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DIFFERENCES IN MOTOR ABILITIES OF SUCCESSFUL AND LESS SUCCESSFUL GROUPS OF BASKETBALL PLAYERS FROM 12 TO 14 YEARS OLD

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Abstract
The research is based on a sample of 132 cadet basketball players (the more successful group counts 69, and the less successful 63 respondents) from 12 participating clubs of the Sarajevo Canton cadet basketball league. The set of variables in this research is composed of 12 motor tests. Among the motor tests for evaluating locomotor speed, agility and reflex power, the following tests were applied: time to run sections of 5, 10, 15, and 20 m, T - agility test, Line agility test, Zig - Zag agility test, vertical reflection on feet - hands on to the side (sqaut jump), vertical reflection on the feet with a swing of the hands (sqaut hand free jump), vertical reflection after jumping from a height of 40 cm (drop jump), 10 consecutive vertical reflections on the feet (repeating vertical jumps), one-legged horizontal jump from a standing position (standing long jump). After determining, i.e. adjusting the data values to characteristics that are suitable and valid for the use of designed analyzes and providing exact answers to the defined hypotheses, the following procedures were used for data processing and analysis in this paper: measure of central tendency, variability and shape of distribution of 12 motor tests, univariate F tests to determine the classification of respondents into groups based on the level of success, multivariate analysis of variance (Manova) to determine the differences between groups of successful and less successful basketball players in terms of motor skills. The information and results obtained from the analyzes can serve as a basis for modeling programs for the recognition of talents in basketball.

Key words: Multivariate analysis (Manova), basketball, motor skills of structures

INTRODUCTION

Achieving high sports results depends on numerous factors. Certainly one of the primary factors for success in sports refers to knowing the anthropological status of each individual who participates in sports. An individualized approach and the establishment of exact anthropometric, motor, functional and psychological diagnoses and desired profiles are the basic elements and assumption of choosing and leading the process of developing a long-term basketball career. A basketball coach must supervise and ensure the balanced development of players, i.e. his physical structure, improvement of visual and motor coordination, development of the necessary basic and specific motor skills taking into account the evolutionary processes associated with the pace of growth and maturation of the player. (Sánchez-Muñoz, C.; Zabala, M.; Williams, K., 2012; Šimonek, J.; Horička, P.; Hianik, J., 2016).
It is significant to investigate, analyze and in professional practice present information about the values and Given the limited attention that is focused on predicting performance in team sports, the interrelationships between the parameters of body composition and motor abilities represented by the parameters of locomotor speed, specific basketball agility and explosive power. There is also a noticeable lack of previous studies that would compare the physical and speed-strength qualities of basketball players of different levels of success as well as players of different basketball positions. The problem of defining the structure of the motor space is very current and is quite present in numerous researches. A large number of previous studies of motor abilities on different populations of respondents indicate a complex structure of the motor area and a different individual contribution of each segment of the motor area to achieving high results in each sports activity (Delija and Mraković, 1993; Jašarević, 2004; Bajrić, et al. 2013; Halilović et al. 2013).
The aim of this paper is to determine the latent structure of motor skills of basketball players aged 12-14 years from Sarajevo Canton/Federation of Bosnia and Herzegovina.

METHODS

Participants

The sample of respondents included a group of 132 (the more successful group counting 69, and the

less successful counting 63 respondents) basketball players aged 12 to 14 from 12 clubs participating in the cadet basketball league of Sarajevo Canton.
In order to comply with the Helsinki ethical principles in research, statements of parents were provided about their consent to test minors and the publication of their results.

Variables
Competitive performance of basketball players

According to this criterion, basketball players are divided into two groups. Group 1 – more successful basketball players and Group 2 – less successful basketball players. The competitive performance of basketball players is on a rating scale from 1 to 5. Each basketball player was assigned a rating from 1 to 5 based on two criteria (Table 1).
1. Team ranking at the end of the competition: All teams (12 basketball clubs) that participated in the Sarajevo Canton Cadet League for the 2019 season were grouped into 3 categories (1st-4th place; 5th-8th place; 9th-12th place).
2. Quality of basketball players within the team (as assessed by the coach). Each coach divided the basketball players of his team into three quality groups (above average - players who play the game, average - other basketball players who are members of the first lineup and reserves who contribute to the quality of the game; below average - basketball players who rarely or never enter the game).
Basketball players who were assigned grades 4 and 5 were classified in the group of more successful basketball players, and basketball players who were assigned grades 1, 2 and 3 were classified in the group of less successful basketball players (Grgantov et al. 2013).

Table 1. Procedure for categorizing the individual value of basketball players

Placement of the team in the championship	Member of the representation	Above average player	Average player	Below average player
(1-4)	5	5	4	3
(5-8)	5	4	3	2
(9- 12)	5	3	2	1

Data analysis

Differences between groups of successful and less successful basketball players in terms of somatic parameters were checked by tests for Multivariate Analysis of Variance (Manova) with a significance level of $p \leq 0.05$.
Before using the Multivariate Analysis of Variance, preliminary tests checked the assumptions of normality, linearity, univariate and multivariate atypical points, and multicollinearity.
The contributions of individual sets of analyzed variables to differentiate groups of successful and less successful basketball players by sets of analyzed variables were determined by the F test for univariate analysis of variance with a significance level of $p \leq 0.05$ and adequate Bonferroni adjustment considering the number of dependent variables.
The importance (magnitude) of the influence of the values of the individual variables of motor abilities in relation to the groups formed by the performance of basketball players were determined by the values of Partial Eta Squared.
Multiple comparisons of determined group mean values by sets of variables were analyzed with LSD Post Hoc tests.

RESULTS AND DISSCUSION

Two groups of basketball players, more successful basketball players counting 69 and less successful basketball players counting 63 players, were subjected to Multivariate Analysis of Variance in order to determine differences in the levels and structures of sets of motor skills variables. The mean values and standard deviations of motor skills variables of basketball players classified into 2 groups according to the level of success are shown in table 2.

Table 2. Mean values and standard deviations of motor skills variables of basketball players of different quality groups

	Group by quality	Mean	Std. Deviation	N
CMJ hands on hip	More successful	31.429	4.9044	69
	Less successful	29.857	4.7227	63
	Total	30.679	4.8645	132
CMJ with momentum	More successful	39.313	6.1766	69
	Less successful	37.154	6.3759	63
	Total	38.283	6.3415	132
CMDJ40 jump	More successful	31.016	4.9979	69
	Less successful	29.484	5.1705	63
	Total	30.285	5.1195	132
STIFNESS - 10 jumps	More successful	29.223	4.6965	69
	Less successful	26.883	4.9265	63
	Total	28.106	4.9308	132
A long jump from a standing position	More successful	216.261	23.0336	69
	Less successful	210.730	24.1535	63
	Total	213.621	23.6474	132
Running 5 m	More successful	1.1307	.08458	69
	Less successful	1.1594	.09972	63
	Total	1.1444	.09288	132
Running 10 m	More successful	1.9190	.11918	69
	Less successful	1.9720	.13033	63
	Total	1.9443	.12695	132
Running 15 m	More successful	2.5471	.14705	69
	Less successful	2.6589	.17299	63
	Total	2.6005	.16891	132
Running 20 m	More successful	3.2187	.17648	69
	Less successful	3.3748	.21971	63
	Total	3.2932	.21245	132
T- test of agility	More successful	10.6864	.63245	69
	Less successful	11.4094	.77540	63
	Total	11.0314	.78968	132
Line agility test	More successful	12.7242	.82922	69
	Less successful	13.3541	.85852	63
	Total	13.0248	.89750	132

All mean values of motor skills variables have decreasing group indicators. This means that members of a more successful group have better values and members of a group of less successful basketball players have lower values. Basketball players from the more successful group compared to their peers from the less successful group have better reflective abilities in all CMJ tests and the standing long jump test. They also have better indicators in all tests of locomotor speed by running. It should be noted that the results in the running tests are inversely scaled, i.e. lower values represent better capabilities. The same is the case

with the results of the agility tests, which are lower or better in the better group of basketball players. All multivariate tests (Pillai's Trace, Wilks' Lambda, Hotelling's Trace and Roy's Largest Root) confirm that groups of basketball players formed by quality level differ significantly by linear combination of dependently variable motor parameters (Table 3). The statistical significance of all tests is at the highest level and amounts to Sig. =.000.

Table 3. Multivariate significance tests of group differences of basketball players by parameters of motor skills

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.999	21361.719[b]	11.000	120.000	.000	.999
	Wilks' Lambda	.001	21361.719[b]	11.000	120.000	.000	.999
	Hotelling's Trace	1958.158	21361.719[b]	11.000	120.000	.000	.999
	Roy's Largest Root	1958.158	21361.719[b]	11.000	120.000	.000	.999
KVALGR	Pillai's Trace	.346	5.766[b]	11.000	120.000	.000	.346
	Wilks' Lambda	.654	5.766[b]	11.000	120.000	.000	.346
	Hotelling's Trace	.529	5.766[b]	11.000	120.000	.000	.346
	Roy's Largest Root	.529	5.766[b]	11.000	120.000	.000	.346

Such data from multivariate tests allow us to use univariate F tests to investigate the statistical taxonomic significance of all variables of the motor skills of cadet basketball players for classifying respondents into groups formed by quality level.Previously, Levene's test was used to check the assumption of violation of equality of variance. Considering that no variable has a significant value of Levan's test, i.e. Sig<.05 we can state that the variances are equal. (Table 4.) Tests the null hypothesis that the error variance of the dependent variable isequal across groups.

Table 4. Levene's test of equality of variance of motor ability variables of groups of basketball players of different quality levels

	F	df1	df2	Sig.
CMJ hands on hip	.488	1	130	.486
CMJ with momentum	.126	1	130	.724
CMDJ40 jump	.083	1	130	.774
STIFNESS - 10 jumps	.091	1	130	.763
A long jump from a standing position	.003	1	130	.953
Running 5 m	.700	1	130	.404
Running 10 m	.061	1	130	.805
Running 15 m	.676	1	130	.412
Running 20 m	1.862	1	130	.175
T- test of agility	2.508	1	130	.116
Line agility test	.014	1	130	.905

The results of the Univariate F tests for the motor skills variables of cadet basketball players of different quality levels are shown in Table 5.

Table 5. Univariate F tests for variables of motor abilities of cadet basketball players of different quality levels

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
KVALGR	CMJ hands on hip	81.364	1	81.364	3.504	.063	.026
	CMJ with momentum	153.515	1	153.515	3.902	.050	.029
	CMDJ40 jump	77.273	1	77.273	2.993	.086	.023
	STIFNESS - 10 jumps	180.377	1	180.377	7.804	.006	.057
	A long jump from a standing position	1007.344	1	1007.344	1.813	.181	.014
	Running 5 m	.027	1	.027	3.184	.077	.024
	Running 10 m	.092	1	.092	5.949	.016	.044
	Running 15 m	.412	1	.412	16.086	.000	.110
	Running 20 m	.802	1	.802	20.403	.000	.136
	T- test of agility	17.214	1	17.214	34.707	.000	.211
	Line agility test	13.067	1	13.067	18.373	.000	.124

A single statistically significant taxonomic value (Sig<.05) has: Line and T test of agility, speed of running the section 10 m, 15 m, 20 m, CMJ Stiffness 10 jumps and CMJ with free hands. Variable standing long jump, CMJ40 jump, CMJ - hands on hips and running a section of 5 meters does not contribute statistically significantly to the group differences in terms of the level of quality of cadet basketball players.

The order of importance of the influence of the group level of quality on the variables of motor skills was established by looking at the value of the Partial Eta Squared column, whose values represent the proportion of variance in the dependent variable (motor skills) explained by the independent variable (quality group).

The order of influence of motor parameters is as follows: t- test of agility 21.1%, running 20 m 13.6%, line agility test 12.4%, running 15 m 11.0%, CMJ Stiffness 10 jumps 5.7%, running 10 m 4.4%, CMJ free hand 2.9%. The analyzed 2 groups of cadet basketball players grouped according to level of quality, statistically significantly differ in the analyzed parameters of motor skills. The group of better quality basketball players has better values in all parameters. The order of influence of the variables on the classification into different quality groups is: t- test of agility (21.1%), running 20 m (13.6%), linear agility test (12.4%), running 15 m (11.0%), CMJ Stiffness 10 jumps (5.7%), 10 m run (4.4%), CMJ - free hands (2.9%).

CONCLUSION

The research is based on a sample of 132 cadet basketball players (a more successful group of basketball players counting 69 and a less successful group of basketball players counting63 respondents) from 12 participating clubs of the cadet basketball league of Sarajevo Canton/Federation of Bosnia and Herzegovina with the aim of determining the structure of measures of somatic characteristics of young basketball players. The set of variables in this research is composed of 12 motor tests.

Among the motor tests for evaluating locomotor speed, agility and reflex power, the following tests were applied: time to run sections of 5, 10, 15, and 20 m, T - agility test, Line agility test, Zig - Zag agility test, vertical reflection on feet - hands on to the side (sqaut jump), vertical reflection on the feet with a

swing of the hands (sqaut hand free jump), vertical reflection after jumping from a height of 40 cm (drop jump), 10 consecutive vertical reflections on the feet (repeating vertical jumps), horizontal horizontal jump on the feet with reflection from the place (standing long jump).

The above analyzes resulted in the following conclusions: The total sample of basketball players divided into two groups of cadet basketball players, grouped according to quality, statistically differ significantly in terms of the analyzed motor qualities. The group of better quality basketball players has better values in all motor skills.

The obtained results can be applied in the planning and programming of the training process in working with young basketball players, as well as a good basis for scientists for future research on the population of young basketball players.

REFERENCES

1. Bayios, I.A., Bergeles, N.K., Apostolidis, N.G., Noutsos, K.S., & Koskolou, M.B. (2006). Anthropometric, body composition and somatotype differences of Greek elite female basketball, volleyball and handball players. Jurnal of Sports Medicine and Physical Fitness, 46(2), 271-280.
2. Carvalho, H. M., Coelho E Silva, M. J., Figueiredo, A. J., Gonçalves, C. E., Philippaerts,R. M., & Malina, R. M. (2011). Predictors of maximal short-term power outputs in basketball players 14-16 years. European Journal of Applied Physiology, 111(5), 789– 796. https://doi.org/10.1007/s00421-010-1703-4
3. Carvalho, H. M., Gonçalves, C. E., Collins, D., & Paes, R. R. (2018). Growth, functional capacities and motivation for achievement and competitiveness in youth basketball: an interdisciplinary approach. Journal of Sports Sciences, 36(7), 742–748. https://doi.org/10.1080/02640414.2017.1340654
4. Carvalho, HM., Coelho e Silva, MJ., Figueiredo, AJ., Goncalves CE, Castagna, C., Philippaerts, RM., Malina, RM. (2011): Cross-validation and reliability of the line-drill test of anaerobic performance in basketball players 14-16 years. Strength Cond Res. Apr;25(4):1113-9.
5. Conte, D., Smith, M. R., Santolamazza, F., Favero, T. G., Tessitore, A., & Coutts, A. (2019). Reliability, usefulness and construct validity of the Combined Basketball Skill Test (CBST). Journal of Sports Sciences, 37(11), 1205–1211. https://doi.org/10.1080/02640414.2018.1551046
6. Cormery B, Marcil M, Bouvard M. (2008). Rule change incidence on physiological characteristics of elite basketball players: a 10-year-period investigation. Br J Sports Med. 42(1):25-30
7. Cui,Y., Liu, F., Bao, D., Liu, H., Zhang, S., Gómez, MÁ. (2019). Key Anthropometric and Physical Determinants for Different Playing Positions During National Basketball Association Draft Combine Test. Front Psychol. 22;10:2359.
8. Grgantov, Z., Katić, R., & Janković, V. (2006). Morphological characteristics, technical and situation efficacy of young female volleyball players. Collegium Antropologicum, 30(1), 87- 96.
9. Hadžić, R., Bjelica, D., & Popović, S. (2012) Comparative study of anthropometric measurement and body composition between elite basketball and volleyball players. Research in Physical Education, Sport and Health, 1(1), 103-108.
10. Hara, M., Shibayama, A., Takeshita, D., & Hay, D.C. (2008). A comparison of the mechanical effect of arm swing and countermovement on the lower extremities in vertical jumping. Human movement science, 27, 636-648.
11. Heishman, A. D., Daub, B. D., Miller, R. M., Freitas, E. D. S., Frantz, B. A., & Bemben,
12. M. G. (2020). Countermovement Jump Reliability Performed with and without an Arm Swing in Ncaa Division 1 Intercollegiate Basketball Players. Journal of Strength & Conditioning Research (Lippincott Williams & Wilkins), 34(2), 546–558.
13. Köklü, Y., Alemdaroğlu, U., Koçak, FÜ., Erol, AE., Fındıkoğlu, G. (2011). Comparison of chosen physical fitness characteristics of Turkish professional basketball players by division and playing position. J Hum Kinet. 30:99-106.
14. Kollos, C., & Tache, S. (2013). Anthropometric indicators and aerobic exercise capacity in young basketball players. Palestrica of the Third Millennium Civilization & Sport, 14(3), 195–199.
15. Loghman, K., Aboalfazl, F., & Ali, Z. (2019). Modeling and designing indices of talent identification in the field of basketball based on physical-motor, psychological, anthropometric, and physiological parameters. International Archives of Health Sciences, 6(2), 59–64. https://doi.org/10.4103/iahs.iahs_58_18

16. Markovic G, Dizdar D, Jukic I, Cardinale M. (2004) Expert model of decision-making system for efficient orientation of basketball players to positions and roles in the game-- empirical verification. (2001). Coll Antropol. 25(1):141-52.
17. Sampaio, J., Ibáñez, G. S., & Feu, S. (2004). Discriminative Power of Basketball Game- Related Statistics by Level of Competition and Sex. Perceptual & Motor Skills, 99(3), 1231–1238. https://doi.org/10.2466/pms.99.3f.1231-1238
18. Sampaio, J., Janeira, M., Ibáñez, S. Lorenzo, A. (2006). Discriminant analysis of game- related statistics between basketball guards, forwards and centres in three professional leagues. Eur. J. Sport Sci., 6, 173–178. [CrossRef]
19. Toriola, A.L., Adeniran, S.A., & Ogunremi P.T. (1987). Body composition and anthropometric characteristics of elite male basketball and volleyball players. The Journal of Sports Medicine and Physical Fitness, 27(2), 235-239.
20. Tsunawake, N.,Tahara, Y., Moji, K., Muraki, S., Minowa, K., & Yukawa, K. (2003). Body composition and physical fitness of female volleyball and basketball players of the Japan inter-high school championship teams. The journal of physiologocal anthropology and applied human science, 22(4), 195-201.

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