ДОИ 10.7251/NSK1801136P
UDK 796.012.1-053.2
Оригинални научни рад

Tijana Perović, [1]
Tatjana Ćeremidžić,
Dejan Ćeremidžić,
Vladan Savić
Faculty of Physical Education and Sport
University of East Sarajevo

DIFFERENCES IN MOTOR SKILLS OF BOYS OF THE AGE FROM 10 TO 13

Abstract: *This study was conducted with the aim to determine differences in motor skills of boys of the age from 10 to 13, divided into groups: Footballers, Karate players and Non-athletes from the area of city of East Sarajevo. The study included athletes from Football club "Tango", athletes from Karate club "Igman" and pupils from "Sveti Sava" primary school, "Petar Petrović Njegoš" primary school, "Aleksa Šantić" primary school and "Jovan Dučić" primary school. Total sample of participants was 84 boys. The sample was divided into three groups:*

1. *Footballers (24 boys from FC "Tango")*
2. *Karate players (23 boys from KC "Igman") and*
3. *Non-athletes (37 boys included only in teaching of physical education).*

Boys athletes (Footballers and Karate players) were included in sport activity at least for 4 years. After statistical data processing, the results of the study showed that there are statistically significant differences in motor skills between the participants.

Key words: *motor skills, karate players, footballers, non-athletes*

Introduction

Motor skills of athletes are skills which are the basis in solving simple and complex motor problems, and with the aims of rational, efficient and successful performance of moving during the realization of the desired goal. Motor skills take part in realization of all moving structures. Motor skills enable strong, precise, long-lasting and coordinates performance of various motor goals. Motor skills are very complex and genetically conditioned, with high coefficient of inheritance, and thus they have to be known well in order to work on their increase. Motor skills are, in spite of numerous studies, still a relatively poorly studied field. Besides, the opinions of the examiners do

[1] tikash85@yahoo.com

not coincide in terms of the number of the structure of motor skills, as well as in the content and application of tests. There is a problem in the field of motor skills which was the obstacle for almost all examiners, and it refers to a very weak reliability of measuring instruments, considering that in most motor tests intercorelation was near zero because of the small quantity of information which individual motor skills emit.

According to some studies, the structure of motor skills is consisted of unique and very complex movements. Motor behaviour and the success depend on nerve-muscle system, movement device and other functions of the organism.

Case of this study are differences in motor skills of boys of the age from 10 to 13, divided into groups Footballers, Karate players and Non-athletes from the region of East Sarajevo city. The aim of the study was to estimate the effects of possible changes of motor skills of children who are, apart from regular teaching of physical education, included into sports activities for at least 4 years (Footballers and Karate players) in comparison with the kids who only have physical education teaching (Non-athletes), as well as differences in motor skills between athletes (Footballers and Karate players).

Methods

Participant sample

The population out of which the sample of participants was taken is defined as the population of the pupils from four primary schools from the area of East Sarajevo city, of the age of 10 to 13 (± 6 months), clinically healthy, male and without distinct psychophysical aberrations. The study included pupils from "Sveti Sava" primary school, "Petar Petrović Njegoš" primary school, "Aleksa Šantić" primary school and "Jovan Dučić" primary school. Total sample of participants was 84 boys. The sample was divided into three groups:

1. Footballers (24 boys from FC "Tango")
2. Karate players (23 boys from KC "Igman") and
3. Non-athletes (37 boys included only in teaching physical education).

Boys who are athletes (Footballers and Karate players) were included into sport activity at least for 4 years.

Variable sample

The choice of variables was conducted based on the subject and aim of the study. In this study for the assessment of motor skills of the pupils we used eight motor tests, which were defined as: movement structuring, tonus regulation and synergy regulation, excitation intensity regulation and excitation duration regulation.

Mechanism for structure (trajectory) of the movement

1. Leg taping **(MTAPZ)**
2. Forward fold – shift– touch **(MPZD)**

Mechanism for tonus regulation and synergy regulation
3. One-legged stand with eyes closed **(MRAV)**
4. Deep forward fold on the bench **(MDPK)**

Mechanism for excitation intensity regulation
5. Standing long jump **(MSDM)**
6. Running 20 meters from high start **(M20VS)**

Mechanism for excitation duration regulation
7. Hanging in a pull-up **(MVZG)**
8. Torso lifts on Swedish bench **(MDTK)**

Results and discussion

Basic statistical parameters

In Tables 1, 2 and 3 the descriptive statistical parameters of motor skills are shown for the sample of boys of the age from 10 to 13, divided into groups Footballers, Karate players and Non-athletes.

Table 1. Descriptive statistical parameters of motor skills of FOOTBALLERS

Variable	N	Mean	Min.	Max.	Std.Dev.	Skew.	Kurt.
MTAPZ	24	22.67	16.00	32.00	3.83	0.45	0.32
MPZD	24	18.42	14.00	23.00	2.08	-0.08	0.34
MRAV	24	21.03	5.00	51.00	14.75	**1.27***	0.40
MDPK	24	15.54	4.00	33.00	6.07	0.78	1.92
MSMD	24	181.50	142.00	250.00	22.25	0.98	2.73
M20VS	24	3.38	2.78	4.27	0.46	0.48	-1.07
MVZG	24	40.17	8.00	96.00	26.63	0.74	-0.65
MDTK	24	14.92	9.00	25.00	4.65	0.98	0.11

Legend: **N-** number of participants; **Mean** – arithmetic mean; **Min.** – minimal result; **Max.** – maximal result; **Std.Dev.** – standard deviation of arithmetic mean; **Skew**.– asymmetry of the result distribution curve ; **Kurt**. – flatness of the result distribution curve**.**

By inspection of the above, based on amounts of asymmetry (Skew.) and flatness (Kurt.) of the result distribution curve, it can be concluded that the results of all motor skills are normally distributed, which is the main precondition for the continuity of statistical analysis for determination of differences of motor skills between the named groups. It is observable only in balance (MRAV) in group Footballers (Table 1), as well as in torso lifts on Swedish bench (MDTK) in group Non-athletes (Table 3), that positive asymmetry of distribution curves was prominent (Skew.=1.27; 1.26), which is a consequence of several high values of the results, or high number of smaller values in the zone of arithmetic mean of these variables, which points to the fact that these tests were somewhat harder for the participants of these groups.

By analysing the values of arithmetic mean, the range between minimal and maximal result, standard deviation (Table 1), as well as the flatness of the result

distribution curve of motor skills of the group Footballers, reduced homogeneity can be observed in all measured skills, except in the standing long jump test (MSDM), where the measures of variability are on a satisfying level, considering the fact that in the range of results approximately 6 standard deviations are contained, and the value of flatness of the result distribution is positive and high (Kurt.≥2.73).

Table 2. Descriptive statistical parameters of motor skills of KARATE PLAYERS

Variable	N	Mean	Min.	Max.	Std.Dev.	Skew.	Kurt.
MTAPZ	23	25.52	19.00	30.00	2.71	-0.48	0.36
MPZD	23	20.52	15.00	28.00	3.20	0.31	-0.24
MRAV	23	65.70	14.00	163.00	48.87	0.68	-1.04
MDPK	23	21.00	10.00	35.00	6.02	0.42	0.51
MSMD	23	186.87	144.00	230.00	22.46	-0.05	-0.32
M20VS	23	3.46	2.55	4.32	0.54	0.27	-1.31
MVZG	23	61.70	22.00	91.00	18.77	-0.44	-0.56
MDTK	23	20.74	8.00	42.00	8.22	0.71	0.66

Legend: **N**- number of participants; **Mean** – arithmetic mean; **Min.** – minimal result; **Max.** – maximal result; **Std.Dev.** – standard deviation of arithmetic mean; **Skew**.– asymmetry of the result distribution curve ; **Kurt**. – flatness of the result distribution curve.

By analysing the values of arithmetic mean, the range between minimal and maximal result, standard deviation (Table 2), as well as the flatness of the result distribution curve of motor skills of the group Karate players, reduced homogeneity can be observed in all measured skills, considering the fact that in the range of results approximately 6 standard deviations are not contained, and values of flatness of the result distribution are low and negative (Kurt.≤2.75).

Table 3. Descriptive statistical parameters of motor skills of NON-ATHLETES

Variable	N	Mean	Min.	Max.	Std.Dev.	Skew.	Kurt.
MTAPZ	37	19.70	12.00	28.00	3.39	0.37	0.61
MPZD	37	16.78	10.00	24.00	3.51	-0.29	-0.25
MRAV	37	12.03	2.00	30.00	8.80	0.77	-0.66
MDPK	37	17.35	0.00	30.00	6.66	-0.68	0.41
MSMD	37	159.68	117.00	230.00	23.45	0.71	1.15
M20VS	37	4.08	3.12	5.35	0.58	0.39	-0.56
MVZG	37	12.23	0.00	37.00	10.32	0.72	-0.60
MDTK	37	2.95	0.00	9.00	2.38	**1.26***	0.83

Legend: **N**- number of participants; **Mean** – arithmetic mean; **Min.** – minimal result; **Max.** – maximal result; **Std.Dev.** – standard deviation of arithmetic mean; **Skew**.– asymmetry of the result distribution curve ; **Kurt**. – flatness of the result distribution curve.

By analysing the values of arithmetic mean, the range between minimal and maximal result, standard deviation (Table 3), as well as the flatness of the result distribution curve of motor skills of the group Non-athletes, reduced homogeneity can be observed in all measured skills, considering the fact that in the range of results approximately 6 standard deviations are not contained, and values of flatness of the result distribution are low and negative (Kurt.≤2.75).

Student's t-test

After calculated arithmetic means of all motor skills of boys of the age from 10 to 13, by using Student's t-test for independent samples, their difference for the pairs of groups was calculated, or, the difference between the parameters of the groups Footballers and Karate players, then groups Karate players and Non-athletes, and between groups Footballers and Non-athletes was calculated (Tables 5 and 6).

Table 4. Differences in motor skills of Footballers and Karate players (T-test)

Variable	Mean Footballers	Mean Karate players	t- value	Df	p
MTAPZ	22.67	**25.52**	-2.94	45	**0.005***
MPZD	18.42	**20.52**	-2.68	45	**0.010***
MRAV	21.03	**65.70**	-4.28	45	**0.000***
MDPK	15.54	**21.00**	-3.09	45	**0.003***
MSMD	181.50	186.87	-0.82	45	0.415
M20VS	3.38	3.46	-0.53	45	0.600
MVZG	40.17	**61.70**	-3.19	45	**0.003***
MDTK	14.92	**20.74**	-3.00	45	**0.004***

Legend: **Mean Footballers** – arithmetic mean of group of footballers; **Mean Karate players** - arithmetic mean of group of karate players; **t value**– coefficient value of t-test for testing of the significance of differences; **Df** – degrees of freedom; **p**– coefficient of the significance of differences of arithmetic means; ***-** statistically significant level of differences of arithmetic means

By inspection of Table 4, where the results of Student's t-test for the calculation of differences between Footballers and Karate players in motor skills are shown, it can be concluded that there is statistically significant difference in the space of mechanism for movement structure (the speed of individual moves - MTAPZ and forward fold–shift–touch MPZD) on the level of significance $p \leq 0.01$, in the space of mechanism for regulation of tonus and synergy regulation (balance - MRAV and flexibility - MDKP) on the level of significance $p \leq 0.00$ and $p \leq 0.01$, as well as in space of mechanism for regulation of excitation duration) static power – MVZG and repetitive power – MDTK) on the level of significance $p \leq 0.01$.

Only in the space of mechanism for regulation of excitation intensity (explosive power - MSDM and speed - M20VS) there was no statistically significant difference between these groups.

Table 5. Differences in motor skills of Karate players and Non-athletes (T-test)

Variable	Mean Karate players	Mean Non-athletes	t- value	Df	p
MTAPZ	**25.52**	19.70	6.96	58	**0.000***
MPZD	**20.52**	16.78	4.14	58	**0.000***
MRAV	**65.70**	12.03	6.54	58	**0.000***
MDPK	**21.00**	17.35	2.14	58	**0.037***
MSMD	**186.87**	159.68	4.44	58	**0.000***
M20VS	**3.46**	4.08	-4.16	58	**0.000***
MVZG	**61.70**	12.23	13.18	58	**0.000***
MDTK	**20.74**	2.95	12.41	58	**0.000***

Legend: **Mean Karate players**– arithmetic mean of group of karate players; **Mean Non-athletes** - arithmetic mean of group of non-athletes; **t value**– coefficient value of t-test for testing of the significance of differences; **Df** – degrees of freedom; **p**– coefficient of the significance of differences of arithmetic means; ***-** statistically significant level of differences of arithmetic means

By analysis of Table 5, where the results of Student's t-test for the calculation of differences between groups Karate players and Non-athletes in motor skills are shown, it can be concluded that there is statistically significant difference in all examined latent dimensions of motor space, on the level of significance $p \leq 0.00$, except for flexibility (deep forward fold on the bench – MDPK), where the significance was on the level $p \leq 0.05$.

Table 6. Differences in motor skills of Footballers and Non-athletes (T-test)

Variable	Mean Footballers	Mean Non-athletes	t- value	Df	p
MTAPZ	**22.67**	19.70	3.17	59	**0.002***
MPZD	**18.42**	16.78	2.05	59	**0.045***
MRAV	**21.03**	12.03	2.99	59	**0.004***
MDPK	15.54	17.35	-1.07	59	0.288
MSMD	**181.50**	159.68	3.62	59	**0.001***
M20VS	**3.38**	4.08	-5.00	59	**0.000***
MVZG	**40.17**	12.23	5.77	59	**0.000***
MDTK	**14.92**	2.95	13.24	59	**0.000***

Legend: **Mean Footballers** – arithmetic mean of group of footballers; **Mean Non-athletes** - arithmetic mean of group of non-athletes; **t value**– coefficient value of t-test for testing of the significance of differences; **Df** – degrees of freedom; **p**– coefficient of the significance of differences of arithmetic means; ***-** statistically significant level of differences of arithmetic means

By analysis of Table 6, where the results of Student's t-test for the calculation of differences between groups Footballers and Non-athletes in motor skills are shown, it can be concluded that there is statistically significant difference in all latent dimensions of motor space, where better results were observed in boys from the group Footballers, except in flexibility (deep forward fold on the bench - MDPK), where boys Non-athletes had better results, but only in numerical range, not statistically significant. The level of significance of differences in all variables amounted to $p \leq 0.00$, except in variable forward fold–shift–touch (MPZD) , where it was $p \leq 0.05$.

Conclusion

Obtained results of the differences between Footballers and Karate players showed statistically significant differences in space of mechanism for movement structure (speed of individual and forward fold–shift–touch), in space of mechanism for tonus regulation and synergy regulation (balance and flexibility), as well as in space of mechanism for regulation of excitation duration (static power and repetitive power) in favour of boys Karate players, while in space of mechanism for regulation of excitation intensity (explosive power and speed) there was no significant difference. Also, statistically significant differences in all motor skills were identified in boys from group Karate players, who had better results in comparison with group of boys who were not included in sports activities, i.e. Non-athletes. In boys Footballers, in comparison with boys Non-athletes, statistically significant differences were identified in all motor skills, except in flexibility. From these results it can be concluded that group Non-athletes has the lowest amounts of all motor skills, and group Karate players has highest amounts, except in speed, where group of Footballers has the highest values. The results of this study in terms of differences in motor skills in three groups of boys, Footballers, Karate players and Non-athletes, are in accordance with the results of previous studies (Pržulj, 2007, Pržulj, 2008 Bratić, 2009, Ćeremidžić, 2013. Šiljegović 2015 and others).

The reason for this state of motor skills of boys Non-athletes can be found in quality of diet and sedentary lifestyle. Poorer quality of diet means larger, uncontrolled and more frequent food intake, in which mostly fats and glucose are present, while sedentary lifestyle means lack of physical activity due to inactive use of free time and transport. Most of the kids spend their free time in front of the computer, on social networks or playing video games, which are the consequence of a growing expansion of the Internet in households. The combination of poor quality of diet and lowered or no physical activity negatively impacts on the results of motor skills in pupils.

Similar results of the state of motor skills in pupils were found by other authors (Findak and Mraković, 1998), who state that the characteristic of the current state of the children and the young was the fall of motor and functional skills, so instead of the growth parallel to the age of the child, they actually fall, for which the cause is bigger limitation of muscle straining. Unlike this negative trend of the development of motor skills of the pupils in longer period, many authors stated, based on the sample of athletes of that age, stated positive acceleration of these skills (Grantov, Dizdar and Janković, 1998; Kamasi, 2001; Marelić, Žufar and Omrčen, 1998; Stojanović and Kostić, 2002; Stojanović, Kostić and Milkić, 2005; Stojanović, Nešić and Karalić, 2008).The assumption of this higher level of motor skills is that the demands of club selections in Karate and Football contributed to a better development, or regular and systematic training.

Motor skills are very important for the optimal growth and development of children, and thus for their health. They develop from the birth and their development goes through certain changes which occur over the years and that development is not always the same in boys and girls. For every motor skill there is a specific period in which the biggest changes happen. Physical activity is specified as the most important

factor which has influence on the change of the level of motor skills (Prskalo et al., 2011).

Optimal level of motor skills is especially important for optimal growth and development. (Findak et al., 1996). Continuous and systematic physical exercise is needed for their development, and two lessons of physical education are not satisfactory. Exactly for that reason, the creation of a habit of using free time correctly, with physical education and movement is becoming, from the physical education point of view, the main educational goal (Prskalo, 2004).

Common characteristic of the influence on motor skills lies in the fact that the possible influence on the skills with higher level of innateness is smaller and vice versa. In order to have influence on skills with higher level of innateness, the process of transformation should start as early as it can, respecting the sensitive periods for the development of certain qualities and skills (Findak et al., 1996; Mraković, 1997; Prskalo, 2004).

The results of previously conducted studies in the area of motor skills become obsolete fairly quickly, so it is necessary for such studies to be repeated periodically, in order to obtain a better insight into their actual value.

Literature

Bratić, M. (2009). The effects of experimental practical training on changes of situational motor skills of young karate players. Science-professional journal "Sport and health", Faculty of physical education and sport, Pale.

Ćeremidžić, D. (2013). Differences in levels of motor skills of members of football school "Olimp". Third international conference "Sport sciences and health". Banja Luka. Paneuropean University Apeiron)

Findak, V., Metikoš, D., Mraković, M. I Neljak, B. (1996). Applied kinesiology in schooling – Norms. Croatian pedagogy-literary society. Zagreb: Faculty of physical education of the University of Zagreb).

Grgantov, Z., Dizdar, D. i Janković, V. (1998). Structural analysis of the volleyball game elements based on certain anthropological features. Kinesiology, 30:44-51.

Kamasi, F. (2001). (Preparation period – physical preparation with special emphasis on the development of explosive power. Conference proceedings Contemporary volleyball: Directions of development and improvement 44-59. Novi Sad: Republic Institute for Sport).

Marelić, N., Žufar, G. i Omrčen, D. (1998). Influence of some situation-related parameters on the score in volleyball. Kinesiology, 30:55-65.

Mraković, M. (1997). Introduction to systematic kinesiology. Zagreb: Faculty of physical education of the University of Zagreb).

Pržulj, D. (2007). The effects of conditioning training on development of motor skills of young athletes in preparation period. Science-professional journal "Sport and health", 2 (1).

Pržulj, D. (2008). Effects of basic preparation for the development of motor and functional skills of athletes. Science-professional journal "Sport and health", Faculty of physical education and sport, Pale).

Prskalo, I. (2004): The basics of kinesiology, Petrinja: Teaching academy.

Prskalo, I., Kraljević, Ž. i Kovačić, M. (2011). The place of living predictor of gender dimorphism of some motor skills in primary education, U: Prskalo I, Novak D. (ur) Physical and health culture in 21st century – Student competences, pp. 394-399. Poreč: Croatian kinesiology association).

Stojanović, T., Kostić, R. (2002). The effects of the plyometric sport training model on the development of the vertical jump of volleyball players. Facta universitatis, Series: Physical Education, 1(9):11-25.

Stojanović, T, Kostić, R, Milkić, D. (2005). Supplement to the modeling of volleyball motorics of selected younger players in Serbia (Prilog modeliranju odbojkaške motorike selektiranih pionira Srbije). 10. Congress of European College of Sport Science, code 4901.

Stojanović, T, Nešić, G, Karalić, T. (2008). Comparative analysis of motor models of pioneer volleyball selections of Serbia in the period from 1996 until 2004. Journal of anthropological society of Serbia, 43:229-237).

Šiljegović, T. (2015). Differences in anthropological characteristic between athlete and non-athlete school children. Doctoral thesis. Faculty of physical education and sport University of East Sarajevo.