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Original research article

THE DIFFERENCE IN SOME MOTOR SKILLS BETWEEN JUDOKAS AND NON-ATHLETES OF AN EARLY SCHOOL AGE

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Abstract. *The aim of this research is to determine the difference in motor skills between male judokas and non-athletes of an early school age. The sample of participants in this research was made up of 42 boys, aged between 7 and 8. The sample was divided into two subsamples, one of which consisted of judokas (N=22) of the "Kinezis" University Judo Sports Club from Niš, and the other of students of the "Vožd Karađorđe" Elementary School from Niš (N=20). A battery of tests consisting of 13 measuring instruments was used to estimate: A battery of tests consisting of 13 measuring instruments was used to estimate: Explosive strength – Long jump (MLJ, in centimeters), High jump (MHJ, in centimeters), Medicine ball throw (MTMB in meters); movement frequency speed – Hand tapping (MHT, in frequency), Feet tapping against the wall (MFTW, in frequency); Running speed – 20-meters sprint (M20S in seconds); Repetitive strength – Sit-ups in 60 seconds (MSU, in frequency), Knee push-ups (MKPP, in frequency); Prone lying back extension (MHPT in degrees), flexibility – Standing forward bend (MBOTF, in centimeters), Standing backward bend (MBBTF, in centimeters), Standing side bend-left (MLSBTF, in degrees), Standing side bend-right (MRSBTF, in degrees). After the results were acquired, the conclusion was reached that 6 of the total 13 variables show a statistically significant difference between judokas and non-athletes. In all 6 of them, judokas exhibited better results (MLJ, MTMB, M20S, MRT, MKPP, and MHPT). The other 7 variables showed no significant difference (MHJ, MHT, MFTW, MBOTF, MBBTF, MLSBTF, and MRSBTF). Having in mind the fact that a great number of PE teachers give very large significance to monitoring the development of motor skills of students, the results of this paper prove that practicing judo contributes to improving the motor skills of children, so it can serve as an idea to supplement physical education, as an obligatory subject, with elements of judo or to include judo in the elementary school curriculum.*

Key words: *motor skills, early school age, judo training*

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INTRODUCTION

In the last few decades, motor skills were one of the most commonly researched subjects in the field of physical education (Gadžić & Vučkovič, 2012). They can be defined as human skills that take part in solving motor tasks and condition successful movement (Gligorov, Naumovski & Kasum, 2010). Motor skills of students determine their development in every way. This is why it is important to plan and organize everyday physical activities in accordance to the age of the students, their psychophysical characteristics and individual capabilities (Nikolić, Kocić, Berić, Cvetković & Kržalić 2015). The degree of the development of students' motor skills is significantly conditioned by their proper growth and development (Gadžić & Vučkovič, 2012). The period of the child's development between the ages of 7 and 12 is known as the early school age. The characteristic of this period is relatively slow growth in terms of height compared to other growth and development periods (Đurašković, 2002). The annual increment in height and weight is not particularly expressed, which positively influences the forming and perfection of motor skills (Prodanović, Šljivić, Kurtović, Kurtović, & Devedžić, 2013). It is known that students of an early school age develop motor skills quite fast and that properly applied physical activity contributes to the development of motor skills (Nikolić et al., 2015). Bala (1991) states that the period between the ages of 4 and 12 is a time when the development of motor skills can be extremely positively influenced. Physical education classes are very important and significant in this phase (Đurašković, 2002), but it is a period when students are rarely involved in sports activities, and the frequency, intensity, and often the content of preschool and elementary school exercises are not stimulating enough to additionally develop motor skills (Bala, 1991). It is necessary to facilitate the better development of psychophysical characteristics of children through different exercises and various training. However, a serious mistake can be made by coaches who apply, i.e., adapt, the training process suited to older age categories to children of a younger age in order to achieve better results. In this period, it is also not advisable to use unilateral training which can lead to asymmetric unilateral development (Đurašković, 2002). The training process in judo, as well as other sports, with children of an early school age differs from working with older age groups in terms of the methods and means applied (juniors and seniors). At this age, greater attention is paid to technical preparation, i.e., the work is focused towards acquiring the basic techniques of judo through different methodological procedures. Learning of the techniques and technical preparation starts by training and continues through practice until movement habits are acquired. In order to properly and efficiently perform judo techniques, a certain level of motor skills is needed (Ilić, Mudrić, Kasum, Ćirković & Gavrilović, 2012). They have a large influence on success in judo combat, so special attention should be paid to the development of these skills from the very first training in the judo gymnasium (Drid, Janoš, & Obadov, 2008). Judo is a high-intensity activity where the judoka tries to throw the opponent on his/her back or subdue him on the floor (Bala & Drid, 2010). In order to perform the technique more efficiently, it is necessary to apply it in the right manner, i.e., to use the right moment, amount of strength and speed. Therefore, in order to execute a successful sporting performance, it is necessary to possess the motor and energy capacity which will enable a successful execution of the technique (Drid & Todorov, 2014). Bala and Drid (2010) have also reached the conclusion that motor skills are very significant for achieving success in judo, as well as that special attention should be paid to perfecting motor skills. Ilić et al. (2012) have noticed that the development of motor skills and technical

preparation are interrelated. This means that the work on developing judo techniques influences the development of motor capabilities and vice versa. Earlier research indicated that young judokas possess significantly better motor skills compared to students that only exercise during PE classes (Obadov, Drid, & Nurkić, 2006; Drid, Obadov, & Bratić, 2006). It should be born in mind that environmental factors, including carefully planned and programmed methods of training, contribute to shaping motor skills, along with genetic predispositions (Bala & Drid, 2010). The aim of this research was to determine the difference in motor skills between male judokas and non-athletes of an early school age.

METHOD

The sample of participants in this research was made up of 42 boys, aged between 7 and 8. The sample was divided into two subsamples, one of which consisted of judokas (n=22) of the Kinezis University Judo Sports Club (UJSCK) from Niš, and the other of elementary school children of the Vožd Karađorđe Elementary School from Niš (N=20). The participants from the Kinezis UJSCK had previously been training for at least 6 months while the students of the Vožd Karađorđe Elementary School did not practice any sport. All of the participants, their parents, teachers and coaches were familiar with the aim of the research, and the parents signed a consent form allowing their children to participate in the research. A battery of tests consisting of 13 measuring instruments was used to estimate: Explosive strength – Long jump (MLJ, in centimeters), High jump (MHJ, in centimeters), Medicine ball throw (MTMB in meters); movement frequency speed – Hand tapping (MHT, in frequency), Feet tapping against the wall (MFTW, in frequency); Running speed – 20-meters sprint (M20S in seconds); Repetitive strength – Sit-ups in 60 seconds (MSU, in frequency), Knee push-ups (MKPP, in frequency); Prone lying back extension (MHPT in degrees), flexibility – Standing forward bend (MBOTF, in centimeters), Standing backward bend (MBBTF, in centimeters), Standing side bend-left (MLSBTF, in degrees), Standing side bend-right (MRSBTF, in degrees).

Data processing was performed using the SPSS 20 statistics software. Data analysis was performed via a t-test for independent samples to determine the differences, descriptive statistics were used to determine the frequencies for obtaining important percentages significant for this research, and a Kolmogorov-Smirnov test was done to determine the normality of data distribution.

RESULTS

Before determining a possible difference in motor skills between children practicing judo (J) and children not practicing sports (N), a Kolmogorov-Smirnov test was performed on both groups in order to determine the normality of distribution (Tables 1 and 2).

Based on the results shown in Table 1, it can be seen that the assumption of the normality of distribution for the judokas group was not disproved (Sig.>0.05) (Pallant, 2011).

Based on the results shown in Table 2, it can be seen that the assumption on the normality of distribution for the non-athletes group was not disproved (Sig.>0.05).

Table 1 Kolmogorov-Smirnov test for the judokas

Variables	Statistic	df	Sig.	Variables	Statistic	df	Sig.
MLJ (cm)	.070	22	.200*	MKPP (freq.)	.118	22	.200*
MHJ (cm)	.119	22	.200*	MHPT (deg)	.152	22	.200*
MTMB (m)	.136	22	.200*	MBOTF (cm)	.101	22	.200*
MHT (freq.)	.132	22	.200*	MBBTF (cm)	.109	22	.200*
MFTW (freq.)	.166	22	.119	MLSBTF (deg)	.114	22	.200*
M20S (s)	.142	22	.200*	MRSBTF (deg)	.164	22	.125
MSU (freq.)	.101	22	.200*				

Table 2 Kolmogorov-Smirnov test for children non-athletes

Variables	Statistic	df	Sig.	Variables	Statistic	df	Sig.
MLJ (cm)	.135	20	.200*	MKPP (freq.)	.189	20	.058
MHJ (cm)	.124	20	.200*	MHPT (deg)	.163	20	.169
MTMB (m)	.129	20	.200*	MBOTF (cm)	.127	20	.200*
MHT (freq.)	.141	20	.200*	MBBTF (cm)	.153	20	.200*
MFTW (freq.)	.181	20	.085	MLSBTF (deg)	.155	20	.200*
M20S (s)	.150	20	.200*	MRSBTF (deg)	.180	20	.087
MSU (freq.)	.138	20	.200*				

Table 3 T-test for independent samples

Variables	Sample	N	Mean	Std. Deviation	t	p	Eta Squared
MLJ (cm)	Judokas	22	134.18	12.985	3.899	**.000**	**.275**
	Non-athletes	20	117.20	15.230			
MHJ (cm)	Judokas	22	20.45	3.677	1.716	.089	.070
	Non-athletes	20	18.28	4.429			
MTMB (m)	Judokas	22	2.45	.385	3.337	**.002**	**.218**
	Non-athletes	20	2.08	.338			
MHT (freq.)	Judokas	22	51.64	7.913	- .685	.497	.012
	Non-athletes	20	53.55	10.135			
MFTW (freq.)	Judokas	22	13.64	3.374	1.358	.182	.044
	Non-athletes	20	12.25	3.226			
M20S (s)	Judokas	22	4.65	.381	- 3.485	**.001**	**.233**
	Non-athletes	20	5.12	.500			
MSU (freq.)	Judokas	22	33.82	6.336	3.094	**.004**	**.193**
	Non-athletes	20	28.50	4.559			
MKPP (freq.)	Judokas	22	37.59	8.726	16.589	**.000**	**.863**
	Non-athletes	20	5.95	1.877			
MHPT (deg)	Judokas	22	68.23	13.804	9.430	**.000**	**.690**
	Non-athletes	20	30.40	12.010			
MBOTF (cm)	Judokas	22	106.09	12.106	1.662	.104	.065
	Non-athletes	20	99.65	13.014			
MBBTF (cm)	Judokas	22	44.76	10.979	.445	.659	.005
	Non-athletes	20	43.05	14.014			
MLSBTF (deg)	Judokas	22	37.92	9.149	.269	.790	.002
	Non-athletes	20	37.29	6.036			
MRSBTF (deg)	Judokas	22	30.28	8.856	-1.556	.128	.057
	Non-athletes	20	34.15	7.039			

Key: N – number of participants; Mean - mean value; Std. Deviation – standard deviation from the arithmetic mean; p – level of significance; Eta Squared - effect size (differences between the groups); *NB* – the significance level is p>0,05.

In Table 3, the t-test for independent samples shows that there is a statistically significant difference between children practicing judo and those that do not practice any sport with the variable MLJ (t=3.899; p=.000). Based on the Mean, it can be seen that children practicing judo (Mean=134.18) achieved better results than children that did not practice any sport (Mean=117.20). Judging by Eta Squared (Eta Squared=0.275), it can be seen that the difference between the groups is large. According to Cohen, 0.01 marks a small effect (small difference), 0.06 marks a medium effect (difference), and 0.14 and more marks a large effect (Pallant, 2011). Apart from that, there is a statistically significant difference between children practicing judo and those that do not practice any sport for the variable MTMB (t=3.337; p=0.002). Based on the Mean, it can be seen that children practicing sports (Mean=2.45) achieved better results than children that did not practice any sport (Mean=2.08). Judging by Eta Squared (Eta Squared=0.218), it can be seen that the difference between the groups is large. A statistically significant difference between children practicing judo and those not practicing any sport also exists for the following variables:

- M20S (t=-3.485; p=0.001), where better results were achieved by children practicing judo (Mean=4.65) than children not practicing any sport (Mean=5.12). Judging by Eta Squared (Eta Squared=0.233), it can be seen that the difference between the groups is large;
- MSU (t=3.094; p=0.004), where better results were achieved by children practicing judo (Mean=33.82) than children not practicing any sport (Mean=28.50). Judging by Eta Squared (Eta Squared=0.193), it can be seen that the difference between the groups is large;
- MKPP (t=16.589; p=0.000), where better results were also achieved by children practicing judo (Mean=37.59) than children not practicing any sport (Mean=5.95). Judging by Eta Squared (Eta Squared=0.863), it can be seen that the difference between the groups is large;
- MHPT (t=9.430; p=0.000), where better results were also achieved by children practicing judo (Mean=68.23) than children not practicing any sport (Mean=30.40). Judging by Eta Squared (Eta Squared=0.690), it can be seen that the difference between the groups is large.

DISCUSSION

After obtaining the results, the conclusion was reached that among the 13 variables used to estimate motor skills, six showed a statistically relevant difference between judokas and non-athletes aged 7 and 8 (better results were determined in judokas at MLJ, MTMB, M20S, MSU, MKPP, MHPT). The other seven variables showed no significant difference (MHJ, MHT, MFTW, MBOTF, MBBTF, MLSBTF, MRSBTF). Judokas exhibited significantly better results in two out of three variables when explosive strength was concerned, which was estimated using the following instruments: long jump (MLJ), high jump (MHJ), and throwing of a medicine ball (MTMB). Specifically, variables MLJ and MTMB exhibit a statistically relevant difference, which points to the fact that explosive strength of the lower and upper extremities is more prominent with judokas than non-athletes. However, the variable MHJ does not exhibit a significant difference. This result is probably the consequence of judo practices, where the accent was placed on developing the explosive strength of the entire body; however, when the lower extremities

are examined in isolation, it is obvious that more attention is given to exercises in the sagittal and frontal plane than in the transverse plane. Speed was tested using the 20-meter sprint (M20S), as well as hand tapping (MHT) and feet tapping against the wall (MFTW) for segmental speed. The only variable in which a significant difference was determined (in favor of the judokas) was M20S, since they ran 4.65 seconds on average, as compared to non-athletes whose arithmetic mean was 5.12 seconds. The other two variables pointed to the frequency of extremity movements, but no significant difference emerged. In comparison to other motor skills, speed is the hardest to perfect in human beings. For example, in the past 100 years (from the first Olympics to the present), world records have been improved by 12–20% in endurance sports; by 20–30% in jumps; over 50% in weight lifting and athletic throws, and only 9–10% in 100- and 200-meter sprints. It is especially difficult to increase the frequency of movement, which is considered predominantly genetically conditioned and can be improved until the ages of 14 or 15. Later improvement is achieved mainly at the expense of force increase, endurance, and technical perfection (Željaskov, 2004). This leads to the conclusion that the speed and frequency results acquired are expected. Repetitive strength of the participants was estimated using the following measurement instruments: sit-ups in 60 seconds (MSU), hyperextensions of the torso while lying down (MHPT), and knee push-ups (MKPP). After the results were acquired, it can be seen that there is a statistically significant difference in all the variables of repetitive strength in favor of the judokas. The greatest difference can be noticed in the MKPP variable, where the judokas did 37.59 push-ups on average, and non-athletes had an average of 5.95. Eta Squared from Table 3 shows that there is a significant difference in favor of the judokas in the MSU variable. The specific character of the throwing technique and a great number of throw repetitions in the training process in judo requires engaging the abdominal muscles, which positively influences the development of the repetitive strength of this muscle group (Ilić et al., 2012). When the entirety of the motor skills is considered, we see that the area of repetitive strength shows the greatest difference. The research by Bala and Drid (2010) showed that young judokas (11–16 years of age) were better at repetitive and static strength, running speed and whole body coordination exercises when compared to their peers who do not practice sports. Similar results were determined by Ilić et al. (2012). By analyzing their results, they ascertained that judokas showed significantly better results in the following variables of motor capabilities: repetitive strength, speed strength, and agility, while suppleness and strength endurance showed no significant differences. The present research also did not show significant differences between judokas and non-athletes regarding suppleness, i.e., torso flexibility. To be more precise, the area of flexibility had four measurement instruments: bent-over torso flexibility (MBOTF), bent-back torso flexibility (MBBTF), left side-bent torso flexibility (MLSBTF), and right side-bent torso flexibility (MRSBTF). Flexibility measurements were performed using the Spinal Mouse device and the results given in Table 3 are shown in degrees. However, despite the present and previously mentioned research, Sekulić, Krstulović, Katić, & Ostojić (2006) compared the effects of judo and recreational practice, and after an experimental 9-month program, they reached the conclusion that seven-year-old boys participating in judo practices in this period showed significantly better torso flexibility results than their non-athlete peers. A similar research by Krstulović, Kvesić, & Nurkić (2010) reached the conclusion that flexibility in seven-year-old female judokas was significantly better compared to their peers that were included in a recreational sports program. However, Drid et al. (2009) reached the conclusion that there was no statistically

significant difference in torso flexibility between judokas and those that do not practice this sport; however, judokas showed better results in other motor skills. The level of flexibility is significantly influenced by the temperature of the practice area. A higher temperature increases flexibility, while lower temperature significantly reduces it (Stojiljković, 2003). This can be one of the reasons, having in mind that non-athlete measurements were performed in the heated classroom of the Vožd Karađorđe Elementary School while the judokas were examined in the gym of the Faculty of Sports and Physical Education, where the temperature was significantly lower compared to the classroom. It should also be considered that motor skills are a complex area and that the curriculum, i.e., practice organization, does not always pay equal attention to developing all of the capabilities, so it is possible that our flexibility results were a consequence of inadequate commitment to this motor skills area during judo practice. Similar to the present study, Drid & Todorov (2014) proved better and more significant results in almost every variable in favor of judokas when compared to their peers that were not members of any sports collective. When the results of other papers with the same aim as the present study are taken into consideration, it can be seen that the results obtained are similar or match ours, while the research performed by Janoš, Obadov, & Drid (2008) obtained significant differences in all of the variables tested in favor of the judoka subgroup and suggested in this study that the development of motor skills in students is better under the influence of systematic judo practice when compared to the students that just attend physical education classes. Having in mind the fact that a number of PE teachers give very large significance to monitoring the development of the motor skills of students (Milanović, Radisavljević, & Pašić, 2010), the results of this paper prove that practicing judo contributes to improving the motor skills of children, so it can serve as an idea to supplement physical education, as an obligatory course, with elements of judo or to include judo in the elementary school curriculum. According to the results they obtained, Kasum and Ćirković (2009) also put forward an idea that PE classes should be enriched with elements of judo and other combat sports. Experts dealing with the problem of selecting young athletes determined that the best time to commence training with young judokas is between eight and ten years of age (Dragić, 1996; Bompa, 2000), which is an early school age. Practicing combat sports has multiple benefits, the most significant being: promoting physical fitness, greater mental strength and self-control, faster thought processes, stress relief, concentration, respecting and understanding yourself and others, confidence, socialization, larger scope of movement, as well as obtaining a practical form of self-defense, and a very nice form of entertainment (Kasum, Gligorov, & Nastasić-Stošković 2011).

CONCLUSION

By summarizing the results of the present study, it is concluded that only the area of flexibility and the variables that point to extremity movement frequency showed no significant difference between the groups. Other motor skill areas - speed, explosive strength (with an exception of CMJ) and repetitive strength showed significant differences in favor of judokas. Some participants from the judoka group were submitted to a training process for slightly over six months. We consider that it is not a sufficient period of time to develop complete motor skills in children of this age. Segmental speed, which is genetically predetermined, requires more time in continual training in order to reach the desired outcome.

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RAZLIKE U NEKIM MOTORIČKIM SPOSOBNOSTIMA IZMEĐU DŽUDISTA I NESPORTISTA MLAĐEG ŠKOLSKOG UZRASTA

Cilj ovog istraživanja je utvrđivanje razlike u motoričkim sposobnostima između džudista i nesportista mlađeg školskog uzrasta muške populacije. Uzorak ispitanika je činilo 42 dečaka, uzrasta 7 i 8 godina. Uzorak je bio podeljen na dva subuzorka, od kojih su jedan činili džudisti (N=22) UDžSK "Kinezis" iz Niša, a drugi učenici (N=20) O.Š. "Vožd Karađorđe" iz Niša. Baterijom testova od 13 mernih instrumenata procenjivana je: Eksplozivna snaga – Skok u dalj (MLJ, u cm), Skok u vis (MHJ u cm), Bacanje medicinke (MTBM u m); Brzina frekvencije pokreta – Taping rukom (MHT u frekfenciji), Taping nogama o zid (MFTW u frekfenciji); Brzina – Sprint na 20 metara (M20S u sekundama); Repetitivna snaga – Podizanje trupa za 60 sekundi (MSU u frekfenciji), Sklekovi sa kolena (MKPP u frekfenciji); Zaklon trupa u ležanju (MHPT u stepenima), Fleksibilnost – Fleksibilnost trupa u pretklonu (MBOTF u cm), Fleksibilnost trupa u zaklonu (MBBTF u cm), Fleksibilnost trupa levi otklon (MLSBTF u stepenima), Fleksibilnost trupa desni otklon (MRSBTF u stepenima).Nakon dobijenih rezultata došlo se do zaključka da od ukupno 13 varijabli, kod 6 postoji statistički značajna razlika između džudista i nesportista, Kod svih 6 bolje rezultate su pokazali džudisti (MLJ, MTBM, M20S, MSU, MKPP, MHPT). U preostalih 7 varijabli nije postojala značajna razlika (MHJ, MHT, MFTW, MBOTF, MBBTF, MLSBTF, MRSBTF). Imajući u vidu činjenicu da veliki broj nastavnika fizičkog vaspitanja pridaje vrlo veliki značaj u praćenju razvoja motoričkih sposobnosti učenika, rezultati našeg rada su dokaz da praktikovanje džudoa doprinosi poboljšanju motoričkih sposobnosti dece, pa može poslužiti i kao ideja da se fizičko vaspitanje, kao obavezan nastavni predmet, dopuni elementima džudoa ili sam džudo uvrsti u nastavni plan i program osnovne škole.

Ključne reči: *motorika, mađi školski uzrast, džudo trening*