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MOTOR PERFORMANCE OF AUSTRIAN AND SLOVAK PUPILS – A COMPARATIVE ANALYSIS

ŠIMONEK JAROMÍR[1]

ABSTRACT. Introduction. Authors compare the school physical education systems in Austria and Slovakia. **Material and method**. A comparative analysis was performed on two samples of pupils (n=85; male 38, female 47) aged 13-14 years in two different countries – Slovakia (n=43) and Austria (n=42). They focus on motor performance of boys and girls and compare the results in 5 selected tests: Sit and Reach, Standing Broad Jump, Sit-Ups in 30 seconds, Bent Arm Hang and 10 x 5m Shuttle Run. Authors expected that difference in the number of P.E. lessons in Austria and Slovakia can influence the level of motor performance of pupils (both male and female). Since the selected Austrian school provided longer P.E. lessons (150 min per week) than the Slovak school (90 min, they expected that Austrian pupils will perform better than their Slovak peers. **Results**. Based on the comparison we can assume that despite the lower number of P.E. lesson, Slovak boys and girls mostly showed better motor performance than the Austrian pupils. Statistically significant differences in favour of Slovak pupils were observed in the variables Standing Broad Jump, Sit-Ups in 30 seconds, Bent Arm Hang and 10 x 5m Shuttle Run (both genders. Austrian girls registered better results only in the Bent Arm Hang test. **Conclusion**. Results of our survey did not validate our expectations that Austrian pupils would have showed better motor performance than their Slovak counterparts, despite the higher number of P.E. lessons in Austria. Better performance can be attributed to sedentary behaviour of Austrian adolescents and higher physical activity of Slovak pupils during their leisure time.

Keywords*: Motor performance; Slovak and Austrian adolescents, P.E. lesson*

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Introduction

Currently, the educational systems in Slovakia as well as Austria are arranged based on the international standard for classification of education - ISCED. In both countries the law declares the right for free of charge compulsory education. In Slovakia pupils are granted a 150-eur worth contribution for covering catering and accommodation costs of ski courses once in the period of lower secondary education. In Austria a gratis skipass can be acquired under certain conditions. Other costs are covered by the pupil himself.

Unfortunately, the new Act on Education in Slovakia has brought reduction of the number of compulsory P.E. lessons to two at all levels of education. Only few schools have good material conditions to ad done or more lessons based on school educational program, which offers the teacher a space for initiative and creativity. In Austria, this problem does not exist and number of lessons varies regarding to the type and level of school, however, it does not drop under 2 lessons per week. Curricula of both systems offer a sufficient space for various physical activities open for new trendy sports. They are more attractive for children and youth. Thanks to the natural character of the country in Austria, pupils have opportunity to try non-traditional physical activities, such as skiing, snowboarding, climbing, mountaineering, etc. Other attractive activities include dance, acrobatics, or martial arts, which form a solid component of Austrian curriculum.

Research problem

Diverse development, both political and economic, of the two neighbouring countries within the Central Europe has influenced educational systems in both countries, which obviously results in different attitudes to physical activity of pupils at school and also out of school. Therefore, we raised the following research questions:

1. Is there any difference between motor performance of Austrian and Slovak pupils attending lower secondary education (ISCED 2)?
2. Does the amount of compulsory physical education influence the level of motor performance?

Aim of research. Our comparative research aimed at comparing the two systems of education in P.E. at lower secondary level in Austria and Slovakia, thus contributing to the knowledge of attitudes of pupils to physical activity at school and out of school.

Limits of the survey: We are fully aware that our sample (n=169) represents only a marginal available selection of the population year and we cannot do any far-reaching conclusion out of it. Among other limits is the use of population norms from the year 2002. However, we can presume that certain trends in the motor development of children can be seen from this survey.

The following **research hypotheses** have been set forth:

Hypothesis 1: The level of motor performance of Austrian elementary school male pupils will be higher than the one of Slovak pupils.

Hypothesis 2: The level of motor performance of Austrian elementary school female pupils will be higher than the one of Slovak pupils.

Hypothesis 3: The number of obligatory lessons of P.E. impacts the level of motor performance of pupils.

Methods and sample

Participants. The sample formed 85 pupils (42 Austrian and 43 Slovak pupils) attending lower secondary education (ISCED 2). As to genders, 29+18 female and 14+24 male pupils. 2 schools were randomly selected for the research: NMS (Neue Mittel Schule) 27 Bertha von Suttnerv in Linz (Austria) and Secondary Grammar School at Golianova 68 in Nitra. Both schools are situated at the outskirts. Testing took place during two P.E. lessons in both countries and twice with a two-week-period break.

Set of motor tests used to assess the level of motor performance of pupils. In order to obtain data on the level of motor performance of pupils the method of testing using the system EUROFIT was used. Five tests were selected: ***Sit and Reach, Standing Broad Jump, Sit-Ups in 30 seconds, Bent Arm Hang and 10 x 5m Shuttle Run.*** For finding out the amount of time devoted to performing out-of-school physical activities, explorative questionnaire method was used. Respondents were submitted short questionnaire with 12 questions focusing on personal data (age, gender, grade) of the pupil, and the amount of time devoted to sport activities outside the lessons.

Research data were processed and analysed using mathematic and statistical methods (mean, median, minimum value, maximum value, standard deviation, 5% and 95% percentile, Mann-Whitney U-test and Cohen´s test. The level of $\alpha = 0.05$ was used. Graphic form was used for description of the data distribution – factorized box plot. Cohen´s coefficient (Table 1) served for evaluating the effect between two independent values:

$$d = \frac{M_1 - M_2}{SD_{pooled}}, \text{ where } SD_{pooled} = \sqrt{\frac{SD_1^2 + SD_2^2}{2}}, M_1 - M_2$$

Represents difference of two arithmetic means of the compared variables, SD_1^2 a SD_2^2 represent the square number of standard deviation of the variables analysed.

Table 1. Criterion of evaluation of Cohen´s coefficient

Effect of the coefficient	Resulting effect
$d \geq 0{,}80$	Large effect
$d \in \langle 0.50 - 0.80 \rangle$	Medium effect
$d \in \langle 0.20 - 0.50 \rangle$	Small effect

Results and discussion

For the verification of the hypotheses the data were extracted concerning motor performance of individual pupils by means of motor tests. Results of EUROFIT tests represented depending variables, while gender and country of origin were independent variables.

In the following tables are presented descriptive statistical data of depending variables. Table 2 depicts descriptive statistics of variables for Austrian pupils, Table 3 for Slovak pupils, Table 4 describes statistics for boys and Table 5 for girls, regardless of their country of origin.

Table 2. Descriptive statistics of Slovak pupils (both genders)

Variable	Average	Median	Min. value	Max. value
Bent Arm Hang [s]	6.5556	2.2300	0.0000	32.1600
Standing Broad Jump [m]	1.7088	1.7000	1.3000	2.2500
Sit-ups [30 s]	24.5814	25.0000	10.0000	33.0000
Shuttle run (10x5m) [s]	18.9783	18.7500	16.7000	21.5300
Sit And Reach [cm]	19.2326	20.0000	4.0000	38.0000
Variable	**Std. Deviation**	**5% Perc.**	**95% Perc.**	**Missing data**
Bent Arm Hang [s]	8.5214	0.0000	24.5560	0
Standing Broad Jump [m]	0.2103	1.3500	2.1000	3
Sit-ups [30 s]	5.0532	15.4000	32.0000	0
Shuttle run (10x5m) [s]	1.1903	17.1040	21.3330	2
Sit And Reach [cm]	8.4292	6.5000	36.8000	0

Table 3. Descriptive statistics of Austrian pupils (both genders)

Variable	Average	Median	Min. value	Max. value
Bent Arm Hang [s]	8.5530	6.0550	0.0000	38.8300
Standing Broad Jump [m]	1.5138	1.5350	0.6800	1.9300
Sit-ups [30 s]	19.7750	20.0000	9.0000	26.0000
Shuttle run (10x5m) [s]	20.3124	20.4700	17.2300	23.2800
Sit And Reach [cm]	13.3382	13.9000	1.0000	29.0000
Variable	**Std. Deviation**	**5% Perc.**	**95% Perc.**	**Missing data**
Bent Arm Hang [s]	9.0510	0.0000	29.8390	2
Standing Broad Jump [m]	0.2762	1.0535	1.8995	2
Sit-ups [30 s]	4.2757	10.1000	25.9500	2
Shuttle run (10x5m) [s]	1.5978	17.5370	22.8070	1
Sit And Reach [cm]	6.4766	2.6250	25.5350	2

Table 4. Descriptive statistics of both Austrian and Slovak boys

Variable	Average	Median	Min. value	Max. value
Bent Arm Hang [s]	10.5641	7.5500	0.0000	38.8300
Standing Broad Jump [m]	1.7051	1.7100	1.1400	2.2500
Sit-ups [30 s]	22.1622	23.0000	10.0000	32.0000
Shuttle run (10x5m) [s]	19.4274	19.2150	16.7000	22.8400
Sit And Reach [cm]	11.7595	10.0000	1.0000	23.0000
Variable	**Std. deviation**	**5% Perc.**	**95% Perc.**	**Missing data**
Bent Arm Hang [s]	10.3912	0.0000	32.8270	1
Standing Broad Jump [m]	0.2205	1.3290	2.1150	1
Sit-ups [30 s]	4.0860	12.7000	28.4000	1
Shuttle run (10x5m) [s]	1.5812	17.0800	22.5265	0
Sit And Reach [cm]	5.7070	2.3500	22.1000	1

Table 5. Descriptive statistics of both Austrian and Slovak girls

Variable	Average	Median	Min. value	Max. value
Bent Arm Hang [s]	5.0683	2.8500	0.0000	27.1600
Standing Broad Jump [m]	1.5305	1.5500	0.6800	2.1000
Sit-ups [30 s]	22.3478	22.0000	9.0000	33.0000
Shuttle run (10x5m) [s]	19.8336	19.6700	17.1400	23.2800
Sit And Reach [cm]	20.1180	19.1000	6.0000	38.0000
Variable	**Std. deviation**	**5% Perc.**	**95% Perc.**	**Missing data**
Bent Arm Hang [s]	6.3611	0.0000	22.6575	1
Standing Broad Jump [m]	0.2718	1.0640	2.0200	4
Sit-ups [30 s]	6.0781	10.7000	32.0000	1
Shuttle run (10x5m) [s]	1.5204	17.2800	22.2850	3
Sit And Reach [cm]	7.7958	7.5900	36.6500	1

The comparison shows that boys perform better in the test Bent Arm Hang (10.56 s) than the girls (5.07 s). In the test Standing Broad Jump boys jumped further (1.7 m) than the girls (1.53 m). Boys and girls showed approximately the same performance in the test Sit-ups (22 repetitions). Boys were faster than girls (by 0.41 s) in the Shuttle Run Test 10x5 m. As expected, girls recorded better result (20.12 cm) than boys (11.75 cm) in the Sit And Reach test.

Differences in motor performance of Austrian and Slovak boys

Hypothesis 1 expressed the assumption that there exist a statistically significant difference in the motor performance of Austrian and Slovak boys, in favour of the former ones. To verify the assumption on the level of 0.05 nonparametric Mann-Whitney U test was used for the results in the selected motor tests. Results are presented in Table 6.

Table 6. Results of Mann-Whitney U test for hypothesis 1

Mann-Whitney U Test (Country) Marked tests are significant on the level p <.05000					
Variable	**Sum. r. gr. 1**	**Sum. r. gr. 2**	**U**	**Z**	**p-value**
Bent Arm Hang [s]	284.5000	418.5000	142.5000	0.56369	0.572963
Standing Broad Jump [m]	324.0000	379.0000	103.0000	1.80069	0.071753
Sit-ups [30 s]	316.5000	386.5000	110.5000	1.56582	0.117393
Shuttle run (10x5m) [s]	212.5000	528.5000	107.5000	-1.81568	0.069420
Sit And Reach [cm]	323.5000	379.5000	103.5000	1.78503	0.074257

The test showed that all p-values are higher than the level $\alpha = .05$. We can state that the hypothesis H_0 is not refused. There are not significant differences between the results of tests between Austrian and Slovak boys (Table 7).

Table 7. Results of Cohen´s test for hypothesis 1

	Slovak boys			**Austrian boys**			**Cohen´s coefficient**	
Variable	**Mean**	**Std. deviation**	**n**	**Mean**	**Std. deviation**	**n**	**d**	**Effect size**
Bent Arm Hang [s]	12.2136	11.0589	14	9.5600	10.0815	23	0.2508	Small effect
Standing Broad Jump [m]	1.8036	0.2214	14	1.6452	0.2017	23	0.7477	Medium effect
Sit-ups [30 s]	23.6429	4.3431	14	21.2609	3.7321	23	0.5883	Medium effect
Shuttle run (10x5m) [s]	18.7821	1.2241	14	19.8038	1.6655	24	0.6990	Medium effect
Sit And Reach [cm]	13.7500	5.9509	14	10.5478	5.3210	23	0.5673	Medium effect

Figure 1 depicts box plots of individual parameters separately for boys from Slovakia (left side) and from Austria (right side).

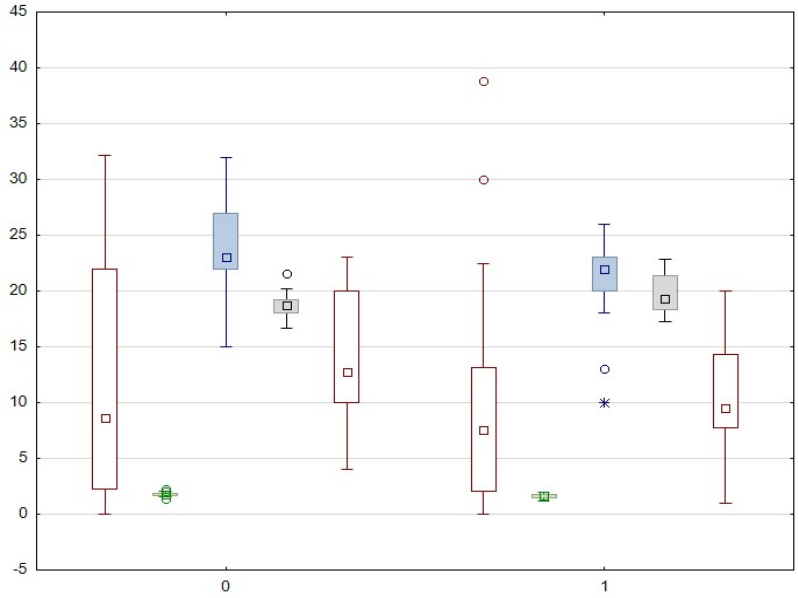

Figure 1. Factorized box plot of analysed variables according to the variable „country" (boys). Explanations: from left to right: T1, T2, T3, T4, T5 (for Slovakia) and T1, T2, T3, T4, T5 (for Austria)

Differences in motor performance of Austrian and Slovak girls

Hypothesis 2 expressed the assumption that there exist a statistically significant difference in the motor performance of Austrian and Slovak girls, in favour of the former ones. To verify the assumption on the level of 0.05 nonparametric Mann-Whitney U test was used for the results in the selected motor tests. Results are presented in Table 8.

Table 8. Results of Mann-Whitney U test for hypothesis 2

Mann-Whitney U Test (Country) Marked tests are significant on the level p <.05000					
Variable	**Sum. r. gr. 1**	**Sum r. gr. 2**	**U**	**Z**	**p-value**
Bent Arm Hang [s]	597.5000	483.5000	162.5000	-1.90022	0.057405
Standing Broad Jump [m]	726.5000	219.5000	66.5000	3.82537	0.000131
Sit-ups [30 s]	860.5000	220.5000	67.5000	4.06215	0.000049
Shuttle run (10x5m) [s]	440.0000	550.0000	62.0000	-4.02527	0.000057
Sit And Reach [cm]	761.0000	320.0000	167.0000	1.79782	0.072207

The following statements can be deduced from Table 8:

- The first variable – Bent Arm Hang – p-value is 0.057405, which means that H_0 is not refused. Performance of both Austrian and Slovak girls is not significantly different.
- The second variable – Standing Broad Jump – p-value is 0.000131, which is less than $\alpha = 0.05$, thus H_0 is refused. There are significant differences between the results of Austrian and Slovak girls in this test.
- The third variable – Sit-ups – p-value is 0.000049, which means that the hypothesis H_0 is refused. There are significant differences between the results of Austrian and Slovak girls in this test.
- The fourth variable – 10x5m Shuttle Run – p-value is 0.000057, which means that we refuse H_0. There are significant differences between the results of Austrian and Slovak girls in this test.
- The fifth variable – Sit And Reach – p-value is 0.072207, which means that H_0 is not refused. Performance of both Austrian and Slovak girls is not significantly different. (Table 9).

Table 9. Results of Cohen´s test for hypothesis 2

	Slovak girls			Austrian girls			Cohen´s coefficient	
Variable	**Mean**	**Std. Deviation**	**n**	**Mean**	**Std. deviation**	**n**	**d**	**Effect size**
Bent Arm Hang [s]	3.8241	5.3297	29	7.1906	7.5168	17	0.0517	No effect
Standing Broad Jump [m]	1.6577	0.1890	26	1.3359	0.2675	17	0.1697	No effect
Sit-ups [30 s]	25.0345	5.3751	29	17.7647	4.2357	17	0.1502	No effect
Shuttle run (10x5m) [s]	19.0800	1.1828	27	21.0306	0.1632	17	0.1632	No effect
Sit And Reach [cm]	21.8793	8.2371	29	17.1135	6.0808	17	0.0658	No effect

Figure 2 depicts box plots of individual parameters separately for girls from Slovakia (left side) and from Austria (right side).

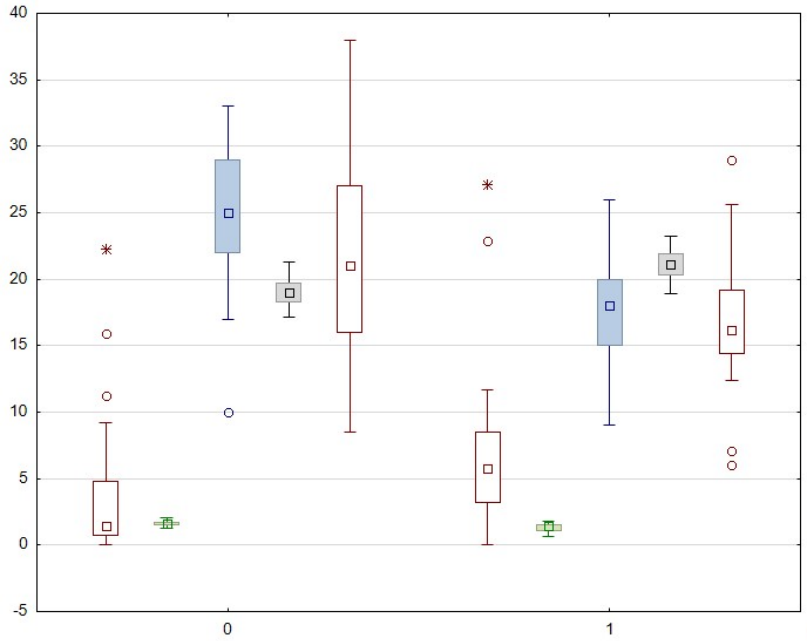

Figure 2. Factorized box plot of analysed variables according to the variable „country" (girls). Explanations: from left to right: T1, T2, T3, T4, T5 (for Slovakia) and T1, T2, T3, T4, T5 (for Austria)

Conclusions

By means of evaluation of the results we succeeded in getting the following answers to the research hypotheses:

Hypothesis 1: The level of motor performance of Austrian elementary school male pupils will be higher than the one of Slovak pupils.

The results showed that the level of motor performance of Austrian pupils was slightly lower than their counterparts´ one in Slovakia. Thus, the ***hypothesis 1 was not confirmed.***

Hypothesis 2: The level of motor performance of Austrian elementary school female pupils will be higher than the one of Slovak pupils.

The results of tests showed that Austrian girls performed better only in the first test. They showed higher level of strength ability of arms. In all the other 4 tests Slovak girls performed better. They showed significantly higher level of strength abilities of the trunk and legs, as well as agility and flexibility. Differences in tests No. 2, 3 and 4 were also statistically significant, in favour of the Slovak girls. ***Hypothesis 2 was not confirmed***.

Hypothesis 3: Number of obligatory lessons of P.E. impacts the level of motor performance of pupils.

If the number of P.E. lessons impacts the motor performance of pupils, the Austrian pupils should have performed better in motor tests than the Slovak pupils. With regard to the number of P.E. lessons (and their length) in Austria (150 min per week) and the number of lessons (2 per week) lasting for 90 min per week, we can state that the ***hypothesis 3 was not confirmed.***

Results of our survey did not validate our expectations that Austrian pupils would have showed better motor performance than their Slovak counterparts in both genders. The performance also did not depend on the number of P.E. lessons at school. We can thus express our assumption that Slovak boys and girls participate in more physical activities during their leisure time and the Austrian boys and girls are more sedentary.

Many EU member countries, among them also Slovakia or Austria, attempt to introduce new attractive physical activities and modern methods of teaching into the P.E. lessons. In the centre of curricula and teaching plans stand individual learning needs and prerequisites of pupils focused on the pupil and not on the teacher. Even evaluation is more humanism-oriented in the sense that they focus less on performance and more on positive emotions and enjoyment of pupils at lessons. In Austria, stress is put on the way the pupil shows his/her enjoyment with the future expected positive attitude to physical activities. Despite various research results we could come to the conclusion that the number of P.E. lessons not always influences optimum development of motor performance and skills. The main aspects are clear structure of the lesson, modern methods of teaching and improving the skills of pupils. Very important aspect is also the active time used by the teacher for practical movement of pupils. The time lost by long-lasting changing of dress, talking and idle time does not contribute to effective time use. Results of empiric studies proved that quality of P.E. lessons depends also on the effectiveness of educational time exploitation.

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PARENTS' INFLUENCE ON ATTITUDES OF ADOLESCENTS TOWARDS SPORT AND PHYSICAL ACTIVITY IN A CHANGING SOCIETY: THE CASE OF TRANSYLVANIA

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ABSTRACT. Nowadays, minimal data are available on active behaviors of young people in Romania, relatively new entry in the European Union. Within this country, physical activity behavior patterns of adolescents aged 14-18 years from the region of Transylvania's have been scarcely studied. To examine and better understand these behaviors, a Likert-scale-based questionnaire was administered to a sample of 750 adolescents. The questionnaire aimed to detect the involvement of the Romanian adolescents from Transylvania region in physical activity and sport and to understand who was influencing them the most in choosing the type of physical activity and sport. Our data show the role of parents, as main educational agents, in influencing the involvement of adolescents in physical activity and sport. Parental influence seems to be more significant for girls and boys living in rural areas than for those from cities. In conclusion, this study wants to encourage, via educational support, Romanian parents to reflect on their own characteristics, orientations and pedagogical models to better play their role as educators in Romanian society.

Keywords: *physical activity, parents, family, education, values.*

ABSTRACT. ***Influenţa părinţilor în ceea ce priveşte atitudinea adolescenţilor faţă de activitatea fizică şi sportivă într-o societate în schimbare: cazul Transilvaniei.*** În zilele noastre, în România, ţară integrată recent în Uniunea Europeană, sunt disponibile date minime privind comportamentele active ale tinerilor. Tiparele comportamentului fizic al adolescenţilor în vârstă de 14-18 ani din regiunea Transilvaniei au fost rareori studiate. Pentru a examina şi pentru a

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înţelege mai bine aceste comportamente, unui eşantion de 750 adolescenţi a fost administrat un chestionar bazat pe scara Likert. Chestionarul conceput în scopul de a detecta implicarea adolescenţilor români din regiunea Transilvania în activitatea fizică şi sportivă şi să scoată în evidenţă influenţa anumitor categorii de persoane care au influenţat cel mai mult alegerea tipului de activitate fizică şi sportivă. Datele obţinute scot în evidenţă rolul părinţilor, ca principalii agenţi educaţionali, în influenţarea implicării adolescenţilor în activitatea fizică şi în sportivă. Influenţa parentală pare a fi mai semnificativă pentru fetele şi băieţii care trăiesc în mediul rural decât pentru cei din oraşe. În concluzie, acest studiu doreşte să încurajeze părinţii români, prin intermediul sprijinului educaţional, ca să reflecteze asupra propriilor caracteristici, orientări şi modele pedagogice pentru a-şi juca mai bine rolul de educatori în societatea românească.

Cuvinte cheie: *activitate fizică, părinţi, familie, educaţie, valori.*

Introduction

To increase the quality of life is a primary objective of modern society, to which every citizen must participate. In modern society, sport and physical activities occupy an increasingly important place both in terms of quantitative and qualitative increase. An active and systematic activity can ensure the independence of the individual-medium-society relationship. This activity must be done rationally. We must take into account the physiological particularities of those who practice it, the society and the environment they live in.

Practicing exercise and sport is a right to all people; actually, having formative goals and moral, aesthetic and cultural valences, sport is addressed to all people of all social categories. Its practice expresses the need of human beings for movement and desire of expressing their psychomotor potential. This need is the starting point for the search for a healthy way of life.

By practicing them in clubs, fitness centers outdoors, sport and physical activity provide people with an outstanding opportunity to develop new relationships the possibility of improving communication skills. In current society, with new, significant political, social, demographic and economic changes, the practice of sport and physical activity acquires new valences and meanings related fun, risk, esthetic values, communication, social integration, and so on. Actually, the practice of physical activity and sport influences the personality of young people. Often, physical activities are practiced to improve the physical condition for prevention purposes in moderate programs with social effects. These effects deal with the group involvement and changes in body image of people who are involved in.

A good physical condition implies the person's ability to function with force and liveliness, without excessive fatigue, with enough energy to prevent physical stress. Such a condition can significantly reduce the risk of mental disorders in adults of both genders. Regularly practiced, physical activity and sport can stimulate emotional functions so that stress factors are more easily tolerated.

After the collapse of the socialist bloc and joining the European Union, Romania has increased the lifestyle quality of its population. Romanians' behaviors have become more similar to those of Western Europe, especially in the higher socioeconomic status (SES) groups (Biddle et al., 2009; Soos et al., 2014).

Childhood obesity is rising steadily in the industrialized world, and low levels of physical activity are likely to be a primary cause (Kipping et al., 2012; Biddle et al., 2004). Some theorists claim that personality can be modeled by sport and physical exercise. Furnham (1990) has stressed the effects of sport and recreational activities as a means for socializing and changing the lifestyle through different patterns of interaction with various individuals that can substantially influence the functioning of personality.

Family plays a crucial role in changing adolescents' attitudes and the perception of physical activity and sport. Families are responsible for the way adolescents perceive physical activity and sport and acquire values through them. This is particularly true for parents who are models for their adolescents. Parents having a high level of education and social status tend to focus more on active behaviors. They are mainly interested in helping their adolescents learn to live according to a healthy lifestyle gained through sport and physical activity.

For parents, to have a positive influence on their adolescents, it is important not to have a mere practical conception of sport and physical activity but be aware of their real role and function as educators and parents taking care of the future of their children. They must be capable of justifying and explaining to their adolescents why they must be physically active in a coherent way in the lifespan. The parents must be role models for their adolescents. Also, they have to be provided with tools making them capable of clarifying their knowledge and values like educators.

Among the main determinant factors through which parents influence the perception of physical activity and sport of their adolescents, there is the social status of the family, its social environment, the size of the family, housing conditions, parents' education, level of education, urbanization, everyday circumstances, and nutrition.

Also, the social status of a family can be influenced by several environmental conditions, such as social affiliation, social relations, cultural environment, habits, and so on.

Early investigations on the influence of parents and family about the perception of sport and physical activity by children and adolescents have stressed the complexity of this influence (Ponthieux, Barker 1965; Prudham 1969, Quell, Sattel, 1976; Farmosi, 2011).

Different social classes, ethnic groups, and different cultures have different child-rearing habits. The social situation of the family is mainly influenced by father's education, his occupational status, and of income of parents. Renson et al. (1979) concluded that the father's occupational status is, more than education, a dominant factor in influencing the attitude towards physical activity and sport in children. There is no doubt, however, that occupation and education are closely related.

The social circumstances of the family affect adolescents' development, personality and motor behaviors. A better social situation and education of parents create a better educational situation (Farmosi, 2011). Urbanization and territorial environment are two other factors influencing attitude towards Physical Activity and sport in youngsters.

Urbanization, which is related to the settlement of population, can influence both motor behaviors and development of adolescents. In the same way, different geographical environments and the lifestyles (rural or urban) tied to them can have a similar impact.

Theoretical framework

Therefore, in this study, we present data on how family influences adolescents involvement in sport and physical activity. Our scope is to provide perspective researchers with useful baseline data to investigate the changes in lifestyle and attitudes towards sport and physical activity by adolescents in the area of Transylvania region.

The Research on sports socialization, both theoretical and experimental, has highlighted the role played by the following main educational agents (Isidori et al., 2014):

1) family;
2) school;
3) peer group;
4) coaches;
5) sports promotion institutions;
6) mass media;
7) spectators and fans.

In the last three decades, the Romanian family, due to relevant economic, social and demographic changes, has experienced significant changes regarding lifestyles. Therefore, as an adaptation response, people have changed their behaviors. In so doing, each geographical area has adopted a particular and specific way of life, which has affected and influenced the behavior of its inhabitants. This effect and influence are mirrored in two main attitudes towards physical activity and sport, mainly active or sedentary behavior.

In our study, we will try to show the importance of family as the primary educational agent capable of influencing the perception of and the attitude towards physical activity and sport of Romanian adolescents aged 14-18 years from Transylvania.

Method

Participants

750 students aged between 14 and 18 years have participated in the study. The sample was composed of 164 females, and 181 males from urban geographical areas and 199 females and 206 males from rural geographical areas (Table 1) randomly selected in different primary and secondary schools from eight Romanian counties (Covasna, Harghita,Bistrita-Nasaud, Maramures, Salaj, Bihor and Cluj). The sample was represented by adolescents belonging to families whose classification of socioeconomic status by parents' occupation can be largely considered on the 'average' for SES. All students involved in the study were regular students attending regular classes of Physical Education in the school.

Table 1. Number and age of the research participants, divided by gender and birthplace.

Participants N (mean age, SD)		Birthplace		
		Urban	**Rural**	**Total**
Gender	**Female**	164 (15.81, 1.37)	199 (16.22, 1.17)	363 (16.03, 1.28)
	Male	181 (15.89, 1.31)	206 (15.90, 1.42)	387 (15.90, 1.37)
Total		345 (15.85, 1.34)	405 (16.05, 1.31)	750 (15.96, 1.33)

Questionnaire

To carry out the research, a questionnaire validated in a previous study was used (Isidori et al., 2014). The questionnaire aimed to detect the motivations, attitudes, and behaviors of students concerning physical and sports practice. The original Italian version has been translated into Romanian language and validated with a forward-backward process, verifying its comprehensibility, clarity, and conformity.

In this work, only the data relating to questions on the influence of parents and various educational agents on the choice and practice of sports activity by Romanian adolescents were analyzed. Participants responded to the statement «your parents have influenced you in order to practice regular physical activity and sport» and have to indicate their level of agreement on a 5-point Likert scale (1=at all; 2=less; 3=moderate; 4=much; 5=very much).

When asked «who did influence you most in choosing the type of physical activity and sport you are engaged in? », participants had to choose among the following options: 1. Parents; 2. Brothers or sisters; 3. My Physical Education teacher; 4. Another teacher; 5. A coach; 6. My friends; 7. Church; 8. Somebody else/who?

Data analysis

A descriptive analysis was carried out by taking into account and focusing on all variables of interest. Firstly, the percentages for the answers were calculated. Secondly, the relationships between the answers, gender, and birthplace variables were analyzed. For this reason, the Cramer's V was calculated, and standardized residuals were analyzed to identify significant differences.

Results

1) *Parents' influence*

The data show that overall 40% of the students who participated in the survey consider the influence of parents to be moderate in physical activity and sport regular practice. In the analysis, the answers 1 and 2 (at all/less) and 4 and 5 (much/very much) were grouped. 28.53% of the participants declared that the parents had a little or no influence on their attitudes towards and the choices related to physical activity and sport, while 31.47% considered the influence of parents relevant or very relevant (Fig. 1).

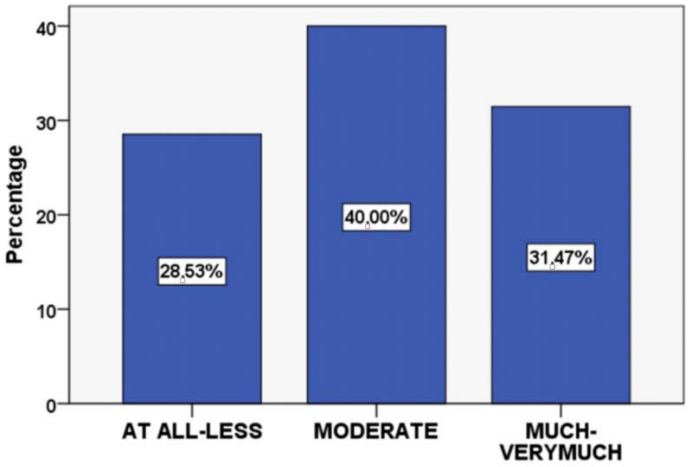

Figure 1. Parents' influence on physical activity and sport regularly practiced by adolescents

2) *Who did influence you most in choosing the type of physical activity?*

The data showed that friends are those who have influenced most (18.0%) and, after that, the parents (14.4%). The other preferences are distributed in this way: brothers or sisters 3.2%; the physical education teacher 7.6%; another teacher 1.1%, the coach 5.85%; the church (0.4%) (Tab.2). Taking into account multiple responses that also include the previous categories, parents (35.4%) seem to have a more significant influence than friends (24.3%). Using this criterion, also the physical education teacher seems to have a certain weight in the choice of students (14.1%).

3) *Parents' influence and Gender*

The differences are significant (Cramer's V=.172, p <.001). The analysis of standardized residuals shows differences in the responses according to gender (at all/less, female=10.0%, male=18.5%). A more significant number of male students, compared to the females, claims to be at all or less influenced by the parents in the regular practice of physical and sport activity (Fig. 3).

4) *Parents' influence and Birthplace*

We have found significant differences regarding the relationship between parents influence and birthplace (Cramer's V=.179, p <.001). Standardized residuals analysis shows that a more significant number of students living in rural areas (21.1%) considers the influence of parents in sports practice to be very strong (much-very much) compared to students living in an urban context (10.4%) (Fig. 4).

Table 2. Frequencies and percentages of answers to the question «Who did influence you most in choosing the type of physical activity?» (n=632)

	Frequency	Percentage	Cumulative percentage
Parents	91	14.4	14.4
Brothers or Sisters	20	3.2	17.6
My Physical Education Teacher	48	7.6	25.2
Another teacher	7	1.1	26.3
A Coach	37	5.9	32.1
My friends	114	18.0	50.2
Church	3	0.5	50.6
Somebody else	49	7.8	58.4
Parents + Brothers or Sisters + Other Responses	52	8.2	66.6
Parents + P.E. Teacher	41	6.5	73.1
Parents + My Friends	40	6.3	79.4
OtherResponses	130	20.6	100.0
Total	632	100.0	

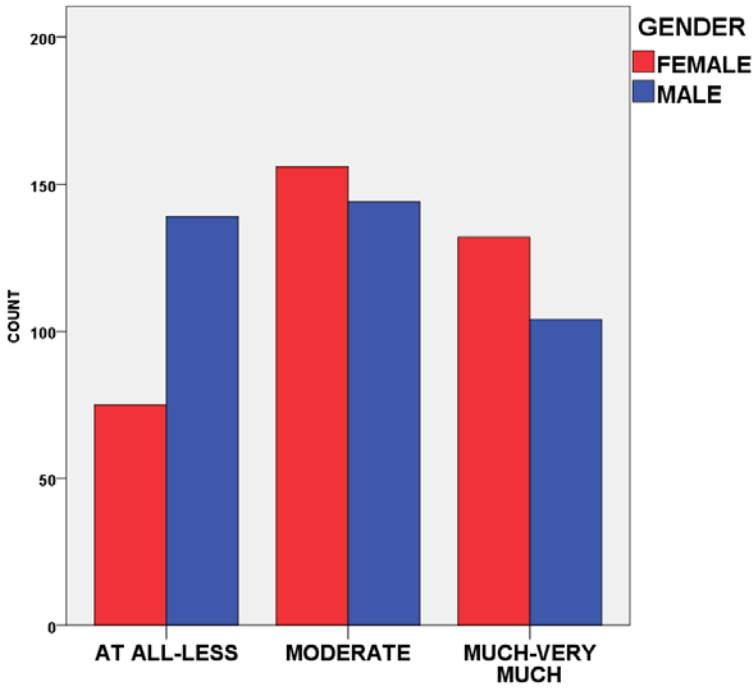

Figure 3. Influence of parents on the regular practice of physical activity and sport according to gender

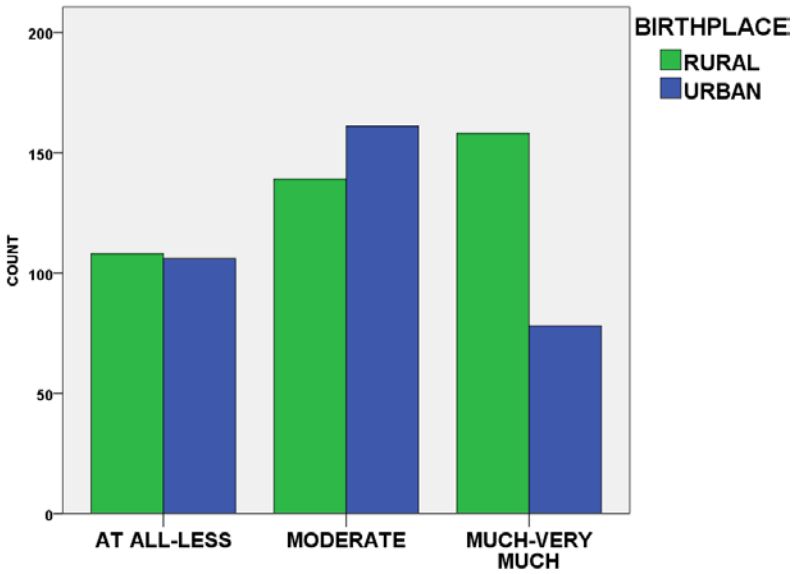

Figure 4. Influence of parents in the regular practice of physical and sport activity according to birthplace

Discussion and conclusions

The analysis of parents influence on the preferences and attitudes towards physical activity and sport in Romanian adolescents can detect and reveal socio-economic status, social problems and the policies of governmental bodies for what it refers to sports facilities, as well as the policies of the labor market (more than 3millions of Romanians work abroad).

Our data show that 40% of respondents consider the influence of parents to be moderate in sports practice; 31.47% believe that such influence is very significant, while 28.53% think it is very low or inexistent. These opinions seem to vary according to gender and place of residence. The males affirm to be less influenced than females by their parents in the practice of physical and sport activities. Instead, compared to their peers living in urban areas, adolescents living in rural areas consider parents as the most influent agents on their lives. About the influence regarding the choice of the type of physical activity, the role of friends is primary and is followed by that of parents. Taking into account the same categories (parents and friends) provided along with other answers, parents generally assume greater relevance for adolescents (35.4%) than their friends (24.3%).

The questionnaire we have adapted and utilized in this study wants to encourage Romanian parents to reflect on their characteristics, orientations and pedagogical models. This study shows the importance of family and parents as primary educational agents in making adolescents involved in physical activity and sport.

In conclusion, we can affirm that it is always the philosophy regarding the orientation towards and the conceiving of sport and physical activity adopted by the family to make these two bodily practices an outstanding means for educating Transylvanian adolescents by giving them the opportunity to become active members of Romanian and European society.

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PERFORMANCE-STRUCTURE ANALYSIS OF ELITE JUNIOR BOY TENNIS PLAYERS

DOBOS KÁROLY[1]

ABSTRACT. Introduction: Extremely complex factors lie behind sport performance in tennis. In order to evaluate the importance and weight of these factors, it is important to examine them each by each. **Objective:** The aim of the research was to examine the performance-structures lying behind the physical performance of elite junior boy tennis players and to analyse the relationship between the calendar year and physical variables. **Method:** Altogether 80 elite junior boy tennis players participated in the research. Their average age was 14.30±2.22 years. Eleven different field tests were applied. **Results:** Correlations were found between the calendar year age and all the physical variables, the 5-meter linear run and the agility, the explosive strength of the leg, the 5-meter sprint and the agility. The speed of serve showed correlation with the dominant-side upper limb, the upper body and the explosive strength of the leg. Furthermore, there was a correlation between the shoulder flexibility and the flexibility of the lower limb, the flexibility of the lower leg, the explosive strength of the leg and the agility, the flexibility of the shoulder and the speed of serve. **Conclusions:** A differentiation in the conditioning training of elite junior boy tennis players is recommended based on their age, from the age of 11, together with the joint developmental trainings of explosive strength and flexibility, agility and explosive strength of the leg, the improving of explosive strength in the lower and upper limbs, and the use of 5 meter linear run and the athletic throws as a means of training.

Key-words: *tennis, conditioning abilities, performance-structure, correlation*

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Introduction – Objective

Extremely complex factors lie behind sport performance. In order to evaluate the importance and weight of these factors, it is important to examine them. The author focused on conditional abilities in this research, as tennis movements are such a series of special motor performances, the level of which greatly influence short-term and long-range competition performance. Furthermore, due to the appearance of modern equipment and playing surfaces in tennis, the speed of play is becoming faster, thus the physical requirements of the game in the case of a professional player have increased considerably. In the author's opinion this statement is true for elite junior players as well, who are still at the beginning of their career owing to their age; their biological state of development lags behind those of adults, which presents itself in their technical and tactical repertoire and their movement dynamics. However, considering their competition system (competing all year round, playing on different playing surfaces) and the increasing number of excellently trained opponents, they show similarities to professional adult tennis players. Thus the level of physical ability is of decisive importance as well.

Several researches have studied the conditional abilities of elite junior boy tennis players with field tests (Baiget et al., 2013; Filipčič & Filipčič, 2005 a, b; Filipčič et al., 2010; Girard & Millet, 2009; Kramer et al., 20017; Meckel et al., 2015; Roetert et al., 1992, 1996; Unierzyski, 1994). A great part of the researches was focussed on putting the relationship between competition performance and conditional abilities into the forefront. They did not deal much with an analysis of the performance structures, which lie in the background of physical performance. But the opening up of a relation system between the physical variables cannot be looked at as a side-issue, as the level of trainedness is not only determined by the level of each component, but the relationship among the components, that is to say, the structure of characteristics (Nádori, 2005). A further interesting question is the analysis of calendar year age and the relationship among physical variables in the field tests, as junior tennis players have to compete in age categories based on their calendar year of birth.

This is why the aim of this research was to analyse the performance structure of elite junior boy tennis players which underlies their physical performance, based on the field tests. Furthermore, the relationship between calendar year age and physical variables was also analysed. Another aim was to provide suggestions regarding the physical preparation characteristics of junior elite boy tennis players, based on the expected results of the research.

Methods

Participants

The sample for the research included the best Hungarian boy tennis players of the 12-, 14-, 16- and 18-year-old age categories, who are among the top forty best players on the ranking list in their age categories. Sampling in the given age category was carried out with the stratified random sample; thus, 20 boys were measured in each age category. The total number of the tested players was 80 (N=80) and their average age was 14.30±2.22 years. The sample represented the total population of the best Hungarian junior boy tennis players. They had three to seven years of competition experience and played 40-70 decisive matches annually.

Before the survey the participants were informed both in oral and in written forms about the testing procedure. All players had a medical certification and declaration of agreement from their parents. The experimental design was approved by the Ethical Committee of Public Health Division of the Budapest Government Office (permission # 7878/2014), and was in harmony with the principles of the Helsinki declaration (Harriss & Atkinson, 2011).

Table 1. The selected motor ability tests

CODE	NAME OF THE VARIABLE	DIMENSIONS ASSESSED
H	Hexagon (.01 s)	Agility and coordination
R5	5-meter run (.01 s)	Acceleration and quick first step
SLJ	Standing long jump (m)	Explosive strength of the legs
OMBT	Overhead medicine ball throw -1kg (m)	Neuromuscular power of the body and explosive strength of the upper body
OLBT	Overhand little ball throw-80 g (m)	Explosive strength of the dominant shoulder and arm, neuromuscular power of the body
SERV	Serve speed (km/h)	Neuromuscular power of the body
PU30	Push ups in 30 s (freq.)	Explosive strength endurance of the upper body
SH5x10	5x10-meter shuttle run (.01 s)	Linear directional agility (change of direction speed)
SR	Spider run (.01 s)	Multidirectional tennis-specific agility (change of direction speed)
STR	Sit and reach (cm)	Flexibility of the hamstring and trunk muscles
STS	Shoulder turning with stick	Shoulder flexibility

Eleven different field tests were applied to assess the fitness level of the tennis players considering the data in the special literature, and the researches and suggestions (Eurofit, 1993; Fernandez-Fernandez, Ulbricht & Ferrauti, 2014; Quinn & Reid, 2003; Nádori et al., 2005; Roetert & Ellenbecker, 2007; Ulbricht, Fernandez-Fernandez & Ferrauti, 2013). The reasons why they were used is as follows: they are well-known and simple; and a great part of them (the majority of them) well models the tennis-specific physical demands and technical components compared to the general laboratory tests. Besides these, they fulfil the criteria of the primary and secondary tests.

Testing was done indoors, before the main competition season. The items of the test had to be executed in the late morning hours after the pre-determined fifteen-minute standard warm-up in proper clothing (tennis shoes for clay court, comfortable shorts, T-shirt). The tennis players had no intensive physical activity 24 hours prior to testing. Four players were tested at the same time, and their order was predetermined.

The order of testing was as follows: hexagon test; 5-meter run; standing long jump; overhead medicine ball throw; overhand small ball throw; serve; and push-ups in 30 seconds; 5x10-meter shuttle run; spider run; sit and reach; shoulder turning with stick. Before each test one attempt was given, except for the serve, in which case they had a chance to execute 20 warm-up services. Players were allowed three attempts before the 5-meter run, standing long jump, overhead medicine ball throw and overhand small ball throw; eight for serving; two attempts for the hexagon run; and only one for sit and reach, shoulder turning with stick, and 5x10-meter shuttle and spider run. For the push ups they had 30 seconds to reach their best result. In terms of rest, after the warm up and between the tests they had four minutes, between the attempts one minute, and in the measuring of the speed of serve, only a 20 second rest. Players used their own rackets during the testing of their serves. “Calibrated” measuring instruments were used during testing: a GUR-1 type measurer was used for the 5-meter sprint and 5x10-mter runs; a Casio hand stop watch, with an accuracy of 0.01 seconds, was used for the hexagon and spider run; a measuring tape with 1 mm of accuracy was used in measuring the explosive strength of the upper body and the dominant arm when throwing a stuffed (1 kilo) and a small (103 gram, diameter 8 cm) ball; the “Stalker ATS II” serve speed measurer of 1 km/h accuracy was used for measuring the speed of serve executed with 53-56 gram weight and 6.5 cm diameter “Slazinger ultravis”-type tennis balls; and a 1.5-meter-long stick with 1 cm grading and a 45 cm high and 30x45 cm large measuring box was used for the flexibility tests. Only one person did the measuring of the tests.

Statistical analyses

First, the scatter of the data was elaborated with the Shapiro-Wilk W test. One part of the data did not complete the requirements of the normal scatter, thus, the basic statistical indices were given based on the median and quartile range (Table 2). In measuring the correlation, the non-parametric Spearman rank-correlation method was used. The statistical analysis of the data was carried out with SPSS 13.0 software.

Table 2. Basic statistical table of elite boy junior tennis players (N: 80)

Variable	Median	Range
H	11.12	1.99
R5	1.20	0.12
SLJ	2.00	0.41
OMBT	11.95	5.71
OLBT	42.30	15.38
SERV	161.00	38.00
PU30	21.00	11.00
SH5x10	19.28	1.76
SR	19.39	2.85
STR	15.00	9.50
STS	82.50	30.00

***Legends**: H-hexagon; R5- 5 meter run; SLJ- standing long jump; OMBT- overhead medicine ball throw; OLBT- overhand little ball throw; SERV- serve speed; PU30- push ups in 30 s; SH5x10-5x10 meter shuttle run; SR-spider run; STR-sit and reach; STS- Shoulder turning with stick.*

Results

A correlation was found between the calendar year age and all the physical variables. The 5-meter linear sprint showed a correlation with the results of the agility tests. The explosive strength of the legs showed a correlation with the 5-meter linear sprint and agility. The speed of serve correlated with the explosive strength of the dominant side upper limb, the upper body and the leg. In addition, there proved to be a correlation between the results of the agility tests.

The results of the flexibility test showed correlations with each other. The flexibility of the lower limb correlated with the explosive strength of the leg and agility. There was a correlation between the flexibility of the shoulder joint and the speed of serve as well. The explosive strength endurance of the upper limb showed a correlation with the speed of serve (Table 3).

Discussion

The correlation between physical abilities and calendar year age support the findings in the special international literature (Fernandez-Fernandez, Ulbricht & Ferrauti, 2014; Quinn & Reid, 2003; Nádori et al., 2005; Roetert & Ellenbecker, 2007). Thus, the statement that older elite junior boy tennis players play faster and move more dynamically than their younger mates, owing to their increasing physical abilities, proves to be evident.

Biological age is a better forecaster of level of physical abilities than chronological age (Mészáros, 1990; Ochi & Campbell, 2009). In spite of this, the author think that the research aimed at studying the relationship between calendar year age and conditional abilities makes sense, as the players have to compete in the age groups determined by the International Tennis Federation (ITF). The categorisation of tennis players is based not on biological, but calendar year age. Stemming from this, the competition circumstances matching the certain age categories and the condition levels of the competitors during the preparation should be emphasised.

Table 3. Correlation matrix of elite junior boy tennis players (N: 80)

V	A	H	R5	SLJ	OMBT	OLBT	SERV	PU30	SH5X10	SR	STR	STS
A	1	-0.41*	-0.75*	0.79*	0.82*	0.76*	0.84*	0.69*	-0.63*	-0.78*	-0.29*	-0.36*
H		1	0.61*	-0.53*	-0.48	-0.45	-0.47	-0.45	0.65*	0.55*	-0.28*	-0.02
R5			1	-0.86*	-0.81	-0.76	-0.75	-0.67	0.73*	0.81*	-0.39*	-0.12
SLJ				1	0.87*	0.81*	0.83*	0.77	-0.73*	-0.79*	0.44*	0.21
OMBT					1	0.86*	0.87*	0.68*	-0.68	-0.77	0.44*	0.21
OLBT						1	0.79*	0.59*	-0.65	-0.75	0.40*	0.11
SERV							1	0.68*	-0.65	-0.75	0.40*	-0.30*
PU30								1	-0.58	-0.63	0.28	-0.30
SH5x10									1	0.79*	-0.25*	-0.19
SR										1	-0.36*	-0.23
STR											1	-0.25*
STS												1

Legends: *A-age; H-hexagon; R5- 5 meter run; SLJ- standing long jump; OMBT- overhead medicine ball throw; OLBT- overhand little ball throw; SERV- serve speed; PU30- push ups in 30 s; SH5x10-5x10 meter shuttle run; SR-spider run; STR-sit and reach; STS- Shoulder turning with stick; *p<0,05.*

The flexibility of the shoulder joint showed a "negative" tendency with age. The data obtained reinforces the results of previous researches (Kibler et al., 1996; Roetert, Ellenbecker & Brown, 2000). The flexibility of the lower limb also showed a negative correlation with age. The flexibility of the shoulder joints and the lower limbs of elite junior tennis players decreases with age as a result of the repeated and one-sided loading of the upper body (deriving from the nature of the sport) due to the explosive starts, sudden stops, fast leg supports and vertical jumps characteristic of the legwork of a tennis player. This is why the development of the effectiveness of the upper body – mainly the shoulder joint – and the lower leg should be given priority in the preparation process of junior tennis players.

The 5-meter linear sprint showed a positive correlation with agility. Professional tennis players generally cover four meters between the strokes, and the maximal distance between the shots is 8-12 meters (Weber, Pieper & Exler, 2007). Thus, tennis players cannot reach the maximum of their running speed, so they rarely show their traditional acceleration running technique. According to the author this statement is also true for junior tennis players as well, with a difference: the dynamics of their movement are much smaller. This is why the ability that makes the tennis player able to speed up within a very short distance is of utmost importance. This is well modelled by the 5-meter linear sprint test. Furthermore, forward movements provide the basis for multi-directional movements (Klika, 2010). Thus, the performance shown in the 5-meter linear sprint of elite junior tennis players provides a proper basis for tennis-specific agility.

Several researchers have found correlation between the explosive strength of the lower limb and different sprint lengths (Baker & Nance, 1999; Cronin & Hansen 2005; Girard & Millet, 2009; Wisloff et al., 2004) and the explosive strength of the leg and running speed with direction-change (agility) (Asadi, 2012; Miller et al., 2006; Thomas, French & Hayes, 2009). The development of explosive strength in the lower limb is of key importance, as the majority of the legwork in tennis is characterised by explosive starts (quick first steps) and runs. So the tennis player who is able to exert explosive strength against the ground is able to move fast on the court and speed up within a short distance. The results obtained reinforced the results of the aforementioned researches in junior boy tennis players participating in our research.

The speed of the serve in elite junior tennis players showed a positive correlation with the strength of their dominant side upper limb, upper body and their legs. The results well-represent the statement that the lengthening-shortening cycle of the strokes (the so called "plyometric movement form") is the most frequent type of contraction in tennis, as the coordination pattern of

the majority of strokes is made up of these contractions. So those tennis players who can most effectively make use of their power are able to hit the ball most strongly, and they have the strongest serves. Furthermore, the explosive force-exertion manifested in the overhand little ball and overhead medicine ball throw can be well-transferred to the movement structure of the serve; this is why the application of plyometric practice throws is indispensable in initiating the proper force impact (hitting power), with a special hint to those athletic-type of throws (ball throw, two-hand heaves and putts) which aid in the learning and perfecting of technical elements in tennis. Besides all these, the development of the explosive strength of the legs is also important, as the lower limbs play a decisive role in creating hitting power. The results reinforce the suggestions in the special international literature and their research results (Dobos, 2011; Fernandez-Fernandez, Ulbricht & Ferrauti, 2014; Quinn & Reid, 2003; Roetert & Ellenbecker, 2007; Reid, Chow & Crespo, 2003).

The results of the agility tests show positive correlations among them. Agility is a complex ability, in which the running speed with direction change and the factors in relation to perception play a role (Young, James & Montgomery, 2002). In addition, the technical components of agility (special foot skills, different movement patterns, leg supports, and the movement coordination necessary for their execution) also play a determining role in agility. Based on all these results, it can be concluded that agility requiring a linear run (5x10-meter sprint) provides a suitable technical basis for agility requiring multidirectional movements (hexagon test, spider run). Furthermore, agility is an important part of the quick first step (Klika, 2010), which appears in the agility tests used by our research team, so a close correlation among the agility tests is expected.

As mentioned earlier, the explosive strength of the lower limb muscle is determinant in creating the proper hitting power and in running speed with direction changes. The flexibility of tendons is of decisive importance in the effective execution of the lengthening-shortening contraction of the muscles. The researches of Wilson, Murphy and Pryor (1994) proved that training aimed at the development of flexibility adds to an increase in elastic energy and increases the efficiency of muscle work through its lengthening and shortening contraction. So the results of the correlation of the standing long jump, the speed of serve and agility tests with the flexibility of the lower limb is not surprising, as the coordination pattern of the majority of strokes and take-off and direction change are made up of these contractions.

Proper flexibility ensures the anatomic range of motion at the joint, the optimal length of the muscles at rest, optimizes the flexibility of the muscles, improves movement coordination, and increases the effectiveness of force exertion (Eliott, 2003; Roetert & Ellenbecker, 2007). Thus, the speed of serve and flexibility of the shoulder are not surprising.

The data showed that the flexibility of the lower limb correlated negatively with the flexibility of the shoulder joint. The result confirms the results of Anloague et al., (2012), who carried out research on college baseball players, finding the flexibility of the lower limb can provide useful information in judging the dysfunction of the shoulder joint.

The explosive strength endurance of the upper limb showed a positive correlation with the speed of serve. In tennis the explosive strength of the upper limb is as important as that of the lower one. In the speeding up phases of the technical elements (forehand and backhand groundstrokes and serve) it is the pectoralis major muscles, the muscles in the shoulder girdle and those of the stroking arm which show great activity (Reid, Chow & Crespo, 2003). Furthermore, stemming from the nature of the sport, a huge repeated and unbalanced load has an effect on the upper body (trunk) in the junior age category players, also. Matches can last for hours, during which the players can execute even several hundred strokes; this is why, if they want to maintain the level of their hitting quality and do not want to get injured, the endurance of the explosive strength in the upper body and the half-symmetric strengthening of the dominant and non-dominant part of the body has to play an important role in the preparation of junior tennis players.

Conclusions

A differentiation in the conditioning training of elite junior boy tennis players is recommended based on their age, from the age of 11, together with the joint developmental trainings of explosive strength and flexibility, agility and explosive strength of the leg, the improving of explosive strength in the lower and upper limbs, and the use of 5 meter linear run and the athletic throws as a means of training.

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RELATIONSHIP BETWEEN PRE-TREATMENT HABITUAL PHYSICAL ACTIVITY AND SUCCESS OF ASSISTED REPRODUCTION

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ABSTRACT. Introduction. The increasing incidence of infertility, the stagnation of success rates of its treatments, and the reasons for success vs. failure are current research topics both from psychosocial and lifestyle point of view. Objective. The aim of the study was to examine the effects of pre-treatment physical activity (PA) on the level of infertility-related distress and on outcome measures in women undergoing assisted reproductive therapy (ART). **Methods.** A prospective observational cohort study was carried out involving 45 female patients with infertility diagnosis in a university hospital-based fertility centre during March – July 2017 with the follow up of outcome measures in May 2018. Standardized psychological questionnaires and pre-treatment PA habits were administrated. **Results.** 60% of the women reported regular physical activity. 73.3% self-reported normal mood state (average 5.0±4.1) with BDI-13 and 91.1% self-reported normal level of distress (average 2.3±2,1) with GHQ-12. Moderately high stress by social concern (42.7±8.8) and very high stress level by sexual (39.2±6.5) and by relationship concern (48.4±9.1) of FPI was found. Significant difference between active and inactive group was described for PICS Self Regulating System (p= .034). Significant relationship between pre-treatment PA and successful pregnancy (p=.036) was found. **Conclusions.** Infertility specific scales provide more appropriate description on mental status of ART patients than general scales. Pre-treatment

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PA could positively affect success of ART. However, for more impressive results, detailed assessment of physical activity, increased number of participants, and further examinations are needed.

Key words: *physical activity, assisted reproduction, mental health, infertility-related stress, outcome measures*

Introduction and Hypotheses

A global prevalence of 12% to 15% of 1-year infertility was described by McLaren in 2012 (McLaren, 2012). In accordance with these notes the current annual European monitoring report of the European Society of Human Reproduction and Embryology (ESHRE) presents growing number of assisted reproductive therapy (ART), with the 640 144 cycles initiated in 2012 described more than threefold increase (3.14) in the number of cycles compared to the previous fifteen years and double (1.97) increase compared to ten years ago. However, for in vitro fertilisation (IVF) cycles the clinical pregnancy rates per aspiration and per transfer are stable with 29.4% and 33.8% respectively. Rates are similar for intra-cytoplasmic sperm injection (ICSI) with 27.8 and 32.3 %, respectively (Calhaz-Jorge et al., 2016).

The situation in the Hungarian fertile age population is quite similar, 10 to 15% of couples of fertile age struggles with fertility problems (Bernard & Krizsa, 2006) and the results after ART are also similar: 920 IVF and 3502 ICSI are conducted with 31.7% and 34.5 % of pregnancies per aspiration (Calhaz-Jorge et al., 2016). The increasing incidence of infertility, the stagnation of success rates of the treatments, reasons for success vs. failure are current research topics both from psychosocial and lifestyle point of view. It could be hypothesized that by decreasing the level of infertility related distress, abundance of pre-treatment moderate intensity physical activity will increase the success rate of ART. Therefore, the purpose of the present study was to examine the effect of physical activity (PA) and stress on success of ART.

Material and methods

A cross-sectional, observational cohort study was conducted with consecutive sampling using self-administrated questionnaire in paper-pencil form.

Data collection was carried out at the Assisted Reproduction Unit, Department of Obstetrics and Gynaecology, University of Pécs, Hungary. Patient enrolment into ART procedure was approved by two independent physicians. Participants were recruited into this study according to the date of the consultation. The routine examination on the 3rd day of the unstimulated cycles presented a good possibility to get in contact with the patients and invite them to participate. The test battery was given to 100 female patients and 45 has returned untill July 2017. The follow up of outcome measures was conducted in May 2018.

All female patients with both female and male factors of infertility who were indicated for fertility treatment (IVF/ICSI) were consecutively invited to participate in the study according to the following inclusion criteria. Participants had a BMI ≥ 18 kg/m^2 and ≤ 38 kg/m^2 and had any significant abnormality relevant to the ART procedure and outcome (metabolic and vascular diseases including diabetes mellitus, metabolic syndrome, fatty liver diseases and atherosclerosis, severe endometriosis (stage III or IV) and/or adenomyosis. Participants were not at significant risk of severe ovarian hyperstimulation syndrome (OHSS), were not diagnosed with major depressive disorder (MDD) or any other mental disorders, and had no significant physical or mobility impairments.

Assessment Scales

The variables of the conceptual framework were measured by a survey: self-reporting questionnaires were filled out at home in a conventional paper-pencil form. Questionnaires were returned at the 21st day of the unstimulated cycles.

Socio-demographic characteristics were obtained by using questions regarding age, educational level, income, marital status, duration of partnership, duration of infertility, BMI and lifestyle habits. Psychosocial characteristics will be assessed by measuring the domains of depression/subjective well-being, anxiety, perceived stress, and infertility-related stress. To identify PA and exercise habits in general, participants reported on the frequency of exercise.

A total score was computed from the General Health Questionnaire (GHQ-12) as a screening tool of mental health. It is used as the outcome index of psychological distress experienced within the past few weeks. This scale focuses on breaks in normal functioning rather than on life-long traits. The questionnaire is scored on a 4-point Likert-type scale, and the cut-off point was 5 to determine the respondents' level of psychological well-being (Goldberg & Blackwell, 1970).

Beck Depression Inventory (BDI-13) was applied for reporting respondents' mental health status. BDI is widely used to measure the intensity of depression in general population (Aaron T Beck, 1979; A. T. Beck & Beck, 1972; Aaron T. Beck, Steer, & Carbin, 1988; A. T. Beck, Ward, Mendelson, Mock, & Erbaugh, 1961), and in infertile patients as well (Khademi, Alleyassin, Aghahosseini, Ramezanzadeh, & Abhari, 2005; Smeenk et al., 2001). The questionnaire represents how the subject has been feeling in the last week. Each question has a set of at least four possible responses, ranging in intensity. A total score is computed and reflects the outcome index of depression. The validated Hungarian version of the short-form of the inventory with 13 items was completed by the respondents (Kopp & Fóris, 1993; Reynolds & Gould, 1981).

To examine infertility-related stress with a specific scale, the Fertility Problem Inventory (FPI) was queried. FPI is a 46-item questionnaire developed to measure the level of infertility-related stress (Newton, Sherrard, & Glavac, 1999). Patterns of infertility-related stress differed depending on gender, fertility history, and infertility diagnosis. The scale consists of five subscales identifying the following domains: social concerns (FPI1), sexual concerns (FPI2), relationship concerns (FPI3), rejection of childfree lifestyle (FPI4) and need for parenthood (FPI5). Permission for using validated Hungarian version of FPI was sent to the authors (Cserepes, Kollar, Sapy, Wischmann, & Bugan, 2013).

In line with positive psychology, Psychological Immune Competence System (PICS, also known as Psychological Immunity System Inventory – PISI) was applied. The questionnaire consists of 80 items and includes sixteen factors, which are divided into three subsystems: Approach Belief System, Monitoring-Creating Executing System and Self Regulating System. The subsystems are based on key psychological functions and refer to the mental resistance and adaptive coping capacity of the subjects (A Oláh, 2004; Attila Oláh, 2005).

Ethical approval

The study was reviewed and approved by the University Of Pécs, Clinical Center, Regional and Local Research Ethics Committee (Nr. 6955). Participants provided written informed consent prior to initiation of any study-related procedures, as shown by a signature on the Informed Consent Form. The investigation conforms to the principles outlined in the Declaration of Helsinki.

Data analysis

Statistical analyses were performed using SPSS 22.0 software (SPSS Inc., Chicago, IL, USA). Normality of data distribution was tested by Kolmogorov-Smirnov test. Depending on distribution, Student t-test or Mann-Whitney U-test

were used to compare continuous variables. The association between two continuous variables was tested by Spearman's or Pearson's correlation coefficients and between two categorical variables was tested by chi square test. Multivariate analysis (logistic regression) was used to test the effect of psychological scales and PA on the two outcome groups. Data was expressed as mean ± SD and the significance level of $p<0.05$ was considered in each case.

Results

General characteristics

The major socio-demographic characteristics of the study population are presented in the first table. 45 female patients in reproductive age (33.2±5.4 years), with mostly normal weight (64,1%, BMI 18.5–24.9 kg/m2) participated in the study. They were sampled from a larger proportion with higher educational degree (46.7%) and with satisfactory economic status (87.5%). Each participant was either married or lived with a partner, and the duration of the partnership was 7.7±4.3 years on average with 3.1±2.0 years long child-wish.

Participants rated their health particularly good or very good, only 3 women reported 'fair general health' and another 3 women reported 'worse health during the treatment than before'. Participants experienced in average 5.0±2.9 psychosomatic symptoms during ART. In general, they self-reported a healthy lifestyle regarding diet, tobacco use and PA. Around 60% of them claimed to be physically active. We found various cases of infertility, duration and type of treatments. However, participants typically received IVF/ICSI (51.1%) with one year long (11.9±13.3 mounts) treatment because of female indication (33.3%).

Table 1. Socio-demographic data

Socio-demographic Data N=45	
Age (years)	
Mean (SD)	33.2 (5.4) 5.41)
Education	
Low	6 (13.3%)
Intermediate	18 (40.0%)
High	21 (46.7%)
Marital status (N=44)	
Married	24 (53.3%)
Partner	20 (46.7%)
Place of residence	
County seat	16 (35.6%)
City	15 (33.3%)
Village	14 (31.1%)

Income	
Completely satisfied	4 (8.9%)
Rather satisfied	31 (68.9%)
Rather dissatisfied	10 (22.2%)
Health Status and Lifestyle	
BMI (kg/m2. N=39)	
Mean (SD)	24.2 (5.3%) 5.32)
Underweight (<18.5)	2 (5.1%)
Normal weight (18.5–24.9)	25 (64.1%)
Overweight (25–29.9)	3 (7.7%)
Obesity (>30)	9 (23.1%)
Self-Rated Health - Before ART	
Excellent	3 (6.7%)
Very good	16 (35.6.0%)
Good	23 (51.1%)
Fair	3 (6.7%)
Self-Rated Health - Undergoing ART	
Much better	3 (6.7%)
Something better	7 (15.6.0%)
Same kind	32 (71.1%)
Somewhat worse	3 (6.7%)
Psychosomatic Symptoms	
Mean (SD)	5.0 (2.9) 5.32)
Healthy Diet	
Pay particular attention	6 (13.3%)
Pay some attention	31 (68.9%)
Not really	8 (17.8%)
Tobacco Use (N=44)	
Heavy	0 (0.0%)
Light	10 (22.7%)
Non-Smoker	34 (77.3%)
Exercise (N=44)	
Often	13 (29.5%)
Sometimes	14 (31.1%)

BDI_Categrories

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	33	73,3	73,3	73,3
	2,00	8	17,8	17,8	91,1
	3,00	3	6,7	6,7	97,8
	4,00	1	2,2	2,2	100,0
	Total	45	100,0	100,0	

Not	17 (37.8%)

Infertility	
Case of infertility	
Female	15 (33.3%)
Male	4 (8.9%)
Dual	2 (4.4%)
Undefined (by medical professionals)	8 (17.8%)
Unknown (to the respondents)	16 (35.6%)
Type of ART Treatment – at baseline (N=31)	
IVF/ICSI	23 (51.1%)
IUI	3 (6.7%)
OI	5 (11.1%)
Examination in progress	14 (31.1%)
Duration of the Treatment (months)	
Mean (SD)	11.9 (13.3) 13.43) 5.32)
Min - Max	0 - 48.0
Child-wish (years)	
Mean (SD)	3.1 (2.0) 13.43) 5.32)
Relationship (years)	
Mean (SD)	7.7 (4.3) 13.43) 5.32)

Psycho-social characteristics

GHQ-12 resulted in average 2.3±2.1 value. Only four patients exceeded cut-off point 5, indicating the presence of mental health disorder.

At BDI-13, 73.3% of patients self-reported normal mood state. However, the study revealed various levels of depression within the cohort: results revealed that eight women were living with mild-, three women were living with moderate-, and one woman was living with severe depression. By invitation to the study, psychological support was offered for every patient who deemed it necessary. In comparison with previous reports on community samples, we can claim that the mean 5.0±4.1 depression level of this ART population lies within the normal range (Freeman, Boxer, Rickels, Tureck, & Mastroianni, 1985; Hearn, Yuzpe, Brown, & Casper, 1987; Reading, Chang, & Kerin, 1989; Smeenk et al., 2001). (Table 2)

We examined the psycho-social variables (BDI-13, GHQ-12) according to the duration of treatment (less or more than 3 years), but we could not find any differences between the variables (BDI-13: p=0.536, GHQ-12: p=0.803).

Table 2. Pre-treatment psycho-social characteristics of women undergoing ART

Measure	Mean	SD	Median	Range	IQR lower	IQR upper
Child-wish (years)	11.9	13.3	6.5	48.0	.3	20.3
Duration of treatment (months)	3.2	2.0	3.0	8.5	2.0	3.9
GHQ-12 Score	2.3	2.1	2	10	1	3
BDI Score	5.0	4.1	5	18	2	7.5
Σ FPI	175.9	24.3	179.5	89.0	161.3	193.0
FPI1 Social Concerns	42.7	8.8	43.5	36	35	49
FPI2 Sexual Concerns	39.2	6.5	41	26	35	44.5
FPI3 Relationship Concerns	48.4	9.1	49	35	42	58
FPI4 Rejection of Childfree Lifestyle	22.3	5.8	23	23	18	25
FPI5 Need for Parenthood	23.1	5.7	24	22	17	27
Σ PICS	38.9	3.9	38.5	18.5	36.4	41.1
PICS Approach Belief System	13.7	1.6	13.6	6.1	12.4	13.6
PICS Monitoring-Creating Executing System	13.0	1.8	12.8	9.3	12.2	12.8
PICS Self Regulating System	12.0	2.2	12.3	9.0	10.5	12.3

For the purpose of measuring the level of infertility-related stress, a more specific tool, the FPI was applied and moderately high *Global stress* (175.9±24.3) was explored. In the five domains of the questionnaire we found low stress by *Need for parenthood* (23.1±5.7), average stress by *Rejection of childfree lifestyle* (22.3±5.8), moderately high stress by *Social concern* (42.7±8.8) and very high stress level by *Sexual-* (39.2±6.5) and by *Relationship concern* (48.4±9.1). Figure 1. Shows these results.

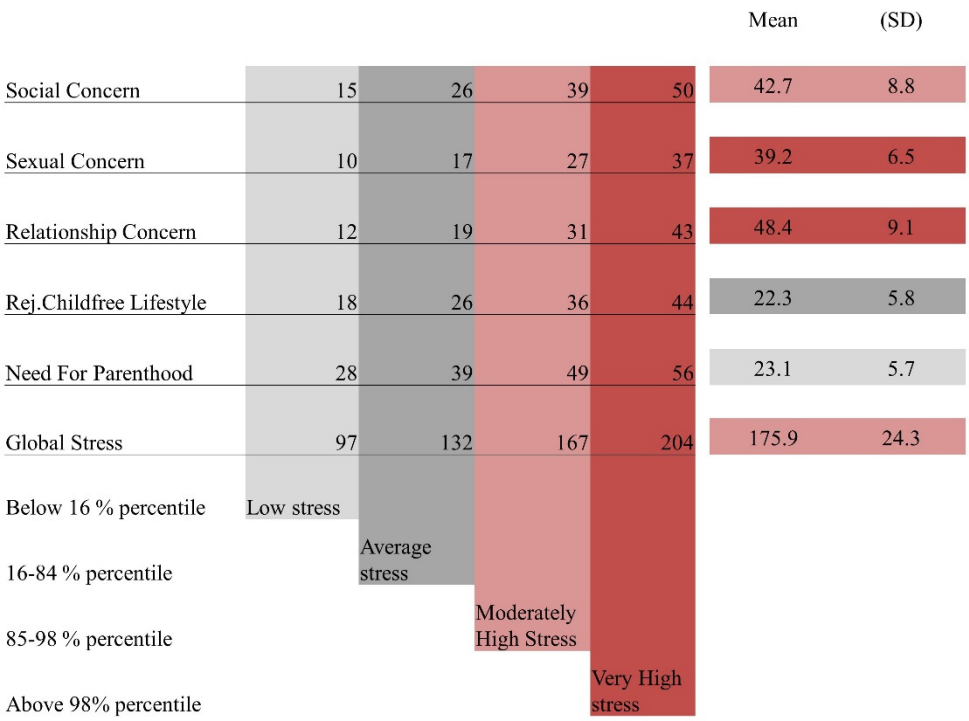

Figure 1. Infertility-related stress

Infertility related stress measured by Fertility Problem Inventory (FPI) in women undergoing assisted reproductive therapy (ART) (N=45)

Relationship between psycho-social characteristics and physical activity

Based on physical activity patterns, women were divided into two groups and means of baseline measures (child-wish, duration of the treatment and psycho-social scores) were compared regarding PA as the grouping variable (active/inactive). Results showed statistically significant difference between the groups only for PICS *Self Regulating System* (p= .034). (See in Table 3) *Synchronicity, Impulse control, Emotion control and Irritability control* belongs to this subsystem, which stabilize the person's inner emotional life and thus ensures the functioning of the first two subsystems.

Exercise Induced Differences in Psychological Health Domains in ART.

Table 3. Relationship between psycho-social characteristics and physical activity

	Active		**Inactive**		
Measure	Mean	SD	Mean	SD	p
Child-wish (years)	3.4	2.3	2.9	1.5	.980
Duration of treatment (months)	13.5	14.1	9.9	11.9	.453
GHQ-12 Score	2.6	2.5	2.1	1.9	.692
BDI Score	4.8	4.8	5.1	3.9	.422
Σ FPI	178.8	22.9	175.1	25.4	.660
FPI1 Social Concerns	45.1	7.2	41.3	9.6	.227
FPI2 Sexual Concerns	39.7	6.0	39.3	6.8	.894
FPI3 Relationship Concerns	47.6	10.7	49.3	8.0	.875
FPI4 Rejection of Childfree Lifestyle	22.8	6.2	22.1	5.8	.502
FPI5 Need for Parenthood	23.1	6.0	23.1	5.7	.979
Σ PICS	38.9	3.6	39.1	4.6	.502
PICS Approach Belief System	13.2	2.1	12.9	1.8	.283
PICS Monitoring-Creating Executing System	12.0	2.5	12.0	2.1	.772
PICS Self Regulating System	13.2	1.6	14.2	1.4	**.034***

During the follow up of outcome measures we received limited information for various reasons. Some patients continued the treatments elsewhere or interrupted the therapy. From the 38 known women six successfully conceived. All of the latter six women belonged to the physically active group. Positive significant relationship between pre-treatment PA and successful pregnancy (p=.036) was found.

In this sample neither univariate tests nor multivariate analysis showed any difference on pre-treatment psychological measures between the two outcome groups, which may possibly be due to the relatively small sample size.

Discussion

It was assumed that by decreasing the level of infertility related distress, abundance of pre-treatment physical activity will increase the success rate of ART. In our survey 60% of the women studied announced regular physical activity. Measured by general scales, 73.3% of the whole study population self-reported normal mood state (average 5.0±4.1) with BDI-13 and 91.1% normal level of distress (average 2.3±2,1) with GHQ-12. Regarding an infertility specific scale, moderately high stress by social concern (42.7±8.8) and very high stress level by sexual- (39.2±6.5) and by relationship concern (48.4±9.1) of FPI was found. Significant difference between active and inactive group was described for PICS Self Regulating System (p= .034). During the follow up of outcome measures only six successful pregnancies were be noted, all of which carried out by women who belonged to the physically active group. Positive significant relationship between pre-treatment PA and successful pregnancy (p=.036) was found.

Stress and female reproduction is an extensively investigated topic (Dobson, Ghuman, Prabhakar, & Smith, 2003; Ferin, 1999; Greil, 1997; Magiakou, Mastorakos, Webster, & Chrousos, 1997). Clinical and empirical research proved the notion that infertility is distressing and emotional instability due to grief and depression, anger, guilt, shock or denial, anxiety or loss of control influence the outcome of fertility treatments (Dunkel-Schetter & Lobel, 1991; Greil, 1997).

Smeenk et al demonstrated in a multicentre prospective study with survey methods that pre-treatment levels of perceived anxiety (P = 0.01) and depression (P = 0.03) are significantly positive related to treatment outcome in IVF/ICSI. Similarly to our results, they measured 5.6±5.1 BDI-13 scores in 291 women who reached embryo transfer (Smeenk et al., 2001). Their findings on the level of depression belong to the normal range of community samples (Freeman et al., 1985; Hearn et al., 1987; Reading et al., 1989; Smeenk et al., 2001). Jacob et al. investigated this particular question and took attention on studies that use standardized (general) scales on distress. Most of these found that the infecund patients are not significantly more clinically depressed than fertile controls (Jacob, McQuillan, & Greil, 2006). The only study with differing results was carried out by Domar et al., who reported the results of BDI-21 using cut-off score 9 (instead of the commonly recommended cut-off score of 21), and 13 when using for clinical diagnosis of depression. With the first they described 36.7% of participants were diagnosed with depression, and with the second scoring 8.4% of women studied were recognised as a person living with depression (Alice D Domar, Broome, Zuttermeister, Seibel, & Friedman, 1992).

To investigate the negative effect of pre-treatment levels of anxiety and depression on the outcome of IVF/ICSI, Smeenk et al. also administrated a *mixed method* study with 168 female patients. They compared the role of self-reports and endocrine variables, measured by concentration of adrenaline and cortisol, applying two general scales, BDI and State-Trait Anxiety Inventory (STAI) scales in ART. Similarly to their previous study, BDI scores were 5.4±4.7 in average. Significantly positive correlation was found between urinary adrenaline concentrations at baseline, embryo transfer (ET), and the scores on depression at baseline. By successful treatment, lower concentrations of adrenaline at oocyte retrieval and lower concentrations of adrenaline and noradrenaline at ET were observed. We extended our research with endocrine aspects in line with the work of abovementioned authors.

Kee et al. in their study on psychological strain in IVF compares average stress levels of 138 women with BDI. Women with unsuccessful IVF history had significantly higher level of depression than the IVF-success women (Kee, Jung, & Lee, 2000).We did not found differences in BDI 349ikcores in the two outcome groups p=747) Regarding the duration of infertility, BDI were moderately elevated in the first stage (< 3 years), authors described a decreasing trend in psychological stress with an advanced infertility duration. On depression scales, the intermediate and final duration of infertility patients showed less symptomatology than the first-stage patients. In our research we did not find differences in BDI scores between the two outcome groups or regarding the duration of infertility (p=0.536).

Cserepes and co-authors investigated the infertility-related stress in a Hungarian infecund population and examined the effects of gender roles, child wish motives, subjective well-being, and marital relationship on the experience of infertility according to the conceptual framework using a general (BDI) and a fertility specific (Fertility Problem Inventory (FPI)) scale as well. Depressive symptoms were correlated with infertility-related distress and fertility specific quality of life. In case of female patients, the researchers highlighted the importance of social (24.96±7.86) and relationship concerns (18.70±6.59) or rather the domain of need for parenthood 9(44.07±7.61) (Cserepes et al., 2013). In our study conflicting results were found, as social and relationship concerns triggered moderate and very high stress levels, whereas the need for parenthood remained on average level.

Another fertility specific instrument, the Fertility Quality of Life (FertiQoL) questionnaire was developed to reliably measure the impact of fertility problems and its treatment on quality of life (QoL) (Boivin, Takefman, & Braverman, 2011). Cserepes et. al conducted research using FertiQoL on

Hungarian sample and in cross-cultural comparison. Comparing fertility specific and general questionnaires can be found in the literature in relation to FertiQol-BDI (Cserepes, Korosi, & Bugan, 2014), FertiQol-Hospital Anxiety and Depression (HADS) (Aarts et al., 2011; Dural et al., 2016), FertiQol – WHOQOL (Boivin et al., 2011).

Impact of psychological interventions on pregnancy rates in infertile women is underlined by Domar et. al (A. D. Domar et al., 2000; A. D. Domar, Gross, Rooney, & Boivin, 2015). Other studies shift focus to lifestyle behaviours of women undergoing IVF and efficacy of mind/body intervention (A. D. Domar, Conboy, Denardo-Roney, & Rooney, 2012; A. D. Domar et al., 2011) In general, systematic reviews describe non-pharmacological interventions, such as exercise improving not only physical performance but other domains of quality of life (Francisco Meneses-Echavez, Gonzalez-Jimenez, & Ramirez-Velez, 2015; Kimmel, Haas, & Hermanns, 2014; Levine & Land, 2015; Mishra et al., 2012; Salakari, Surakka, Nurminen, & Pylkkanen, 2015).

We found a study on the connection between PA and psychological factors in IVF by Valoriani et al. Authors studied Hatha-yoga (HY) not only as exercise, but also as a psychological adjuvant, and found that women who are more distressed are more likely to accept psychological support before starting an IVF cycle and that in these women HY practice was associated with distress reduction ($p<0.0001$ for GHQ-12) (Valoriani et al., 2014).

PA appears to be beneficial during pregnancy as well. PA seems to reduce risks of gestational chronic diseases without adverse effects on the neonates (Downs, Chasan-Taber, Evenson, Leiferman, & Yeo, 2012; PAG, 2008; Pivarnik et al., 2006). In the absence of any contraindications following the American Congress of Obstetricians and Gynaecologists recommendations, pregnant women should engage in moderate intensity exercise for at least 30 minutes on most, if not all, days of the week (ACOG, 2002, 2015). However, there are no definitive physical activity guidelines for women attempting conception, particularly for the window of implantation and luteal phase. Most of the studies take attention to risk of frequent vigorous PA on fertility (Green, Daling, Weiss, Liff, & Koepsell, 1986; Wise et al., 2012) and on success of ART (A. D. Domar et al., 2012; Morris et al., 2006). To describe PA levels both instrumental and self-report studies were published.

In line with our findings on the benefits of pre-treatment activity, Moran et al. reported positive effect of lifestyle intervention including exercise and diet in conjunction with ART in overweight and obese women and described elevated successful pregnancy rate (12 / 18 vs 8 / 20) in the intervention group compered to controls (Moran, Tsagareli, Norman, & Noakes, 2011).

Conclusions

Infertility specific scales provide more appropriate description on mental status of ART patients than general scales. Pre-treatment PA could positively influence success of ART. However, for more impressive results, detailed assessment of physical activity, increased number of participants, and further examinations are needed.

Limitations

Results of this study are advised to be interpreted in light of the low number of research participants. Further research should explore the correlation between pre-treatment PA and infertility rates with larger sample size, applying more accurate measurement of moderate-intensity PA.

Possibilities for further research

The relationship between psychosocial stress and the release of adrenal hormones in relation to success of IVF/ICSI is still moderately discussed (Boivin and Takefman 1995). We intend to expand the current research to gain understanding on the biomedical point of view beside the psychosocial factors. This will provide the opportunity to compare the role of self-reports with endocrine variables.

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Conflict of interest

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

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A POSSIBLE RESEARCH METHOD OF IMPROVING PERFORMANCE CAPABLE KNOWLEDGE IN YOUTH BASKETBALL BY APPLYING COMPLEX SPORT CONDITIONING PROGRAM

NAGY BENEDEK ÁGOST[1]

ABSTRACT. From the aspect of the energy management, today's basketball player profile can be divided to four resources: *physical, mental,* spiritual and emotional (Woods, Jordan, 2010). We intended to observe the physical and mental part of this system. In every age category the athletes must increase their current potentials and reach the master or expert level (Baracskai,2007)**.** Our research supervised the special basketball demands and the implementations to a training program that could help us to get a correct picture what, when, whom, how, where and why to teach (Winter, 1997). We researched the game performances as the ingredients of competitiveness based on a research of BSMPG (2010) that broke down the game and gave us exact scientific data of the modern basketball game. **Purpose of study.** Evaluate of every scientific hypothesis. Observing a special conditional program that is used yearly for a men university basketball team. The main goal of our research is to analyses the common effects of these programs for the game performances of the players. Understanding the sports carrier profiles of the participants regarding to their game performances. We'd like to find the details of the improvement of the game performances with a new methods that will separate the team and individual parts of the training process. Our hope is that our results, findings will be useful for planning the basketball practices. We look for the answers which practice topics, drills, tests, types and methods are the most effective to increase the special game performance in this model. **Methods.** We looked for the answers to why and how questions with our descriptive research methods. We guaranteed the validity of our work to choose our model systemically. We followed a longitudinal and panel investigation to guarantee the proper tests data. The data were analyzed statistically with ANOVA, regression, T probe. We have also used some expert explanation from the gathered data. Hudl video analyzer program.

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Results. The number of the high intensity sprint increases with the more ball possessions. (56/game, every 43-45 sec). The maximal vertical jumps of the players are predictable with the sum of the field goal attempts + blocks + rebounds (cc.10%). The defensive footwork is only 28 % of the playing time of a player. **Conclusions.** The longitudinal investigation was reasonable because the goals and the programs must be changed within the yearly practice plan. The teaching methods depends on the changes of the offensive strategy of the team. The more information we have about the physical and mental resources, the effective practice plan can be designed. A competitive conditional program can be properly designed that will consider the significant variants due to our findings. There is a significant connection between the performance of the practice program and the game performance.

Keywords: *conditioning, performance capable knowledge, physical resources, performance trend*

INTRODUCTION

From the aspect of the energy management, today's basketball player profile can be divided to four resources: *physical, mental,* spiritual and emotional (Woods, Jordan, 2010). We intended to observe the physical and mental part of this system. In every age category the athletes must increase their current potentials and reach the master or expert level (Baracskai, 2007).

We took the results of a BSMPG (2010) as a basis from the conditioning side, which describes the structure of modern basketball game with scientific figures.

Performance capable knowledge and competitive performance

Competitive performance is the aptitude of the athlete's ability to compete, that is, in a special and high state of excitement, consisting of two major components, both of which have a decisive role in action and performance.

I. **Ability to perform** is a subfield that can be developed through training, can be learnt (through developing physical, coordination and other skills). The ability to perform is mainly an educational task, so its development is a constant goal of the trainer.

II. By **capability to perform**, we mean the athlete's attitude towards requirements, their teammates, their coach, their emotional relationship to work, their revealing behavior. It can be developed but with lots of conflict in educational situations. It becomes a crucial factor at the higher level of preparation.

Scientific foundations

Our research is based on the scientific statistical results presented below. According to our findings, not only the research problem but the preparation itself should be based on these.

Theoretical bases of the conditioning program

Keith D'Amelio (2010) defines the structural features of the basketball game in his 2010 Boston research. These features were examined in case of the chosen team.

Basketball Game Breakdown.

Table 1. Basketball Game Breakdown. Own editing based on (BSMPG, 2010)

NBA — National Basketball Association, USA — Statistics
The average heart rate of male players during the game is 169 beats per minute. Plus-minus 9 beats per minute. McInne, Carlson, McKenna (1995)
There is a higher intensity sprint every 20 to 30 seconds. More than one hundred of these occur during a game.
In the NBA 2015/16 season, there were players, who ran an average of 4.41 kilometers in 67 games.
A maximum of 40-50 jumps per player.
There is a change of direction every 2-3 seconds.
30% of the time spent in the court is defensive footwork.
They play with close to maximum intensity 15% of the time.

HYPOTHESES

1. As the number of possessions increases, the number of high-intensity sprints increases as well, which thus occur every 20-30 seconds.
2. The combined value of certain scores in match statistics can be used to indicate the maximum number of jumps during the matches.
3. The team's time spent with defensive footwork is 30%.

OBJECTIVES

- Checking our hypotheses.
- Longitudinal understanding of college team's specific conditioning program and evaluating the combined effect of training work completed to competitive performance.
- Examining the participants' sports profiles with regards to competitive performance.
- Understanding the tendencies of the development of performance capable knowledge – competitive performance - at individual and team levels with a new approach.

We aimed to evaluate efficiency with the scientific understanding of the applied *conditioning programs* to make the results usable in practice. We have been researching which training materials, exercises, tests, training types and training methods are the most effective ways to improve performance in case of our sample.

RESOURCES AND METHODS

- We chose the method of *descriptive research*, where we aimed to answer the questions what and why through the exact measurement of different features. The **representativeness of the research within the team** was ensured by stratification and then by *systematic sampling*. The sample members were divided into two relatively homogeneous groups (layers) prior to sampling to reduce the possibility of errors. In our case, we found a more practical way than random sampling; the members of the two layers were placed in alphabetical order, numbered and then selected members x.
- By *cross-sectional and longitudinal analysis* of the sample's participants, data was collected at different times, which was also done on the whole sample. This way, we got a performance trendline, but we also made *panel surveys*, namely our observations were performed with the same people as well.
- We performed physical and conditioning tests in accordance with the pre-competitive period based on Brittanham (1996) and Foran &Pound (2007); their shooting performance was also characterized by general and per position measurements. Statistical data was made clear using our own tests and hudl.com/ reports.

We examined the trainers' programs that they have been using for years and asked their assistance to access to the exercises and tests of their conditioning programs. We provided feedback on our analyses on a week to week basis.

The content of measuring the ability to perform

NBA test exercises were used to measure the conditioning abilities (Foran, & Pound, 2007); on the one hand, because this is the highest-rated basketball in the world, and on the other, their professionals are at the forefront of the sport and scientific research related to the sport.

The number of maximum jumps based on the estimated and calculated individual results show significant similarities for the tested players.

Table 2. NBA conditioning tests and their shortcomings (Own editing)

Pre-test assessment	Additional information	Performance categories	Tests	Problems (K. D'Amelio)	Five plus tests
Height	Wearing shoes	Lower body strength	Vertical jump (from standstill) Vertical jump (from run-up)	It does not fully reflect the strength of the lower body.	- Hop and stop - One-legged squats
Height	Without shoes	Agility and explosiveness	Lane agility (Agility test around the penalty area)	Too much treading and defensive footwork that does not reflect the real needs of the game.	Modified Lane agility
Weight	Wearing shorts, half-naked and without shoes	Speed	3/4 court sprint	Too linear, it rarely happens in basketball without changing direction.	Illinois agility test Conrad (2014)
Touching height	Wearing shoes	Upper body strength	Bench press (maximum reps) University age group: 84kg High school age group: 61kg	It is not the most appropriate tool to predict NBA potential and upper body strength.	
Width		Flexibility	(Sit and reach)		
		Stamina			4x17 length (4x15m)

Conceptualization

We have selected the types of observations and measurements that meet the objectives of our research.

The measurement of performance capable knowledge was carried out by our own conditioning tests by doing the same tests with the layers at three different times.

The tests include: strength, maximum strength, speed, explosiveness/ agility, flexibility, physical characteristics, balance, and hand-eye coordination measurement.

The tests started with a general survey (height, weight, etc.). These can be found in the first column (Table 2).

The third column contains the performance categories and associated tests, along with the five plus tests, which were suggested to be included in the program based on *Keith D'Amelio's (2010)* research.

The scientific literature has highlighted the following shortcomings, among others:

- Measuring vertical jump from a standstill; does it really measure lower body strength?
- Do the speed and directional changes used in lane agility tests (agility test around the penalty area) reflect the abilities used during basketball?
- With the ¾ court sprint, can we really measure the speed that the players reach during the transition from offense to defense?
- Does the bench press test really reflect the strength of the upper body?

Hudl video analysis program

The objective analysis of the matches was enabled by the HUDL video analysis and statistical program, which was also successfully used in case of conditioning program (Hudl 2017).

Conditioning tests

Tests and performance evaluation tools provided a comprehensive picture about the players; and about the speed, stamina, agility, endurance, explosive and flexibility programs.

The surveys are not only needed for individual development before, during and after the training programs, but also the resulting rankings can be used to motivate and encourage players to deliver their best possible performance (Foran &Pound 2007).

The measurement protocol

After a general, then sport-specific warm-up, performing the test exercises with the participants. The test was carried out by the athletes in the presence of the coaches. Only tests carried out with appropriate techniques and speed, as well as within the time limits were regarded as valid. There was no match or very demanding training on the test day or the day before.

Statistical methods

- To compare the average of groups with identical dispersion and normal distribution, we used the one-way ANOVA method.
- Relationships between variables were performed by regression analysis. We expected that we could predict the value of a dependent variable based on several independent variables.
- Differential analysis and probability variables were performed with paired- and two-sample T tests.

Analysis of the matches

At the start of the championship, with the knowledge of the opponents, the coaches made suggestions regarding the prospective main competitions. As a starting point, these matches were regarded as basis for the checks. The development of the championship helped us specify the list of supposed main competitions. These main competitions were well-defined in time.
The definition of main competitions:

- They were in the middle of the macrocycles.
- Another condition was to have close results.
- The position on the table.

RESULTS

Research results of the conditioning program

Based on the three measurements, except for the one-legged squats, progress can be detected for the players in the results of the fitness tests.

Within the tests, significant differences can be observed in the players' performance in the below cases.

In case of the lane agility tests, based on the two-sample t-test, the results of players #3 and #5 showed significantly less improvement than players #1, #2 and #4 ($t=3.092$, $p=0.037$).

In case of the mod. agility test the performance of player #1 shows a remarkable improvement compared to the other players (t=3.033, p=0.039).

For the analysis within the team, the two-sample t-test based on the number of training sessions does not show any significant differences.
The results of the aforementioned lane agility show differences during the per position analysis.

Table 3. Results of the conditioning tests (Own editing)

		Lane ag. (second)	Mod. ag. (second)	Illinois test (second)	One-legged squat (centimeter)		3/4 court (second)
September	#1	11.32	2.85	15.25	15	16	3.28
	#2	11.82	3.02	15.36	32	36	3.31
	#3	11.92	2.99	15.38	16	22	3.38
	#4	12.14	2.95	15.81	80	80	3.37
	#5	12.56	3.25	15.9	70	75	3.52
May	#1	10.58	2.6	14.82	15	15	3.22
	#2	11.26	2.9	15.28	31	33	3.28
	#3	11.78	2.9	15.31	11	17	3.36
	#4	11.88	2.9	15.05	66	68	3.31
	#5	12.41	3.2	15.58	68	70	3.44
Difference	#1	0.74	0.25	0.43	0	-1	0.06
	#2	0.56	0.12	0.08	-1	-3	0.03
	#3	0.14	0.09	0.07	-5	-5	0.02
	#4	0.26	0.05	0.76	-14	-12	0.06
	#5	0.15	0.05	0.32	-2	-5	0.08

„There is a higher intensity sprint every 20 to 30 seconds, more than 100 of these occur during a match"

	Hop and stop (meter)		Vertical jump from run-up (centimeter)	Vertical jump from standstill (centimeter)	Sit and reach (centimeter)	Bench press (repetitions)	4x 17 (second)
September	2.13	2.17	82	56	14	1	59
	2.10	190	73	53	4	5	60
	2.27	2.13	91	57	6	24	62
	2	2.13	74	50	4	1	65
	2.01	1.99	70	50	-9	16	68
May	2.16	2.18	82	56	14	1	59
	2.17	201	80	54	4	6	60
	2.32	2.17	93	58	13	26	62
	2.04	2.15	74	50	5	1	61
	2.05	2.03	78	55	-6	20	68
Difference	0.03	0.01	0	0	0	0	0
	0.07	11	7	1	0	1	0
	0.05	0.04	2	1	7	2	0
	0.04	0.02	0	0	1	0	-4
	0.04	0.04	8	5	3	4	0

As the number of ball possessions and the number of points shot from fast break increased on a team level, the number of high-intensity sprints also increased per player in case of our sample.The team's season average is 55 high intensity sprints/match. An intense sprint occurred in every 43-45 seconds. (In the NBA it's 80 sprints/48 minutes/35-36second) The team had an average of 69 ball possessions.

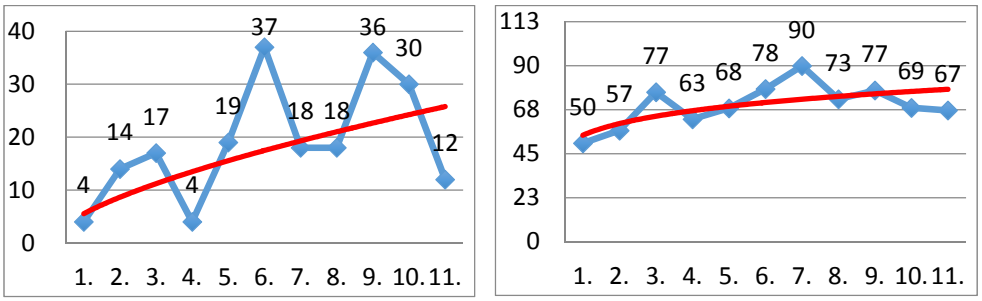

Figure 1. (Left side) Points from transitions (on team level) *X=Gamedays Y= Points from transitions (on team level)* (Right side) Number of ball possessions *X=Gamedays Y= Number of ball possessions*(Own editing)

Figure 1 based on the research and statistical results of the analysed 11 matches clearly shows that the trendline increasing simultaneously with the number of points shot from transitions and number of ball possessions.

Based on the observations, it can be seen per match that how many seconds pass on average between two high intensity sprints. The average scores of matches declined slightly towards the end of the season. The matches were closer.

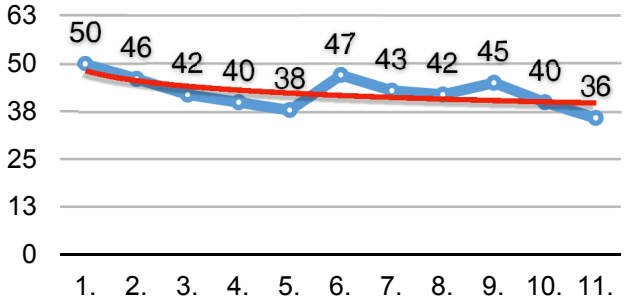

Figure 2. Time between sprints (in seconds) (Own editing)
X=Gamedays Y= Time between sprints (in seconds)

The connections were examined separately in case of the five players chosen during the research; these confirm the team level average values.

Table 4. The playing time of the players and number of sprints per match (Own editing)

Match	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Avg.	
Minute Player #1	40	40	40	37	40	38	39	40	40	40	40	39.45	
Sprint	48	53	59	57	70	50	60	62	56	63	64		
Minute Player #2	37	36	40	32	40	34	38	40	36	40	40	37.55	
Sprint	52	52	63	53	66	53	58	63	54	61	70		
Minute Player #3	27	28	27	28	30	27	28	29	30	31	31	28.73	
Sprint	36	42	46	50	55	37	41	44	42	54	56		
Minute Player #4	15	15	13	14	0	14	14	0	16	13	14	11.64	
Sprint	8	10	11	10	0	8	9	0	9	11	12		
Minute Player #5	13	13	13	13	0	14	14	0	13	14	15	11.09	
Sprint	6	7	7	8	0	10	7	0	7	9	11		
Total: Minute	132	132	133	124	110	127	133	109	135	138	140		128.45
Total: Sprint	150	164	186	178	191	158	175	169	168	198	213		177.27
Seconds between sprints	53	48	43	42	35	48	46	39	48	42	39		43.85

Minutes total: 128.45	**Total number of sprints: 180.36**	**Seconds between sprints: 43.13**	**High intensity sprints/match: 55**

„The maximum number of jumps during a match is 40-50"

Approximate number (+/-10% difference) from the statistics (rebound+shot+block).

The Hudl program allows counting the total and maximum number of jumps.

The goal on a team level is to increase the number of rebounds, blocks and field attempts.

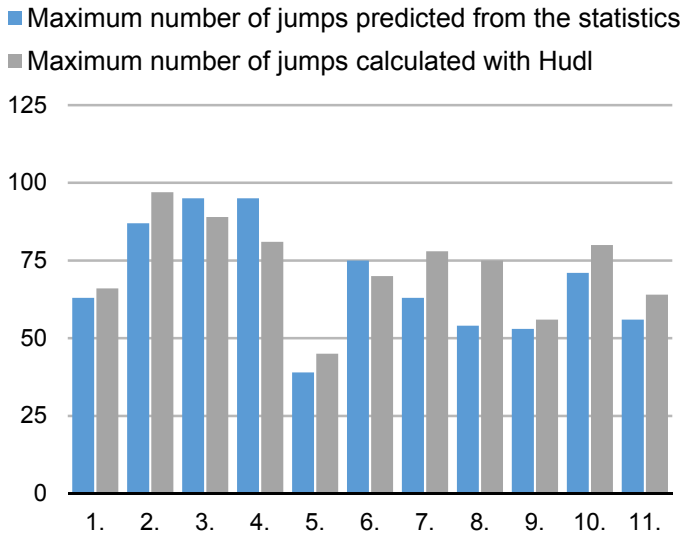

Figure 3. The total of maximum jumps of players 1 (calculated and estimated)
X=Gamedays Y=Number of jumps (Own editing)

The maximum number of jumps individually can be predicted from the statistics. For the five players, a difference of +/- 10% was detected per match. On a team level, the match statistics should be taken into account with caution as the errors can add up more significantly.

The number of maximum jumps based on the estimated and calculated individual results show significant similarities for the tested players.

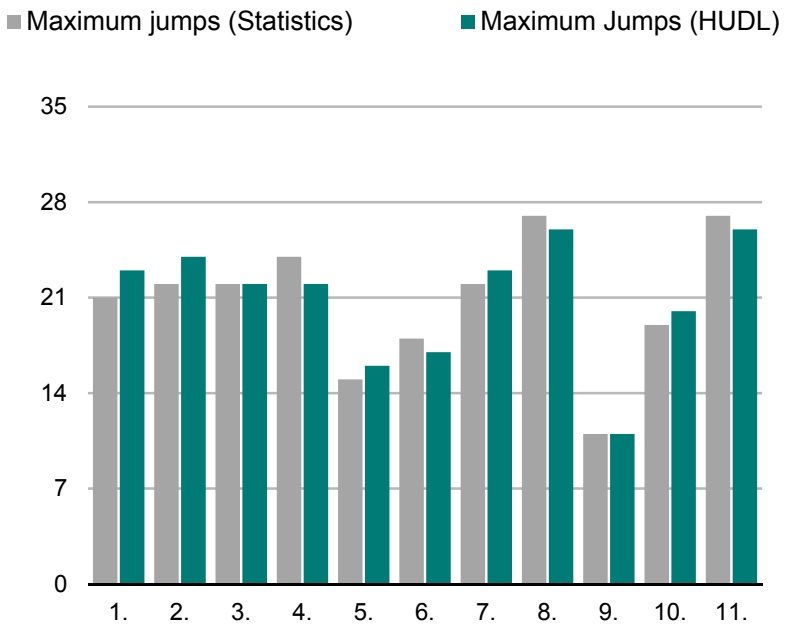

Figure 4. The ratio of the number of jumps and the amount of time played per match (pcs/min) *X= Gamedays Y= Number of jumps* (Own editing)

„The players spend 30% of the time with defensive footwork"

We were able to measure the players' time spent with defensive footwork using the Hudl program.

On average, the team spends 31 minutes with defensive footwork on the court, which is 24% of the 128 average minutes.

Interestingly, player #1 spends 8,77 minutes with defensive footwork on the court. This is 22% of the 39.45 minute average match.

Players spend on average 24% of their playing time with defensive footwork. This is essentially true even if the playing time between players is significantly different.

Table 5. The correlation between playing time and time spent with defensive footwork (Own editing)

Player	Time spent on court in minutes (average)	Time spent with defensive footwork in minutes (total)	Time spent with defensive footwork in minutes (average)	Time spent with defensive footwork in percentage
#1	39.45	96.45	8.77	22%
#2	37.55	96.31	8.76	23%
#3	28.73	85.19	7.74	27%
#4	11.64	28.25	2.57	22%
#5	11.09	30.45	2.77	25%
Average	128			24%

The five players on average spend between 21.16% and 27.14% of their playing time with defensive footwork.

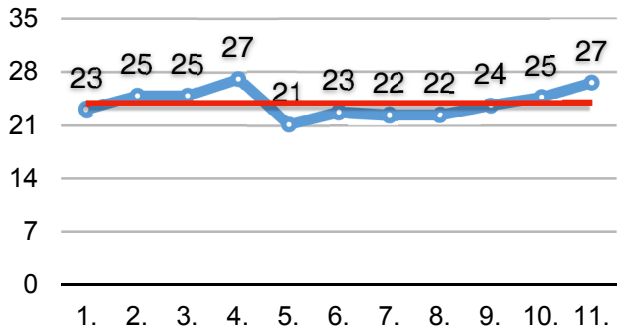

Figure 5. Percentage of time that was spent by defensive sliding (5 players)
X=Gamedays Y=ercentage of time that was spent by defensive sliding (Own editing)

The total number of time spent per match for the five players was between 117 and 130 minutes. At least 29 minutes were spent with defensive footwork; the longest time was 56 minutes.

Evaluation of match performance

In addition to analysis of the tests, we also examined the results of the matches (regression analysis). It can be stated that the explanatory power of the Value Point System (VPS) is strongly determined by the results of the tests, which is demonstrated by the R Square=0,894 value of the linear regression test.

Furthermore, we examined the results of some of the typical values of the matches (number of sprints, defensive footwork, jumps, field points, free throws, number of match points) (variance analysis (ANOVA)). Significant differences were observed between the players in case of each result ($t_{sp=}$6.772, p=0.002, $t_{vl=}$22.883, p=0.000; $t_{fJumps=}$6.871, p=0.002; t_{sec}=11.556, p=0.000; $t_{freethrow}$=5.795, p=0.004; $t_{mpoints}$=6.156, p=0.004). In our hypothesis, we assume that these results are affected by the number of training sessions attended.

It can be stated that from the match efficiency values based on the number of training sessions attended, only the number of sprints showed difference (t=12.206, p=0.001).

Thus it can be stated that the number of sprints during the matches (which is one of the determinants of the players' performance), can be significantly improved by increasing the attended training sessions as opposed to the other values. The analysis per position did not reveal any significant differences.

DISCUSSION

Hypotheses review

1. The number of the **high intensity sprint increases** with the more ball possessions. (56/game, every 43-45 sec)
2. The maximal **vertical jumps of the players are predictable** with the sum of the field goal attempts + blocks + rebounds (cc.10%)
3. The **defensive footwork** is only 24% of the playing time of a player.

It can be stated that the methods of education are related to the team's offensive strategy, the changes in individual abilities and the time available.

The more specific knowledge we have about *the physical and mental resources*; the more effective plan can be prepared.

A competitive conditioning program can be developed which takes into account the variables that are typical of the sample, since the partial results show a significant correlation between performance measured during the trainings and matches.

Conclusion

As the number of ball possessions and points shot from fast break increased on a team level, the number of high intensity sprints also increased per player in case of our sample.

There is a significant correlation between the amount of field attempts, rebounds and blocks and the result of video verification. (max.10% difference)

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IMPROVING PERFORMANCE CAPABLE KNOWLEDGE IN YOUTH BASKETBALL BY APPLYING WITH TARGETED SHOOTING PROGRAM

NAGY BOTOND ÁGOSTON[1]

ABSTRACT. Today's basketball player profile can be divided to four resources: *physical. mental.* spiritual and emotional (Woods, Jordan, 2010). Our research supervised the special basketball demands and the implementations to a training program that could help us to get a correct picture what, when, whom, how, where and why to teach (Winter, 1997). We researched the game performances as the ingredients of competitiveness based on a research of (Baker and Shea, 2013) and the theory of Four Factors by Dean Oliver (2004) as our starting points**. Purpose of study**. Evaluate of every scientific hypothesis. Observing a special shooting program that is used yearly and simultaneously for a men university basketball team. The main goal of our research is to analyses the common effects of these programs for the game performances of the players. Understanding the basketball player profiles of the participants regarding to their game performances. We'd like to find the details of the improvement of the game performances with a new method that will separate the team and individual parts of the training process. Our hope is that our findings will be useful for planning the basketball practices. We look for the answers which practice topics, drills, tests types and methods are the most effective to increase the special game performance in this model. **Methods.** We looked for answers on why and how questions with our descriptive research methods. We guaranteed the validity of our work to choose our model systemically. We followed a longitudinal and panel investigation to guarantee the proper tests data. The data were analyzed statistically with ANOVA regression, T probe. We have also used some expert explanation from the gathered data. Hudl video analyzer program. **Results**. 1. The game statistics of the players who took part on the individual shooting and conditional program do not affect the trend lines of the game performances. 2. The eFG% and FTF do not affect the trend lines of the game performances. No significant different because of the field goal and free throw attempts (434/193 - 88/49 and 99/78 - 39/26). 3. The players who were

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involved of the morning sessions had more attempts on the games and so higher point/game averages. (49.3 PPG - 14.1 PPG). They executed their shots with a colorful technical repertoire. Their game performance and statistics were more effective. **Conclusions.** The longitudinal investigation was reasonable because the goals and the programs must be changed within the yearly practice plan. The teaching methods depends on the changes of the offensive strategy of the team. The more information we have about the physical and mental resources, the more effective practice plan can be designed. A competitive shooting program can be properly designed that will consider the significant variants due to our findings. There is a significant connection between the performance of the practice program and the game performances.

Keywords: *shooting program, performance capable knowledge, physical resources, performance trend*

INTRODUCTION

From the aspect of the energy management. today's basketball player profile can be divided to four resources: *physical. mental.* spiritual and emotional (Woods. Jordan. 2010). Our research supervised the special basketball demands and the implementation to a training program that could help us to get a correct picture what. when. whom. how. where and why to teach (Winter. 1997).

- From a coordination point of view. I analyzed a categorically structured shooting program of a university basketball team. for which the theoretical background was based on. inter alia. the research of (Baker and Shea 2013) and (Shea, 2014). Also on Dean Oliver's Four Factor theory (2004).

MAIN PROBLEMS

Performance capable knowledge and competitive performance

Competitive performance is the aptitude of the athlete's ability to compete that is in a special and high state of excitement.

Shooting program's theoretical background

Six references were considered relevant.

1.) The first and perhaps most important tool to measure game efficiency in modern basketball is the application of the Four Factor Statistical Schema (Oliver, 2004).

In accordance with the subject of our research. effective field goal percentage and free throws are given special attention.

- *Effective FG% —> eFG% = (FGM + 0.5*FG3M)/FGA*
- Turnover TO% —> Poss. = FGA - OR + TO + 0.4 * FTA
- Offensive rebound OR% —> OR% = OR / (OR + Opponents Def Reb)
- *Free throw factor (two counting possibilities) FTF —> FTA/FGA or FTM/FGA*

2.) Other research has also found that free throw performance is of key importance in the team's success or failure (Kozar, Vaughn, Lord, Whitfield, Dye, 1994).

3.) The B.E.E.F. (namely Balance. Eyes. Elbow in. Follow through) method is a simple way of teaching and improving basic techniques (Barney and McGaha, 2006).

4.) As per *Reliability and factoral validity of basketball shooting accuracy tests* research: the tests must be timed. carried out like a game **(**Pojskić, Šeparović, Užičanin, 2011). The Bosnian research confirms the importance of the time factor. meaning that the implementation of time constraints can make the completion of tests game-like.

5.) Lupton (2016) embodies the performance of the 'ideal basketball player'. Lupton strengthens us in the belief that it is worth customizing the conditioning and shooting goals to individuals.

6.) According to a Slovakian research. individual training was 54.84% of the training program. with the shooting program being 38.12%. (Zambová, Tománek.,2012)**.** that is. very significant.

HYPOTHESES

1. The performance trendline is moved to a balanced positive direction by those players' game statistics who participate in morning training sessions.
2. eFG% and FTF on their own do not affect the competitive performance trendline.
3. Those who participate in extra work perform better by completing special shooting and conditioning programs *simultaneously. which* will help to save time and win games (Nagy 2012). They are expected to be more active during the games. with more attempts and gaining points in more diverse ways. Significant correlation is expected between the improvement of individual test results and performance during the games.

OBJECTIVES

- Checking my hypotheses.
- Understanding the tendencies of the development of performance capable knowledge – competitive performance - at individual and team levels with a new approach.

I aimed to evaluate efficiency with the scientific understanding of the applied *shooting program* to make the results usable in practice. I have been researching which training materials. exercises. tests. training types and training methods are the most effective ways to improve performance in case of our sample.

RESOURCES AND METHODS

- The **representativeness of the research within the team** was ensured by stratification and then by *systematic sampling*.
- By *cross-sectional and longitudinal analysis* of the sample's participants. data was collected at different times. which was also done on the whole sample. This way. I got a performance trendline. but I also made *panel surveys*. namely our observations were performed with the same people as well.
- I made sure that the data and variables obtained during measurements and tests are related to the concepts emphasized based on the theoretical background. This is how I aimed to ensure the *validity* of the research.
- Throughout the year I carried out the functional mapping of the technical knowledge needed by the sport. placed these in the training program. collected and evaluated the data; in order to get a correct picture what. when. whom. how. where and why to teach (Winter. 1997)

Hudl video analysis program

The objective analysis of the games was enabled by the HUDL video analysis and statistical program. which was also successfully used in case of conditioning and shooting programs. (Hudl 2017)

Operationalization

The measuring tools

1. The nine types of **shooting program** workouts were divided into three main categories. The program strives to be gradual. but at the same time to have developing and educational effect. from the most general to the more specific tasks.

The coaches identified 14 categories in which each player needs to develop. These were tailored individually. I made documentation.

Based on these. I have created a personalized shooting test.

The measurement protocol

After a general. then sport-specific warm-up. performing the test exercises with the participants. The test was carried out by the athletes in the presence of the coaches. Only tests carried out with appropriate techniques and speed. as well as within the time limits were regarded as valid. There was no game or very demanding training on the test day or the day before.

Statistical methods

- To compare the average of groups with identical dispersion and normal distribution. I used the one-way ANOVA method.
- Relationships between variables were performed by regression analysis. I expected that we could predict the value of a dependent variable based on several independent variables.
- Differential analysis and probability variables were performed with paired- and two-sample T tests.

Checking the competitive performance

The technical tests used to check competitive performance were divided into 11+2 categories. This means that a field goal attempt was tagged with one of the 11 labels shown in Table 4.

For example: A player gets the ball outside of the arc and shoots right away. against a defender. with a time constrains. For us. this means / Catch and shoot / Contested Shot / Buzzer beater / Jump shot /. The plus two categories are the free throw and all shots. in which all 11 categories are included.

Table 1. The 11+2 categories of checking competitive performance (Own editing)

All shots	Free throw	Buzzer beater	Catch and shoot	Contested shot	Drive	Off balance	Post move	Jump shot	Layup	Hook	Floater	Dunk

Analysis of the games

At the start of the championship. with the knowledge of the opponents. the coaches made suggestions regarding the prospective main competitions. As a starting point. these games were regarded as basis for the checks. The development of the championship helped me specify the list of supposed main competitions. These main competitions were well-defined in time.

The definition of main competitions:

- They were in the middle of the macrocycles.
- Another condition was to have close results.
- The position on the table.

Measurability

- During the research. it was ensured that with the help of the test I obtain data on shooting safety. competitiveness and the level of technical knowledge – both during trainings and games.
- There are weekly training tests. which consist of categories appropriate for the given day. It is important to note that changes could be made in the shooting program but not in the tests.
- With Hudl video analysis and statistical program. I got detailed reports and results on performance capable knowledge. both on team and individual levels.
- Changes in competitive performance were characterized by statistical results of main competitions. Changes based on training programs were verified by periodic shooting tests. My aim was to compare whether the trends in training programs can be found in the development of competitive performance.

Shooting program

Shooting program is well-suited for measuring performance capable knowledge and competitive performance. In case of my research. this is based on:

1. The preliminary program of the team's head coach. that has been developed using the experience gained over the past few years.
2. Studying the teams and players of NBA. researches. using the results from these and applying various individual training programs and techniques.

Research results of the shooting program

- The simultaneous application of a shooting and conditioning program helps to save time and win games (Nagy 2012) because there is a significant correlation between individual test results and game performance improvement.
- Based on the statistical analysis of the current games. the conditioning and shooting programs can be modified. resulting in improvement.
- Those who participated in the extra work perform better; their athlete's personality has also developed. Their performance capable knowledge reached a higher level.
- Apart from the goals of the team. the coaches also defined individual goals that I documented.

The (nine) types of the shooting program's training material were divided into three main categories. The program strives to be gradual but at the same time to have developing and educational effect. It goes from the most general to the more specific tasks. Of course. there are no 'clean days'. i.e. only one category on any given day. These are mixed. but the categories corresponding to the given day are in majority.

At the beginning of the week. days after the game. mainly technical shots were included in the training. In the middle of the week there was a greater emphasis on repetitive shots. Days before the game gamelike shots received the most attention.

Table 2. Nine types of the shooting program (Own editing)

Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**
Mainly technical shots	**Mainly repetitive shots**		**Mainly gamelike shots**		**Gamelike shots or Game day**	
1. Technical						
	2. Repetitive	2. Repetitive				
3. Free throw	3. Free throw	3. Free throw	3. Free throw	3. Free throw	3. Free throw	3. Free throw
	4. Stressed	4. Stressed	4. Stressed			
		5. Special	5. Special			
6. Per segment	6. Per segment	6. Per segment	6. Per segment	6. Per segment	6. Per segment	6. Per segment
7. Per position	7. Per position	7. Per position	7. Per position	7. Per position	7. Per position	7. Per position
8. Situational	8. Situational	8. Situational	8. Situational	8. Situational	8. Situational	8. Situational
9. Competition	9. Competition	9. Competition	9. Competition			

In addition, the coaches identified 14 categories. in which each player had to develop within the shooting program. These were tailored individually. which was documented as per the below.

Table 3. 14 categories of individual goals (Own editing)

Sub-goals														
#	**Goal #1**	**Goal #2**	**Goal #3**	**Goal #4**	**Goal #5**	**Goal #6**	**Goal #7**	**Goal #8**	**Goal #9**	**Goal #10**	**Goal #11**	**Goal #12**	**Goal #13**	**Goal #14**
#1				Outnumbering	From inbound		Contra layup	Contra mid-range	Drive and kick	Pick and roll	From 1:1	Cut	Run	Endgame situation
#2				Outnumbering	From inbound		Contra layup	Contra mid-range	Drive and kick	Pick and roll	From 1:1	Cut	Run	Endgame situation
#3	Center basic techniques	From rebound	Drive	Outnumbering	From inbound		Contra layup	Contra mid-range	Drive and kick	Pick and roll	From 1:1	Cut	Run	Endgame situation
#4				Outnumbering			Contra layup	Contra mid-range	Drive and kick	Pick and roll	From 1:1	Cut	Run	
#5	Center basic techniques	From rebound	Drive	Outnumbering	From inbound		Contra layup		Drive and kick	Pick and roll	From 1:1	Cut		Endgame situation
Categories	**Center basic techniques**	**From rebound**	**Drive**	**Outnumbering**	**From inbound**	**Basic technique**	**Contra layup**	**Contra mid-range**	**Drive and kick**	**Pick and roll**	**From 1:1**	**Cut**	**Run**	**Endgame situation**

Personalizing the test

Those athletes who are playing in several positions have to do more tests.

Based on the shooting program. I have prepared the survey material. namely the test.

Table 4. The shooting test (Own editing)

Test						
1. Repetitive	**2. Free throw**	**3. Stressed**	**4. Special**	**5. Per position**	**6. Situational**	**7. Competition**
From 3 places V movement mid-range	10 shots. 1 shoots. 1 collects. 1 runs	25 triples. 15 sprint	2 inbound location foot-back-spin	6" organized dribbling +1 fake	Team-level measurement —> 3' 3 people's connection. dribble entry task. against 2 defenders	3' —> 30 treys —> 6 places
Team-level measurement —> 3'. 2 Cut to the center from the place of throw-in. in a row		Star drill mid-range. 3 laps		5 center technique		
		Team-level measurement —> 4'15"		Solo 4 technique		
				Mikan exercise. 30"		

According to the coaches' expectations. the test was personalized. The table below shows which tests should each player perform. These are characterized per position and per person.

Table 5. Test broken down to individuals, with partial results (Own editing)

Individualized test								
Player #1	**From 3 places V movement mid-range**	**10 shots. 1 shoots. 1 collects. 1**	**25 triples. 15 sprints**	**2 inbound location foot-back-**	**6" organized dribbling +1 fake**	**Solo 4 technique**	**3' —> 30 treys —> 6 places**	**Throw-in**
Test 1	18	10	19	3	4	4	35	93
Test 2	21	10	19	4	4	5	36	99
Test 3	23	10	20	6	4	8	38	109
Player #2	**From 3 places V movement mid-range**	**10 shots. 1 shoots. 1 collects. 1**	**25 triples. 15 sprints**	**2 inbound location foot-back-**	**6" organized dribbling +1 fake**	**Solo 4 technique**	**3' —> 30 treys —> 6 places**	
Test 1	20	9	13	3	4	5	36	90
Test 2	22	10	15	4	4	6	35	96
Test 3	23	10	18	5	4	7	36	103
Player #3	**From 3 places V movement mid-range**	**10 shots. 1 shoots. 1 collects. 1**	**25 triples. 15 sprints**	**2 inbound location foot-back-**	**5 center technique**	**Solo 4 technique**	**Mikan exercise. 30"**	**3' —> 30 treys —> 6**

Test 1	23	8	17	6	17	2	26	25	124
Test 2	23	10	16	5	18	4	26	28	130
Test 3	22	10	16	5	18	6	25	30	132
Player #4	**From 3 places V movement mid-range**	**10 shots. 1 shoots. 1 collects. 1**	**25 triples. 15 sprints**	**2 inbound location foot-back-**	**6" organized dribbling +1 fake**	**Solo 4 technique**	**3' —> 30 treys —> 6 places**		
Test 1	18	7	6	2	3	2	11		49
Test 2	18	7	8	3	4	3	11		54
Test 3	20	8	12	3	4	5	13		65
Player #5	**From 3 places V movement mid-range**	**10 shots. 1 shoots. 1 collects. 1**	**Star drill mid-range. 3 lans**	**2 inbound location foot-back-**	**5 center technique**	**Mikan exercise. 30"**	**3' —> 30 treys —> 6 places**		
Test 1	12	10	10	4	14	21	21		92
Test 2	14	10	10	4	16	19	20		93
Test 3	17	10	12	3	19	23	21		105

- I highlighted the test results of five players. Players #1. #2 and #3 participated both in the morning and evening workouts. while players #4 and #5 only attended the evening training sessions.

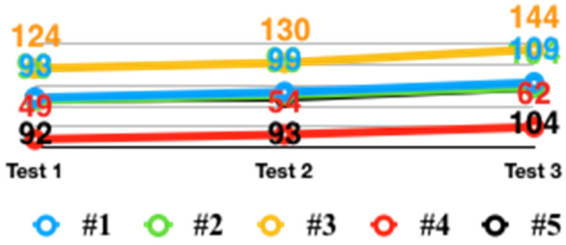

Figure 1. Test results of the five players (Own editing)

- Players #1. #2 and #4 play the same or almost the same position. They had to complete the same tests.
- Players #3 and #5 play almost on the same position. player #3 had to perform one additional test.
- It can be seen that all five players have improved their performance test-by-test.
- However, it can be observed that those players who participated in the morning training sessions have significantly higher values than those who attended only the evening workouts.
- During the shooting tests. all five players showed progress. however, there was a significant difference between those who attended the morning workouts and those who did not.

Table 6. Test broken down to individuals from the aspect of development (Own editing)

		From 3 places V movement mid-range	10 shots. 1 shoots. 1 collects. 1 runs	25 triples. 15 sprints or Star drill mid-range. 3 laps	2 inbound location leg-back-spin	6" organized dribbling +1 fake or 5 center techniques	Solo 4 techniques or Mikan exercise. 30"	3' —> 30 treys —> 6 places	Made shots
Player 1	Test 1	18	10	19	3	4	4	35	93
	Test 3	23	10	20	6	4	8	38	109
	Change	127.78%	100.00%	105.26%	200.00%	100.00%	200.00%	108.57%	117.20%
Player 2	Test 1	20	9	13	3	4	5	36	90
	Test 3	23	10	18	5	4	7	36	103
	Change	115.00%	111.11%	138.46%	166.67%	100.00%	140.00%	100.00%	114.44%
Player 3	Test 1	23	8	17	6	17	2	25	98
	Test 3	22	10	16	5	18	6	30	107
	Change	95.65%	125.00%	94.12%	83.33%	105.88%	300.00%	120.00%	109.18%
Player 4	Test 1	18	7	6	2	3	2	11	49
	Test 3	20	8	12	3	4	5	13	65
	Change	111.11%	114.29%	200.00%	150.00%	133.33%	250.00%	118.18%	132.65%
Player 5	Test 1	12	10	10	4	14	21	21	92
	Test 3	17	10	12	3	19	23	21	105
	Change	141.67%	100.00%	120.00%	75.00%	135.71%	109.52%	100.00%	114.13%

The analysis of the shooting test results (variance analysis (ANOVA)) shows improvement in each task. with the exception of player #3. and I can show significant difference between the players in all test exercises. The results of player #3 show only minor changes. presumably. during the tests the player was in better form and fitness level than the others. During the games. his performance was determining.

For this reason, I have checked (with two-sample t-test) if I can detect any differences based on the established groups (per position and the frequency of training session attendance).

Based on the positions. I have found differences in case of exercise 4 (t=4.840. p=0.017). Players #1. #2 and #4 performed better than players #3 and #5 as field players are more likely to use the exercise described in the test.

The results of the two-sample t-tests carried out per position and frequency of training attendance show that in exercise 3 (t=-3.548. p=0.041). and in the total number of made shots. player #4 shows the biggest improvement. The reason for this might be that the first survey was due at the end of September. It can be assumed that by that time. player #4 still has not reached the expected competitive form. and thus under-performed compared to himself during the test. Then on the third test at the end of May. when the team was preparing for the finals. he was closer to his ideal form and the completed shooting program could also have an effect. (Note: Players #1. #2 and #4 played on the same position. Players #1 and #2 also worked out in the mornings and had much higher values than player #4. The performance of players #1 and #2 improved to a lesser extent; however, their achieved value is significantly higher.)

During the analysis of the games. the following 13 metrics were used:

- FGM: Field Goals Made
- FGA: Field Goals Attempted
- FG%: Field Goal Percentage
- 2 FGM: 2-point Field Goals Made
- 2 FGA: 2-point Field Goals Attempted
- 2 FG%: 2-point Field Goal Percentage
- 3 FGM: 3-point Field Goals Made
- 3 FGA: 3-point Field Goals Attempted
- 3 FG%: 3-point Field Goal Percentage
- FTM: Free Throws Made
- FTA: Free Throws Attempted
- FT%: Free Throws Percentage
- eFG%: Effective Field Goal Percentage

- I picked five players from the team. Three of them regularly participated in the morning and evening training sessions. Two of them were training only during the evening sessions. The upper part of the table shows the overall attempts of the team. the three players and two players during the games. The lower part of the table shows the average of the attempts for the team. the three players and two players.
- It can be seen from the table that those who participated in the morning trainings as well have dominantly more field goal attempts. made field goal attempts. free throw and made free throw attempts.
- Moreover. it can be seen that they score three times as many points as those who only train in the evening.
- Those who participated in the morning trainings had significantly more attempts at the games. making their points/game average notably higher. (49.3 PPG - 14.1 PPG)

The eFG% and the FTF do not show significant difference between the three and two players. but this is due to the number of field goal attempts and free throw attempts. (434/193 - 88/49 and 99/78 - 39/26).

Table 7. The team. the three and two players' total and average number of attempts. during the 11 major games (Own editing)

Total	Made field goal attempt	Field goal attempt	Point / Game	Made free throw	Free throw attempts
Team	**420**	**875**	**97.3**	**134**	**192**
3 players	**193**	**434**	**49.3**	**78**	**99**
2 players	**49**	**88**	**14.1**	**26**	**39**
Average	**Made field goal attempt**	**Field goal attempt**	**Point / Game**	**Made free throw**	**Free throw attempts**
Team	**38.2**	**79.5**	**97.3**	**12.2**	**17.5**
3 players	**17.5**	**39.5**	**49.3**	**7.1**	**9.0**
2 players	**5.4**	**9.8**	**14.1**	**2.9**	**4.3**

- The following three figures show the eFG% of the team. the three and two players and the corresponding performance trendlines during the 11 games. (Note: The last three games were a series of physical stress; they had to play three games in three days. The two players have 9 games because they did not play in two games.)
- It can be seen that in case of the team. the performance trendline is stagnant. the change is minimal. It increases in case of the three players. while it decreases in case of the two players. However. the previous table is important as it shows the number of attempts.

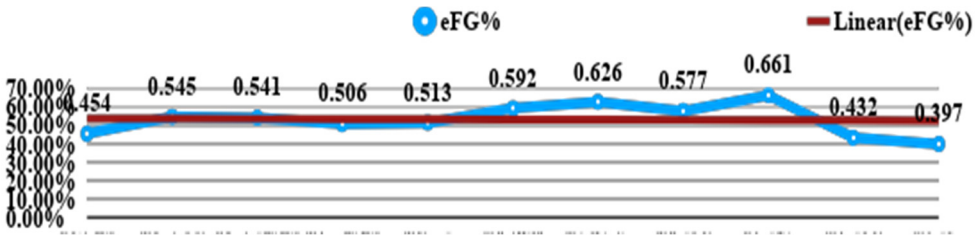

Figure 2. The team's eFG% and the corresponding trendline (Own editing)

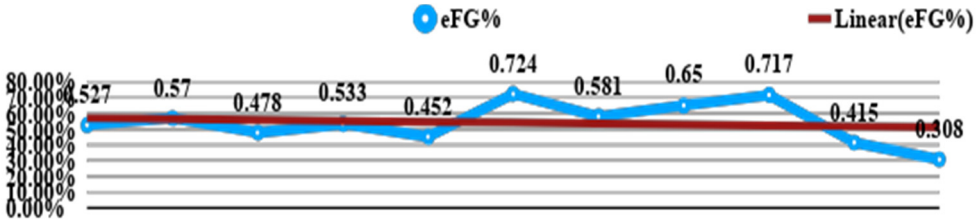

Figure 3. The three players' eFG% and the corresponding trendline (Own editing)

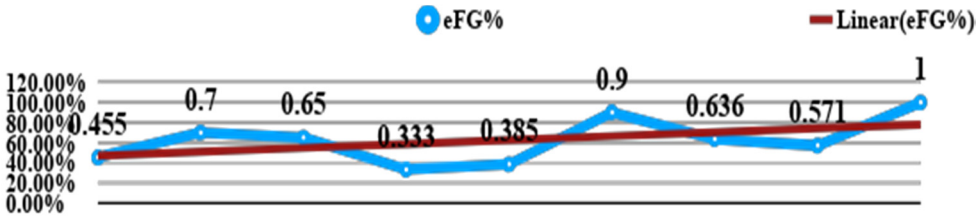

Figure 4. The two players' eFG% and the corresponding trendline (Own editing)

- The three figures below show the free throw factors of the team. the three players and the two players. as well as the corresponding performance trendline during the 11 major games. (Note: The last three games were a series of physical stress; they had to play three games in three days. The two players have 9 games because they did not play in two games. 0.01 value means that during the game. there were no free throw attempts or no made free throw attempts.)
- It can be seen that in case of the team. the performance trendline is stagnant. the change is minimal. Minimal change can be observed in case of the three players. while there is a significant decrease in case of the two players. However. here just as in the case of eFG%. the previous table is of great importance where the number of attempts was visible.

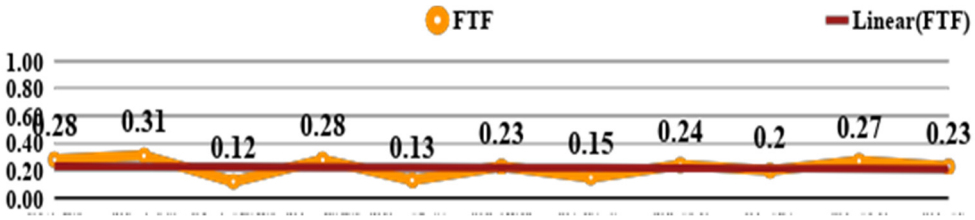

Figure 5. The team's FTF and the corresponding trendline (Own editing)

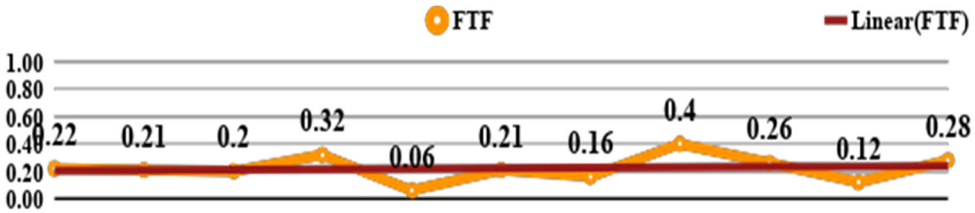

Figure 6. The three players' FTF and the corresponding trendline (Own editing)

Figure 7. The two players' FTF and the corresponding trendline (Own editing)

- Players #1 and #2 attend training sessions on a regular basis; their performance is determined by the shooting program.
- Even though player #3 attends the morning sessions. his performance is not efficient enough compared to the others. has not been able to make as much progress. This is probably due to his performance capability (his relationship with training. the coach. motivation. etc.) or his general physical condition as he was often injured.
- Player #4 has good capabilities. is able to improve his performance and show good results without the morning training sessions. The reason for this might be that the first survey was due at the end of September. It can be assumed that by that time. player #4 still has not reached the expected competitive form. and thus under-performed compared to himself during the test. Then on the third test at the end of May. when the team was preparing for the finals. he was closer to his ideal form and the completed shooting program could also have an effect. (Note: Players #1. #2 and #4 played on the same position. Players #1 and #2 also worked out in the mornings and had much higher values than player #4. The performance of players #1 and #2 improved to a lesser extent; however, their achieved value is significantly higher.)
- Player #5 fits into the statistics. shows improvement. but only to a small extent.

Hypotheses review

1. **Not accepted** the assumption that the performance trendline is moved to a balanced positive direction by those players' game statistics who participate in morning training sessions.
2. The hypothesis was **accepted** that. eFG% and FTF on their own do not affect the competitive performance trendline. The eFG% and FTF does not show any significant difference between the three and two players. but this is due to the number of field attempts and free throws. (434/193 - 88/49 and 99/78 - 39/26)
3. **Partially true** that the performance improved for those who participated in the morning shooting program.

Those who participated in the morning training sessions had more attempts during the games. making their points/game average significantly higher (49.3 PPG - 14.1 PPG). Those who attended the morning trainings attempted to score in more diverse technical repertoire. The tests confirm that those who completed the shooting program have improved their statistical results during the games. thus their competitive performance.

DISCUSSION AND CONCLUSIONS

Longer term research is justified as the development tasks change during the preparatory year. Data collection completed with the end of the season. With the new knowledge it is possible to analyze the new season as well to compare the new values will be received during the next season.

The shooting program can be developed which takes into account the variables that are typical of the sample. since the results show a significant correlation between performance measured during the trainings and games.

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STUDY ON THE IMPLEMENTATION OF THE BADMINTON GAME IN EXTRACURRICULAR ACTIVITIES AT GRADES V. AND VI.

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ABSTRACT. The paper studies the impact of the implementation of the Badminton game extracurricular activities at secondary school level, and certain aspects relating to the benefits that the game of Badminton brings to the instructive- educational process. Thus, in addition to providing good health, the game of Badminton practiced in an appropriate manner by students at young ages, forms their team and competition spirit, strong characters and feelings of belonging to a community or idea, builds healthy moral values and creates elites. The idea is that Badminton proves to be one of the best ways to achieve the objectives of physical education and sport with regard to the development of the motor qualities of speed and skill. Even more, a constant interest of the students towards the game can be noticed. As a result, the game of Badminton is an alternative to the established sports, with a significant impact on the young generation.

Key words: *Gymnasium, Badminton, Extracurricular, Motor Qualities, Alternative.*

REZUMAT. ***Studiu privind implementarea jocului de badminton în activităţile extracurriculare la nivelul claselor a V-a şi a VI- a.*** Lucrarea urmăreşte impactul implementării jocului de badminton în activităţile extracurriculare la nivelul treptei gimnaziale, şi anume aspecte cu privire la beneficiile pe care jocul de badminton le aduce procesului instructiv- educativ. Astfel, pe lângă asigurarea unei stări bune de sănătate, jocul de badminton folosit în mod corespunzător de elevi, la vârste fragede, le formează acestora spirit de echipă şi competiţie, caractere puternice şi sentimente de apartenenţă la o comunitate sau idee,

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induce valori morale sănătoase şi creează elite. Ideea este că badmintonul se dovedeşte a fi o modalitate optimă de atingere a obiectivelor educaţiei fizice si sportului cu privire la dezvoltarea calităţilor motrice viteza şi îndemânarea. De asemenea se poate observa interesul susţinut al elevilor faţă de jocul de badminton. Ca urmare, jocul de badminton este o alternativă la sporturile consacrate, cu un impact major asupra tinerei generaţii.

Cuvinte cheie: *Gimnaziu, Badminton, Extracurricular, Calităţi Motrice, Alternativă.*

Introduction

The educational system in Romania is undergoing a period of essential transformations with the purpose of adjusting education to the international standards of developing the students' personality. Extracurricular activities and in particular sport activities support the improvement of the process of teaching and learning and also the acquisition by pupils of skills that are necessary for social inclusion.

The secondary school period creates the most favourable conditions for learning the Badminton game and for the acquisition of some actions related to sports discipline. Practiced at this age, the game of Badminton can be included in the vast system of physical education, both as an activity carried out in the form of the game, and al so as a sport branch.

The didactic technology focuses on the techniques used for reaching the instructive and educational aims, types of teacher and student organization in the lesson – principles, methods, activity types – material resources, the entire assemble of teacher – student interaction, aimed at conducting the educational activity in the best conditions (Marcu, 1989, p. 85).

Through the use of motor skills in badminton, in the form of physical exercise (running, jumping, hits with multilateral influences on the body), the educational objectives, which refer to the formation of a varied motor baggage and the improvement of motor qualities, are achieved. By its specificity, the game of Badminton requires in all of its forms special speed and increased skill, motor quality switch area easily acquired at the age of 11- 13 year sold, when the bases of the physiological substrate of these two qualities are developed, which would later be more difficultly influenced.

Badminton is a technical sport which requires very good eye-hand coordination, the psychological training having its own determinant role in performance achievement (Rus, 2008, p. 13).

Thus, my reason and purpose is that the game of Badminton, as a constantly designed and practiced activity, contributes to the development of the physical condition and motor power ability of the students.

Objectives

a) To determine the impact of extracurricular activities on the development of the motor capacity of the students;
(b) The assessment of the degree of the physical development and technical preparation of pupils in classes V and VI;
(c) The development and application of the specific means system for developing the general motor capacity within the extracurricular Badminton classes.
(d) Theoretical and experimental argumentation by checking the efficiency of the extracurricular motor activities practiced in grades V and VI.
(e) To stimulate students to start practicing this sport at a level of performance.

Conditions (place, the groups of students and research stages)

The study was conducted within the framework of the extracurricular sport activities at the "Iuliu Hatieganu" School in Cluj-Napoca –a school with good facilities (28/15 m sports hall; 40/20 m handball court, two football courts with synthetic surface of 40/20 m each), appropriate for pursuing extracurricular sport activities.

The pedagogical experiment was conducted on a group of 64 students (boys and girls) in classes V and VI at" Iuliu Hatieganu" Secondary School in Cluj-Napoca. The work was carried out in two weekly meetings in the first and second semester, starting on 21st of September 2015 and up to 17th of June 2016 in the following steps:

- establishing the groups of students: the experimental group (E.G.) and the witness group (W.G.)
- carrying out the control tests
- the development of the experimental factor - action systems;
- establishing the data processing system and the criteria for the hypothesis in order to conduct the conclusions and recommendations.

Both the experimental group and the witness group are mixed groups of 32 students each. In the experimental group there are 16 boys (8 from Class V and 8 from Class VI) and 16 girls (8 from Class V and 8 from Class VI), and in the witness group there are 16 girls (8 from Class V and 8 from Class VI) and 16 boys (8 from Class V and 8 from Class VI).

The experiment was conducted with groups which had the same operating conditions for both the initial and the final test.

Initial tests were carried out in the period between 21 September and 19 October 2015, and the final ones took place in the period between 16 May and 17 June 2016.

The experiment was developed during a school year in which the methods required by the school curricula were used for the witness group, and the methods I had chosen for the achievement of the objectives for the experimental group.

The methods of research

In order to objectively achieve the content and the complex character of the motor activities within the framework of the extracurricular lessons organized with the students of grades V and VI, we have applied various methods of research through which we wanted to obtain the data on the impact of the Badminton game upon the development of the students' motor power ability.

The study of the bibliographic material available in the sports literature

I have studied the sports literature regarding the specific issues of physical education for students in secondary school, didactic research papers (curricula and publications) and I have also used the internet to research the most recent materials on scientific methods.

Pedagogical observation

The method of observation consisted in the permanent monitoring of the teaching activities both within the experimental group and the control group, through effective participation in the preparation, planning, design and conducting of the Badminton physical education and sport lessons. The method has been applied at all stages of research and the data obtained has allowed the formulation of conclusions regarding the organized extracurricular activity.

The test method.

The test is a measuring instrument, a scientific way of measuring certain phenomena, motor qualities, individual skills.

The statistics- arithmetic method

As a method of processing and interpreting the data collected during the research, statistics has established itself in recent decades, its knowledge becoming essential for any researcher and specialist.

The data collected from different groups allows certain appreciation of the value and the frequency with which they appear. The description of the group must be done based on objective data.

The arithmetic mean - is the most commonly used static indicator in the interpretation of the collected data and the one which is to beta ken into account in all future calculations. It also provides an accurate me a sure of the central tendency.

The examination methods used in the research

In order to highlight the level of motor development of the group of students, a study of performance we carried out in the first stage and the collected data provided an objective examination of the students with regards to motor development.

For both the initial and the final testing the following control tests were used:

1. Touch the boards
2. Moving with added steps in the 4 corners of their own field(4x4,5m)
3. The long and short serve

Methods used in the examination:

Lesson 1 - Date 21.09.2015 - 25.09.2015 for learning the stroke
Lesson 2 - Date 28.09.2015 - 02.10.2015 for learning movements
Lesson 3 - Date 05.10.2015 - 09.10.2015 for learning and consolidating the waiting position and move
Lesson 4 – Date 12.10.2015 - 30.10.2015 for learning the serve
Lesson 5 – Date 02.11.2015 - 13.11.2015 to consolidate the serve
Lesson 6 - Date 16.11.2015- 27.11.2015 for learning the low serve
Lesson 7 - Date 30.11.2015 - 11.12.2015 for consolidating the low serve
Lesson 8 - Date 14.12.2015 - 15.01.2016 for learning backhand low serve technique
Lesson 9 - Date 18.01.2016 - 29.01.2016 for consolidating backhand low serve technique
Lesson 10 - Date 01.02.2016 - 05.02.2016 for learning the forehand overhead stroke
Lesson 11- Date 15.02.2016 – 19.02.2016 for consolidating the forehand overhead stroke
Lesson 12 – Date 22.02.2016 - 04.03.2016 for learning the overhead smashes
Lesson 13- Date 07.03.2016- 18.03.2016 for consolidating the overhead smashes
Lesson 14 - Date 21.03.2016 - 25.03.2016 for learning the direct serve
Lesson 15 – Date 28.03.2016 - 08.04.2016 for consolidating the direct serve
Lesson 16 - Date 11.04.2016 - 15.04.2016 for learning the direct smashes
Lesson 17 – Date 18.04.2016 - 06.05.2016 for consolidating the direct smashes

Lesson 18 – Date 09.05.2016 - 13.05.2016 for learning the right smash serve
Lesson 19 - Date 16.05.2016 – 27.05.2016 for consolidating the right smash serve
Lesson 20 - Date 06.06.2016 – 17.06.2016 for the consolidating the right strokes

The exercises commonly used during the lessons were the following:

- Placing the racket in a string plane parallel with the ground position, in the open palm, with spread fingers, along the diagonal from the thumb root to the hipotenar area of the palm and flexing the fingers;
- Performing the flexing and extension from the fist articulation, with the racket in hand (the forearm and the racket must form an angle of about 135°);
- Performing the flexing and extension, combined with the pronation and supination of the forearm;
- Performing successive hits with alternate change of the grip;
- Adopting the (high) ready position during the game;
- Going from this position to a lower one; running on the court, turning to the teacher at signal and adopting the correct ready position;
- Vertically hitting the shuttlecock while walking and slowly running;
- Mimicking the serve without a racket;
- With the suspended shuttlecock: performing the actual hit. The focus will be on synchronizing the weight transfers on the front leg, with action of the left arm and the right arm;
- Letting the shuttlecock fall freely and performing the serve.
- Vertically sending the shuttlecock, with a low left strike.
- Performing the stroke with a partner, at a distance of 2-3 m, increasing to 5-7 m.
- Holding the shuttlecock suspended at chest level with the left hand; the retracted arm with the racket hits the shuttlecock; the strike must be executed by the extension of the elbow and fist articulation;
- Vertical strikes of the shuttlecock, at chest level;
- Practicing this strike with a partner at a 2-3 m distance;
- The suspended positioning of a shuttlecock or another object and striking it with arm extension for developing the correct evaluation of the hitting point;
- Performing the same strike with a partner, above the head. The focus is on using the grip for the right strike and not the chest one;
- Practicing the low left strike, with a partner, at small distances;
- Performing the low left strike, while taking a step forward or sideways;
- Performing sending the ball to a paper basket by direct strike. After consistent successful strikes, the distance to the basket will be constantly increased.
- Performing a backhand and sending the shuttlecock in a basket. After consistent successful strikes, the distance to the basket will be constantly increased.
- Returns to the partner situated in their field, at a small or big distance, without a net.

- Returns to the partner situated in their field, at a small or big distance, over the net.
- Returns to the partner situated in their field, with different strikes: smash, lob, stop, net shot.
- Returns to the partner situated in their field, with different strikes: smash, lob, stop, net shot, in different directions: back and forth, parallel with the baseline or the diagonal of the field (in cross).
- Theme games: the points are earned in specific conditions (after a lob, a smash etc.)

Results

TEST 1. THE DYNAMICS OF THE RESULTS RECORDED AND STATISTICAL AVERAGE OF THE BOYS AND GIRLS GROUPS IN THE EXAMINATION "REACH THE PLATES "

Table 1. The arithmetic means (initial and final testing) of the sample" reach the plates", boys and girls grades V and VI experimental and control groups

Girls / Group	E (a V-a) M (a V-a)	T.I.=11.15 T.I.=11.25	T.F.=10.82 T.F.=11.13
	E (a VI-a) M (a VI-a)	T.I.=10.78 T.I.=10.89	T.F.=10.44 T.F.=10.83
Boys / Group	E (a V-a) M (a V-a)	T.I.=11.03 T.I.=11.08	T.F.=10.63 T.F.=10.98
	E (a VI-a) M (a VI-a)	T.I.=10.34 T.I.=10.46	T.F.=9.98 T.F.=10.40

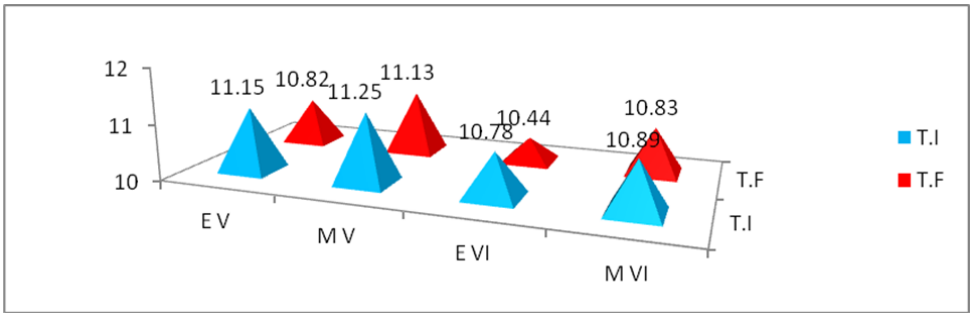

Figure 1. The arithmetic means (initial testing and final testing), groups of girls classes V and VI (experimental and control groups) for the "reach the plates" test

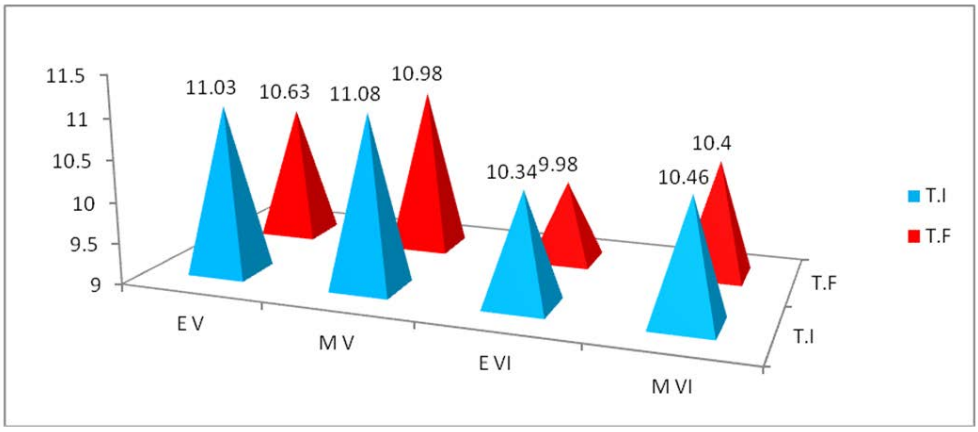

Figure 2. The arithmetic means (initial testing and final testing), groups of boys grades V and VI (experimental and control groups) for the "reach the plates" test

TEST 2. THE DYNAMICS OF THE RECORDED RESULTS AND STATISTICAL AVERAGES OF GROUPS OF BOYS AND GIRLS IN THE TEST WITH STEPS "MOVEMENTIN THE FOUR CORNERS OF THE COURT(S) OF BADMINTON"(4X 4.45 M).

THE RESULT IS RECORDED IN SECONDS AND TENTHS.

Table 2. Arithmetic means (initial and final testing) of the test with steps" Movement in the four corners of the court(s) of Badminton"(4x 4.45 m) girls and boys classes of V and VI experimental and control groups

Girls / Group	E (a V-a)	T.I.=14.21		T.F.=13.89
	M (a V-a)	T.I.=14.28		T.F.=14.21
	E (a VI-a)	T.I.=14.02		T.F.=13.67
	M (a VI-a)	T.I.=14.17		T.F.=14.09
Boys / Group	E (a V-a)	T.I.=13.36		T.F.=12.95
	M (a V-a)	T.I.=13.47		T.F.=13.36
	E (a VI-a)	T.I.=13.07		T.F.=12.57
	M (a VI-a)	T.I.=13.21		T.F.=13.09

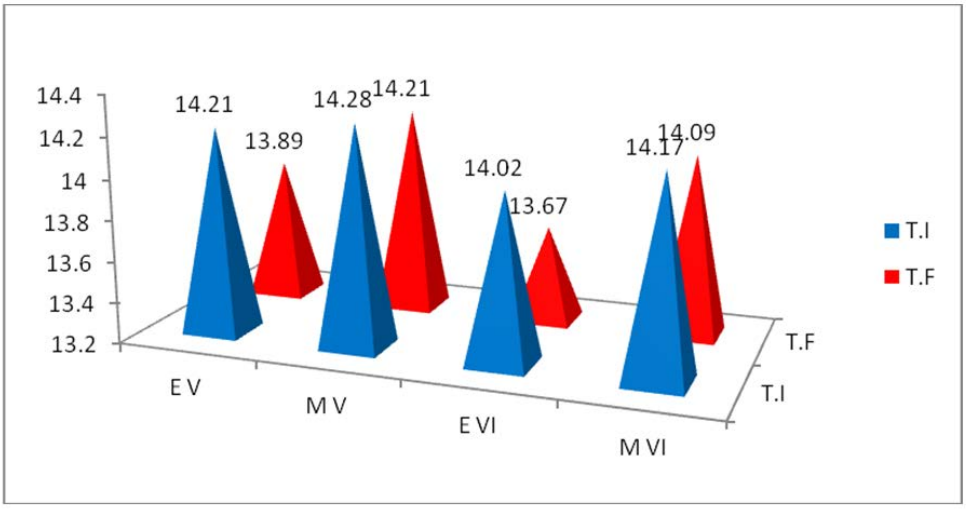

Figure 3. Arithmetic means (initial testing and final testing) for the groups of girls at the "(added steps) movement in the four corners of the Badminton court" test (4x 4.45 m)

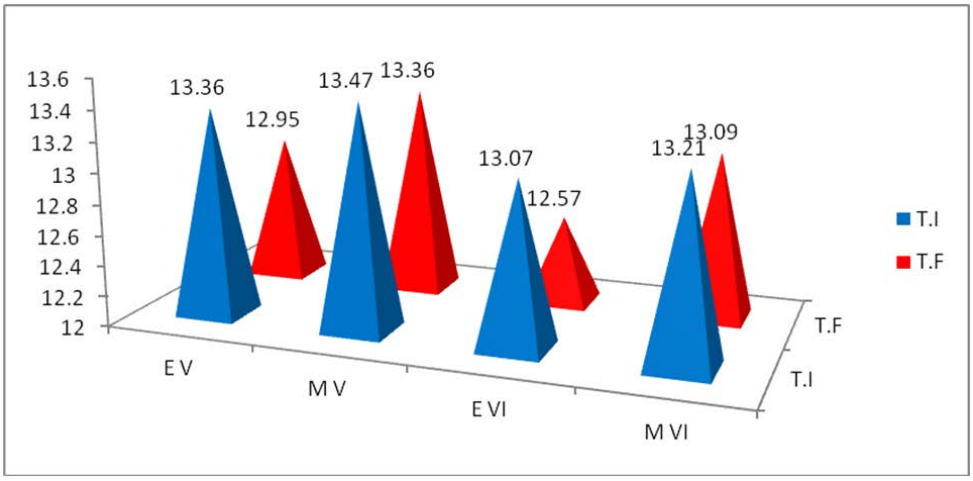

Figure 4. Arithmetic means (initial testing and final testing) for the groups of boys at the "(added steps) movement in the four corners of the Badminton court" test (4x 4.45 m)

TEST 3. THE DYNAMICS OF THE RESULTS RECORDED AND STATISTICAL AVERAGES OF GROUPS OF BOYS AND GIRLS IN THE LONG AND SHORT SERVE TEST".

Table 3. arithmetic means (initial and final testing) of the" Long and short serve test" boys and girls classes V and VI experimental and control groups

Girls / Group			Long Service	Short Service		Long Service	Short Service
	E (a V-a)	T.I.=	1.25	1.75	T.F.=	3	3.5
	M (a V-a)	T.I.=	1.12	1.50	T.F.=	1.62	1.87
	E (a VI-a)	T.I.=	1.37	1.87	T.F.=	3.37	3.75
	M (a VI-a)	T.I.=	1.12	1.62	T.F.=	1.5	1.87
Boys / Group	E (a V-a)	T.I.=	1.12	1.5	T.F.=	3.12	3.75
	M (a V-a)	T.I.=	1	1.37	T.F.=	1.75	1.75
	E (a VI-a)	T.I.=	1.25	1.62	T.F.=	3.5	4
	M (a VI-a)	T.I.=	1.12	1.37	T.F.=	1.75	1.75

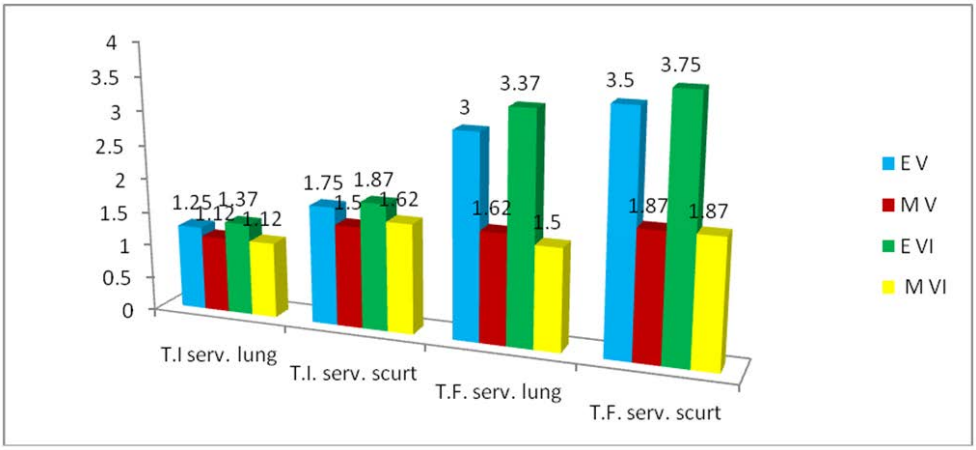

Figure 5. The arithmetic means (initial testing and final testing), groups of girls in the "long and short serve" test

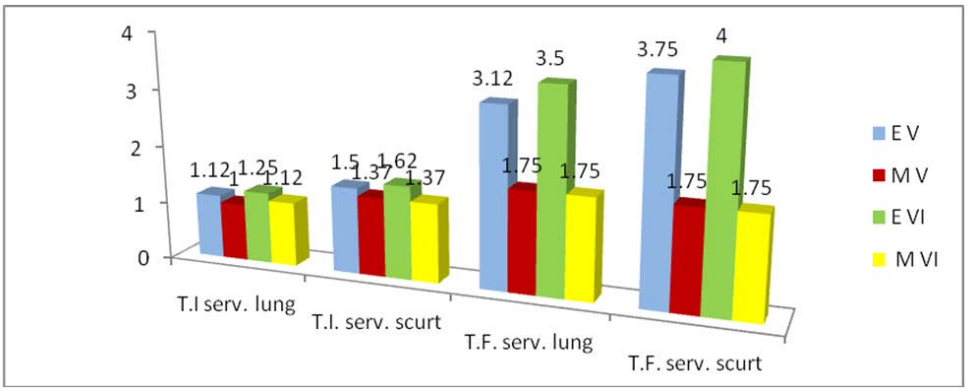

Figure 6. The arithmetic means (initial testing and final testing), groups of boys in the "long and short serve" test

Conclusions

The purpose of the study in this scientific method paper has been to observe the impact of the Badminton game within the framework of extracurricular activities as a form of learning in a non-formal and relaxing manner, with a major role in the development of the motor qualities, but also from a psychosocial point of view.

During the physical education hours, more precisely at the end of them, when the students were requested feedback on the impact of physical education lessons, I have surveyed their interest in playing Badminton, initially perceived as being easy, fun and not requiring sustained physical effort. Groups of students were formed, eager to practice this sport in extracurricular activities carried out in the course of a school year (September to June) with a frequency of 2x/week, 60-minute training sessions, using the school equipment.

We have created a series of tests (3 in number) applied under the same conditions to both the witness group and the experimental group and I found that the performance of the experimental group was significantly better than the one of the witness group (according to the tables).

To my great satisfaction, the frequency of pupils in these activities was more than 90%, as students displayed joy in playing Badminton, while also manifesting interest in the knowledge of the theoretical aspects of this game. As a result of the application of the final tests (May/June) the experimental group obtained significantly better results compared to the witness group (according to the graphs).

The benefits that the game of Badminton brings to the educational process and to the harmonious development of the students are multiple. Thus, in addition to providing good health, the game of Badminton used in an appropriate manner at young ages develops team spirit and competition, strong characters and the feeling of belonging to a community or idea, builds healthy moral values and creates elites. I would first suggest that physical education teachers promote the Badminton game among students and parents and include the game on the list of optional subjects, and last but not least - encourage students to participate in national and international competitions.

The idea is that Badminton proves to be one of the best ways of achieving the objectives of physical education makes it, in conclusion, an alternative to the established sports with a major impact on the young generation.

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JUMPING REACTION TIME AND POWER OUTPUT OF YOUNG FEMALE BASKETBALL PLAYERS

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ABSTRACT. ***Introduction.*** Human muscle power is important regardless of what one is or does. The link between muscle power and reaction time may have its roots in agility. Understanding the links between these may help the overall improvement of the power output in different actions either in day to day activities or in sport competitions. ***Objectives.*** The aim of this paper was to determine if the jumping reaction time correlates with the power output for young female basketball players. ***Materials and Methods.*** The participants in this study were young female basketball players (N = 8), aged from 13 to 14 years that underwent two tests: the jumping reaction time test and the power output test using the MGM-15 carpet. ***Results.*** There was a negative correlation between the reaction time of jumping and the power output. ***Conclusion.*** There is a correlation between the jumping reaction with a visual sign and the jumping power output of the subject.

Keywords: *basketball, reaction time, muscle power, jumping*

REZUMAT. Timpul de reacţie pentru săritură şi puterea la baschetbalistele junioare. Introducere. Puterea musculară este importantă indiferent de domeniul de activitate. Legătura dintre puterea musculară şi timpul de reacţie îşi are originea în agilitate. Înţelegerea legăturii dintre acestea poate ajuta la îmbunătăţirea globală a puterii în diferite activităţi, fie în viaţa de zi cu zi, fie în competiţii sportive. **Obiective**. Scopul lucrării de faţă este de a determina dacă timpul de reacţie pentru săritură se corelează cu puterea în cazul jucătoarelor de baschet. **Materiale şi metode**. Participantele în acest studiu au fost jucătoare de baschet (N=8) cu vârsta de 13 şi 14 ani care au fost supuse la două teste: timpul de reacţie pentru săritură şi evaluarea puterii folosind covorul MGM-15. **Rezultate.** A fost o corelaţie negativă între timpul de reacţie şi putere.

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Concluzie. Există o corelaţie între timpul de reacţie la un stimul vizual şi puterea produsă a subiecţilor.

Cuvinte cheie: *baschet, timp de reacţie, putere musculară, săritură.*

Introduction

Human muscle power is important whether one is an elderly person or a cyclist, a dancer, or a child with cerebral illnesses. The speed of movement determines the ability to generate muscle power. This will decide the velocity of contraction of the active muscles, and in turn generate the power through the power–velocity relationship of skeletal muscle (Sargeant, 2007).

If an individual has adequate muscle mass, if the speed of movement is limited, for example, by osteo-arthritis then, the power generated in dynamic tasks may be limited. This may lead to instability of body posture and gait. The ability to resist fatigue, in other words the reserve of power-generating capability, will be low at slow movement speed. The nature of the task itself, including the external forces that need to be overcome and the equipment being used, may constrain the speed of movement (Zoladz et. al. 1999).

Understanding the capability for generating and sustaining muscle power in the performance of 'whole-body' tasks, including human locomotion, crucially requires information on the speed of movement interpreted in relation to the optimum speed for maximum power for that movement.

The power developed by the muscles is different from the traction force of the muscle contraction. Power measures the muscle labor in a given period of time. The power is dependent not only to the force of contraction of the muscle, but also to the length and the number of contractions in a minute (Johnson & Bahamonde, 1996).

Agility may be characterized by measuring the time from an external stimulus given to a subject, such as light or sound, to the response of his/her body. Whole body reaction time in jump is generally used as an index of agility in sports science (Kai et. al., 2012).

The activity of the primary motor cortex consists of two components, one responsible for the preparation of movement and one for the execution of it. In the movement execution period, transmission of both muscle contraction and the resultant physical energy is required.

Kai et. al. (2012) revealed a high correlation between jumping reaction time and the light stimulus to movement initiation. They also found that the processing velocity was shown to reflect the whole body reaction time in jumping. The outcome suggests that improvement of body performance can be achieved not only by muscle stretch and elastic energy recruitment training but also by faster neural processing.

Objectives

The aim of this paper was to determine if the jumping reaction time correlates with the power output for young female basketball players.

A secondary objective of this paper was to identify whether or not the results of two testing equipments, the MGM-15 Jumping Carpet and AMTI Netforce, can be correlated regarding the jumping action of a subject.

Methods

Subjects

The participants in this study were young female basketball players (N = 8), aged from 13 to 14 years that underwent two tests: the jumping reaction time test and the power output test using the MGM-15 carpet.

Methods and the Steps of the Research

We used the MGM-15 Jumping Carpet for test. The test consists of 15 jumps on both legs that must not be bent during the execution. The software from the MGM-15 Jumping Carpet laid out, among others, one measurement for each subject named Average Unit of Power.

P.U. (Average Unit of Power) – it is measured during the jumps on both legs and offers data regarding: (a) the level of conditional training in sport performance; (b) information regarding the relation between force and speed.

The second test used was a simple visual reaction for jumping using the AMTI Netforce platform. The subject was supposed to perform a vertical two-legged jump when a visual signal was given. The platform recorded the time, in milliseconds, from the presence of the visual signal to the actual jump. The subjects had to repeat this test 3 times and the average times for each of them was recorded.

Results

Tabel 1. Average values of reaction and power for each of the subjects

Subject	Average Jump_Reaction	Average Power_Output
1	0.467	3.2
2	0.552	2.85
3	0.491	4.18
4	0.698	1.77
5	0.423	4.69
6	0.364	3.79
7	0.542	4.32
8	0.381	5.34

A Pearson product-moment correlation coefficient was computed to assess the relationship between the jumping reaction time and power output of young female basketball players. There was a negative correlation between the two variables, r = -0.775, n = 8, p = 0.024. Overall, there was a strong, negative correlation between jumping reaction time and power output. Increases in jumping reaction were correlated with decreases in power output.

Table 2. Correlation test between the jumping reaction test and the power output test

Correlations

		Jump_Reaction	Power_Output
Jump_Reaction	Pearson Correlation	1	-.775*
	Sig. (2-tailed)		.024
	N	8	8
Power_Output	Pearson Correlation	-.775*	1
	Sig. (2-tailed)	.024	
	N	8	8

*. Correlation is significant at the 0.05 level (2-tailed).

Conclusion

Considering the results of our statistical analysis we can state that there is a correlation between the jumping reaction with a visual sign and the jumping power output of the subject. The fact that the correlation is negative suggest that the faster the jump is performing, with regards to the appearance of the visual sign, the higher the power output is.

The existence of the correlation between the two variables also confirms, to some degree, the possibility of using the two equipment's incorporated in our study, the MGM-15 Jumping Carpet and the AMTI Netforce, to evaluate the jumping in sports.

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REACTION TIME AND COORDINATION FOR FEMALE BASKETBALL PLAYERS THROUGH THE USE OF MGM-15 JUMPING CARPET

MOCA COSMIN MIHAI[1]*, GHERŢOIU DAN MIHAI[1]

ABSTRACT. ***Introduction.*** Coordinative abilities (dexterity) rely on the movement control and regulation processes: they are of crucial importance in many sports, as they allow athletes to easily control their motor actions. ***Objectives.*** The aim of this paper was to determine if there is a correlation between the reaction time and the coordination coefficient for basketball players. ***Materials and Methods.*** The participants in this study were female basketball players (N = 9), aged from 16 to 17 years that underwent two measurements: the jumping reaction time test and the coordination coefficient test (EVC) using the MGM-15 carpet. ***Results.*** There was a positive correlation between the jumping reaction time and EVC, r = 0.996, n = 9, p = 0.000. ***Conclusion.*** The reaction time and the coordination coefficient showed a strong correlation.

Keywords: *basketball, reaction time, coordination, jumping*

REZUMAT. Timpul de reacţie şi coordonarea la jucătoarele de baschet folosind covorul pentru sărituri mgm-15. Introducere. Abilităţile coordinative 9dexteritatea) se bazează pe control motor şi procese regulatoare: ele sunt de importanţă crucială în multe sporturi deoarece permit sportivilor să şi controleze cu uşurinţă acţiunile motrice. **Obiective.** Scopul acestei lucrări este de a determina dacă este o corelaţie între timpul de reacţie şi coeficientul de coordonare la jucătorii de baschet. **Material şi metode**. Participanţii în acest studiu au fost jucătoare de baschet (N=9), cu vârsta de 16 şi 17 ani. A fost măsurat timpul de reacţie pentru săritură şi coeficientul de coordonare (EVC) folosind covorul MGM-15. **Rezultate.** A fost o corelaţie pozitivă intre timpul de reacţie şi EVC, r=0.996, n=9, p=0.000.

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Concluzii. Timpul de reacţie şi coeficientul de coordonare sunt corelate puternic.

Cuvinte cheie: *baschet, timp de reacţie, coordinare, săritură*

Introduction

Quickness is the ability to perform a single (non repeated) movement in the shortest time and it is a crucial skill in sports. The analysis of contact times is an effective means to evaluate athletes' acyclic rapidity and it was recently used to quantify the performance of professional athletes during lateral plyometric exercises (Wong et.al., 2012).

Coordinative abilities (dexterity) rely on the movement control and regulation processes: they are of crucial importance in many sports, as they allow athletes to easily control their motor actions. Moreover, they permit to learn complex movements in a relatively rapid way (Atan and Akyol, 2014).

Reaction times depend on motor nerve conduction velocity and are commonly divided between auditory reaction times (ART) and visual reaction times (VRT). It has been demonstrated that ART are less important than VRT, since it is essentially a visual game (Spierer et. al., 2011; Ruschel et. al., 2011).

All athletes who are involved in team sports should have some advantages in their motor skills as well. These skills are to be improved by training. It is a fact that strength, agility, endurance, flexibility, and balance all of which are the factors used consecutively in aerobics and anaerobic systems which affect the performance of both team sports and individual sports (Tamer,2000). In order to be successful in sport events, an athlete must show a high performance with regard to physical and motor skills. One of the parameters that enables an athlete to have such performance is reaction time (Koç et. al., 2006). Reaction time is defined as the time that elapses between receiving an immediate and unexpected stimulus and reaction given to it, however, reaction time changes based upon factors such as age, gender, condition, fatigue, high altitude, alcohol, nicotine and use of physcotroptic substances. (Colakoglu et. al., 1993). Hand-eye coordination plays an important role especially in individual sports that require high motor hand skills such as handball, volleyball, basketball and racket sports (Menevşe, 2011). Fox and his fellows stated that athletes with better performances also have better reaction time than the others.

Objectives

The aim of this paper was to determine if there is a correlation between the reaction time and the coordination coefficient for basketball players, measured using the MGM-15 jumping carpet.

Methods

Subjects

The participants in this study were female basketball players (N = 9), aged from 16 to 17 years that underwent two measurements: the jumping reaction time test and the coordination coefficient test (EVC) using the MGM-15 carpet.

Methods and the Steps of the Research

We used the MGM-15 Jumping Carpet for test. The test consists of 15 jumps repeated 3 times: once for the left leg, once for the right one and last time on both legs. The legs must not be bent during the execution of the jumps. The software from the MGM-15 Jumping Carpet offered out, among others, two measurements for each subject named: reaction time and EVC (energetic variance coefficient). The reaction time is measured in milliseconds, while the coefficient is just a quantifiable number. The test was repeated 3 times and the average value for the two variables was recorded.

Results

After the tests, the data collected was centralized in Table 1.

Table 1. Collected data for each subject regarding the average reaction time and average EVC

Subject	Reaction_Time	EVC
1	0.325	6
2	0.458	11
3	0.39	8
4	0.452	11
5	0.332	6
6	0.377	7
7	0.489	14
8	0.462	13
9	0.401	8

Table 2. Correlation between the reaction time and EVC

		Reaction_Time	EVC
Reaction_Time	Pearson Correlation	1	.966**
	Sig. (2-tailed)		.000
	N	9	9
EVC	Pearson Correlation	.966**	1
	Sig. (2-tailed)	.000	
	N	9	9

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

A Pearson product-moment correlation coefficient was computed to assess the relationship between the jumping reaction time and EVC of female basketball players. There was a positive correlation between the two variables, r = 0.996, n = 9, p = 0.000. Overall, there was a strong, positive correlation between jumping reaction time and EVC. Increases in jumping reaction were correlated with increases in coordination coefficient.

Conclusion

Even though for both variables measured the values obtained by the athletes were under expectations considering their training and level of performance, the correlation of the two can't be questioned. The reaction time and the coordination coefficient showed a strong correlation. This implies that the jumping reaction time for basketball players is linked with their level of coordination.

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THE PROMOTION OF SOME GEOGRAPHICAL PLACES AS TOURIST AND LEISURE DESTINATIONS BY SPORTS EVENTS. CASE STUDY: HALF MARATHON BICHIGIU (BISTRIȚA-NĂSĂUD COUNTY, ROMANIA)

BÎCA IOAN[1]

ABSTRACT. Recent years have diversified and enhanced sports and outdoors leisure activities, which has led much of the population, irrespective of age and profession One of these sports activities is the race that is found well represented in mountain marathons. Any mountain marathon requires a certain geographical area of deployment, whose natural and cultural-historical charge may be a attractive target for participants, and the competition itself can establish that place as a destination for tourism and leisure. Is the case Halfmarathon Bichigiu sporting event held in the village Bichigiu from Bistrița-Năsăud (Romania), that can become a future tourist destination and leisure powered by it echoes. This paper analyzes this event, the technical details of the route and adherence to various categories of participants, inventorying and assessing the same time, the attractive potential of this place, in order to develop and exploit tourism planning strategies.

Key words: *trail running, mountain marathon, outdoor activities, active leisure, mountain runner, Năsăud Border Regiment, cultural tourism*

REZUMAT. ***Promovarea unor locuri geografice ca destinații turistice și agrementale prin intermediul unor evenimente sportive. Studiu de caz: semimaratonul Bichigiu (județul Bistrița-Năsăud, România).*** În ultimii ani s-au diversificat și intensificat activitățile sportive și agrementale în aer liber, fapt care a antrenat o mare parte din populație, indiferent de vârstă și profesie. Una dintre aceste activități sportive este alergarea care se regăsește foarte bine reprezentată în maratoanele montane. Orice maraton montan presupune un

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anumit spaţiu geografic de desfăşurare, a cărui încărcătură naturală şi cultural-istorică se poate constitui ca obiectiv atractiv pentru participanţi, iar competiţia în sine poate consacra locul respectiv ca destinaţie pentru turism şi agrement. Este şi cazul evenimentului sportiv Semimaratonul Bichigiu, desfăşurat în localitatea Bichigiu din judeţul Bistriţa-Năsăud (România), care poate deveni o viitoare destinaţie turistică şi agrementală propulsată de ecourile acestui eveniment. Lucrarea de faţă analizează organizarea acestui eveniment, elementele tehnice ale traseului şi aderenţa la diferitele categorii de participanţii, inventariind şi evaluând, în acelaşi timp, potenţialul atractiv al acestui loc, în scopul elaborării unor strategii de amenajare şi valorificare turistică.

Cuvinte cheie: *maraton montan, activităţi în aer liber, agrement activ, alergător montan, Regimentul Năsăudean de Graniţă, turism cultural*

INTRODUCTION

In recent years, intensified sporty outdoor activities for leisure and for maintaining physical fitness. The causes for this fact are multiple and illustrates the rapid transformations that records human society. Of those cases may be listed:

- internet access and dissemination of information;
- progress recorded in outdoor equipment;
- increasing standard of living and leisure time;
- formation of behaviours and mentalitys oriented to active leisure, improving and maintaining physical fitness;
- maintaining health;
- the need for personal development, socialization and belonging to different groups concerned with sports.

In this context, there are also marathons, mass competitions bringing together hundreds of participants and involves a special logistics (team of organizers and volunteers, track points hydration, ambulance and mountain rescue, etc.). Among these competitions can be mentioned: Faget Marathon (Cluj), Apuseni Marathon, Piatra Craiului Marathon, Braşov Marathon, Retezat Marathon, Bucegi Marathon 7500, Via Maria Theresia Marathon (Călimani) etc.

All these competitions used to conduct a certain geographical area (mountainous and hilly areas, rivers, lakes, towns, villages, protected areas) that have a certain natural or cultural-historical charge. This collection of attractive facets is part of sporting events, and locations they own can be promoted in this way as leisure and tourist destinations because, in addition, to competitions participating athletes and supporters, friends or relatives.

MATERIALS AND METHODS

In order to achieve this study were the following methodological steps:

- making of direct observations on the Bichigiu Half Marathon and on the geographical environment in which it took place;
- consulting the literature on the study area and on the cultural-historical fetures of Bichigiu village (Geografia României, 1987; Bîca, 2010; Şotropa, 1925; Păcurariu, 1994; Roşca, 2008; Ilovan, 2009; Daroşi, 2013);
- prelucrarea datelor statistice oferite de organizatorii evenimentului sportiv (OM Association).
- processing statistical data provided by the event organizers (OM Association).

STUDY AREA

The village Bichigiu is situated in the valley Bichigiu (tributary of the river Salauta, Somesul Mare), between the Ţibleş Mountains and Suplai Hills (fig. 1).

Fig. 1. Geographical localization of Bichigiu village in Bistriţa-Năsăud County

Geomorphological axis of this area is Bichigiu Valley, which comes under intrusive magmatic massive Ţibleş (Magura Neagra) and is bordered by hilly peaks with altitudes between 700-900 m, which descends from the mountains to the Ţibleş, Sălăuţa and Somesul Mare valleys. Thus, in the vicinity of the village lies to north Obicna Fiezel (Şurila peak, 853 m) and to south Obcina Hârbului (889 m). Vegetable formations that takes these hills are made of Fagus sylvatica forests and meadows.

In terms of cultural and historical aspects, the village Bichigiu attested to the early sixteenth century, when is mentioned a monastery in the area (1523), become part of Năsăud Regiment Border in mid seventeenth century (1762), and the prominent historical figure is Tanase Todoran (1659-1763), a 104 years old man who rebels against Habsburg authorities and is killed at Salva village in 1763.

At the instigation of Tanase Todoran, the border guards of two battalions refused to be sworn in May 10, 1763, near Salva village, in the presence of Bishop Petru Pavel Aron and General Bukow. Their refusal was related to the fact that in this way they had to abandon the Orthodox denomination to join the Uniate Church. As a result, Todoran Tanase and others involved in the movement were executed: Tanase Todoran by breaking wheel and the other two were hanging: Vasile Dumitru of Mocod, Grigore Manu of Zagra, and Vasile Oichi from Telciu. Other peasants were punished by blows of rods (Şotropa, 1925; Păcurariu, 1994; Roşca, 2008).

RESULTS AND DISCUSSIONS

Mass sporting event called the Bichigiu Half Marathon was organized by the OM Association from Bistriţa city (fig.2), was charitable and had three sections: half marathon, relay and children race (fig. 3). At the half marathon signed up 116 people, aged between 16 and 67 years (fig.4), the relay was attended by 136 athletes, aged between 25-57 years (fig.5), and children race brought together participants aged 10 to 14 years.

Fig. 2. The poster of the sporting event
(source: Semimaratonul Bichigiu facebook)

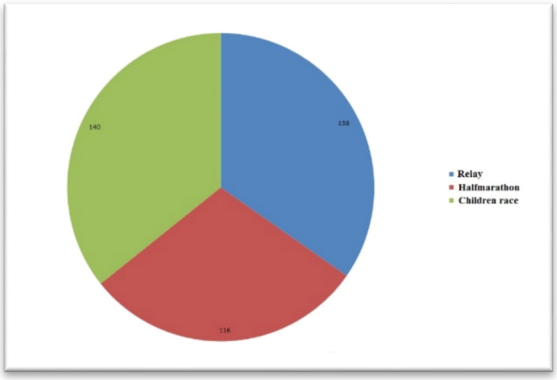

Fig. 3. Distribution of sports participants
(source: OM Association Bistrița)

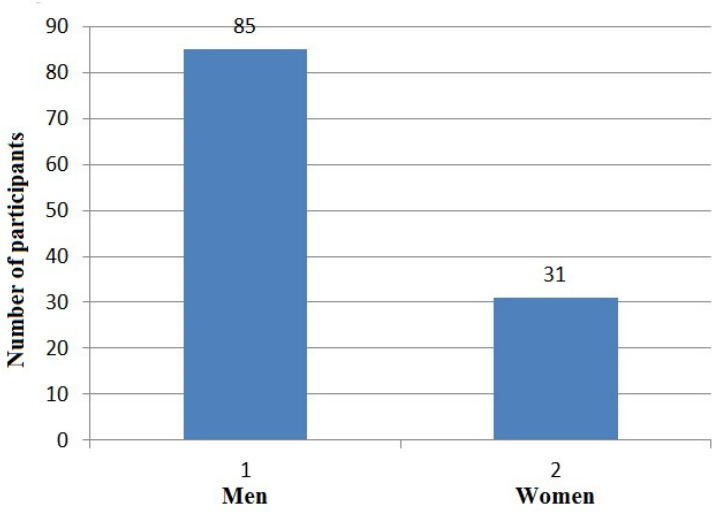

Fig. 4. The genres structure of participants to half marathon contest
(Source: OM Association Bistriţa)

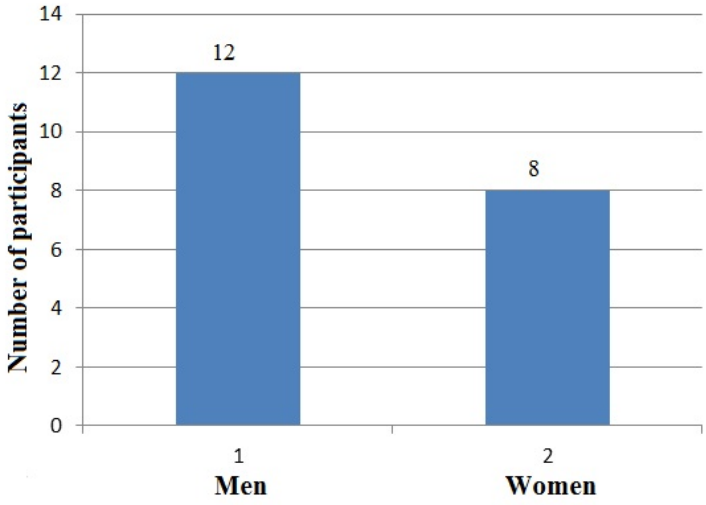

Fig. 5. The henre structure of participants to relay contest
(Source: OM Association Bistriţa)

At half-marathon and relay athletes came from several counties, such as: Bistrița-Năsăud, Cluj, Maramureș, Sălaj, Mureș, Brașov, and children came from villages Bistrița-Năsăud County (Prundu Bârgăului, Tureac, Bichigiu, Telciu, Nușeni).

The Half Marathon route presented the following technical characteristics:

- Start and Finiș: Zăpode Cabin, 520 m altitude;
- Lenght of the route: 21 km;
- Maximum altitude: 889 m on Măgura Hârbului;
- Minimum altitude: 520 m at Zăpode Cabin and Ideciu Valley;
- Level difference: 369 m;
- The geomorphology of the route: sloping ground, the flat surfaces of the ridge, descend, climbing crossing slopes, forest land, meadow land, dirt roads, ravines (fig. 5, 6);

Fig. 6. Conducting half-marathon route map terrain
(Source: map myhike.com-with changes)

- The description of the route: the route went up from Zăpode Cabin (520 m), entered the forest, reached the summit, headed westward atop Monastery, arrived at Holy Trinity Monastery in Bichigiu-Ideciu Pass (650 m), descend to Ideciu Valley, rose to Dealul Mărului, achieved Măgura Hârbului (889 m), and directed towards the NW, which has been the jonction with the common section of the route, going down to the finish (fig.7).

Relay route was 10 km in length, distributed in 4 participants, and children race was 2 km long and ran through the streets of the village Bichigiu.

Fig. 7. The geomophologic profile of half marathon route
(Source: map myhike.com-with changes)

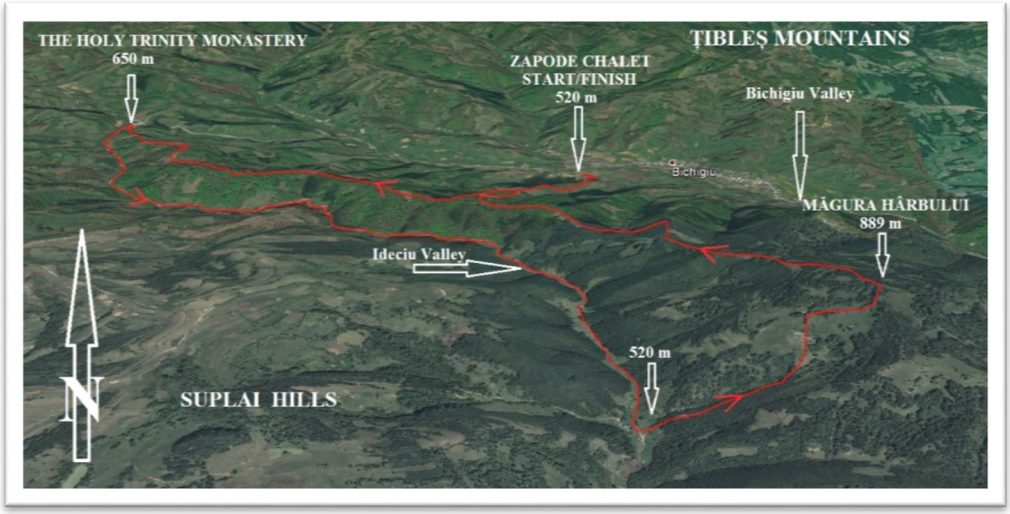

Fig. 8. The 3 D reprezentation of half marathon route
(Source: google earth.com-with changes)

Tourist dimension of this area is supported by the following attractive targets, which were associated with the sporting event:

a) nature objectives:
- high hill landscape (700-800 m), intrusive magmatic massif Țibleș (1840 m);
- the forests and the meadows;
- forest fruits (strawberries), herbs and edible mushrooms;

b) anthropic objectives:
- the historic past: Bichigiu was a member settlement of Năsăud Border Regiment (1763-1851), the martyr Tănase Todoran who rebelled against Habsburg authorities in 1763, the monastery documented in 1523;
- The Holy Trinity Monastery, Bichigiu ortodox church;
- traditional architecture of the farms;
- traditional activities: crop, making hey, shepherding;
- tourist cabin Zăpode (accommodation, restaurants, fishing lake, rustic feasts);

At the end of the event was conducted a survey on a random sample of 100 athletes, which included the following questions:

- will enjoyed organizing the event?
- It was relevant marathon route / relay?
- did you liked the area?
- did you return to Bichigiu?
- what should be done as Bichigiu become a tourist destination?

The result of this survey was favorable to organizers, but also to the place itself, all respondents giving positive answers and suggestions related to the development of the village as a tourist destination and leisure, such as: the arrangement of the access road to the tourist cabin Zăpode and parking, marking the route of the half marathon for hiking and montain biking, identify other hiking trails in the area, the diversification of tourist services provided by the tourist cabin Zăpode (center rental, guiding), training local people in accommodation activities, providing traditional food and tourist guiding etc., involvement of local and county autohorities to promoting the etc.

As a confirmation, in July 2018, was organized at the Zăpode tourist cabin The Two Wheels Camp, which brought together 20 participants who carried out activities of mountain biking and cycling on the route of Half Marathon (fig.8).

Fig. 9. The poster of The Two Wheels Camp Bichigiu event
(source: https://tabara pe 2 roti bichigiu facebook.com)

In terms of interaction with the natural and socio-economic elements, it was observed that the impact of sport on the environment was reduced, half marathon and relay routes overlapping on forest roads for the most part and less on the meadows, so there it wasn't triggered the erosion of land, destruction of vegetation or disturbing of economic activities.

CONCLUSIONS

The sporting event called Bichigiu Half-Marathon gathered a large number of athletes in several counties and had the following purposes:

- the charity purpose: money from donations being directed towards building a house for a disadvantaged family in the Bungard village (Bistrița-Năsăud);
- the sports purpose: promoting Bichigiu ot the map of mass sports events in Romania;
- tourism purpose: promoting Bichigiu area as a tourist destination for leisure and adventure (hiking, cycling, berries, herbs and mushrooms prelevation, cultural events, monastic and religious tourism).

In the next period, it is necessary a strategy to develop and promote Bichigiu village, which must include:

- encouraging the private initiative in the field of tourism infrastructure and services;
- marking the half-marathon route for practicing hiking and cycle tourism (markers, panels);
- elaborating a promotional brochure that will contain the main objectives of this attractive area.

The actors involved in developing and implementing this strategy would be: Năsăud County Council, Telciu City Hall, non-governmental associations, travel agents.

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***Semimaratonul Bichigiu facebook, accessed at 06.06.2018 and 11.06.2018.

***Tabăra pe 2 roți de la Bichigiu facebook, accessed at 06.08.2018.