct access for patients to physical therapy services is currently under debate. Direct access for patients seeking physical therapy care might reduce waiting time and costs, and thus be of benefit for patients and health insurance companies (Kopkow et al., 2016).

Analysis of health care services and physiotherapy services from different aspects is indispensable for the planning, implementation and monitoring of more aimed, more effective and more economic services.

Objectives

The purpose of this study was to assess current evidence and evaluate the impact of physical therapy guideline adherence on subsequent health care costs and utilization for patients.

Methods

Data Sources is from Value in Health (2011-2016) and an electronic search was conducted in PubMed, at the 15th of January 2017. Key words were used independently and in combination including: physical therapy, physiotherapy and utilization.

Results

The initial search of each database results were as follows: Value in Health (15) and Medline (PubMed) (41). Thus, a total of 56 results were identified. After applying the inclusion criteria and omitting duplicates, 23 articles remained and were included in this review.

In *Nigeria*, the practice of physiotherapy on a first-contact basis is not common. Nigerian physiotherapists depend largely on referrals from medical doctors from different areas of medical practice. A lot of people in need of physiotherapy services, however, do not always get the required guidance to that effect and the few who are fortunate to access the services cannot fathom the 'strange' procedures with which they are treated.

Maruf et al. (2012) study examined the awareness, attitude, belief, and utilization of physiotherapy services in a Nigerian sample. This was a cross-sectional survey involving 885 adult residents of Nnewi in southeastern Nigeria. Awareness of physiotherapy existence was high (61.8%). Many of the respondents (29.7%) got their information about physiotherapy from hospitals and 20.8% thought that government should be responsible for creating awareness about physiotherapy. The majority of respondents (89.6%) felt they needed to know

more about physiotherapy while 56% felt their current knowledge about physiotherapy was enough to advise others on physiotherapy services. Almost all the participants (93%) thought that physiotherapy should be in all hospitals, while 41.3% and 35.6% respectively reported physiotherapy to be always and sometimes effective. Of those who had received physiotherapy, 22.7% and 20.2% felt satisfied and impressed respectively. The majority of respondents (70.5%) claimed they would recommend physiotherapy services, and 61.1% stated that they would prefer physiotherapy services to indigenous health services. Out of these, 43.2% claimed they would discourage the use of indigenous health services. In terms of cost effectiveness, 44.8% preferred physiotherapy to indigenous health services. Ignorance (38.7%) was the most frequently reported reason for preferring indigenous health services to physiotherapy. Indigenous health services was reported to have done more harm than good 55-99% of the time (31.8%). The majority of the participants thought that physiotherapy is necessary and that it contributes to the well-being of individuals who seek its services. The majority of participants believed that physiotherapists can make diagnosis and as well, treat individuals who seek their services (Maruf et al., 2012).

In the USA, Louw, Puentedura and Diener (2016) determined the referral patterns, utilization and indications for postoperative physical therapy (PT) for lumbar radiculopathy. In this study sixty-five patients who underwent LS for radiculopathy completed outcome measures on pain and disability prior to, and 1, 3, 6 and 12 months after LS. They also completed a questionnaire regarding postoperative PT at the 12-month follow-up. The majority of patients (59.32 %) attended PT after LS for an average of 14 visits and rated PT favorably. Forty-five percent of the patients who did not attend PT after LS were of the opinion that they would have benefitted from PT after LS, and 62.5 % of these patients reported the surgeon not discussing postoperative PT after LS. Patients with longer duration of symptoms prior to surgery, with greater leg pain scores 1 month after surgery, and who did not feel as well prepared for surgery at the 1 year follow-up were more likely to receive PT, but this did not result in significantly better outcomes on any measure at any follow-up period and did not predict attendance in PT after LS. There is a need to determine if a subgroup of patients following LS exists who will respond favorably to postoperative PT (Louw et al., 2016).

Hanney et al. (2016) in their systematic review suggest: the majority of studies show a small difference in the number of PT visits between those participating in an adherent and non-adherent treatment program. For three studies the difference ranged from 1 to 2 fewer visits for those participating in an adherent care program. However, the study by Childs et al. revealed a large difference of almost 9 visits. Little difference existed for prescription medication

use as did differences for additional physician office visits. Also, while the use of subsequent emergency department care was low (approximately 3% in the sample), there was little difference between those participating in an adherent versus non-adherent program. However, significant differences in advanced imaging was reported between those participating in an adherent and non-adherent treatment program. There seems to be conflicting evidence with regards to surgical procedures. While two studies demonstrated fewer surgical cases, another study demonstrated an increase in surgical cases for those participating in an adherent physical therapy program. Preliminary evidence suggests that adherence to established clinical practice guidelines may assist with decreasing healthcare utilization and costs. Additional research based on prospective randomized controlled trials are needed to provide high quality evidence regarding the impact of guideline adherence among patients with low back pain (Hanney et al., 2016).

Riley, Tafuto and Brismée (2016) studied what percentage of physical therapy (PT) referrals had a specific diagnosis and treatment orders. Additionally, specific and non-specific diagnoses and treatment orders were compared in regards to PT units billed, average visits per referral, and average cost per referral. The charts of 1,000 patients treated in outpatient PT underwent a retrospective chart review. Interferential statistics were used to determine if there was a statistically significant difference between specific and non-specific diagnoses and treatment orders in regard to PT units billed, average visits per referral, and average cost per referral. Twenty-nine percent of all referring diagnoses were non-specific in nature and 58% contained treatment orders that were non-specific. Charts with a specific diagnosis had a statistically significant higher utilization as compared to non-specific diagnoses ($p \leq 0.001$). Patients with a specific treatment order also displayed a statistically significant larger average in billed units, average visits per referral, and average reimbursement per referral than those without a specific treatment order ($p \leq 0.0001$). Our findings suggest that a physician diagnosis and referral may not be required to direct care for patients seeking PT services. Third-party payers that require a physician referral for PT services may be delaying access to healthcare and increasing costs (Riley et al., 2016).

Degenerative lumbar spondylolisthesis is a condition often identified in symptomatic low back pain. A variety of treatment algorithms including physical therapy and interventional techniques can be used to manage clinically significant degenerative spondylolisthesis.

Sclafani J. et al. (2016) in their retrospective, observational study utilized the 5% national sample of Medicare carrier claims from 2000 through 2011 in Colorado State. A cohort of beneficiaries with a new ICD-9 diagnosis code for degenerative lumbar spondylolisthesis was identified. Current procedural terminology codes were used to identify the number of procedures performed

each year by specialty on this cohort. A total of 95,647 individuals were included in the analysis. Average age at the time of initial diagnosis was 72.8 ± 9.8 years. Within this study cohort, spondylolisthesis was more prevalent in females (69%) than males and in Caucasians (88%) compared to other racial demographics. Over 40% of beneficiaries underwent at least one injection, approximately one third (37%) participated in physical therapy, one in five (22%) underwent spinal surgery, and one third (36%) did not utilize any of these interventions. Greater than half of all procedures (124,280/216,088) occurred within 2 years of diagnosis. The ratio of focal interventions (transforaminal and facet interventions) to less selective (interlaminar) procedures was greater for the specialty of Physical Medicine and Rehabilitation compared to the specialties of Anesthesiology, Interventional Radiology, Neurosurgery, and Orthopedic Surgery. The majority of physical therapy was dedicated to passive treatment modalities and range of motion exercises rather than active strengthening modalities within this cohort. Interventional techniques and physical therapy are frequently used treatment modalities for symptomatic degenerative spondylolisthesis. Understanding utilization of these techniques is important to determine relative clinical efficacies and to optimize future health care expenditures (Sclafani et al., 2016, a; Sclafani et al., 2016, b)

In the United States, outpatient physical therapy is underutilized in treating multiple sclerosis.

Lin Mu (2016) in his cross-sectional study observed that approximately 1,2 million visits (crude N.:2404, 1997-2012) occurred annually from United States adults with multiple sclerosis. Among these, physical therapy was offered in 69 thousand visits, corresponding to the weighted prevalence of 5.7%. Of these visits reflecting physical therapy utilization, 79,5% were visits from women, 76,2% from whites, 49,4% from individuals aged 40 to 55. [...] Of note 53,9% off all visits offering physical therapy were to patients with private insurance and 98,8% in metropolitan areas (Lin, 2016).

Plantar fasciitis is responsible for 1 million ambulatory patient care visits annually in the United States.

Fraser, Glaviano and Hertel (2017) in their retrospective review of the PearlDiver patient record database was used to evaluate physical therapist utilization and use of manual therapy and supervised rehabilitation in patients with plantar fasciitis between 2007 and 2011. An International Classification of Diseases code (728.71) was used to identify plantar fasciitis, and Current Procedural Terminology codes were used to identify evaluations (97001), manual therapy (97140), and rehabilitation services (97110, 97530, 97112). A total of 819 963 unique patients diagnosed with plantar fasciitis accounted for 5 739 737 visits from 2007 to 2011, comprising 2.7% of all patients in the database. Only 7.1%

(95% confidence interval: 7.0%, 7.1%) of patients received a physical therapist evaluation. Of the 57 800 patients evaluated by a physical therapist (59.8% female), 50 382 (87.2% \pm 0.4%) received manual therapy, with significant increases in utilization per annum. A large proportion (89.5% \pm 0.4%) received rehabilitation following physical therapist evaluation. Despite plantar fasciitis being a frequently occurring musculoskeletal condition, a small proportion of patients with plantar fasciitis were seen by physical therapists. Most patients who were evaluated by a physical therapist received manual therapy and a course of supervised rehabilitation as part of their plan of care (Fraser et al., 2017).

Direct access to physical therapist services is available in all 50 states, with reported benefits including reduced health care costs, enhanced patient satisfaction, and no apparent compromised patient safety.

Boissonnault's & Lovely's (2016) study emphasize that forty-two percent of the survey respondents (20 of 47) reported that their facility offered direct access to physical therapist services, but fewer than 10% of patients were seen via direct access at 95% of the facilities offering such services. The most frequently reported obstacles to model implementation and utilization were lack of health care provider, administrator, and patient knowledge of direct access; its legality in Wisconsin; and physical therapists' differential diagnosis and medical screening abilities. Respondents representing direct access organizations reported more timely access to physical therapist services, enhanced patient satisfaction, decreased organizational health care costs, and improved efficiency of resource utilization as benefits of model implementation (Boissonnault & Lovely, 2016).

Whereas *in Germany*, the aim of Kopkow et al. (2016) study is to evaluate the health care situation for physical therapy services included in the catalogue of remedies from 2004 up to 2014. To obtain information regarding physical therapy services included in the catalogue of remedies, the freely available "Heilmittel-Informationen-System (GKV-HIS)" was used. Data from the regional Associations of Statutory Health Insurance Physicians as well as data from federal reports were extracted for the years from 2004 up to 2014. Prescription of physical therapy increased continuously from 2004 and 2014. In 2004, 155 677 860 and in 2014, 254 695 514 physical therapies were prescribed (increase of 61%). The highest number of physical therapies was prescribed in Saxony for all years, whereas in North Rhine-Westphalia and Hessen the lowest number per 1 000 GKV insured persons. Gross sales from physical therapy services differed between federal states and were the highest in Saxony (2004: 59.8; 2009: 54.6, 2014: 76.7) and Baden-Wuerttemberg (2004: 60.0; 2009: 57.6; 2014: 68.0). The results of this study show utilization of physical therapy services as defined in the catalogue of remedies in Germany to be heterogeneous (Kopkow et al., 2016).

Weber et al. (2016) observed in Germany the frequency of the use of physical therapy in the last 12 months in the 0 to 17-year-olds in the KiGGS-baseline survey was 6,4% with higher use during infancy and adolescence. The socio-economic status of parents was not associated with the use of physical therapy. A migration background decreased the probability of the use of physical therapy, for example, among children aged 0 to 2 years ($OR_{adjusted}$: 0,5 [95% CI: 0,2-1,0]). In those with scoliosis, the use of physical therapy was almost twice as frequent in infancy as in adolescence (58,4 vs. 34,4%). A maximum of 15% of all children and adolescents with back pain reported the use of physical therapy. When ADHD was diagnosed at preschool age, the probability of using physical therapy was increased ($OR_{adjusted}$: 5,1 [95% CI: 1,4-18,6]). The health problems, which were assessed in the KiGGS-baseline survey and considered for this analysis could explain 37% of the use of physical therapy in the 0 to 2-year-olds. In the other age groups, 59 to 62% could be explained. Comparison of the KiGGS-baseline survey with health insurance data shows similar frequencies and patterns of the use of physical therapy and can therefore be used for the analysis of healthcare questions on the use of physical therapy. The data point to potential deficits in treatment in population segments and for some conditions (Weber et al., 2016).

Palliative care is an approach that improves the quality of life of patients with incurable and progressive illnesses; therefore, in these situations physiotherapy can play an important role.

Woitha K. et al (2017) in their study examined the integration and utilization of physiotherapy in palliative and hospice care services in Germany. A cross-sectional survey including all palliative care units, specialized outpatient palliative care teams and hospices in Germany (n = 680) in 2013 was carried out. The response rate was 43.5% (n = 296). Physiotherapy is predominantly applied in palliative care units (79%) but rarely in hospices (38%) and outpatient palliative care teams (30%). A structured physiotherapeutic assessment is rarely carried out even on palliative care units (26%). Despite its significant potential to relieve symptoms, physiotherapy is not systematically integrated into palliative care practice in Germany (Woitha et al., 2017)).

Physiotherapy services are reimbursed on a fee for service method in the ambulatory care in *Hungary*. The aim of Molics et al. (2011) study is to analyze the utilization of physiotherapy services in Hungary. Data were derived from the financial database of the National Health Insurance Fund Administration, the only health care financing agency in Hungary. We analyzed the year 2008. Medical procedures which can be performed by physiotherapists were included into the study. Medical procedures are listed according to the Hungarian version of the International Classification of Procedures in Medicine of WHO. Altogether 151 medical procedures were used by physiotherapists. The following top-11

medical procedure were responsible for more than half (52.5 %) of total activities: ultrasound therapy (8.2 %), iontophoresis (6.5 %), muscle strengthening exercise (4.8 %), individual training (4.4 %), training for circulation improvement (4.1 %), hand massage (4.0 %), passive movement of multiple limb (4.0 %), middle frequency treatment (3.8 %), mobilization of joints (3.3 %), exercises against resistance (3.2 %), education of using medical devices (3.1 %), extension of contracture (3.1 %). Total annual health insurance reimbursement of physiotherapy services was 7.34 billion HUF (42.7 million USD; 29.2 million EUR). Physiotherapy care proved to be a highly concentrated health service where 11 medical procedures out of 151 are responsible of more than half of activity and health insurance reimbursement (Molics et al., 2011).

Molics et al. (2012) evaluate the most frequent outpatient care physiotherapy services provided for trauma patients, based on age and regional distribution. The 151 different types of treatment codes are listed in the chapter of the Guidelines of HHIA for 'Physiotherapists, massage-therapists, conductors and other physiotherapy practices'. Of the physiotherapeutic services provided for trauma patients, the knee and lower leg injuries (ICD code S80-89) occurred with the highest incidence. Data collected from the year 2008 were further analyzed based on the distribution among the 7 different Hungarian regions and based on age distribution, set to 5 years intervals. The total number of the provided 151 different types WHO-classified physiotherapy services was 29045736 in the year of 2008; 3188650 of them with the ICD code group S00-S99 with the highest incidence: 713898 of services for knee and lower leg injuries (S80 -S89). The highest number of physiotherapy treatment in total of 86048 cases was provided for patients in the age group 30 to 34, followed by age group of 35 to 39 with 77903 cases. The average number of cases was 71.17/1000 persons. Injuries related treatments occurred with the highest incidence in the Central-Hungarian region (81.07 cases/1000 population) and with the lowest incidence in the Western-Transdanubian region (62.52 cases/1000 population). In case of the traumatic injuries, the highest demand of the outpatient care physiotherapy services occurred for knee and lower leg injured patients (Molics et al., 2012,a).

Trauma injuries account for 3.471.657 cases in the annual number of the physiotherapy-related activities (32.318.413 cases) showing an approximately 10.5% prevalence. The annual number of extremity injuries is the greatest, while that of the torso, neck and head injuries is the smallest. Most cases treated in the region of the knee and leg with 794.326 cases (22.88%), followed by the region of the upper extremity. The 20 most commonly used activities out of 151 with 86.35% incidence shows a varied content. Increase with age, the 10.000 per capita physiotherapy procedures is on the rise. There is no significant difference between the mean values in both genders (females=3272.54, males=3349.70). Until 49 years of age for men, and over 50 years of age for women the number of injury-related cases are greater (Molics et al., 2012, b).

Physiotherapy activities of the annual number of 32.318.413 cases, such as 19.095.614 musculoskeletal cases show 59.09% incidence with an annual cost of approximately 4.5 billion Hungarian Forint (HUF). The 20 most frequently used interventions show 79,19% incidence. The average number of cases in physiotherapy activities of the most common diseases accounts for 12.015 dorsopathies, 6.305 arthropathies and 3.461 soft tissue disorders per 10.000 inhabitants. By males and females, the average number of cases accounts for 8.061 and 15.589 dorsopathies, 4.110 and 8.295 arthropathies, 2.592 and 4.245 soft tissue disorders. The 20 most common interventions in musculoskeletal and soft tissue disorders represent high number of cases, but show varied composition with regard to active and passive procedures. Concerning the number of cases in interventions, females show lower incidence for dorsopathies, arthropathies and soft tissue disorders as well. Changes in the number of cases justify the high incidence of musculoskeletal disorders in the older patients (Molics et al., 2013, a).

In 2009 the average number of cases undergoing physiotherapy activities following lower extremity injuries per 10,000 persons were the following: „hip and thigh injuries” 249.75 male cases and 443.7 female cases; „knee and leg injuries” 927.64 male cases and 668.25 female cases, and „ankle and foot injuries” 307.58 male cases and 245.75 female cases. According to Molics et al. study, the number of physiotherapy activities for patients with injuries of the lower extremity showed significant differences between genders (Molics et al., 2013, b).

Trauma injuries account for 3471657 cases within the annual number of the physiotherapy-related activities (32318413 cases) are showing an approximately 10.5% prevalence. Increasing with age, the number physiotherapy procedures per 10000 population is on the rise with a national mean value of 3386. There is no significant difference between the mean values in both genders (females=3272, males=3349). The highest number of physiotherapy treatment is provided for the men patients in the age group 55 to 59 (4525) followed by age groups of 35 to 45 with 4225 and 4272 cases. The oldest women age group show the highest value in this gender (7664), followed by age groups of 75 to 85 with 6057 and 6041 cases per 10000. The number of injury-related cases are higher in men until 49 years of age, but over 50 years of age is higher for women. In case of the traumatic injuries, the highest demand of the outpatient care physiotherapy services occurred older injured patients. The claim indicators were significantly higher for men and women over 50 years of age (Molics et al., 2013, c).

The total number of the provided 151 different types WHO-classified physiotherapy services was 32.318.413 in the year of 2009; 19.095.614 (59,09%) of them with the musculoskeletal and connective tissue diseases. The prevalence of the dorsopathia diseases were 51,17% in the group of the musculoskeletal

and connective tissue diseases. The average number of cases of physiotherapy activities per 10,000 persons accounted for 12.015 cases in 2009. The average number of cases per 10,000 persons for males and females were 15.589 cases for males and 8.061 cases for females. The number of cases increases from the 20. age groups in the men and women patients. The highest number of physiotherapy treatment is provided for both genders in the age group 50 to 59 followed by age groups of 60 to 74. The physiotherapy services occurred with the highest incidence in cases of the 'diseases of the musculoskeletal system and connective tissue' ICD group. The dorsopathia diseases at the ICD groups show the highest prevalence, indicating the importance of prevention (Molics et al., 2013, d).

In 2009 altogether 190986 patients with neurological disorders received physiotherapy treatment in outpatient care, representing 1331675 cases and got 388.215 million Hungarian Forint health insurance reimbursements. The number of patients with nerve, nerve root and plexus disorders was 39 patients/10 000 population for males and 66 patients/10000 population for females. The number of patients with cerebral palsy and other paralytic syndromes was 49 patients/10000 populations for males and 35 patients/10000 population for females. The number of patients with episodic and paroxysmal disorders was 33 patients/10000 population for males and 52 patients/10000 populations for females. In the outpatient physiotherapy care the utilization indicators for female patients were higher in nerve, nerve root and plexus disorders and episodic and paroxysmal disorders, while in cerebral palsy and other paralytic syndromes the utilization by male patients was higher. There are important age and gender inequalities in the utilization of physiotherapy care of patients with neurological disorders (Molics et al., 2015).

The number of specialized home care visits in Hungary accounted for values between 1106396 and 1310093 in the period of 2010 - 2014. The rate of completed visits amounted to 55-60% regarding specialized care and 40-45% to physiotherapy services. Within physiotherapy services, physiotherapy showed to highest incidence with the number of visits between 390092 and 483654. This represents approximately 85% frequency each year opposite to electrotherapy and speech therapy min. 22918 (83,62%) patients in 2010 and 31217 (88,55%) patients in 2014 (Molics et al., 2016; Járomi et al., 2016).

Conclusion

Utilization of physiotherapy in the word is different but where they oft use this therapy the health care costs became reduced.

To ensure the quality of physical therapy services, inter professional and patient relevant research is needed (Kopkow et al., 2016).

The number of physiotherapy rounds gives reason to reconsider financing and requires more support for the elaboration of physiotherapy services (Molics et al., 2016).

REFERENCES

- Childs, J.D., et al. (2015). Implications of early and guideline adherent physical therapy for low back pain on utilization and costs. *BMC health services research*. 15(1):150. doi: 10.1186/s12913-015-0830-3 pmid:25880898.
- Boissonnault, W.G., & Lovely, K. (2016). Hospital-Based Outpatient Direct Access to Physical Therapist Services: Current Status in Wisconsin. *Phys Ther*. 96(11):1695-1704. doi: 10.2522/ptj.20150540
- Fraser, J.J., Glaviano, N.R., & Hertel, J. (2017). Utilization of Physical Therapy Intervention Among Patients With Plantar Fasciitis in the United States. *J Orthop Sports Phys Ther*. 47(2):49-55. doi: 10.2519/jospt.2017.6999.
- Hanney, W.J., Masaracchio, M., Liu, X., & Kolber, M.J. (2016). The Influence of Physical Therapy Guideline Adherence on Healthcare Utilization and Costs among Patients with Low Back Pain: A Systematic Review of the Literature. *PLoS One*. 11(6):e0156799. doi: 10.1371/journal.pone.0156799.
- Járomi, M. et al. (2016). Number of patients in physiotherapy services within specialized home care in Hungary between 2010 and 2014. *Value in Health*, 19(7): A484-A485. doi: 10.1016/j.jval.2016.09.799
- Kopkow, C., Lange, T., Schmitt, J., & Petzold, T. (2016). Utilization of Physical Therapy Services in Germany from 2004 until 2014: Analysis of Statutory Health Insurance Data. [Article in German: Physiotherapeutische Versorgungssituation in Deutschland von 2004 bis 2014. Analyse des Ordnungsverhaltens bei Versicherten der Gesetzlichen Krankenversicherung]. *Gesundheitswesen*. doi: 10.1055/s-0042-116229
- Lin, M. (2016). Physical Therapy Utilization in the Management of Multiple Sclerosis in the United States. *PM&R*. 8(9S): S274. doi: 10.1016/j.pmrj.2016.07.516.
- Louw, A., Puentedura, E.J., & Diener, I. A descriptive study of the utilization of physical therapy for postoperative rehabilitation in patients undergoing surgery for lumbar radiculopathy. *Eur Spine J*, 25(11):3550-3559. doi: 10.1007/s00586-016-4457-9.
- Maruf, F.A., Ekediegwu, E.C., Akinpelu, A.O. & Nwankwo, M.J. (2012). Awareness, Belief, Attitude and Utilization of Physiotherapy Services in a Nigerian Population. *Journal Of The Nigeria Society Of Physiotherapy*. 20.
- Molics B, et al. (2011). Utilization of physiotherapy services in Hungary. *Value in Health*, 14(7): A353.

- Molics B, et al. (2012).(a); The annual health insurance activity of physiotherapy procedures related to definition in outpatient care. [Hungarian: A fizioterápiás jellegű tevékenységek éves egészségbiztosítási finanszírozásának meghatározása a járóbeteg-szakellátásban.] *Nővér*. 25(6): 21-27.
- Molics B, et al. (2012).(b); Regional and age distribution evaluation of the outpatient care physiotherapy services for high incidence traumatic injuries. *Value in Health*. 15:(7): A519.
- Molics B, et al. (2013). (a); Utilization indicators of physiotherapy care in musculoskeletal and connective tissue disorders for outpatient care. [Hungarian: Fizioterápiás járóbetegellátás igénybevételi mutatói a mozgásszervi kórképek kezelésében.] *Magyar Traumatológia Ortopédia Kézsebészet Plasztikai Sebészet*. 56(4): 305-315.
- Molics B, Kráncz J, Schmidt B, Sebestyén A, Nyárády J, Boncz I. (2013). (b); Utilization of physiotherapy services in case of trauma disorders of the lower extremity in the outpatient care. [Hungarian: A fizioterápiás jellegű tevékenységek igénybevételi mutatói a járóbeteg-szakellátásban az alsó végtag traumatológiai kórképei esetében.] *Orv Hetil*. 154(25): 985-992.
- Molics B, et al. (2013).(c); Frequency of outpatient physiotherapy services in trauma disease in Hungary. *Value in Health*, 16(3): A230.
- Molics B, et al. (2013). (d); Age and Gender Distribution of Outpatient Care Physiotherapy Services fo Dorsopathia Diseases in Hungary. *Value in Health*, 16(7): A574.
- Molics B, et al. (2015). Health insurance aspects of physiotherapeutic care of neurology disorders in outpatient care. [Hungarian: A neurológiai kórképek fizioterápiás ellátásának egészségbiztosítási vonatkozásai a járóbeteg szakellátásban.] *Ideggyogy Sz*, 68(11-12): 399-408.
- Molics, B., et al. (2016). Utilization of physiotherapy visits completed in specialized home care in Hungary between 2010 and 2014. *Value in Health*, 19(7): A481-A482.
- Riley, S.P., Tafuto, V., & Brismée, J.M. (2016). Retrospective analysis of physical therapy utilization by the specificity of the diagnosis and order written on the referral. *Physiother Theory Pract*. 32(6):461-467. doi: 10.3109/09593985.2016.1145310
- Sclafani, J.A., Constantin, A., Ho, P.S., Akuthota, V., & Chan, L. (2016). (b); Descriptive Analysis of Spinal Neuroaxial Injections, Surgical Interventions and Physical Therapy Utilization for Degenerative Lumbar Spondylolisthesis within Medicare Beneficiaries from 2000-2011. *Spine (Phila Pa 1976)*.
Doi: 10.1097/BRS.0000000000001724
- Sclafani, J.A., Ho, P.S., Mayfield, C., Ukegbu, U., Akuthota, V., & Chan, L. (2016).(a); Interventional Treatment and Physical Therapy Utilization for Degenerative Lumbar Spondylolisthesis Within Medicare Beneficiaries From 2000-2011: Descriptive Analysis and Impacts on Surgery Frequency. *PM R*8(9S):S160. doi: 10.1016/j.pmrj.2016.07.043.
- Weber, A., et al. Utilization of Physiotherapy Services by Children and Adolescents - Results of the KiGGS- Baseline Survey. [Article in German. Inanspruchnahme von Physiotherapie im Kindes- und Jugendalter – Ergebnisse aus der KiGGS-Basiserhebung] *Gesundheitswesen*. Apr 7. doi: 10.1055/s-0042-100728.

- Woitha, K., Schneider, N., Wunsch, A., Wiese, B., Fimm, S., & Müller-Mundt, G.(2017). Die Einbindung und Anwendung der Physiotherapie in der Hospiz- und Palliativversorgung. [Article in German. Integration and utilization of physiotherapy in hospice and palliative care: A survey on clinical practice in Germany]. *Schmerz*.(1):62-68. doi:10.1007/s00482-016-0151-4.
- World Confederation for Physical Therapy (WCPT). (2011). *Policy statement: Description of physical therapy*. Retrieved from: <http://www.wcpt.org/policy/ps-descriptionPT>.