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Differences in Anthropometric Characteristics between Junior Handball and Volleyball Players

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Abstract

The purpose of this study was to describe anthropometric characteristics of junior handball and volleyball players from the Serbian National League as well as to make a comparison between them. 61 male athletes were enrolled in this study, divided into three groups: 15 handball players, 14 volleyball players and 32 healthy sedentary subjects. The variables sample included 20 anthropometric measures that defined longitudinal and transversal dimensionality of skeleton, volume and mass of the body, and subcutaneous adipose tissue. The descriptive statistics were expressed as a mean (SD) for each variable, while the ANOVA and the LSD Post Hoc tests were carried out to detect differences between group. The results showed that a significant difference was found in variables body height, body weight, elbow diameter, thigh skinfold, calf skinfold, but no significant difference was found in the remaining 15 variables. Therefore, these findings may give coaches from the region better working knowledge and suggest to them to follow recent selection process methods and to be more careful during the process of talent identification.

Keywords: *Morphological Characteristics, Different Sports Activity, Comparison, Male Athletes*

Introduction

Optimal biomechanical and physiological capacity is necessary if the athlete wants to be competitive at the professional level (Bozic & Berjan Bacvarevic, 2018; Coh, Zvan, Boncina, & Stuhec, 2019). Logically, from junior athletes who are competing in top leagues are expected to have optimal morphological characteristics and motor abilities for the functional requirements of the sport in question (Jaksic, Lilic, Popovic, Matic, & Molnar, 2014; Sermaxhaj, Popovic, Bjelica, Gardasevic, & Arifi, 2017; Gardasevic, Akpinar, Popovic, & Bjelica, 2019). Although it is very important increasing the physical fitness of athletes, without taking into consideration the assessment of their body composition and their nutritional status we will not be able to reach the top result (Vasiljević, Bjelica, Popović, & Gardašević, 2015; Gardasevic & Bjelica, 2020). It's well known that specific anthropometric characteristics are significantly associated with sports results, and that absolute size contributes to a significant percentage of the total variance associated with sports results, therefore contemporary sport science is designed to identify talents as precisely and as early as possible (Akpinar, Zileli, Şenyüzlü, & Tunca, 2012; Masanovic, 2018). However, talent identification is very demanding so we have to be very careful, mostly due to the reason that the pace of growth and development is an individual characteristic (Matthys et al., 2011; Popovic, Bjelica, Jaksic, & Hadzic, 2014), some children later reach maximum body height, and some athletes compensate for their lower morphological predisposition by psychophysical ability (Vila Suarez, Ferragut, Alcaraz, Rodríguez Suarez, & Cruz Martinez, 2008; Rexhepi & Brestovci, 2010).

The characteristics of the activities that handball players perform during training and matches are different from those of volleyball. Handball is a game that contains physical contact, requires great durability and strength and it is considered as one of the fastest team sports (Bilge, 2013; Bjelica, Popovic, & Gardasevic, 2016; Gusic, Popovic, Molnar, Masanovic, & Radakovic, 2017). Consist specific manoeuvres such as jumping, pressurizing, blocking and shooting on goal. On the other hand, there is no contact in volleyball because two teams of six players are separated by a net. In this

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game, movement patterns significantly differ from those in handball, this game includes a large number of spiking, jumping, power hitting, blocking, and setting that is mainly based on a high level of strength and power (Palao, Lopez-Martinez, Valades, & Hernandez, 2019; Marques, & Marinho, 2009).

Many researchers have hypothesized that athletes in training might be expected to exhibit structural and functional characteristics that are specifically favourable to sports they play (Pojskic, Separovic, Muratovic, & Uzicanin, 2014; Monson, Brasil, & Hlusko, 2018). Therefore, changes in the body structure of handball and volleyball players are expected, so that they can complete the requirements of the they activity in an effective manner (Massuça & Fragoso, 2011). It is evident a lack of data from Eastern Europe, especially the Western Balkan region considering that most of the descriptive data concerning characteristics of handball and volleyball players come from America and Western Europe. Therefore, it is necessary to extend the data collected and increase knowledge regarding the anthropometric characteristics of athletes from the Western Balkans (Popović, Bjelica, Jakšić, & Hadžić, 2014; Masanovic, Milosevic, & Corluka, 2018).

Hence, the purpose of this study is to describe anthropometric characteristics and body composition profiles of junior handball and volleyball players from the Serbian National League, and to detect possible differences in relation to the competition levels.

Methods

In this study were enrolled 61 male athletes. They were divided into three groups: 15 handball players (16.93±0.59 yrs.) from the Serbian Junior Premier League, 14 volleyball players (17.36±0.74 yrs.) from the Serbian Junior Premier League and 32 healthy sedentary subjects from the same country (17.34±0.60 yrs.).

Anthropometric research technique was used for data collection. A total of 20 anthropometric measures were evaluated which defined the longitudinal and transversal dimensionality of skeleton, body volume and body mass, and subcutaneous adipose tissue: body height, body weight, elbow diameter, wrist diameter, knee diameter, ankle joint diameter, minimum circumference of the upper arm, maximum circumference of the upper arm, minimum circumference of the forearm, maximum circumference of the forearm, minimum circumference of the upper leg, maximum circumference of the upper leg, minimum circumference of the lower leg, maximum circumference of the lower leg, skinfold thickness of the upper arm, skinfold thickness of the forearm, skinfold thickness of the thigh, skinfold thickness of the calf, skinfold thickness of the chest and skinfold thickness of the abdomen. Anthropometric research was conducted according to IBP standards, while respecting the basic rules and principles related to the selection of parameters, standard conditions and measuring techniques, as well as the standard measuring instruments calibrated before measuring.

The data obtained in the research was processed using the application statistics program SPSS 20.0, (Chicago, IL, USA) adjusted for use on personal computers. The descriptive statistics were expressed as a mean (SD) for each variable. Analysis of variance (ANOVA) and the LSD Post Hoc test were carried out to detect to detect differences between group for each variable. The significance was set at an alpha level of 0.05.

Results

Anthropometric characteristics of subjects are shown in Table 1. There were significant differences in five out of 20 variables among the groups. Observing the results of the central tendency and dispersion parameters of we immediately notice that athletes have better values in 19 variables, while in terms of control group, have better values in only one variable.

Table 1. Descriptive data and ANOVA of male athletes enrolled in the study (n=61)

Variables	Handball (n=15)	Volleyball (n=14)	Control (n=32)	ANOVA
	Mean ± Standard Deviation			
Body height (cm)	181.51±5.33	194.28±5.30	178.26±7.26	.000*
Body weight (kg)	74.73±10.17	82.04±8.58	70.27±14.09	.014*
Elbow diameter (mm)	69.95±4.32	75.69±3.85	70.84±3.50	.000*
Wrist diameter (mm)	59.96±6.21	59.69±3.71	58.56±2.89	.481^
Knee diameter (mm)	101.17±7.36	97.81±4.79	99.62±4.30	.242^
Ankle joint diameter (mm)	76.48±6.21	74.00±3.00	73.47±4.28	.116^
Upper arm circumference (min) (cm)	29.17±2.81	28.68±1.88	28.66±3.65	.864^
Upper arm circumference (max) (cm)	31.47±2.92	30.57±1.88	30.16±3.88	.452^
Lower arm circumference (min) (cm)	17.10±1.17	16.82±.70	16.95±1.03	.755^
Lower arm circumference (max) (cm)	25.83±2.03	25.72±1.44	25.84±2.18	.979^
Upper leg circumference (min) (cm)	40.27±3.54	40.90±2.30	39.08±3.90	.235^
Upper leg circumference (max) (cm)	56.53±5.63	56.11±3.36	54.59±6.67	.504^
Lower leg circumference (min) (cm)	23.60±1.45	24.25±2.02	23.14±1.67	.133^
Lower leg circumference (max) (cm)	37.77±2.86	37.46±1.99	36.48±3.22	.307^
Upper arm skinfold (mm)	6.20±1.22	5.29±1.12	7.17±3.82	.125^
Lower arm skinfold (mm)	6.77±1.70	6.21±.90	7.83±3.37	.131^
Thigh skinfold (mm)	14.40±4.27	11.19±3.53	17.20±8.40	.023*
Calf skinfold (mm)	11.60±2.87	7.98±1.58	11.95±4.82	.007*
Chest skinfold (mm)	9.60±3.46	8.39±2.12	11.86±8.34	.205^
Abdomen skinfold (mm)	9.59±4.03	8.38±1.94	11.81±8.75	.248^

Legend: n = number of subjects; ^ = non-significant; * = significant difference between the groups

Table 2. The LSD Post Hoc test for different parameters among the subjects

Dependent Variable	Sport	Sport	Sig	Dependent Variable	Sport	Sport	Sig
Body height	volleyball	control group	.000*	Lower leg circumference (min)	volleyball	control group	.047*
		handball	.000*			handball	.309^
	control group	volleyball	.000*		control group	volleyball	.047*
		handball	.111^			handball	.393^
	handball	volleyball	.000*		handball	volleyball	.309^
		control group	.111^			control group	.393^
Body weight	volleyball	control group	.004*	Upper arm skinfold	volleyball	control group	.047*
		handball	.112^			handball	.400^
	control group	volleyball	.004*		control group	volleyball	.047*
		handball	.246^			handball	.289^
	handball	volleyball	.112^		handball	volleyball	.400^
		control group	.246^			control group	.289^
Elbow diameter	volleyball	control group	.000*	Thigh skinfold	volleyball	control group	.007*
		handball	.000*			handball	.202^
	control group	volleyball	.000*		control group	volleyball	.007*
		handball	.453^			handball	.187^
	handball	volleyball	.000*		handball	volleyball	.202^
		control group	.453^			control group	.187^
Ankle joint diameter	volleyball	control group	.721^	Calf skinfold	volleyball	control group	.002*
		handball	.152^			handball	.014*
	control group	volleyball	.721^		control group	volleyball	.002*
		handball	.041*			handball	.773^
	handball	volleyball	.152^		handball	volleyball	.014*
		control group	.041*			control group	.773^

Legend: Sig - significance of two-tailed testing of arithmetic mean difference; ^ = non-significant; * = significant ≤ 0.01

Significant differences of anthropometric characteristics among particular sports are shown in Table 2. The LSD Post Hoc test indicated that volleyball players were significantly taller than handball players and subjects from the control group. Volleyball players were significantly heavier than subjects from the control group. Also, volleyball players have significantly higher value of elbow diameter than handball players and subjects from the control group. Subjects from the control group have significantly lower value of ankle joint diameter than handball players and significantly lower value of minimum circumference of the lower leg than volleyball players. Also subjects from the control group have significantly higher value of skinfold thickness of the upper arm and skinfold thickness of the thigh than volleyball players. Lastly, subjects from the control group have had the higher value of skinfold thickness of the calf than handball and volleyball players.

Discussion

Results of this study indicate a strong difference regarding body height among handball and volleyball players on one side and subjects from the control group on the other side which is consistent with previous studies (Taborski, 2007; Lidor & Ziv, 2010). Different type of activity and game rules can explain the observed difference between handball and volleyball players (Masanovic, 2019). However, the worrying fact is that there is no significant difference among handball players and subjects from the control group, because research shows that body height is very important for success in elite handball (Masanovic, Corluka, & Milosevic, 2018). The absence of differences between handball players and subjects from the control group, raises doubts that the selection process has been carried out correctly. This is confirmed by the fact that official statistical data proved that Serbian handball players are shorter than the most successful teams which participated in the IHF Men's Youth World Championship played in Russia 2015. Even teams that were not among the top 10 best ranked teams are significantly higher than Serbian players. For example, the players 13th Korea had an average183.4 centimetres and 19th Poland had an average 190.1 centimetres. This insight may suggest the coaches from Serbia to be more careful during the talent identification as they have a very tall population in general (Arifi, Bjelica, Sermaxhaj, Gardasevic, Kezunovic, & Popovic, 2017; Popovic, Gardasevic, Masanovic, Arifi, & Bjelica, 2017; Masanovic, Gardasevic, & Arifi, 2018; Gardasevic, 2019). On the other hand, junior volleyball players from the Serbian National League were tall enough and with average body height 194.36 centimetres did not lag behind the top European players. This proves the fact that the average body height of the volleyball teams who played the finishing line CEV U17 Volleyball European Championship 2017 in Turkey were as it follows: Russia (199.1 cm), Belarus (192.44 cm), Greece (187.5 cm), Italy (192.33 cm), Bulgaria (195,84 cm), Netherlands (188 cm). However, this is not a surprise, as it is well-known that the density including very tall subjects appears to be characteristic of people from this area (Western Balkan), since a high percentage of people from general population were measured at 190 cm or more (Bjelica et al., 2012; Pineu, Delamarche, & Bozinovic, 2005; Popovic, Bjelica, Molnar, Jaksic, & Akpinar, 2013a; Masanovic, 2018a; Gardasevic, Masanovic, & Arifi, 2018).

Furthermore, it was expected that volleyball players were heavier than handball players and subjects from the control group, mostly due to the fact they are significantly taller than both groups mentioned. The absence of a significant body mass difference between handball players and subjects from the control group is also a surprise, which again points to mistakes during talent identification.

Results related to measures of the skeleton transversal showed that volleyball players have higher value of elbow diameter than handball players and subjects from the control group, while that handball players have higher value of ankle joint diameter than subjects from the control group. It should be noted that greater differences are expected in favour of volleyball and handball players, because many years of training affect the adaptation of the bone system (Marques et al., 2010). However, as this is a junior age, a more extensive adaptation is expected in the future (Gardasevic, Georgiev, & Bjelica, 2012).

Results related to measures of the body volume do not show a significant difference between athletes and subjects from the control group which was not expected. reason is because increasing muscle mass is important to improve strength and power, relevant to sport performance (Kraemer et al., 2004), and precisely the dimensions of the volume are an indicator of muscle mass. Nevertheless, a review of the descriptive data reveals that six of the eight parameters of athlete circumference have more value than the subjects from the control group. On the other side, increase in muscle mass occurs at the end of the growth phase (Arifi, Bjelica, & Masanovic, 2019), also systematic strength training approaches in the later stages (Balciunas, Stonkus, Abrantes, & Sampaio, 2006), these facts can justify the current situation, so there is no need to worry.

Finally, volleyball players have the lowest value of all skinfolds, for three out of six the difference is statistically significant (upper arm skinfold; thigh skinfold, calf skinfold), which is expected since systematic organized training has the effect of reducing fat mass. In most sports, it is well known that excessive fat mass compromises physical performance (Nikolaidis & Vassilios-Karydis, 2011), therefore in most sports it is undesirable. Hence, the absence of a significant difference in the skinfolds thickness of handball players is a surprise. Therefore, it may be suspected that activities are not of adequate volume and intensity, also that the process of talent identification is not well done. However, it is encouraging that handball players have lower values of all skinfolds than subjects from control group.

The importance of anthropometric characteristics in sport performance is a primary concern in creating athletes profiles as well as conditioning programs throughout a season at all levels of competitions (Silvestre et al., 2006), as describing anthropometric characteristics of athletes and detecting possible differences in relation to competition levels may give coaches a better working knowledge of the studied groups of athletes.

Moreover, the results of this study suggest that volleyball players from this study have anthropometric characteristics that are at the level of the world's leading teams, until the handball players are at such a high level. Morphological characteristics of elite handball and volleyball players appear to be of great interest for some authors (Bayios, Bergeles, Apostolidis, Noutsos, & Koskolou, 2006; Popovic et al., 2014; Barraza et al., 2015; Herdy, Costa, Simão, & Selfe, 2018) with the interest of finding the best morphology somatotype for particular sports, competition levels and player positions as well. Comparison of anthropometrics should support coaches with better understanding of specific demands of certain sport, where particular morphology profile of athlete, combined with motor and functional abilities, should express its full potential (Gusic et al. 2017).

The limitedness of this study is an insufficient sample of respondents which makes it impossible to generalize conclusions, especially if you take into account the unexpected data obtained by measuring handball players, so the next study should include more respondents. This approach could certainly contribute to the quality of the results obtained, and in this way would enable more representative data on the basis of which it would gain

an accurate insight into the social inclusion of young people, but would not reduce the contribution of this preliminary study.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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