Sport SPA Vol. 21 Issue 1: 39-45
DOI: 10.51558/1840-4561.2024.21.1.39

DIFFERENCES IN THE SOMATIC CHARACTERISTICS OF THE SUCCESSFUL AND LESS SUCCESSFUL GROUPS OF BASKETBALL PLAYERS OF CADET AGE

Alem Kukić[1], Aleksa Stanković[2], Nermin Salkanović[3]

[1]Primary school "Meša Selimović", Sarajevo, Bosnia and Herzegovina
[2]Faculty of Economics, University of Zenica, BiH
[3]Faculty of Philosophy, University of Zenica, Bosnia and Herzegovina

Original scientific paper

Abstract
The research is based on a sample of 132 cadet basketball players (69 successful cadets and 63 less successful cadets) from 12 participating clubs of the Sarajevo Canton cadet basketball league. The main goal of the research was to determine the structure of the somatic characteristics of young cadet basketball players using a cross-section. The total sample of basketball players divided into two groups of cadet basketball players, divided according to quality, statistically significantly differ in the analyzed somatic parameters. The group of better quality basketball players has better values in all analyzed somatic characteristics. The sample of variables in this research consisted of a set of 14 measuring instruments used to assess the somatic characteristics of young basketball players. 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: - multivariate analysis of variance (Manova) to determine the differences between groups of successful and less successful basketball players by somatic characteristics; - univariate F tests to determine significance for classifying respondents into groups based on the level of their basketball performance.
The results of this research can be useful to coaches for better programming of the training process in working with young basketball players, as well as a good basis for scientists for future research on populations of young basketball players.
Key words: Multivariate analysis (Manova), cadets, basketball, somatic characteristics

INTRODUCTION

Achieving high performance results in sports depends on numerous factors. Performance in basketball competition depends on many factors, the most important of which are the player's somatic structure, motor, technical, tactical, physiological and psychological preparation.
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. Anthropometric measurements, determination of their desirable profiles, as well as profiles of motor skills and their comparison with the profiles of top basketball players have become fundamental research areas for sports training specialists (Dežman, B.; Trninić, S.; Dizdar, D., 2001; Montgomery, P.G. ; Pyne, D.B.; Dorman, J.C., Janeira, S., Lorenzo, 2006). Somatic profiles of basketball players are widely recognized as a crucial factor in the selection process and as an important predictor of performance (Ostojic, S.M.; Mazic, S.; Dikic, N. (2006); Bayios, I.A.; Bergeles, N.K.; Apostolidis, N.G.; Noutsos, K.S. ; Koskolou, D.J.; Fenn, A.J. (2010). Anthropometric characteristics, such as body fat, skin thickness, height, arm span, and body girth are determined as the main components of elite basketball players, so they are often considered as assumptions and indicators of level and game (Vaquera, A.; Santos, S.; Villa, J.G.; Morante, J.C.; García-Tormo, V. (2015).chez-Muñoz, C.; Zabala, M.; Williams, K., 2012; Horička, J.; 2016). Usually, a key component in the process of assigning specific player positions is body height (Dežman, B.; Trninić, S.; Dizdar, D, 2004), in which the tallest players (near the basket) are chosen as centers, and those with lower growth, (further from the basket). (Ostojic, S.M.; Mazic, S.; Dikic, N. (2006); Sallet, P.; Perrier, D.; Ferret, J.; Vitelli, V.; Baverel, G. (2005). Precisely for these reasons, this paper is focused on researching the structure of the somatic characteristics of young basketball players in Sarajevo Canton.

METHODS

Participants

The sample of respondents included a group of 132 (the more successful group counts 69, and the less successful 63 respondents) cadet basketball players from 12 clubs participating in the Sarajevo Canton

cadet basketball league. For more detailed analysis, clubs and basketball players are divided into subgroups depending on the placement in the league competition, evaluation of the individual quality of basketball players.

Variables

Competitive performance of basketball players

According to this criteria, basketball players are divided into two groups:

- Group 1 – more successful basketball players
- 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 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 individual variables of somatic characteristics in relation to the groups formed according to the success 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 (a more successful group of basketball players that counts 69 and a less successful group of basketball players that counts 63 cadets) were subjected to Multivariate Analysis of Variance in order to determine differences in the levels and structures of sets of variables of somatic characteristics. The mean values and standard deviations of the variables of somatic characteristics 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 variables of somatic characteristics of basketball players of different quality groups

Variable	Group by quality	Mean	Std. Deviation	N
Height	More successful	183.912	7.5226	69
	Less successful	179.827	9.4129	63
	Total	181.962	8.6892	132
Body mass	More successful	73.158	12.1629	69
	Less successful	69.011	11.8489	63
	Total	71.179	12.1475	132
Mass height index	More successful	21.509	2.5906	69
	Less successful	21.248	2.7122	63
	Total	21.384	2.6424	132
Reachable height	More successful	239.400	10.1103	69
	Less successful	234.525	11.9288	63
	Total	237.073	11.2418	132
Arm span	More successful	187.603	9.4312	69
	Less successful	182.819	9.5529	63
	Total	185.320	9.7527	132
Hand span	More successful	22.629	1.4424	69
	Less successful	22.244	1.6814	63
	Total	22.445	1.5669	132
Relat. non-lean mass	More successful	64.577	10.2636	69
	Less successful	59.346	9.1146	63
	Total	62.080	10.0438	132
Relative lean mass	More successful	36.443	6.1993	69
	Less successful	33.267	5.4611	63
	Total	34.927	6.0499	132
Total body water	More successful	47.399	7.4716	69
	Less successful	43.608	6.6715	63
	Total	45.589	7.3250	132
Triceps curl	More successful	12.428	4.4830	69
	Less successful	13.306	4.2754	63
	Total	12.847	4.3906	132

All mean values of variables of somatic characteristics have decreasing group indicators, i.e. members of a more successful group have better results, and members of a group of less successful basketball players have lower values. The successful groups are taller, have a higher body mass, a higher mass-height index, a higher reach height, a wider arm span, a wider hand span, a higher percentage of muscle and lean mass, the total amount of body water and a lower triceps skinfold value.

Before moving on to the Multivariate Analysis of Variance, Box's test was used to check the assumption of violation of homogeneity of variance and covariance. Given that the value of Sig is greater than 0.001 and is .002, it can be concluded that this assumption is not violated (Table 3.)

Table 4. Box's test of homogeneity of variance and covariance matrices

Box's Test of Equality of Covariance Matrices[a]

Box's M	97.821
F	1.634
df1	55
df2	53645.793
Sig.	**.002**

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups. a. Design: Intercept + KVALGR

Table 5. Multivariate significance tests of group differences of basketball players by somatic parameters

Effect		Value	F	Hypoth df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	1.000	311647.558[b]	10.000	121.000	.000	1.000
	Wilks' Lambda	.000	311647.558[b]	10.000	121.000	.000	1.000
	Hotelling's Trace	25755.99	311647.558[b]	10.000	121.000	.000	1.000
	Roy's Largest Root	25755.99	311647.558[b]	10.000	121.000	.000	1.000
KVGRUPA	Pillai's Trace	.173	2.530[b]	10.000	121.000	.008	.173
	Wilks' Lambda	.827	2.530[b]	10.000	121.000	.008	.173
	Hotelling's Trace	.209	2.530[b]	10.000	121.000	.008	.173
	Roy's Largest Root	.209	2.530[b]	10.000	121.000	.008	.173

b. Exact statistic

Table 6. Levene's test of equality of variance of variables of somatic characteristics of groups of basketball players of different quality levels

	F	df1	df2	Sig.
Body height	1.492	1	130	.224
Body mass	.106	1	130	.745
Mass height index	.437	1	130	.510
Reachable height	1.077	1	130	.301
Arm span	.003	1	130	.958
Hand span	.197	1	130	.658
Relat. lean mass	.363	1	130	.548
Relative muscle mass	.450	1	130	.504
Total body water	.309	1	130	.579
Triceps curl	.004	1	130	.948

All multivariate tests (Pillai's Trace, Wilks' Lambda, Hotelling's Trace and Roy's Largest Root) confirm that groups of basketball players grouped according to quality level differ significantly by linear combination of dependently variable somatic characteristics (Table 5). The statistical significance of all tests is at a high level and amounts to Sig. =.008. Such data from multivariate tests allow us to use univariate F tests to investigate the statistical taxonomic significance of all variables of somatic characteristics 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 s that the variances are equal. (Table 6.)

The results of Univariate F tests for variables of somatic characteristics of cadet basketball players of different quality levels are shown in Table 7.

Table 7. Univariate F tests for variables of somatic characteristics of cadet basketball players of different quality levels

Source	Dependent Variable		Type III Sum Squer	df	Mean Square	F	Sig.	Partial Eta Squared
KVALGR	Body height		549.436	1	549.436	7.646	.007	.056
	Body mass		566.310	1	566.310	3.923	.050	.029
	BMI		2.245	1	2.245	.320	.573	.002
	Reachable height		782.518	1	782.518	6.449	.012	.047
	Arm span		753.652	1	753.652	8.369	.004	.060
	Hand span		4.870	1	4.870	1.999	.160	.015
	Relat.nonmusc. mass		901.049	1	901.049	9.512	.002	.068
	Relative muscle mass		332.352	1	332.352	9.682	.002	.069
	Total body water		473.189	1	473.189	9.383	.003	.067
	Triceps curl		25.434	1	25.434	1.323	.252	.010

The variables body height, body mass, reaching height, arm span, relative lean mass, relative muscle mass and total body water have a unique statistically significant taxonomic value (Sig<.05). The variables BMI, hand span and tricep fold do not contribute statistically significantly to the group differences in quality level of cadet basketball players.

Insight into the value of the Partial Eta Squared column allows us to analyze the importance (magnitude) of the influence of the group level of quality on the variables of somatic characteristics. Since Partial Eta Squared represents the proportion of variance in the dependent variable (somatic characteristics) explained by the independent variable (quality group), it is also possible to determine the order of importance of that influence.

In this case, the order of influence is as follows:

- relative muscle mass 6.9%
- relative lean mass 6.8%
- total body water 6.7%
- hand span 6.0%
- body height 5.8%
- reach height 4.7%
- body mass 2.9%

It can be concluded that the two groups of cadet basketball players formed by quality are statistically significantly different in the analyzed somatic parameters. The group of better quality basketball players has better values in all parameters. The order of influence of variables on classification into different quality groups is: relative muscle mass (6.9%), relative lean mass (6.8%), total body water (6.7%), arm span (6.0%), body height (5.8%), reaching height (4.7%) and body mass (2.9%).

CONCLUSION

The goal of this transversal research of confirmatory type is reflected in the effort to use an objective, scientifically and methodologically based approach to verify the existence of cadet basketball players in relation to the level of their success in the game and the analyzed somatic characteristics. This approach should offer information essential for the procedures of identifying, developing and selecting young talented basketball players for the basketball. Achieving this goal enables an approach in which

the planning and programming of the training process will emphasize the development of the abilities and skills most essential for success in the basketball game and which can be effectively influenced by adequate training.

The research is based on a sample of 132 cadet basketball players (a more successful group of basketball players – 69, and a less successful group of basketball players - 63 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 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, differ significantly in the analyzed somatic parameters. The group of better quality basketball players has better values in all parameters. The order of influence of variables on classification into different quality groups is: relative muscle mass (6.9%), relative lean mass (6.8%), total body water (6.7%), arm span (6.0%), body height (5.8%), reaching height (4.7%) and body mass (2.9%).

The obtained results can be useful to all trainers for better programming of training content in terms of selection of training content, dosage of load and methodological procedures.

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. Ben Abdelkrim, N.B.; Chaouachi, A.; Chamari, K.; Chtara, M.; Castagna, C. Positional role and competitive-level differences in elite-level men's basketball players. J. Strength Cond. Res. 2010, 24, 1346–1355. [CrossRef] [PubMed]
3. Berdejo-del-Fresno, D., & Gonzalez-Rave, J. M. (2013). The comparative use of the Beep or Yo-Yo test in high-level British female basketball players. International SportMed Journal, 14(3), 119–126.
4. Berri, D.J.; Brook, S.L.; Fenn, A.J. From college to the pros: Predicting the NBA amateur player draft. J. Prod. Anal. 2010, 35, 25–35. [CrossRef]
5. Carvalho, H. M., Coelho E Silva, M. J., Figueiredo, A. J., Gonçalves, C. E., Philippaerts,
6. 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
7. 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
8. 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.
9. Delextrat, A., & Cohen, D. (2009). Strength, power, speed, and agility of women basketball players according to playing position. Journal of Strength and Conditioning Research, 23 (7), 1974-1981.
10. Dežman, B.; Trnini´c, S.; Dizdar, D. Expertmodel of decision-making systemfor efficient orientation of basketball players to positions and roles in the game–Empirical verification. Coll. Antropol. 2001, 25, 141–152. [PubMed]
11. Glatthorn, J.F., Gouge, S., Nussbaumer, S., Stauffacher, S., Impellizzeri, F.M., & Maffiuletti, N.A. (2011). Validity and reliability of Optojump photoelectric cells for estimating vertical jump height. Journal of Strength and Conditioning Research, 25(2), 556–560.
12. Grgantov, Z. (2002). Anthropometric characteristics of elite Croatian male volleyball players. U: Milanović, D. Prot, F. (ur.), Zbornih radova međunarodne znanstvene konferencije "Kinesiology new perspectives", Zagreb, 283-286. Zagreb: Sveučilište u Zagrebu, Kineziološki fakultet.
13. Grgantov, Z. (2005). Identifikacija morfoloških i motoričkih sklopova odbojkašica u odnosu prema uzrastu i situacijskoj učinkovitosti. Doktorska disertacija. Zagreb: Sveučilište u Zagrebu, Kineziološki fakultet.
14. Grgantov, Z., Katić, R., & Janković, V. (2006). Morphological characteristics, technical and situation efficacy of young female volleyball players. Collegium Antropologicum, 30(1), 87- 96.

15. 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.
16. Salaj, S., & Marković, G. (2011). Specificity of jumping, sprinting, and quick change-of direction motor abilities. Journal of Strength and Conditioning Research, 25(5), 1249- 1255.
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]

CORRESPODENCE TO:
ALEM KUKIĆ
E-MAIL: alem.kukic76@gmail.com