

## RELATIONS BETWEEN MORPHOLOGICAL CHARACTERISTICS AND PERFORMANCE OF ELEMENTS OF BASKETBALL TECHNIQUE OF 7TH AND 8TH GRADE ELEMENTARY SCHOOL STUDENTS

Dejan Šumar, Naim Ćeleš and Bojan Međedović

**ABSTRACT:** The aim of this research was to determine the relations and influence of morphological characteristics on the performance of some elements of basketball technique of 7th and 8th grade elementary school students. 85 respondents, students of the 7th and 8th grade of Elementary School "Prekounje" from Bihać participated in the research.

The system for assessing the morphological status was represented by 7 variables that included all four latent spaces (longitudinal dimensionality of the skeleton, transferal dimensionality of the skeleton, volume and mass of the body, subcutaneous fat tissue), while 4 situational-motor tests were used to evaluate the success of performing elements of the basketball technique : (1. Throwing the ball with both hands against the wall and catching it for 30 seconds (BHLR30), 2. Dribbling the ball with the hand in a slalom (VLRS), 3. Throwing the ball into the basket for 30 seconds (ULK30), 4. Lay-ups for 30 seconds (PNK30).

Basic central and dispersion parameters were calculated for all variables which confirmed the normality of the distribution, and the relations between spaces were determined by using the canonical correlation analysis.

The values obtained by canonical correlation analysis indicate a medium-high correlation between morphological characteristics and situational-motor abilities. Two significant pairs of canonical factors were obtained.

**Keywords:** *morphological characteristics, situational-motor abilities, basketball, students, elementary school*

### INTRODUCTION

Basketball has multiple effects on the body of a child and a young person, after all, Naismith created it specifically for the needs of physical education. Considering that basketball is expected to affect the harmonious development of the child's entire body (Granić & Krstić, 2006), its role in physical education is quite natural (Karalejić & Jakovljević, 2001). The ability to solve simple and complex motor tasks, and especially movement structures from sports games, largely depends on different dimensions of anthropological status (Kamberi et al., 2008). In the specification equation according to Pavlović (1977), morphological characteristics and motor abilities are of the greatest importance for success in basketball.

While in some motor situation one body type directly interferes with the implementation of the kinetic program, that same body structure in another motor situation can be extremely favorable, which can be seen in a large number of researches. The problem that appears in this connection consists in finding statistically significant relations between motor abilities and corresponding morphological characteristics, in order to verify and maintain the desired anthropological harmony, which represents one of the desired goals of teaching physical and health education in primary school and sports activities (Pejčić, 2007). Matković (1984) states that the efficient performance of tasks in basketball, considering a great number of explosive activities in the game, largely depends on the specific morphological structure of the basketball player with the dominant role of the body's muscle mass. Significant relations between morphological characteristics and the results of specific motor tests in basketball were established by other researchers (Aruković, 2008; Jašarević, 2004; Pašalić, 2003). Saratlija et al. (2007) found a significant but

moderate correlation between motor tests and morphological characteristics in their research. The highest correlation was observed in the ball throwing and wall bouncing tests with tests that indirectly represent muscle mass and chronological age. Pašalić et al. (2003) determined the interconnection of a set of variables for the assessment of longitudinal dimensionality on the accuracy of passing the ball when it comes to long and medium-long passes in their research, because their quality mostly depends on the length of the lever and the path of the thrown ball. The specific influence of lever length on shooting accuracy was determined, as well as the influence of explosive power on the jump phase of jump-shooting and lay-ups. In the research conducted by Dežman (1982), it was concluded that body height and weight have a significant positive influence on the results in the tests of throwing the ball into the basket from close range, and quick and alternating passing; while the impact on the results in the ball dribbling test in a zigzag line is negative. The author also observed a significant negative influence of fat tissue on the results in all applied situational motor tests.

The main goal of this research is to determine the relation and possible connection between morphological characteristics and situational-motor abilities through the success of performing elements of basketball technique. The subject of this research are the 7th and 8th grade elementary school students and their morphological characteristics and situational-motor abilities in basketball.

### METHODS

The sample consisted of 85 students of the 7th and 8th grades of Elementary School "Prekounje" from Bihać. During the testing, the psychophysical condition of all students was at a satisfactory level.

The following variables were used to test the morphological characteristics of the respondents: 1. Body height (AVIST) 2. Foot length (ADUS) 3. Wrist diameter (ADIRZ) 4. Knee diameter (ADIKO) 5. Body weight (mass) (ATEZT) 6. Abdominal skin fold (AKNTR) 7. Upper arm skin fold (AKNNL).

The following variables were used to test the respondents' situational-motor abilities: 1. Throwing the ball with both hands against the wall and catching it for 30 seconds (BHLR30), 2. Dribbling the ball with the hand in a slalom (VLRS), 3. Throwing the ball into the basket for 30 seconds (ULK30), 4. Lay-ups for 30 seconds (PNK30).

Data processing in this research and application of statistical-mathematical procedures was done in SPSS 25. In order to test the hypothesis that the results obtained by measurement in this research are normally distributed, all manifest variables were processed with standard descriptive parameters. At the multivariate level, the connection between the spaces was determined by applying canonical correlation analysis. On the basis of these methods, information was obtained on the distribution of parameters, correlations, partial correlations and on the interrelations of variables.

## RESULTS AND DISCUSSION

**Table 1.** Basic and central dispersion parameters of morphological characteristics

	Valid N	Mean	Standard Error	Median	Mode	Standard Deviation	Variance	Skewness	Kurtosis	Range	Minimum	Maximum
AVIST	85	161,38	0,75	162,00	163,00	6,92	47,95	0,11	-0,44	32,00	147,00	179,00
ATEZT	85	50,95	1,01	50,50	48,10	9,29	86,34	0,53	-0,02	42,00	34,20	76,20
ADUS	85	24,46	0,14	24,40	24,50	1,26	1,59	0,39	0,53	6,80	21,00	27,80
ADIRZ	85	5,11	0,04	5,10	5,10	0,33	0,11	0,03	0,51	2,00	4,10	6,10
ADIKO	85	9,25	0,06	9,30	9,40 <sup>a</sup>	0,55	0,30	0,28	0,15	2,90	8,00	10,90
AKNTR	85	16,90	0,83	16,00	18,00	7,67	58,83	0,40	-0,67	31,90	4,90	36,80
AKNNL	85	15,55	0,84	14,20	9,80	7,77	60,43	0,80	-0,14	33,20	3,80	37,00

a. Multiple modes exists. The smallest value is shown.

By looking at Table 1, we notice that the skewness values range from 0.03 to 0.8, which tells us that these are normally distributed empirical schedules. This is supported by the values of the mode and the arithmetic mean. In the table, we notice that the students had an average body height of 161.38 cm and a body weight of 50.95 kg. The values of kurtosis range from -0.67 to 0.53 which tells us that the curve representing the distribution of the results

shows a tendency of mild leptokurticity. On the other hand, these data tell us that the chosen tests for the assessment of morphological status are well adapted to the anthropological status of the sample of respondents who entered this research. The average results in the variables AVIST - body height and ATEZT - body weight are within the limits of the expected results for this age.

**Table 2.** Basic and central dispersion parameters of situational-motor abilities

	Valid N	Mean	Standard Error	Median	Mode	Standard Deviation	Variance	Skewness	Kurtosis	Range	Minimum	Maximum
BHLR30	85	17,59	0,60	19,00	20,00 <sup>a</sup>	5,54	30,70	-0,72	0,32	27,00	1,00	28,00
VLRS	85	12,18	0,30	11,60	11,10 <sup>a</sup>	2,72	7,40	1,02	1,20	14,00	7,40	21,40
ULK30	85	4,08	0,30	3,00	2,00	2,74	7,53	1,18	0,98	11,00	1,00	12,00
PNK30	85	1,55	0,15	1,00	1,00	1,37	1,87	0,86	0,11	5,00	0,00	5,00

a. Multiple modes exists. The smallest value is shown.

Table 2 shows the results of the descriptive statistics of the respondents in situational-motor abilities. Skewness values indicate a slight asymmetry in both sides, but it is within normal limits. A slightly higher homogeneity of results was observed in the VLRS test - dribbling the ball with the hand in a slalom,

as indicated by the kurtosis values (1.20). Based on the obtained parameters, we can conclude that the tests for assessing situational-motor abilities are appropriate for the age of the respondents and their situational-motor abilities.

**Table 3.** Matrix of morphological characteristics intercorrelations

	AVIST	ATEZT	ADUS	ADIRZ	ADIKO	AKNTR	AKNNL
AVIST	1	0,473	0,591	0,405	0,443	-0,135	-0,185
ATEZT	0,473	1	0,365	0,487	0,743	0,666	0,593
ADUS	0,591	0,365	1	0,517	0,556	-0,008	-0,021
ADIRZ	0,405	0,487	0,517	1	0,595	0,245	0,177
ADIKO	0,443	0,743	0,556	0,595	1	0,444	0,421
AKNTR	-0,135	0,666	-0,008	0,245	0,444	1	0,843
AKNNL	-0,185	0,593	-0,021	0,177	0,421	0,843	1
Level of significance p=0.01							
Level of significance p=0.05							

The interrelationship of the applied variables of morphological characteristics was analyzed within the matrix of intercorrelations shown in table 3. The matrix of intercorrelations obtained on the basis of the variables of morphological characteristics contains correlation coefficients (connections) of those characteristics. Correlation coefficients indicate only the connection between variables, but not the influence of one on the other. The significance of the correlation coefficient was determined at the level of  $p=.05$  and  $p=.01$ .

At first glance, we can see the connection within the treated variables. A good part of applied morphological variables shows high, moderate, low and insignificant correlation. There is a high correlation and strong connection between the variables for the assessment of skin folds (AKNTR and AKNNL) and it is .843. We could have expected such high correlation coefficients between these two variables because they belong to the same hypothetical factor. There is also a high correlation between the variables of body weight (ATEZT) and knee diameter (ADIKO) and it is .743. The variables for assessing the circular dimensionality are highly correlated with the variables for assessing the amount of subcutaneous fat tissue or body adiposity (ATEZT, AKNTR) .666 and (ATEZT, AKNNL) .593. By examining the correlation coefficients, we can see the connection between the variables that define the latent space of transferal dimensionality (ADIKO and ADIRZ) .595. A high correlation between the variables defining the latent space of longitudinal dimensionality (AVIST and ADUS) .591 was to be expected for this sample of respondents.

**Table 4.** Matrix of situational-motor abilities intercorrelations

	BHLR30	VLRS	ULK30	PNK30
BHLR30	1	-0,488	-0,418	-0,343
VLRS	-0,488	1	-0,512	-0,425
ULK30	0,418	-0,512	1	0,534
PNK30	0,343	-0,425	0,534	1
Level of significance p=0.01				
Level of significance p=0.05				

Table 4 shows the correlation coefficients of the variables for the assessment of specific basketball motor skills, that is, the intercorrelation between the results of the tests for the assessment of situational-motor abilities. The coefficients of

intercorrelations in the correlation matrix range from 0.343 to 0.534. All variables have a moderate correlation (an important connection). Through the analysis of the intercorrelation matrix, the existence of statistical significance in the crossing of variables was determined, which undoubtedly tells us that the applied battery of tests covers well the area of specific basketball motor skills, i.e. situational-motor abilities. The variables ULK30 - Throwing the ball into the basket for 30 seconds and PNK30 - Lay-ups for 30 seconds (.534) have the highest correlation, which is expected because the successful performance of these activities requires a well-developed kinesthetic sense.

**Table 5.** Canonical correlation coefficients of morphological characteristics and situational-motor abilities

	Canonicl R	R-sqr.	Chi-sqr.	df	p	Lambda
0	,572100	,327299	65,73749	28	,000073	,430508
1	,531258	,282235	34,81407	18	,010004	,639970
2	,310382	,096337	8,94823	10	,537037	,891615
3	,115465	,013332	1,04691	4	,902599	,986668

**Table 6.** Matrix of the structure of isolated canonical factors in the space of morphological characteristics

	Root 1	Root 2
AVIST	,909379	,070373
ATEZT	,569520	-,202697
ADUS	,675120	,554695
ADIRZ	,487585	-,008755
ADIKO	,364059	,351459
AKNTR	,017080	-,172410
AKNNL	-,145985	-,267499

**Table 7.** Matrix of the structure of isolated canonical factors in the space of situational-motor abilities

	Root 1	Root 2
BHLR30	,926411	-,240721
VLRS	-,366719	-,319354
ULK30	,657416	,734665
PNK30	,434432	,506359

**Table 8.** Cross-correlation matrix of morphological characteristics and situational-motor abilities

	BHLR30	VLRS	ULK30	PNK30
AVIST	<b>,482494</b>	<b>-,236305</b>	<b>,373433</b>	<b>,230669</b>
ATEZT	<b>,269975</b>	,085927	,142048	,040415
ADUS	<b>,275246</b>	<b>-,204683</b>	<b>,474973</b>	<b>,293999</b>
ADIRZ	<b>,268736</b>	-,123392	,174496	,145076
ADIKO	,101960	-,002119	<b>,281877</b>	,138255
AKNTR	-,007170	,145904	-,062839	-,044602
AKNNL	-,087637	<b>,204633</b>	-,151138	-,156266

By using canonical correlation analysis of morphological characteristics and motor abilities, two pairs of significant canonical factors were isolated, and the results are presented in table number 5.

The value of the canonical correlation coefficient of 0.57 ( $R = .572100$ ) and the amount of common variance of 33% ( $Rsq = .327299$ ) of the first pair of canonical factors indicate the existence of a medium-high correlation between morphological and motor variables. The mentioned correlation is significant at a stricter level of  $p = 0.01$ .

By analyzing the matrix of the structure of the first isolated canonical factor in the space of morphological characteristics (Table 6), we notice that the variables for assessing the longitudinal dimensionality of the skeleton have the greatest projection on the first canonical factor. AVIST – body height has a very high correlation with the first canonical factor in the space of morphological characteristics (.91). The variable ADUS – foot length (.68) has a somewhat lower, but still high, projection on the first canonical factor. The variables ATEZT – body weight (.57) and ADIRZ – wrist diameter (.49) have medium intensity values of the connection with the first canonical factor.

By analyzing the matrix of the structure of the first isolated canonical factor in the space of situational-motor abilities (Table 7), we see that the variable BHLR30 – throwing and catching the ball for 30 seconds (.93) has an extremely high projection on the first canonical factor. The structure of the test with which we assessed this situational-motor ability is such that its structure is made up of movements that are under the control of movement regulation mechanisms that are mostly represented in the basketball game as well.

The canonical correlation between the second pair of canonical dimensions is also moderately high at 0.53 ( $R = .531258$ ) and is explained by 28% of the common variability ( $Rsq = .282235$ ) and is significant at the milder criterion of  $p = 0.05$  ( $p = .010004$ ).

By analyzing the matrix of the structure of the second isolated canonical factor in the space of morphological characteristics (Table 6), we notice that the variable ADIKO – knee diameter (.35) has a projection on the second canonical factor, which we can attribute to the specifics of the sample of respondents, measurement error and an unknown connection.

By analyzing the matrix of the structure of the second isolated canonical factor in the space of situational-

motor abilities (Table 7), we can see that the variable ULK30 – throwing the ball into the basket for 30 seconds (.73) has a high projection on the second canonical factor. A slightly lower, medium-high projection on the second canonical factor has the variable PNK30 - lay-ups for 30 seconds (.51).

By looking at the cross-correlation matrix of morphological characteristics and situational-motor abilities (Table 8), we notice that the variables AVIST - body height and BHLR30 - throwing and catching the ball for 30 seconds have the highest correlation (.48). The variables ADUS - foot length and ULK30 - throwing the ball into the basket for 30 seconds have a slightly lower correlation (.47).

## CONCLUSION

The main goal of this research was to determine the relations between morphological characteristics and motor abilities with the success of performing elements of basketball technique. The sample of respondents in this research consisted of 85 students of the 7th and 8th grades of Elementary School „Prekounje“ from Bihać. 7 variables from the set of tests for the assessment of morphological characteristics were used for the assessment of morphological characteristics, and 4 variables from the set of tests for the assessment of situational-motor abilities were used for the assessment of the success of performing elements of basketball technique. Basic central and dispersion parameters were calculated for all variables, and relations between spaces were determined using canonical correlation analysis. Canonical correlation analysis was used to determine the relations between morphological characteristics and situational-motor abilities, and the obtained results indicate a high correlation between morphological characteristics and situational-motor abilities. Two significant pairs of canonical factors were obtained. According to the obtained results, morphological characteristics in students have a medium-high correlation with situational-motor abilities. This proved that morphological characteristics are important for the performance of tasks in situational-motor tests, and that they indirectly affect the efficiency of the participants of the basketball game.

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### Corresponding authors:

Dejan Šumar  
Faculty of Pedagogy, University of Bihać  
e-mail: [sumar\\_dejan@yahoo.com](mailto:sumar_dejan@yahoo.com)

Naim Čeleš  
Faculty of Pedagogy, University of Bihać  
e-mail: [jasminaim@yahoo.de](mailto:jasminaim@yahoo.de)

Bojan Međedović  
Faculty for Sport and Psychology Novi Sad  
e-mail: [bojan@tims.edu.rs](mailto:bojan@tims.edu.rs)