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Original research article

THE DIFFERENCES IN THE MOTOR AREA OF CADET AND JUNIOR AGE JUDOKAS

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Abstract. *The aim of this research was to establish differences between young judokas of the cadet and junior age. The sample was made up of 50 judokas, members of the cadet and junior national team, 16 to 19 years old. The participants were divided into two groups. One group was made up of cadet judokas (n=25), while the other was made up of the members of the junior team (n=25). In this research we used three tests for every measured motor ability. To estimate the judoka's coordination, the following tests were used: coordination with a stick (STICK), side roll (SIDEROLL), and the obstacle course backwards (OBSTBACKWARDS). To estimate speed we used tests of hand tapping (HANDTAP), right foot tapping (RFOOTTAP) and left foot tapping (LFOOTTAP), to estimate explosive strength, the long jump without running (STANLJUMP), triple jump (TRIPJUMP) and Abalac's test (ABALT). Repetitive strength were estimated by push ups (PUSHUPS), lifting a body from a lying position (MRSPLT) and reverse chin – ups (REVCUPS). To estimate flexibility we used the tests hyperextensions on a bench BENTOVER, the straddle bend (STRADDBENT) and shoulder flexibility test (SHOFLEXTEST), and to estimate balance we used the tests of standing on a bench with eyes open BALEYESOP, standing longitudinally on the bench with eyes closed BALLONGEYESCL and standing transversely on the bench with eyes closed BALTRANSEYESCL. To analyze the obtained results the SPSS 17,0 program was used. To estimate the differences in motor abilities between cadet and junior judokas, we used the Student's T- test for independent samples. The obtained results showed that there are statistically significant differences for explosive strength and balanced flexibility in favour of the junior judokas, and for the other variables there were no statistically significant differences.*

Key words: *judo, motor abilities, juniors, cadets*.

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INTRODUCTION

The relation between motor abilities, morphological characteristics and motor knowledge is very complex. A precondition for the learning and mastering of new motor structures is the high level of basic motor abilities (Bratić, 2003).

Judo belongs to polystructural acyclic activities which are characterised by alternating phases of high load such as: fast change of direction, sudden stops and fast reacting in accordance with the changes in the opponent's activities. Judo is characterised by a variety of movements and a lot of technical elements, tactics, movements of the whole body and limbs in different directions with varying strength and tempo. During one fight, dynamic situations change with the changing of the grips, holds and body posture of both fighters, which demands good dynamic stereotype of holds and throws but also a good ability to make efficient reorganization of dynamic stereotypes and to make new programmes all the time. Because of the complexity of this sport young athletes have to develop a high level of motor abilities.

Motor abilities have a great effect on the results in combat sports. They are defined as a group of dimensions responsible for successful solving of any motor problem, but at the same time as a group of motor reactions also related to other similar anthropological areas (Findac & Neljac, 2006).

The estimation of the structure of the whole motor area or structures of certain segments of the motor area and differences between different segments of the motor area are very important in judo, because it makes it easy for the coaches to programme training, which leads them one step closer to success. The fact that judo belongs to polystructural acyclic activities is why we should pay more attention to research into differences in the motor area of athletes of different ages. The subject of this work are the motor abilities of cadet and junior judokas, and the aim is to establish the difference in the motor area between judokas of a junior and cadet age.

Many authors have dealt with the effects which judo has on the development of motor abilities (Obadov, Drid, & Nurkić 2006; Janos, Obadov, & Drid 2008; Ilić, Mudrić, & Kasum, 2012). Those studies included younger school age children, and we compared a group of participants who practice judo with a group of children who only attended their physical education classes. The results showed that the development of motor abilities is better under the systematic influence of judo training than among children who only attended physical education classes.

Judo is a sport where the dominant role is assigned to motor abilities such as balance, coordination, power, speed and endurance (Lolić & Nurkić 2011). The research which included motor abilities of judokas of different ages (juniors and cadets), with the aim to establish differences among young judokas, was conducted in 2011 and it followed and compared explosive and repetitive strength, speed, coordination and flexibility. Even the training process of younger school age children is slightly different than the training process of older age (junior and cadets) children regarding the relation between technical and physical preparation, and the relation between technical elements and motor abilities is unbreakable whatever the age of the participants. The development of motor abilities influences technical preparation and vice versa (Ilic, Mudric, & Kasum, 2012). This research includes basic motor abilities of the participants who belongs to the junior and cadet selection with the aim to establish differences in their motor area.

METHODS

The sample

The sample of participants was made up of 50 judokas aged 16-19, divided into two groups. One was made up of cadet age judokas (n=25), and the other was made up of junior age judokas (n=25). All of the participants were potential members of the Serbian national team at the time of this research. They belonged to different mass categories and were not suffering from any organic or somatic diseases.

The sample of measurement instruments

Based on the structural model of motor abilities which were defined by Kurelic and contributors (Kurelić et al., 1975), for the estimation of motor abilities we chose variables that are supposed to cover the area of latent dimensions of movement and energetic regulations as they are also present in judo. We tested the following motor abilities: repetitive strength (push ups-PUSHUPS (freq.), lifting a body from a lying position-ABDOS (freq.), and reverse chin – ups-REVCUPS (freq.), explosive strength (the standing long jump-STANLJUMP (cm), triple jump-TRIPJUMP (cm), and Abalac's test-ABALT (cm)), speed (hand tapping-HANDTAP (freq.), right foot tapping-RFOOTTAP (freq.) and left foot tapping-LFOOTTAP (freq.)), flexibility (hyperextensions on a bench-BENTOVER (cm), the straddle bend-STRADDBENT (cm) and shoulder flexibility test-SHOFLEXTEST (cm)), coordination (with a stick-STICK (freq.), side roll-SIDEROLL (s), and the obstacle course backwards-OBSTBACKWARDS (s), and balance (standing on a bench with eyes open-BALEYESOP (s), standing longitudinally on the bench with eyes closed-BALLONGEYESCL (s) and standing transversely on the bench with eyes closed-BALTRANSEYESCL (s)).

Data processing was done by means of basic descriptive statistics, for every applied motor test, and then the central and dispersion parameters were calculated: arithmetic mean (AM), standard deviation (SD), minimal value (MIN), maximal value (MAX), skewness (Sk), kurtosis (Ku). The body mass index was calculated with the formula BMI (kg/m^2) = mass (kg) / (height (m^2), and the participants were classified based on accepted values of over nutrition and fatness for children and adolescents (Chartier et al., 2012).

To analyze the measured values of the motor test, we used the SPSS 17.0 program. Student's T-test for independent samples was used to establish the difference in values of the motor tests of judokas, of the cadet and junior age category. The level of significance was set at $p>.05$.

RESULTS

The parameters in table number 1 show that a lot of the tests have similar results for those central parameters, which implies that the tests were well balanced for the participants. Distribution of the variable ABDOS (1.22), OBSTBACKWARDS (1.34), MRAOPK (2.80), BALLONGEYESCL (1.55), BALTRANSEYESCL (1.93) deviates significantly from the normal (Skew = 1), which can be said for coefficient of elongation (Kurt) for variables OBSTBACKWARDS (3.65), BALEYESOP (7.90) and BALTRANSEYESCL (4.59). Following the BMI, the mean value for juniors is 24,91kg/m^2, which puts them in the normal category (Chartier et al., 2012).

Table 1 Basic descriptive parameters for estimation of motor abilities of junior judoka

	N	RANGE	MIN	MAX	MEAN	SD	SKEW	KURT
PUSHUPS	25	24.00	30.00	54.00	41.16	7.01	.17	-.76
ABDOS	25	20.00	30.00	50.00	36.96	5.10	1.22	1.86
REVCUPS	25	13.00	8.00	21.00	15.48	4.32	-.23	-1.32
STANLJUMP	25	85.00	190.00	275.00	233.28	23.93	-.19	-.88
TRIPJUMP	25	160.00	610.00	770.00	696.40	41.92	-.20	-.54
ABALT	25	26.00	40.00	66.00	54.96	7.76	-.65	-.26
HANDTAP	25	25.00	33.00	58.00	45.76	6.64	-.28	-.51
RFOOTTAP	25	11.00	20.00	31.00	26.64	2.75	-.79	.39
LFOOTTAP	25	10.00	15.00	25.00	18.96	3.06	.39	-.91
BENTOVER	25	45.00	30.00	75.00	57.28	10.54	-.82	.90
STRADDBENT	25	49.00	50.00	99.00	67.76	16.01	.65	-.95
SHOFLEXTEST	25	33.00	55.00	88.00	71.40	10.13	-.11	-1.12
STICK	25	5.61	5.75	11.36	7.60	1.43	.81	.53
SIDEROLL	25	9.45	10.65	20.10	13.93	2.29	.75	.73
OBSTBACKWARDS	25	8.69	8.28	16.97	10.95	1.83	1.34	3.65
BALEYESOP	25	54.35	2.24	56.59	10.48	12.62	2.80	7.90
BALLONGEYESCL	25	13.32	1.74	15.06	5.51	3.74	1.55	1.49
BALTRANSEYESCL	25	5.78	1.07	6.85	2.34	1.32	1.93	4.59

Insight into the central tendency parameters in table 2 shows that many of the tests have nearly the same values of those central parameters, which implies that the tests are relatively well-balanced for the chosen cadet participants. The distribution of the variable BENTOVER (-1.07), STRADDBENT (1.02), BALEYESOP (1.11), BALLONGEYESCL (2.22), significantly deviate from the normal (Skew = 1), and the same can be said for the coefficient of elongation (Kurt) for the variables STRADDBENT (3.93) and BALLONGEYESCL (6.67). According to the BMI, the middle value for cadets is smaller than for juniors and it is 22,88 kg/m^2, which puts them in the normal category (Chartier et al., 2012).

Table 2 Basic descriptive parameters for the estimation of motor abilities of cadet judokas

	N	RANG	MIN	MAX	MEAN	SD	SKEW	KURT
PUSHUPS	25	32.00	20.00	52.00	39.32	7.88	-.64	.58
ABDOS	25	15.00	26.00	41.00	35.64	4.10	-.91	.12
REVCUPS	25	16.00	6.00	22.00	13.68	5.05	-.07	-1.18
STANLJUMP	25	73.00	175.00	248.00	208.32	21.38	-.00	-.84
TRIPJUMP	25	160.00	540.00	700.00	636.36	44.91	-.23	-.92
ABALT	25	20.00	40.00	60.00	47.04	5.97	.29	-.90
HANDTAP	25	20.00	36.00	56.00	44.08	4.92	.49	.09
RFOOTTAP	25	9.00	22.00	31.00	26.68	2.27	.06	-.26
RFOOTTAP	25	13.00	15.00	28.00	19.04	3.23	1.13	1.26
BENTOVER	25	23.00	42.00	65.00	55.96	5.51	-1.07	1.90
STRADDBENT	25	42.00	42.00	84.00	59.56	7.71	1.02	3.93
SHOFLEXTEST	25	30.00	43.00	73.00	58.08	9.03	-.00	-1.29
STICK	25	3.63	6.21	9.84	7.79	1.09	.39	-1.10
SIDEROLL	25	9.62	9.78	19.40	13.55	2.59	.33	-.77
OBSTBACKWARDS	25	5.81	7.88	13.69	10.80	1.72	.06	-1.21
BALEYESOP	25	12.24	2.22	14.46	6.40	3.00	1.11	1.28
BALLONGEYESCL	25	8.24	1.88	10.12	3.59	1.78	2.22	6.76
BALTRANSEYESCL	25	1.72	.75	2.47	1.73	.41	-.39	.31

Table 3 T-test for explosive strength of cadets and juniors

	T-TEST	N	MEAN	T	SIG. (2-TAILED)
STANLJUMP	1	25	208.32	-3.89	.00
	2	25	233.28	-3.89	.00
TRIPJUMP	1	25	636.36	-4.89	.00
	2	25	696.40	-4.89	.00
ABALT	1	25	47.04	-4.05	.00
	2	25	54.96	-4.05	.00

Abbreviations: MESSDM – long jump without running, TRIPJUMP – triple jump, ABALT – Abalak's test 1 – cadets, 2 – juniors

The analysis of table 3, the Student's T-test for independent samples t from -3,89 and its significance of .00, shows us that the differences between average means for the motor test STANLJUMP (standing long jump) are statistically significant. The average results for the motor test TRIPJUMP (triple jump) of the cadet group is smaller than for the junior group and Student's T-test for independent samples t of -4.89 and its level of significance of .00 tells us that differences between arithmetic means for the motor test TRIPJUMP are statistically important. The average result for the motor test ABALT (Abalak's test) and Student's T-test for independent samples t from -4.05 and its significance of .00 tell us that the differences between arithmetic means for the motor test ABALT are statistically significant.

Table 4 T – Test for flexibility of cadet and juniors

	T-TEST	N	MEAN	T	SIG. (2-TAILED)
BENTOVER	1	25	55.96	-.55	.58
	2	25	57.28	-.55	.58
STRADDBENT	1	25	59.56	-2.31	.03
	2	25	67.76	-2.31	.03
SHOFLEXTEST	1	25	58.08	-4.91	.00
	2	25	71.40	-4.91	.00

Abbreviations BENTOVER bend on a bench, STRADDBENT straddle bend, MFLISK shoulder flexibility, 1 – cadets, 2 – juniors

The analysis of table 4, Student's T-test for independent samples, the mean value of the motor flexibility test STRADDBENT, a t value of -2.31 and its significance of .03 show us that the differences between arithmetic means for the motor test of agility STRADDBENT of cadets and juniors are statistically significant. The level of statistical significance (p=0.00) was determined in the flexibility test MFLISK where the t value of the sample is -4.91.

Table 5 Test for balance of cadets and juniors

	T-TEST	N	MEAN	T	SIG. (2-TAILED)
BALEYESOP	1	25	6.40	-1.57	.12
	2	25	10.48	-1.57	.12
BALLONGEYES	1	25	3.59	-2.32	.03
CL	2	25	5.51	-2.32	.03
BALTRANSEYE	1	25	1.73	-2.22	.03
SCL	2	25	2.34	-2.22	.03

Abbreviations: BALEYESOP- standing longitudinally on a bench with both legs with open eyes, BALLONGEYESCL standing longitudinally on a bench with both legs with open eyes, BALTRANSEYESCL transverse standing on a bench with closed eyes, 1- cadets, 2 – juniors.

The analysis of table 5, the Student's T-test for independent samples, the value of -2.32 and level of significance of .03, tells us that differences between arithmetic means for the motor test of agility STRADDBENT of cadets and juniors is statistical significant. The average value of the motor test of balance BALTRANSEYESCL for the group of cadets is smaller than that of the group of juniors, while the Student's T test for independent samples t value of -2.22 and its significance of .03 confirm that the differences between the arithmetic means for the motor test of balance of cadets and juniors are statistically significant for the test BALTRANSEYESCL.

DISCUSSION

Having in mind that for mastering new movement structures and motor tasks a high level of performing the basic motor abilities is needed (Bratić, 2003), in this study we wanted to establish what those abilities which differ within the age category are.

The results which were obtained by statistical data processing in order to establish the differences in the level of manifestation of motor abilities of cadet and junior age judokas, indicated there are no statistically important differences in favor of junior judokas in tests such as explosive strength, balance and flexibility.

Great muscular strength (Kubo et al. 2006) and power are one of the determinants of success in judo (Bratić, Nurkić, & Kasum, 2005). They are the most highly ranked in the hierarchy of training abilities and it is clear that they must be improved from the beginning of practicing judo. The fact that judo is an acyclic polystructural activity which has a lot of fast changes of direction, sudden stops and fast actions, it clearly indicates the importance of explosive strength as the ability of the muscles to manifest significant stress in minimal time (Verhoshanski, 1979, 24). The analysis of the results indicated the existence of statistically important differences in junior judokas (p=0.000) in all the applied tests for the estimation of explosive strength (STANLJUMP, MESTRS, MESABL). The same results were obtained by Lolic & Nurkić (2011) in their study done on a sample of 50 junior (n=25) and cadet age (n=25) judokas. Their results indicated the existence of statistically important differences in favor of junior judokas on the tests of the long jump, triple jump and Abalac's test.

Judo throws, due to their high complexity, must be performed with high speed and accuracy under the constantly changing environment conditions of a bout (Heitkamp, Mayer, Fleck, & Horstmann, 2002). By analysing the structure of performing judo techniques, it can be concluded that those competitors, who in limited time and space can make a fast and precise decision, and who are also fast, strong and flexible, will be more efficient in performing techniques (Nurkić, 2003). A judoka needs to adapt himself to changing time-space conditions in relation to his opponents by adjusting his stances, movements, and technique performance (Franchini, Sterkowicz, Meira, Gomes, & Tani, 2008). Flexibility influences performance in a judo fight in a way that it annuls the opponent's strong movements. Good flexibility helps in avoiding some judo techniques by raising the attacked leg high (Sertić, Sterkowicz, & Vuleta, 2009). Judo allows children to improve more of their fitness capacities compared with recreational sports (Sekulic, Krstulovic, Katic, & Ostojic, 2006). The results of this research indicated the existence of statistically important differences between cadets and juniors on the tests of the straddle bend (STRADDBENT) p=0.003 and shoulder flexibility (SHOFLEXTEST) p=0.000 in favor of junior judokas. In the study of Lolić & Nurkić

(2011) the results of measuring only shoulder flexibility (SHOFLEXTEST) gave statistically important results while other tests, used for estimating this motor ability, did not give any significant difference. Unlike in their study, in this study the cadets showed greater flexibility in the shoulder belt in comparison to the juniors.

Judo sport is characterized by the mastery and skill to achieve victory over the opponent during mutual attacks. In combat, the fighter who has a good performance of judo techniques, who knows how to maintain his balance and at the same time can disturb the opponent's balance and use the mistake of the opponent while performing judo techniques has the advantage (Drid, 2005). Also, judo is highly recommended because it develops sensorimotor adaptabilities involved in balance control, better than dance (Perrin, Deviterne, Hugel, & Perrot, 2002) The results of the study of motor abilities indicated a statistically important difference between juniors and cadets on the tests of standing longitudinally on a bench on both feet eyes open (BALLONGEYESCL) and transverse standing on a bench eyes closed (BALTRANSEYESCL) at a level of significance of $p=0.003$ in favour of the juniors.

The statistical significant difference between cadets and juniors shows the necessity for more researches in the area of balance in further work with judokas of different ages.

In the studies of Obadov, Drid, & Nurkić, 2006 and Drid, Obadov, & Bratić, 2006, done in order to establish the level of motor abilities of the participants who were non-athletes and the participants who practice judo, a statistically significant difference was established in favor of the participants who practice judo in terms of motor abilities of coordination of the whole body, repetitive and speed power. The research which was done by Janos, Obadov, & Drid (2008) on the territory of Vojvodina between students who systematically practice judo and those who only attended physical education classes, determined significantly high differences on all applied variables in the motor area. In recent research (Ilić, Mudrić, & Kasum, 2012) a significant difference between the participants (students who attended only physical education classes and judokas) was established in favor of judokas for three variables: Speed strength, repetitive strength and agility, while flexibility and powerful endurance had no statistically significant difference.

Lolić & Nurkić (2011) obtained statistically significant results for repetitive strength for push-ups, crunches and reverse chin-ups; speed for tests hand and foot tapping; coordination tests, the obstacle course backwards in seconds, the side-roll in seconds and coordination with a baton. In this study there were no statistically significant differences between the group of cadet and junior judokas for the motor tests of repetitive strength, coordination and speed. This led to the conclusion that cadet and juniors' results are, on the basis of the development of repetitive strength, coordination and speed, similar in their mean values, because both groups are included in the training process.

From the given results in this research, it is clear that the sample of young junior judokas is more homogeneous in area of motor abilities in comparison with cadet judokas. Such data can be justified by the fact that juniors train longer and in earlier stages they passed through different programs for the development of motor skills. Quite a large variation of results within each of the applied tests is attributed to the division of different weight categories.

CONCLUSION

This research is done with the aim to establish difference in motor area between judokas of cadet and junior age. On the basis of the given results the research of motor abilities (explosive strength, repetitive strength, coordination, balance, speedand flexibility) gave statistically significant results at explosive strength, balance and flexibility. In mentioned motor abilities middle values were higher at junior judokas, all except the test of shoulder flexibility where cadets gave better results, which can be justified by the fact that the level of flexibility is inversely proportional to the number of years, and that the younger examinees are more flexible than older.

Mean values of the test results can be explained by the duration of training process of junior in comparison to cadet judokas. In the rest of the motor tests there is no statistically significant difference which can be justified with the same or the similar training process in both groups.

The applied instruments fulfil the assumption that it is possible to isolate mentioned dimensions at experimental sample, and also that those dimensions are significant for the success in motor activities – judo, the results of this research will have wide possibilities for applying and they will have practical and theoretical importance.

The results of this research can be used as the basis for longitudinal researches of manifest and latent dimensions of younger judokas, which will enable the establishing the importance of current and potential dimensions of some age categories for the success in judo, and it also can be used for the creating of dimension profile of some age categories, children, young people and adult judokas.

The significance of this study is the possibility that on the basis of the obtained results can be made more adequate selection for further training processes, categorisation of already selected judokas, and also the estimation of their possible achievements. Theoretical application of the results is present in the existence of possible comparison of obtained results with the results of other authors, but also as stimulus for further researcher for detailed research of this complex topic.

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RAZLIKE U MOTORIČKOM PROSTORU KOD DŽUDISTA KADETSKOG I JUNIORSKOG UZRASTA

Cilj ovog istraživanja bio je utvrđivanje razlika između mladih džudista kadetskog i juniorskog uzrasta. Uzorak ispitanika činilo je ukupno 50 džudista, članova šireg spiska kadetske i junirske reprezentacije Srbije, uzrasta od 16 do 19 godina. Celokupan uzorak ispitanika podeljen je u dve grupe. Jednu su činili džudisti kadetskog (n=25), dok su drugu grupu činili džudisti juniorskog uzrasta (n=25). Za potrebe ovog istraživanja, korišćene su baterije od tri testa za svaku od procenjivanih motoričkih sposobnosti. Za procenu koordinacije kod džudista, korišćeni su sledeći testovi: koordinacija sa palicom (STICK), bočno kolutanje (SIDEROLL) i poligon natraške (OBSTBACKWARDS). Za procenu brzine ispitanika, korišćeni su testovi taping rukom (HANDTAP), taping desnom nogom (RFOOTTAP) i taping levom nogom (LFOOTTAP), za procenu eksplozivne snage skok u dalj s' mesta (STANLJUMP), troskok (TRIPJUMP) i Abalakov test (ABALT).

Repetativna snaga procenjivana je uz pomoć sklekova (PUSHUPS), podizanja trupa iz ležanja (ABDOS) i zgiba na vratilu sa podhvatom (REVCUPS). Za procenu fleksibilnosti, korišćeni su testovi pretklon na klupi (BENTOVER), pretklon raskoračni (STRADDBENT) i iskret (SHOFLEXTEST), dok su se za procenu ravnoteže koristili testovi stajanje na dve noge uzdužno na klupici sa otvorenim očima (BALLONGEYESCL), stajanje na dve noge poprečno na klupici sa otvorenim očima (BALEYESOP) i poprečno stajanje na klupici zatvorenih očiju (BALTRANSEYESCL). Za analizu izmerenih vrednosti motoričkih testova, korišćen je program SPSS 17.0. Za utvrđivanje razlika u motoričkim sposobnostima između džudista kadetskog i juniorskog uzrasta, korišćen je Studentov T-test za nezavisne uzorke. Dobijeni rezultati ukazali su na postojanje statistički značajnih razlika kod eksplozivne snage, ravnoteže i fleksibilnosti u korist džudista juniorskog uzrasta, dok kod ostalih varijabli nije bilo statistički značajnih razlika.

Ključne reči: *džudo, motoričke sposobnosti, juniori, kadeti*