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The Comparison of Anthropological Dimensions in the Multivariate Space with Judo Sportsmen at the Age of 13 to 15

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Abstract: The study was conducted on a sample of 92 participants at the age of 13-15, who were in the training process at least a year. The sample of participants is composed of two groups of judo athletes, 50 from Macedonia and 42 from Bosnia and Herzegovina. The aim of this study was to compare the anthropological dimensions between these two groups of participants. For the purposes of this study 28 variables were used: 9 variables for anthropometrical measures, 14 variables for motor dimensions and 5 variables for assessing situational movement structures of judo athletes. The univariate and multivariate statistical methods were identical in some anthropometrical measures, in particular the motor skills and situational movement structures of judo athletes, between groups.

Keywords: groups, judo athlete, univariate analysis, multivariate analysis, situational movement structures.

Introduction

The specificity of this sport is characterized by explosive and very complex movements. That's why this movement structure belongs to the group of poly-structural acyclic activities, which final result is a binary matrix which represents a victory-defeat. The aim of the training process in judo sport is to improve the techniques that are used in the competitions with the opponent (Lolić D., Nurkić M., 2011). Because of these arguments, there is a need of constant conducting of researches which will apply for improving of the motor and specific-motor abilities, especially at younger categories. Kinesiology studies that have been directed at solving problems and determining the legalities in the area of physical development and physical education, clearly showed that through evaluation and assessment we will be able to make a breakthrough in the research of the manifest variables and latent dimensions of man in his anthropological status (Gredelj et al.,).

The significant correlation between the functional abilities and the performance of technical elements in judo, indicate that the improvement of some functional variables can have positive influence on the performance of the same elements during the combat (Bratić M., Nurkić M., Stanković N., 2011). The aim of the training process in judo sport is to improve the techniques that are used in the competitions with the opponent. Judo sport belongs to the sport groups that have significant influence on the transformation of human personality in complete.

The information about the abilities that have a dominant role and that the success in judo depends on, shows the hypothetical equation of the specification of motor space in judo sport for young adult catego-

ries, where the first three places occupy coordination, strength and speed (Sertic, 1997; Lolic, D. & Nurkic 2011). Its regular practice during long time period affects optimal growth of young sportsmen, improves the structure of psychosomatic status, affects the anthropometric and motor dimensions of sportsmen, provides guidance and control of the innate reflex movements or it has significant influence on all spaces (cognitive, sociological, psychological etc.). Judo sport significantly affects the changes in some morphological features and functional abilities of the judo students who are practicing judo in contrast to students who aren't practicing any sports (Ibri, 2011). The relation between basic motor abilities, morphological characteristics and motor knowledge (skill) is a multidimensional and complex space for adequate analyses. It is considered that the higher level of basic motor abilities is based on a prerequisite for successful learning of new motor structure, their improving and applying (Bratic, 2003). Analyzing the previous researches, we can conclude that there is a need for more information that will provide the practice secure grip for successful work.

Methodes

The research was conducted on a stratified sample of participants, male judo sportsmen. In total, it was conducted on 92 competitors at the age of 13-15, members of several clubs from R. Macedonia and Bosnia and Herzegovina. For the purpose of this research, there were conducted measurements of anthropological dimensions in three spaces:

- Assessment of morphological characteristics (9 variables)
- Assessment of motor abilities (14 variables)
- Assessment of situational movement structure of judo sportsmen (5 variables)

1. Variables for assessment of morphological characteristics

- body height (ATLVIS)
- leg lenght (ADUENO)
- arm lenght (ADUŽRU)
- body mass (ATLMAS)
- chest volume (AOBGRU)
- humerus size (AOBNAD)
- femur size (AOBNAT)
- back skin fold (ANABLE)
- stomach skin fold (ANABTR)

2. Variables for assessment of motor abilities

- Tap with arm (MBFTAP)
- Tap with leg (MBFTAN)
- Deep bent on bench (MFLPRK)
- Twisting with stick on shoulders (MELISK)
- Jump in distance from place (MFESDM)
- Jump in height from place (MFESVM)
- Trowing medicine from lying (MFEBML)
- Lifting the body fom lying (MREPTL)

- Lifting the body-back bent (MRCZTL)
- Balance on hemisphere-inner static (MBAPLU)
- Balance on hemisphere-external dinamic (MBAPLV)
- Movement in air (MTKOZR)
- Movement with stick (MTKOSP)
- Movement on the ground (MAGONT)

3. Variables for assessment of situational movement structure of judo sportsmen

for assessment of arm techniques
- ipon-seoi-nage SMISN

for assessment of side techniques
- Uki-goshi SMUGŠ

for assessment of leg techniques
- o-soto-gari SMOSG

for assessment of sacrificial techniques
- tomoe-nage SMTNG

for assessment of fixing techniques (osa-e-komi 4 positions)
- Kesa-gatame, kata gatame, kami shiho gatame, jokoshiho gatame SMKKG

The data obtained from this research according to the characteristics and the size of the chosen sample, are processed in various programs. The original data from the measurements at first were placed in data matrix in Excel, and afterwards statistical parameters were calculated with the program Statistic for Windows 6.0. and the statistical package SPSS. For the needs of this research, the following measures were calculated: arithmetic's mean (MEAN), standard deviation (Std. Dev.) which needs to be at least 1/3 from the value of the mean, minimal (MIN) and maximal (MAX) score, Skew-symmetry of the result distribution, Kurt – curvature of result distribution, K-S- Kolmogorov-Smirnof procedure to establish the distributive normality of the results. The differences between groups on univariate level were established with the t-test for independent samples and variance analysis (ANOVA), and the differences on multivariate level were treated with multivariate analysis (MANOVA).

Results and discussion

Tables 1 and 2 show basic descriptive statistic parameters of the two groups of participants or the participants from R. Macedonia (table 1) and participants from B&H (table 2). Analyzing the data given from table 1 and 2, we can conclude that the distribution of the anthropometric variables, motor variables and situational movement structure variables of judo sportsmen, are moving in the boundaries of normal distribution of the results. On the first participants sample, values of the Gaus curve (Skewness) are in span of moderate symmetry (+1-1), with the exception of the variables ABNABTR=1.81 and MBAPLU=2.313, which indicates the concentration of the results towards smaller values.

Table 1. Basic central and dispersion parameters- participants from Macedonia

	Valid N	Mean	Min	Max	Std.Dev.	Skew	Kurt	max D	p
ATLMAS	50	58,854	40,000	89,000	12,534	,743	-,130	.127	p> .20
ATLVIS	50	167,914	150,000	193,000	9,419	,437	-,125	,093	p> .20
ADUZNO	50	98,246	90,000	113,000	5,229	,814	,228	,134	p> .20
ADUZRU	50	70,926	61,000	82,500	5,127	,047	-,545	,091	p> .20
ANABLE	50	,944	,600	1,600	,256	,620	,185	,113	p> .20
ANABTR	50	1,286	,800	3,000	,427	1,811	4,421	**,206**	**p< ,05**
AOBGRU	50	84,620	67,500	102,000	8,428	,534	,136	,142	p> .20
AOBNAD	50	25,880	21,000	33,000	2,887	,520	,128	,115	p> .20
AOBNAT	50	49,311	40,000	66,000	5,402	1,017	1,408	,112	p> .20
MBFTAP	50	32,160	22,000	39,000	4,022	-,423	-,678	,156	p< ,20
MBFTAN	50	20,880	14,000	28,000	3,600	-,026	-1,013	,142	p> .20
MRCZTL	50	27,440	6,000	60,000	14,452	,553	-,706	,146	p> .20
MREPTL	50	26,840	10,000	60,000	12,129	,586	-,203	,111	p> .20
MBAPLV	50	7,340	1,000	22,000	5,101	,881	-,018	**,223**	**p< ,05**
MBAPLU	50	5,340	1,000	20,000	3,520	2,313	7,088	**,225**	**p< ,05**
MBEBML	50	6,487	4,000	8,920	1,408	-,122	-1,261	,101	p> .20
MKTOZR	50	4,404	3,250	5,780	,564	,419	,458	,112	p> .20
MKTOSP	50	7,190	4,740	11,470	1,850	,690	-,790	,153	p< ,20
MAGONT	50	12,572	9,600	17,200	1,958	,535	-,401	,095	p> .20
MFESDM	50	194,360	148,000	250,000	25,830	-,105	-,649	,094	p> .20
MFESVM	50	35,360	24,000	50,000	6,868	,469	-,870	,158	p< ,20
MFLPRK	50	29,180	15,000	40,000	5,871	-,363	-,610	,122	p> .20
MFLISK	50	75,280	50,000	109,000	13,561	,481	-,060	,151	p< ,20
SMISN	50	3,697	2,000	5,000	,815	-,145	-,984	,157	p< ,20
SMUGS	50	3,680	2,000	5,000	,752	-,161	-,519	,105	p> .20
SMTNG	50	3,462	2,000	4,830	,718	-,148	-,621	,120	p> .20
SMOSG	50	3,297	1,160	4,660	,739	-,792	1,125	,143	p> .20
SMKKG	50	3,784	2,100	4,800	,758	-,495	-,661	,111	p> .20

The values of the Gaus curve (Kurtosis) is platykurtic which indicates bigger discrimination of the results, while the exceptions are variables ANABTR=4.421, MBAPLU=7.088, where we can notice a leptokurtic curve, or bigger concentration of the results around their means. The result distribution of the variables given with the method Kolmogorov-Smirnof, shows that values of the tested variables deviate from the normal result distribution only with three variables (ANABTR, MBAPLV, MBAPLU) on level of p<.05. Similar analysis can be noticed with the second group of participants from B&H. With the second sample of participants the values of the Gaus curve (Skewness) are in span of moderate symmetry (+1-1), with the exception of the variables ABNABTR=1.066, MBAPLU=1.398 and MKTOSP=1.809, which indicates the concentration of the results towards smaller values.

The values of the Gaus curve (Kurtosis) is platykurtic which indicates bigger discrimination of the results, while exception is variable MKTOSP=4.214. The result distribution of the variables given with

the method Kolmogorov-Smirnof, shows that values of the tested variables deviate from the normal result distribution only with the variable MBAPLV, on level of p<.05. To display the differences in the anthropometric characteristics, motor abilities and situational movement structure of young judo sportsmen, table 3 shows: arithmetic's mean (MEAN), standard deviation (Std. Dev.), T-test (t), degrees of freedom (df) and the probability of error in rejection of hypotheses that the difference statistically is not significant (p).

Table 2. Basic central and dispersion parameters- participants from BiH

	Valid N	Mean	Min	Max	Std.Dev.	Skew	Kurt	max D	p
ATLMAS	42	58,564	32,000	92,000	14,242	,342	-,290	,073	p > .20
ATLVIS	42	168,476	147,300	183,600	9,406	-,438	-,607	,098	p > .20
ADUZNO	42	98,359	84,300	108,300	6,525	-,279	-,726	,115	p > .20
ADUZRU	42	73,702	62,000	86,600	4,932	,063	,263	,111	p > .20
ANABLE	42	,945	,600	1,300	,158	-,102	-,027	,135	p > .20
ANABTR	42	1,285	,900	2,100	,259	1,066	1,211	,144	p > .20
AOBGRU	42	84,078	68,000	100,000	8,18	,176	-,555	,136	p > .20
AOBNAD	42	25,457	19,000	34,500	3,498	,329	-,219	,076	p > .20
AOBNAT	42	46,145	33,000	57,000	4,311	-,284	1,465	,087	p > .20
MBFTAP	42	32,464	24,000	38,000	3,485	-,227	-,724	,123	p > .20
MBFTAN	42	20,833	15,000	26,000	2,507	,003	-,061	,106	p > .20
MRCZTL	42	55,785	9,000	110,000	28,937	,242	-1,089	,126	p > .20
MREPTL	42	41,904	10,000	70,000	15,803	-,266	-,682	,100	p > .20
MBAPLV	42	6,428	1,000	17,000	4,037	,920	-,087	**,226**	**p < ,05**
MBAPLU	42	6,142	1,000	20,000	3,948	1,398	2,436	,185	p < ,15
MBEBML	42	6,483	4,200	9,200	1,247	,311	-,756	,098	p > .20
MKTOZR	42	4,312	3,200	5,560	,582	,128	-,249	,089	p > .20
MKTOSP	42	6,207	4,850	11,400	1,364	1,809	4,214	,172	p < ,20
MAGONT	42	12,153	9,100	17,440	2,210	,954	,250	,139	p > .20
MFESDM	42	199,166	135,000	252,000	31,574	-,324	-,799	,134	p > .20
MFESVM	42	34,452	25,000	45,000	5,504	,421	-,931	,172	p < ,20
MFLPRK	42	28,190	10,000	45,000	6,641	-,127	,771	,077	p > .20
MFLISK	42	71,047	35,000	100,000	15,405	,257	-,368	,152	p > .20
SMISN	42	4,118	3,000	5,000	,524	,102	-,900	,160	p > .20
SMUGS	42	4,057	2,300	5,000	,651	-,452	-,080	, 108	p < .20
SMTNG	42	3,540	1,000	5,000	,981	-,436	-,399	,090	p > .20
SMOSG	42	3,680	2,000	4,800	,673	-,223	-,037	,108	p > .20
SMKKG	42	3,744	1,000	4,900	,892	-,826	,620	,120	p > .20

The results from the t-test indicate the fact that on univariate level there is a statistically significant difference between the tests of the three anthropological spaces. The difference is expressed in anthropometric dimensions in the test arm length (ADUZRU) in favor of the participants from B&H which showed that they have bigger extremities, and with the variable femur size (AOBNAT) in favor of the participants from Macedonia who have bigger size of femur.

With the tests from the motor space, the statically significant difference was established with the variables lifting the body-back bent (MRCZTL), and also with the variable lifting the body from lying (MREPTL), and with the variable movement with stick (MTKOSP).

Table 3. t-test of the means of the two groups

	Mean1	Mean2	t-value	df	p	Valid N1	Valid N2	Std.De1	Std.De2
ATLAS	58,854	58,564	,103	90	,917	50	42	12,534	14,242
ATLVIS	167,914	168,476	-,285	90	,776	50	42	9,419	9,406
ADUZNO	98,246	98,359	-,092	90	,926	50	42	5,229	6,525
ADUZRU	70,926	73,702	-2,632	90	**,009**	50	42	5,127	4,932
ANABLE	,944	,945	-,027	90	,978	50	42	,256	,158
ANABTR	1,2860	1,285	,003	90	,996	50	42	,427	,259
AOBGRU	84,620	84,126	,282	90	,778	50	42	8,428	8,282
AOBNAD	25,880	25,457	,635	90	,526	50	42	2,887	3,498
AOBNAT	49,311	46,145	3,064	90	**,002**	50	42	5,402	4,311
MBFTAP	32,160	32,464	-,383	90	,701	50	42	4,022	3,485
MBFTAN	20,880	20,833	,070	90	,943	50	42	3,600	2,507
MRCZTL	27,440	55,785	-6,085	90	**,000**	50	42	14,452	28,937
MREPTL	26,840	41,904	-5,169	90	**,000**	50	42	12,129	15,803
MBAPLV	7,340	6,428	,937	90	,351	50	42	5,101	4,037
MBAPLU	5,340	6,142	-1,030	90	,305	50	42	3,520	3,948
MBEBML	6,487	6,483	,014	90	,988	50	42	1,408	1,247
MKTOZR	4,404	4,312	,760	90	,448	50	42	,564	,582
MKTOSP	7,190	6,207	2,850	90	**,005**	50	42	1,850	1,364
MAGONT	12,572	12,153	,962	90	,338	50	42	1,958	2,210
MFESDM	194,360	199,166	-,803	90	,423	50	42	25,830	31,574
MFESVM	35,360	34,452	,690	90	,491	50	42	6,868	5,504
MFLPRK	29,180	28,190	,758	90	,450	50	42	5,871	6,641
MFLISK	75,280	71,047	1,401	90	,164	50	42	13,561	15,405
SMISN	3,697	4,118	-2,882	90	**,004**	50	42	,815	,524
SMUGS	3,680	4,056	-2,538	90	**,012**	50	42	,752	,652
SMTNG	3,462	3,540	-,434	90	,664	50	42	,718	,981
SMOSG	3,297	3,680	-2,577	90	**,011**	50	42	,739	,673
SMKKG	3,784	3,744	,232	90	,816	50	42	,758	,892

Legend: body height ATLVIS; leg length ADUENO; arm length ADUŽRU; body mass ATLMAS; chest volume AOBGRU; humerus size AOBNAD; femur size AOBNAT; back skin fold ANABLE; stomach skin fold ANABTR; Tap with arm MBFTAP, Tap with leg MBFTAN; Deep bent on bench MFLPRK; Twisting with stick on shoulders MELISK; Jump in distance from place (MFESDM; Jump in height from place MFESVM; Trowing medicine from lying MFEBML; Lifting the body fom lying MREPTL; Lifting the body-back bent MRCZTL; Balance on hemisphere-inner static MBAPLU; Balance on hemisphere-external dynamic MBAPLV; Movement in air MTKOZR; Movement with stick MTKOSP, Movement on the ground MAGONT; ipon-seoi-nage SMISN; Uki-goshi SMUGŠ; o-soto-gari SMOSG; tomoe-nage SMTNG

From a survey conducted on 100 children (Sertić 1997), it was concluded that the tests for evaluation of coordination have a statistically significant impact on the success in judo fight. The differences of the results in situational movement structure of young judo sportsmen were evidenced in three variables: for assessment of arm techniques -ipon-seoi-nage (SMISN), for assessment of side techniques -Uki-goshi (SMUGŠ) and for assessment of leg techniques -o-soto-gari (SMOSG). It is evident that better results in the three variables belong to the first group of participants or that they have better technical characteristics.

According to the results from table 4, which shows the variance analysis (ANOVA) and the multivariate analysis of variance (MANOVA) between the two examples of judo participants, in three anthropological spaces, the statically significant difference has been established with the variables: arm length (ADUZRU) on level p=.009, femur size (AOBNAT) on level p=.002, lifting the body-back bent (MRCZTL) and lifting the body from lying (MREPTL) on level p=.000, also with the variable movement with stick (MKTOSP) on level p=.005.

Table 4. Variance analysis (ANOVA) and Multivariate analysis of variance (MANOVA).

	Mean sqr	Mean sqr	F(df1,2)	p-level
ATLAS	1,92	177,957	,010	,917
ATLVIS	7,21	88,613	,081	,776
ADUZNO	,29	34,284	,008	,926
ADUZRU	175,95	25,396	6,928	**,009**
ANABLE	,00	,047	,000	,978
ANABTR	,00	,130	,000	,996
AOBGRU	5,57	69,936	,079	,778
AOBNAD	4,08	10,114	,403	,526
AOBNAT	228,76	24,359	9,391	**,002**
MBFTAP	2,11	14,343	,147	,701
MBFTAN	,05	9,923	,005	,943
MRCZTL	18340,29	495,193	37,036	**,000**
MREPTL	5180,31	193,870	26,720	**,000**
MBAPLV	18,96	21,594	,878	,351
MBAPLU	14,71	13,848	1,062	,305
MBEBML	,00	1,788	,000	,988
MKTOZR	,19	,327	,578	,448
MKTOSP	22,03	2,711	8,123	**,005**
MAGONT	4,00	4,314	,927	,338
MFESDM	527,37	817,415	,645	,423
MFESVM	18,80	39,488	,476	,491
MFLPRK	22,35	38,865	,575	,450
MFLISK	408,88	208,244	1,963	,164
SMISN	4,05	,486	8,310	**,004**
SMUGS	3,23	,502	6,443	**,012**
SMTNG	,14	,720	,188	,664
SMOSG	3,35	,504	6,642	**,011**

SMKKG	,04	,675	,053	,816
Wilks'				
Lambda	Rao's R	df 1	df 2	p-level
,364995	3,537515	30	61	**,000014**

Legend: body height ATLVIS; leg length ADUENO; arm length ADUŽRU; body mass ATLMAS; chest volume AOBGRU; humerus size AOBNAD; femur size AOBNAT; back skin fold ANABLE; stomach skin fold ANABTR; Tap with arm MBFTAP, Tap with leg MBFTAN; Deep bent on bench MFLPRK; Twisting with stick on shoulders MELISK; Jump in distance from place (MFESDM; Jump in height from place MFESVM; Trowing medicine from lying MFEBML; Lifting the body fom lying MREPTL; Lifting the body-back bent MRCZTL; Balance on hemisphere-inner static MBAPLU; Balance on hemisphere-external dynamic MBAPLV; Movement in air MTKOZR; Movement with stick MTKOSP, Movement on the ground MAGONT; ipon-seoi-nage SMISN; Uki-goshi SMUGŠ; o-soto-gari SMOSG; tomoe-nage SMTNG

With situational movement structure of young judo sportsmen differences were evidenced in three variables: -ipon-seoi-nage (SMISN) on level p=.004, uki goshi (SMUGS) on level p=.012 and with the variable osoto gari (SMOSG) on level p=.011. With the overall system of 28 (twenty-eight) applied variables a statistically significant difference was established between the tested groups of judo sportsmen according to Wilks' Lambda (0.364), Rao's R approximation (Rao's R=3.537) and according to the values for df1=30 and df2=61 and p-level=0.000.

Conclusion

Based on the obtained results for assessment of morphological characteristics and situational movement structure of young judo sportsmen from 13 to 15, members from judo clubs in R. Macedonia and B&H, we can conclude the following:

- with the variables for assessment of anthropometrical characteristics from total 9 variables, the differences were established only in two variables;
- with the motor space from total 14 variables, the differences were established only in two variables;
- and the biggest number of differences from total 5 variables, the differences were established in three situational movement structure of young judo sportsmen.

Generally, we can say that although we are testing two groups of participants who are geographically apart, in anthropometric characteristics and motor abilities we have minimal differences, or we can say that they are participants with similar growth which is probably the result from constant training process. According to the differences of the situational movement structure of young judo sportsmen, probably in the training process in Macedonia they are paying more attention to the situational movement structure.

Timely selection of children in Judo clubs over the age of 11 and 12 is necessary and obligatory (Sertić, Vuleta 1997., Sertić 1997), in order to respect the sensitive stages of development of individual athletes. It is necessary to determine the effects of planned and programmed training process, the effects of exercise in other judo schools, gym regular classes, with other sports, so it would determine the quality of sport schools and programs within the schools.

Only with regular following of the effects of planned training technology, we can asses in the physical development, motor and functional abilities, and level of motor information, motor performance, cognitive and conation dimensions and athlete personality. (Findak,V. 1997).

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Izjava autora

Autori pridonijeli jednako.

Konflikt interesa

Mi izjavljujemo da nemamo konflict interesa.

Authorship statement

The authors have contributed equally.

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Upoređenje antropoloških dimenzija u multivarijantnom prostoru kod džudista uzrasta od 13 do 15 godina

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Sažetak: Istraživanje je izvršeno na uzorku od 92 ispitanika uzrasta 13-15 godina, koji su bili u trenažnom procesu najmanje godinu dana. Uzorak ispitanika sastavljen je iz dvije grupe džudo sportista i to iz Makedonije 50 i Bosne i Hercegovine 42. Cilj ovog istraživanja bio je poređenje antropoloških dimenzija obe dvije grupe ispitanika. Za potrebe ovog istraživanja primijenjeno je 28 varijabli od kojih: 9 varijabli antropometrijskih mera, 14 varijabli za procjenu motoričkih dimenzija i 5 varijabli za procjenu situaciono-kretnih struktura džudista. Primjenom univarijantnih i multivarijantnih statističkih metoda utvrđene su određene razlike kod nekih antropometrijskih mjera, kod određenih motoričkih sposobnosti i kod situaciono-kretnih struktura džudista, između ispitanika pomenutih grupa.

Ključne riječi: grupe, džudista, univarijantna analiza, multivarijantna analiza, situaciono- kretne strukture