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A COMPARATIVE ANALYSISOF THE RESULTS FROM SPECIFIC MOTOR TESTS IN 14, 15 AND 16 YEARS OLD BASKETBALL PLAYERS

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(Original scientific paper)

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Abstract

The survey was conducted on a sample of 54 young basketball players, 18 of which were 14 years of age, 18 were 15 years of age, and another 18 were 16 years of age, in order to determine the differences in the results in the tests for assessing the structural basketball element - handling the ball. The results of the one-factor multivariate variance analysis (MANOVA) showed that the three groups of examinees statistically differed significantly in the whole system of variables. After the one-factor variance analysis (ANOVA) it was determined that the groups differ statistically significantly in all variables: handling the ball with a dominant hand at 20 meters running (V20MDR), handling the ball with a non-dominant hand at 20 meters running (V20MDR) and handling the ball while running between sticks (VODMS). In the three groups of participants, a weaker score was scored in a 20-meter (20-meter) ball with the dominant hand (V20MDR) in terms of a 20m ball handling with the non-dominant hand, which probably suggests that the respondents can't equally successfully lead the ball in maximum running with the dominant and non-dominant hand. The results can be used to compare with other basketball players in the future, but also serve as information in selecting basketball players, planning, programming, and realizing the training with these adult categories.

Keywords*: basketball, ball handling, tests, motor skills*

Introduction

Basketball is one of the most dynamic sports games. It requires the players to raise skills with the opponent, possessing a high level of speed, mobility, explosive force, impeccable technique of moving with a ball and without it, precision in carrying out the passes and shots towards the basket, successful realization of technical and tactical tasks, and above all having a good perception and intelligence.

Each player has certain motor skills on which the innate and acquired abilities have different influence. When it comes to the structure of situational-motor skills, one refers to factors that determine the ability to perform complex motor operations.

For a modern and perfect player, one can be considered a basketball player who accurately and correctly performs all the technical elements, with a ball and without it, in terms of playing. Successful overhaul of basketball technique has great influence on endogenous and exogenous factors, among which the most important are: predispositions, genetic factors, morphological characteristics, working conditions, coaching staff, etc. Practice shows that the greatest influence, in addition to the stated factors, belongs to the player's desire for training and learning, his determination and durability. In basketball, with the properly performed technical elements, with or without the ball, a small amount of energy is consumed, which allows for longer application of the same drills, without disturbing their structure of performance. Because of this, it is of great importance for the game itself to successfully and correctly learn and perfect the technical elements, as well as their proper application during play.

The ball technique includes: holding and catching the ball, adding, running, pivoting, penetrating and shooting the basket. All of the elements above have a great deal of significance for the attack, and the players need to handle them brilliantly. The proper learning of these basketball elements is of particular importance for beginners. There are different approaches to their learning and each of them gives different results.

The aim of the research was to determine and compare the differences in the structural basketball element with a ball - handling, among young basketball players representing North Macedonia, aged 14, 15 and 16 years.

Methods

The sample of respondents is drawn from the youth basketball teams of North Macedonia at the age of 14, 15 and 16 years.

The total sample of respondents was 54 examinees and it was divided into three subcomponents of 18 respondents. The suppositions are named as: the national team of North Macedonia U14, the national team of North Macedonia U15, the national team of North Macedonia U16

A total of 3 variables were used for the purpose of accomplishing the set goal of the survey, for assessing the structural basketball element with the ball - handling, namely: handling a ball with the dominant hand at 20 meters with running (V20MDR), handling a ball with the non-dominant hand at 20 running meters (V20MNDR) and handling the ball while running between sticks (VODTMS).

The measurements were conducted in a registered hall according to the FIBA standards and propositions, before the start of the preparations of the selected representatives of the Republic of North Macedonia. North Macedonia in the specified years (U14, U15 and U16).

A system of photocells was used to measure the duration of the anticipated tasks, which registered the beginning and the end of the movement in the envisaged space.

Preliminary investigations have examined assumptions about the normality, linearity, univariate and multivariate atypical points, the homogeneity of the matrix of variance-covariance and multicollinearity, and no serious disturbances have been observed.

A single-factor multivariate analysis of variance (MANOVA) and single-factor univariate analysis of variance (ANOVA) was then applied, and the LSD-post-hoc test was applied to determine the differences in the analyzed variables.

The SPSS 21 statistical package was used to process the received data.

Results and Discussion

From the overview of (Table 1), it can be seen that the skewness values in most variables in basketball players aged 16 are in the range of the recommended values from -1 to +1, indicating that the distribution of the results is approximately symmetrical. Positive asymmetry - epicorticity (the greater number of results are in the zone of the better ones), is seen only in the variable VODTMS (Sk = 1.12). From the values of the kurtoses it can be seen that all applied variables show solidity (platinum distribution).

The homogeneity of the subsample of basketball players at the age of 16, on the basis of the calculated coefficients of variability, is satisfactory.

Table 1. Descriptive statistics and the normal distribution of specific motor tests in basketball players at the age of 16

	Mean	Minimum	Maximum	SD	CV.	S.E.	Skewness	Kurtosis	K-S
V20MDR	3,31	3,03	3,49	0,11	3,47	0,03	-0,60	0,98	p = .20
V20MNDR	3,49	3,06	3,91	0,23	6,61	0,05	0,38	-0,26	p = .20
VODTMS	5,43	5,16	5,98	0,22	4,01	0,05	1,12	0,71	p = .04

The value of the basic central and dispersive parameters of the applied variables, in the minimum and max result, contains about four or more standard deviations (SD), on the basis of which a satisfactory sensitivity of all variables can be established. Based on the values of the standard deviations (SD) and its ratio with the mean, we can conclude that there is no statistically significant deviation of the results from the arithmetic mean.

The results of the Kolmogorov-Smirnov test (Table 1) showed that apart from the VODTMS variable, all others are normally distributed.

From the overview of Table 2, which shows the results of the central and dispersive parameters of specific motor tests, in basketball players at the age of 15, it can be concluded that most results in the mean are valid because the standard error of the arithmetic mean (SE) in all variables is five times smaller than its mean value. The value of the basic central and dispersive parameters of the applied variables in the

interval minimum (min) and the maximum (max) result contains about four or more standard deviations (SD), on the basis of which satisfactory susceptibility of all tests can be established.

The results of the Kolmogorov-Smirnov test (Table 2) showed that all variables for basketball players at 15 years of age are normally distributed.

Table 2. Descriptive statistics and the normal distribution of specific motor tests in basketball players aged 15 years

	Mean	Minimum	Maximum	SD	CV.	S.E.	Skewness	Kurtosis	K-S
V20MDR	3,48	3,13	3,76	0,21	6,07	0,05	-0,22	-1,10	p = .20
V20MNDR	3,63	3,22	3,96	0,21	5,92	0,05	-0,14	-0,48	p = .12
VODTMS	5,85	5,16	6,56	0,35	6,00	0,08	0,17	-0,26	p = .20

Table 3. Descriptive statistics and the normality of distribution of specific wetting tests in basketball at the age of 14 years

	Mean	Minimum	Maximum	SD	CV.	S.E.	Skewness	Kurtosis	K-S
V20MDR	3,55	3,37	3,72	0,10	2,87	0,02	0,17	-0,32	p = .20
V20MNDR	3,70	3,13	4,10	0,28	7,49	0,07	-0,33	-0,71	p = .20
VODTMS	5,66	5,09	6,26	0,32	5,72	0,08	0,27	-0,37	p = .20

From the inspection of Table 3, it can be seen that the scoring values in most variables in basketball players aged 14 are in the range of the recommended values from -1 to +1, indicating that the distribution of the results is approximately symmetrical.

The homogeneity of the subsample of basketball players at the age of 14, on the basis of the calculated coefficients of variability, is at a satisfactory level.

The value of the basic central and dispersive parameters of the applied variables in the minimum and maximum intervals contains about four or more standard deviations (SD), on the basis of which a satisfactory sensitivity of all variables can be established. Based on the values of the standard deviations (SD) and its ratio with the mean (Mean), it can be concluded that there is no statistically significant deviation of the results from the arithmetic mean.

The results of Kolmogorov-Smirnov's procedure showed that all variables for basketball players at 14 years of age are normally distributed.

Although this is a small selective sample of respondents (top young basketball players), the results of the analysis indicate that in all variables there is a normal distribution of their results, based on which it can be concluded that the degree of normality of distributions of applied manifest variables, meets the necessary methodological and statistical criteria for the application of correct and justified multivariate and univariate statistical procedures for further processing of the received data.

Table 4. Multivariate significance of differences among basketball players of 16, 15 and 14 years of age

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.998	10765.787[b]	3.000	49.000	.000	.998
	Wilks' Lambda	.002	10765.787[b]	3.000	49.000	.000	.998
	Hotelling's Trace	659.130	10765.787[b]	3.000	49.000	.000	.998
	Roy's Largest Root	659.130	10765.787[b]	3.000	49.000	.000	.998
PLAYERS	Pillai's Trace	.515	5.787	6.000	100.000	.000	.258
	Wilks' Lambda	.544	5.808[b]	6.000	98.000	.000	.262
	Hotelling's Trace	.728	5.824	6.000	96.000	.000	.267
	Roy's Largest Root	.515	8.589[c]	3.000	50.000	.000	.340

With the use of multivariate analysis of the variation (MANOVA), i.e. by testing the significance of differences in arithmetic environments in all variables between subsamples of young top basketball players at 16, 15 and 14 years of age (Table 4), a statistically significant difference was established because Wilks' Lambda .544 is of statistical significance at level Q = .000. The size of the partial effect of the determinants (partial n2) shows high values, 262 (Cohen, 1988).

Table 5. Univariate significance of differences between basketball supercars of 16, 15 and 14 years of age

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	V20MDR	.561[a]	2	.281	12.338	.000	.326
	V20MNDR	.405[b]	2	.202	3.456	.039	.119
	VODMS	1.574[c]	2	.787	8.575	.001	.252
Intercept	V20MDR	641.121	1	641.121	28186.103	.000	.998
	V20MNDR	700.877	1	700.877	11966.866	.000	.996
	VODMS	1721.804	1	1721.804	18754.556	.000	.997
PLAYERS	V20MDR	.561	2	.281	12.338	.000	.326
	V20MNDR	.405	2	.202	3.456	.039	.119
	VODMS	1.574	2	.787	8.575	.001	.252
Error	V20MDR	1.160	51	.023			
	V20MNDR	2.987	51	.059			
	VODMS	4.682	51	.092			
Total	V20MDR	642.843	54				
	V20MNDR	704.269	54				
	VODMS	1728.061	54				
Corrected Total	V20MDR	1.721	53				
	V20MNDR	3.392	53				
	VODMS	6.257	53				

In order to determine in which tests there are statistically significant differences, a univariate variance analysis for each variable has been calculated. From the overview of Table 5, it can be concluded that there are statistically significant differences in all three analyzed variables: handling a ball with the dominant hand at 20 meters running (V20MDR) (F = 12.34; p = 0.000), handling a ball with the non-dominant hand at 20 meters running (V20MNDR) (F = 3.46; p = 0.039), handling the ball while running between sticks (VODMS) (F = 8.58; p = 0.001). The highest magnitude of the effect (partial - n2) is present in the 20 meter dominant hand handling (V20MDR) .33 and the lowest in the non-dominant 20 meter ball handling (V20MNDR) .12.

To determine which suppressers there are statistically significant differences in each individual variable, LSD (least significant difference) tests have also been applied.

Table 6. LSD post-hoc tests on variables V20MDR, V20MNDR, VODM

Dependent Variable	(I) PLAYERS	(J) PLAYERS	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
V20MDR	16 y	15 y	-.1788*	.05027	.001	-.2797	-.0779
		14 y	-.2404*	.05027	.000	-.3413	-.1395
	15 y	16 y	.1788*	.05027	.001	.0779	.2797
		14 y	-.0616	.05027	.226	-.1625	.0393
	14 y	16 y	.2404*	.05027	.000	.1395	.3413
		15 y	.0616	.05027	.226	-.0393	.1625
V20MNDR	16 y	15 y	-.1392	.08067	.091	-.3011	.0228
		14 y	-.2082*	.08067	.013	-.3701	-.0462
	15 y	16 y	.1392	.08067	.091	-.0228	.3011
		14 y	-.0690	.08067	.396	-.2310	.0930
	14 y	16 y	.2082*	.08067	.013	.0462	.3701
		15 y	.0690	.08067	.396	-.0930	.2310
VODMS	16 y	15 y	-.4179*	.10100	.000	-.6207	-.2152
		14 y	-.2228*	.10100	.032	-.4256	-.0201
	15 y	16 y	.4179*	.10100	.000	.2152	.6207
		14 y	.1951	.10100	.059	-.0077	.3979
	14 y	16 y	.2228*	.10100	.032	.0201	.4256
		15 y	-.1951	.10100	.059	-.3979	.0077

From the overview of the first section in Table 6, where the post-hoc tests are shown, it can be seen that basketball players at the age of 16 show statistically significantly better results in the 20-meter dominant hand ball handling (V20MDR) compared to the results of the basketball players aged 14 and 15. However, although basketball players at the age of 15 showed better results than basketball players at the age of 14, no statistically significant difference was found in this variable.

The results shown in the second part of Table 6 indicate that basketball players at 16 years of age achieved statistically significantly better results in a 20-meter ball handling with the non-dominant hand compared to the basketball players aged 14 years. Among basketball players aged 14 and 15 and 15 and 16, no statistically significant difference was found in the 20 meter ball handling with the non-dominant hand.

From the inspection of the third part of Table 6, it can be noted that basketball players at the age of 16 show statistically significantly better results in the 20-meter ball handling while running between sticks (VODMS) ranking compared to basketball players aged 14 and 15. Among basketball players aged 14 and 15, no statistically significant difference was found in the 20-meter ball handling while running between sticks, although 14-year-old basketball players showed a better result.

The explosive force and the linear speed combined with the excellent technique of running the ball are key features to achieve a good test result in the tests (V20MDR) and (V20MNDR). The smaller the difference in the result in these two tests, the more it may indicate that the ambidexiness is greater, that is, that the basketball player equally leads the ball both with one and the other, which is not the case with this sample of respondents, given that the difference between these two tests ranged from 0.15 among the respondents aged 15 and 14 and 0.18 seconds to the 16-year-olds.

The rapid change in the direction of movement and then turning, combined with the excellent technique of handling the ball interchangeably with one and the other hand, are crucial for achieving better results in the test (VODMS). The reason for the statistically significant differences in this test could be better motor control by the 16-year-old basketball players, given that they have one or two years of long training process, but also a technique of movement that is perfected to a higher level. However, the differences in the growth and development, i.e., the anthropological differences of basketball players, are not excluded here.

Conclusion

Handling the ball is an element that, according to the meaning and time foreseen for its practice, especially among young basketball players, should be of great importance.

The obtained results show a multivariate significance of the differences among the respondents at 14, 15 and 16 years of age. The univariate significance of differences is present in all three applied tests for assessing structural elements with a ball.

Bearing in mind that this is a small but representative sample of young basketball players from members of the North Macedonian national team, the results obtained can serve to compare and evaluate the achievements of basketball players that would be tested in the future, which would facilitate the selection, planning, programming and realization the training process.

Recognizing the limitations of this research in terms of the number of respondents, we believe that in the future it is necessary to carry out research that will include the same and other tests conducted for a larger number of respondents of different age and gender, as well as the application of methods in order to compile differences regarding playing positions, determining the relationship between the anthropological dimensions of basketball players, etc.

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