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Anthropometric Characteristics and Body Composition of Elite Youth Male Basketball Players – Participants of Junior Euroleague

Características Antropométricas y Composición Corporal de Jugadores de Baloncesto Masculino Juveniles de Élite - Participantes de Junior Euroleague

Milovan Ljubojevic; Danilo Bojanic; Aldijana Nokic; Pavle Malovic & Dragan Bacovic

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SUMMARY: The aim of this research was to determine the differences among the junior basketball players of the BC Partizan and BC Buducnost Voli, in terms of their anthropometric characteristics and body composition. A sample of 22 subjects was divided into two sub-samples. The first sub-sample of the subjects consisted of 11 players of the basketball team Partizan (Serbia), of the average age 17.18 ± 0.50, while the other sub-sample consisted of 11 players of basketball team Buducnost Voli (Montenegro), based on the average age of 17.28 ± 0.30. All players were tested in Podgorica, in a lasting period of two days, while they held international friendly tournament, just before the start of the national championships. Anthropometric characteristics in the body composition were evaluated by a battery of eleven variables: body height (cm), body weight (kg), triceps skinfold, back skinfold, biceps skinfold, abdominal skinfold, thighs skinfold, calf skinfold, body mass index (BMI), percentage of fat and muscle mass (kg). Differences in anthropometric characteristic and composition of the body of the male junior basketball players of two basketball teams were determined by using a discriminatory parametric procedure with t-test for small independent samples. It was found that the basketball players of Partizan are taller and have a lower body mass. Also, there are significant statistical differences by seven: triceps skinfold, back skinfold, biceps skinfold, abdominal skinfold, calf skinfold, thigh skinfold and BMI.

KEY WORDS: Anthropometric characteristics; Body composition; Junior male basketball players.

INTRODUCTION

Sports games, as polystructural sports, abound in movements that vary in length of movement, directions and directions and in this sense require players who possess motoric capability of realizing such movements in the most efficient way (Ochoa *et al*., 2014; Bojanic *et al*., 2020). For this reason, in the modern selection of basketball players, great attention is paid to the analysis of the motor potential of young basketball players (Ljubojevic & Nikolic, 2012). The strategy of the game in basketball tends to reach the best possible position to hit the goal which is, unlike other sports games, at a certain height (3.05 m). It is this fact that distinguishes basketball from other sports, among other things, during the selection of players for this sport. Basketball looks for players with large values of longitudinal dimensions (Koprivica, 1994; Guarav *et al*., 2009; Karalejic & Jakovljevic, 2009), such as: body height, arm length, leg length, arm span, hand length, shoulder width, hips, knee joint width, ankle joint width. Also, other parameters of the morphological structure of the body are very important: body mass, muscle mass, bone mass, body mass index, skinfolds, etc. (Riezebos *et al*., 1983; Shambaugh *et al*., 1991; Ostojic *et al*., 2006).

Basketball is a very popular sport in Serbia. Serbia is one of the most successful national teams when it comes to medals won at the European Championships, World Championships and Olympic Games. A large number of children decide to train basketball in Serbia, so both competition and selection are always good. Younger national selections, as well as younger local selections from Serbia, achieve outstanding results in international competitions. When it comes to Partizan, it is a club with a very long tradition, 21 national championship titles won, six times cup winner, six times winner of the Adriatic

Faculty for Sport and Physical Education, University of Montenegro, Niksic, Montenegro.

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League, three times winner of the Radivoj Korac Cup and the biggest success is winning the European Champions Cup in 1992. years. But, the most important of all is the large number of players who were part of younger generations that played for Partizan, became leaders in this game, on national, international and local level.

Basketball is the second most popular sport in Montenegro (Ljubojevic *et al*., 2020a). Montenegrins, second in the world in terms of average height (Popovic, 2018), are morphologically very predestined for basketball (Ljubojevic *et al*., 2020b). Buducnost Voli is the most trophy-winning club in Montenegro, with 16 national championship titles and 16 national cups won, once winner of the Adriatic League. Regular participant of international competitions under the auspices of ULEB. Also, they have a good basketball school, from where players are formed and play in local clubs and national team of Montenegro, which is the smallest country that has ever participated in the world championship, in China in 2019 (Ljubojevic *et al*., 2020a).

In modern basketball, only players with perfect motor skills, large longitudinal dimensions of the body, along with desirable values of other morphological characteristics, along with essential sports intelligence, talent and appropriate psychological characteristics, can achieve the highest results and achieve long and successful sports careers. This is precisely the reason for analyzing the morphological characteristics and body composition of elite young basketball players, members of the two largest and most successful clubs in two countries, champions in their age group in national championships. Also, both teams are regular participants of the Euroleague for juniors.

Due to all of the above, the aim of this research was to show the values of the morphological characteristics of two male basketball teams. Specifically, to compare variables of the best Serbian male junior basketball club with the variables of the best Montenegrin male junior basketball club.

MATERIAL AND METHOD

Sample of subjects. A sample of the subject consists of total of 22 top-level male junior players who were members of two basketball teams that participated at Euroleague for juniors, and who won the national championships of Serbia and Montenegro. The first sub-sample of the subjects consisted of 11 players of Basketball club Partizan (Serbia), average age 17.18 ± 0.50, and 11 players of Basketball club Buducnost Voli (Montenegro), average age 17.28 ± 0.30. The players were tested in Podgorica, where they participated in an international friendly tournament.

Sample of measures. Anthropometric measurements were taken according to the IBP-International Biology Program recommendations. For the purpose of this study 8 morphological measures have been taken: body height, body weight, triceps skinfold, biceps skinfold, back skinfold, abdominal skinfold, calf skinfold, thigh skinfold, and 3 body composition assessment variables: body mass index (BMI), fat percentage and muscle mass. Tanita body fat scale – model BC-418MA was used to evaluate the body composition. The principle of this scale is based on indirect measurement of the body composition; a safe electrical signal is transmitted through the body via electrodes located in the standalone unit. Tanita scale, thanks to its athletics mode, enables athletes to closely monitor their body weight, health condition and form with all relevant parameters. Anthropometer and caliper were used for morphological measurements.

Data processing method. The data obtained through the research are processed by descriptive and comparative statistical procedures. For each variable, central and dispersion parameters, as well as asymmetry and flattening measures are processed. Differences in anthropometric characteristics and the composition of the body of the basketball players of these two national teams were determined by using a discriminatory parametric procedure with t-test for small independent samples, with statistical significance of $p<0.05$.

RESULTS

Basic descriptive statistical parameters of anthropometric variables and body composition of the basketball players of the two teams, where the values of central measurements and dispersion tendencies are calculated, are presented in Tables I and II: minimal (Min) and maximal (Max) values, arithmetic mean (Mean), standard deviation (S.D.), coefficient of curvature (Skewness) and elongation (Kurtosis). First, the central and dispersion parameters of the variables were analyzed to evaluate the anthropometric characteristic and body composition of the male basketball players of BC Partizan (Table I).

As shown in Table I, it can be noted that all the variables are placed within the normal distribution boundaries, which results are based on dispersion and central parameters. Following the skewness values, it can be observed that in the variables of triceps skinfolds (0.64), back skinfolds

(0.27), abdominal skinfolds (1.85), calf skinfolds (0.47) and BMI (0.96) show that most of the results of these folds are among lower values, which leads us to a positive conclusion, because higher values for subcutaneous fat represent a factor of distraction for professional athletes. Other variables were mostly in higher values: age (1.06), height (-0.36), percentage of fat (-1.44) and muscle mass (-0.26). By looking at the results of the peak of the Gaussian curve (kurtosis), it is evident that for most variables there is no significant deviation from the normal distribution of the results. The most significant deviation from normal values is visible in the variable's abdominal skinfold (4.03) and percentage of fat (1.10).

Table II shows the central and dispersion parameters of the variables that were analyzed to evaluate the anthropometric characteristics and body composition of the junior male basketball players of BC Buducnost Voli.

Table I. Descriptive data for BC Partizan Belgrade junior basketball players (N=11).

Variable	Min	Max	Mean±Sd	Skew	Kurt
Age	16.1	17.8	17.18 ± 0.50	-1.06	1.07
Body height (cm)	183.3	206.6	196.45 ± 6.69	-0.36	0.31
Body weight (kg)	69.7	102.3	83.18 ± 9.99	0.39	-0.30
Triceps skinfold	5.1	11	7.68 ± 1.83	0.64	-0.47
Back skinfold	6.4	9.2	7.83 ± 0.85	0.27	-0.46
Biceps skinfold	3.1	5.2	3.92 ± 0.88	0.56	-1.65
Abdominal skinfold	5.4	14.3	7.95 ± 2.49	1.85	4.03
Calf skinfold	3.4	14.2	8.33 ± 3.61	0.47	-1.01
Thigh skinfold	5.4	13.4	9.13 ± 3.05	0.13	-1.72
Body mass index	19.6	24.8	21.56 ± 1.70	0.96	0.17
Percent. of fat (%)	2	16	12.20 ± 4.76	-1.44	1.10
Muscle mass (kg)	33.4	48.6	41.27 ± 4.74	-0.26	-0.46

Table II. Descriptive data for BC Buducnost Voli junior basketball players (N=11).

Variable	Min	Max	Mean ± Sd	Skew	Kurtosis
Age	16.9	17.7	17.28 ± 0.30	-0.21	-1.53
Body height (cm)	180.0	208.0	191.27 ± 8.81	0.46	-0.69
Body weight (kg)	70.2	92.7	84.54 ± 7.04	-0.87	0.10
Triceps skinfold	6.3	17.4	10.78 ± 3.19	0.71	0.62
Back skinfold	7.4	14.1	10.46 ± 2.27	0.07	-1.14
Biceps skinfold	3.3	9.6	5.82 ± 2.23	0.67	-0.70
Abdominal skinfold	7.4	21.4	13.28 ± 4.90	0.34	-1.40
Calf skinfold	9.3	18.2	13.51 ± 2.78	0.15	-1.03
Thigh skinfold	10.2	20.4	14.66 ± 3.01	0.57	-0.18
Body mass index (BMI)	20.1	25.8	23.19 ± 1.82	-0.48	-0.73
Percentage of fat (%)	1.9	18.2	13.01 ± 5.08	-1.22	1.21
Muscle mass (kg)	32.5	43.5	38.02 ± 3.14	-0.34	0.19

Table III. Descriptive data and t-test of 22 junior basketball players members of two male basketball clubs (Partizan Belgrade and Buducnost Voli).

	Partizan	Buducnost		
Variables	Mean±Std.	Mean±Std.	t	Sig. (2-
Age	17.18 ± 0.50	17.28 ± 0.30	-.575	.573
Body height (cm)	196.45 ±	191.27 ± 8.81	1.551	.138
Body weight(kg)	83.18 ± 9.99	84.54 ± 7.04	-.368	.717
Triceps skinfold	7.68 ± 1.83	10.78 ± 3.19	-2.799	.013
Back skinfold	7.83 ± 0.85	10.46 ± 2.27	-3.590	.003
Biceps skinfold	3.92 ± 0.88	5.82 ± 2.23	-2.624	.021
Abdominal	7.95 ± 2.49	13.28 ± 4.90	-3.217	.006
Calf skinfold	8.33 ± 3.61	13.51 ± 2.78	-3.774	.001
Thigh skinfold	9.13 ± 3.05	14.66 ± 3.01	-4.283	.000
Body mass index	21.56 ± 1.70	23.19 ± 1.82	-2.176	.042
Percentage of fat	12.20 ± 4.76	13.01 ± 5.08	-.385	.704
Muscle mass (kg)	41.27 ± 4.74	38.02 ± 3.14	1.899	.074

Based on the central and dispersion parameters of the values of the skewness and the kurtosis of the players of Buducnost Voli it can be stated that all the variables are within the normal distribution boundaries and that the values are very similar to those of the basketball players from Partizan Belgrade. However, a comparative statistical procedure, t-test (Table III), will show whether this is statistically significant. By the value of the skewness, it can be noticed that most results are normally distributed. The largest significant deviation from the normal values is seen in the variables percentage of fat (1.21) where there are more results accumulated around the distribution center, back skinfold (-1.14) and age (-1.53), while kurtosis values (body height, biceps skinfold, abdominal skinfold, calf skinfold, thigh skinfold and BMI) show that most results are about the final values of these variables.

In order to determine whether there are statistically significant differences in the analyzed variables of the top basketball players of these two teams, the statistical procedure t- test (Table III) was applied.

Based on results of t-test (Table III) it was found that male basketball players of two clubs have statistically significant differences by seven variables: triceps skinfold, back skinfold, biceps skinfold, abdominal skinfold, calf skinfold, thigh skinfold and BMI.

DISCUSSION

Monitoring the anthropological characteristics of young athletes is an obligation imposed by modern sports. Without an adequate process of monitoring and analyzing certain anthropological characteristics of young athletes, there is no quality selection. Also, timely reaction in the case of diagnosing weaker results compared to the expected ones is very important. Furthermore, comparing and striving for the results of top players or teams is the main tendency in modern basketball. Precisely for this reason, we compared two young teams, champions of their countries, who are regular participants of the Euroleague for juniors.

If we compare the average values of BC Partizan and BC Buducnost Voli players, we can conclude the following: BC Partizan players are younger, taller than their peers from BuducnostVoli and have a lower body mass value. Also, Partizan players have other lower values that are at the level of statistical significance: triceps skinfold, back skinfold, biceps skinfold, abdominal skinfold, calf skinfold, thigh skinfold and BMI, as well as a lower value of percentage of fat, but not at the level of statistical significance. When it comes to muscle mass, Partizan players have higher values, but not at the level of statistical significance.

If we compare the values for these two teams with the values of some other club or national teams, then we can say that the results are very interesting. Namely, the average height of the players of Partizan (196.45), of Buducnost Voli (191.27), while the height values of the players of the team that won the Euroleague for juniors in the same year Real Madrid are (197.72). Also, if we compare with the values of the best European teams of the same age for the same season, we can say that the height values of the players in those selections are higher than in our research: Turkey - 201 cm, Slovenia, France, Russia 200 cm, Spain -198 cm (Ljubojevic *et al*., 2020b). If we go a little further, we will see that the results of samples in Partizan and Buducnost are lower than results obtained by Vaquera *et al*. (2015) regarding Spanish national team U18 (198.92±92) and the values from players from Greece (198±8.14) by Gerodimos *et al*. (2005). If we compare the obtained results with the results obtained by Jelicic *et al*. (2002) we will see that the height values of the Partizan players are higher than in the research by Jelicic´ *et al*. (2002) who measured 132 players participating in the European Championship in Croatia (195.44 cm). On the other hand, Buducnost Voli players are shorter. This is an interesting information, which speaks in favor of the fact that BC Partizan pays great attention to the height of players during selection. Buducnost Voli players are taller than their peers from the research by Efremovska *et al*. (2014) from North Macedonia (184.4 cm), as well as players from the junior league of Kosovo (192.10 cm) by Kastrati *et al*. (2022).

The average body mass values of the respondents are approximate and range (Partizan 83.18±9.99 and Buducnost Voli 84.54±7.04).The results of both selections are lower compared to Spanish players (94.05kg), according to Vaquera *et al*. (2015), as well as the results of Greek players where the average value is 94.31kg (Gerodimos *et al*., 2005).The body mass values are slightly higher than those of peers from Tunisia (83.7kg) by Adbelkrim *et al*. (2010). Also, we find lower values in North Macedonia (75.2), which were achieved by Efremovska *et al*. (2014), as well as Kastrati *et al*. (2022) of the junior players of Kosovo. We can see here that higher scores in height and weight have selections that play at a higher level competition and achieve better results.

The results of the t-test the values of all six tested skinfolds were in favor of the team of Partizan and all of them have shown statistical significance. Comparing with other results, it can be concluded that Partizan players have lower values of all six skinfolds compared to the results of Vaquera *et al*. (2015), while Buducnost Voli players have lower values for triceps skinfold, abdominal skinfold, higher values for calf skinfold, thigh skinfold, while values for biceps skinfold are approximately the same. In comparison with the values from the research of Jelicic *et al*. (2002), it can be said that the values of Partizan players in all skinfolds are lower, while the values of Buducnost Voli players are higher in: triceps skinfold, back skinfold, calf skinfold, thigh skinfold, abdominal skinfold are lower, while biceps are skinfold approximately the same. Also, compared to players from Kosovo (Kastrati *et al*., 2022), Partizan players have lower values for all six skinfolds, while Buducnost Voli players have lower valuesfor back skinfold and thigh skinfold, and other values are approximate.

Statistical significance was also found between BMI values. Namely, the differences in the values recorded in body height, body mass, as well as the thickness of skinfolds,

certainly determine the difference between BMI of these two groups of players. Compared to some other researches, the obtained values show a similar relationship as they showed in the previous variables. The BMI value of Partizan players is significantly lower compared to previous research: in the case of players from Spain (Vaquera *et al*., 2015), players from Greece (Gerodimos *et al*., 2005), as well as North Macedonia (Efremoovska *et al*., 2014), as well as players from the European Championship in Croatia, according to research by Jelicic´ *et al*. (2002). This only confirms that the Partizan team is a very well-selected team, at least when it comes to the morphological characteristics of the players. On the other hand, Buducnost Voli players have higher BMI values than Partizan players, but very similar to the results of Vaquera *et al*. (2015) and Jelicic´ *et al*. (2002).

However, statistical significance was not found in the percentage of fat variable. The average values of this variable among the players of both teams are lower compared to the values of the players of North Macedonia (Efremovska *et al*, 2014), Kosovo (Kryeziu *et al*., 2018), and close to the results of Jelicic *et al*. (2002), whose sample includes all players of the highest level of competition in Europe for that age.

Also, statistical significance was not found in the muscle mass variable, and the results of both teams are higher compared to the results of Efremovska *et al*. (2014), while they are somewhat lower compared to the results of juniors in Montenegro (44.09±3.59) according to research (Ljubojevic *et al*., 2020b). This is expected considering that not only players from Buducnost Voli play in the national team of Montenegro, but also players who play in the most successful clubs in Europe.

CONCLUSIONS

The subject of this paper was to study the morphological status of top elite junior male basketball players, to compare variables of the best Serbian male junior basketball club with the variables of the best Montenegrin male junior basketball club. The goal was also to obtain quantitative data that can be used to determine the morphological model and define control of the morphological status of elite basketball players.

The results showed that Partizan players have better results than Buducnost Voli players in almost all the examined variables: they are taller, have fewer skinfolds, lower body mass, higher muscle mass, lower percentage of fat. This may be one of the reasons why Partizan achieves better results in the Euroleague than Buducnost Voli. Also, compared to other teams, these two teams are slightly lower than the best teams, have lower body mass and muscle mass. However, the size of the population from which the selection is made for certain clubs and teams should be considered.

The results can help the professional staff of these two teams in the analysis of the anthropological status of the players. More importantly, the results can be used for further comparisons, selection and monitoring of top young basketball players.

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LJUBOJEVIC, M.; BOJANIC, D.; NOKIC, A.; MALOVIC, P. & BACOVIC, D. Características antropométricas y composición corporal de jugadores de baloncesto masculino juveniles de élite - Participantes de Junior Euroleague. *Int. J. Morphol., 41(3)*:798-803, 2023.

RESUMEN: El objetivo de esta investigación fue determinar las diferencias entre jugadores de baloncesto junior del BC Partizan y BC Buducnost Voli, en cuanto a sus características antropométricas y composición corporal. Una muestra de 22 sujetos se dividió en dos submuestras. La primera submuestra estuvo formada por 11 jugadores del equipo de baloncesto Partizan (Serbia), con una edad media de 17,18 ± 0,50, mientras que la otra estaba formada por 11 jugadores del equipo de baloncesto Buducnost Voli (Montenegro), cuya edad media era de 17,28 ± 0,30 años. Todos los jugadores fueron evaluados en Podgorica, en un período de dos días, mientras se realizaba un torneo amistoso internacional, precisamente antes del inicio de los campeonatos nacionales. Las características antropométricas en la composición corporal se evaluaron mediante una batería de once variables: altura corporal (cm), peso corporal (kg), pliegue cutáneo tríceps, pliegue cutáneo dorsal, pliegue cutáneo bicipital, pliegue cutáneo abdominal, pliegue cutáneo de muslos, pliegue cutáneo de pantorrillas, índice de masa corporal (IMC), porcentaje de grasa y masa muscular (kg). Se determinaron las diferencias en las características antropométricas y la composición del cuerpo de los jugadores juveniles masculinos de baloncesto de los dos equipos de baloncesto mediante un procedimiento paramétrico discriminatorio con prueba t para pequeñas muestras independientes. Se encontró que los jugadores de baloncesto del Partizan eran más altos y tenían una masa corporal más baja. Además, existían diferencias estadísticas significativas en los pliegue cutáneos del tríceps, de la espalda, del bíceps, abdominal, de la pantorrilla y del muslo además de diferencias en el IMC.

PALABRAS CLAVE: Características antropométricas; Composición corporal; Baloncestistas juveniles masculinos.

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Corresponding author:
Milovan Ljubojevic, PhD
Assistant Professor
Faculty for Sport and Physical Education
University of Montenegro
81400, Niksic
MONTENEGRO

E-mail: milovan.lj@ucg.ac.me