INTRODUCTION

According to Viswanathan, Nageswara, & Baskar (2010), profiling is a valuable means of identifying talent, strengths and weaknesses, assigning player positions and helping in the optimal design of training programmes. Thus, it is widely addressed in the scientific literature, as these profiles are primarily important in various sports because absolute size contributes to significant percentage of total variance associated with athletic success (Carvajal et al., 2012). Therefore, the scientists all over the World are looking for the standard formula that can improve the performance of elite players and discover talents as precisely as possible.

The anthropometrical characteristics and body composition of athletic populations has been an interest of trainers, exercise scientists and sport medicine professionals for years and many of them assumed the practicing athletes might be expected to exhibited structural and functional characteristics that are specifically favourable for the sport (Singh et al. 2010). Since each sport have specific demands, every athlete should have specific anthropometrical characteristics and body composition for his own sports discipline. Some sports such as martial arts require much more knowledge regarding this topic than others, because of the weight limits. However, this fact doesn’t decrease the need to investigate the anthropometrical characteristics and body composition of basketball and volleyball players, as adequate body composition and body mass contribute among other factors to optimal exercise and performance. Body mass can influence an athlete’s speed, endurance, and power, whereas body composition can affect strength and agility (Massuça & Fragoso, 2011). In other words, successful participation in both, basketball and volleyball games, next to the high level of technical and tactical skills, also requires from each athlete suitable anthropometrical characteristics and body composition. Therewith, some previous investigations on basketball (Sampaio, Janeira, Ibañez, & Lorenzo, 2006; Ivanović, 2009, and others) and volleyball players (Gualdi-Russo & Zaccagni, 2001; Bayios, Bergeles, Apostolidis, Noutsos, & Koskolou, 2006; Hooper, 1997; and others) have shown that anthropometrical characteristics and body composition highly correlate with the technical and tactical demands.

It is concluded in the previous investigations that players in both mentioned sports are usually...
taller than the subject from general population (Gaurav, Singh, & Singh, 2010) as well as the players from other sports (Rahmawati, Budiharjo, & Ashizawa, 2007). This means that tallness is great advantage in these sports, right from the reason that these sports require from their players handling a ball above their heads (cited in Gaurav et al., 2010). Although, these sports have some similar requirements, basketball and volleyball are two sports with different technical skills and different training and playing procedures and the authors believed it would be reasonable to compare the anthropometrical characteristics and body composition of these athletic to check if there any differences among them. Hence, this investigation can affirm the possible differences that can help in the selection process and possible switching young players from one sports discipline to another one during the growing up period. It is also important to mention that there is most of descriptive data concerning characteristics of basketball and volleyball players from America and Western Europe, although there is a lack of data from our region. Consequently, this study aims to check if this is true for on part of Dinaric Alps countries, the place where live the people with the biggest absolute size (Pineau, Delamarche, & Božinović, 2005).

Therefore, many previous studies have evaluated ideal anthropometric profile of successful basketball and volleyball player (Apostolidis, Nassis, Bolatoglou, & Geladas, 2003; Gualdi-Russo & Zaccagni, 2001; Gabbett, 2008; Marques & Marinho, 2009; Sallet, Perrier, Ferret, Vitelli, & Baverel, 2005; Pelin, Kurkuçoglu, Ozener, & Yazici, 2009) that provide insights into the requirements for competing at top level in particular sports. Moreover, to our knowledge, there were no study has compared these performance between basketball and volleyball at competition level. Hence, the purpose of this study was to describe anthropometric characteristics and body composition of elite basketball and volleyball players and to detect possible differences in relation to competition level.

METHOD

Fifty-nine males were enrolled in the study. They have been divided into three groups: fourteen basketball players (23.50±2.77 yrs) from the basketball premier league, fourteen volleyball players (20.21±2.52 yrs) from the volleyball premier league and thirty-one healthy sedentary subjects (24.94±0.54 yrs).

All respondents were clinically healthy and had no history of recent infection disease, asthma or cardio-respiratory disorders. In addition, all of them gave their written consent and the local ethics committee approved the study protocol. All respondents were assessed for the anthropometric measures required for the calculation of body composition variables (Matiegka, 1921), using standardized procedure recommended by International Biological Program (IBP) standards respecting the basic rules and principles related to the parameter choice, standard conditions and measurement techniques, as well as the standard measuring instruments adjusted before measurement was carried out. Height and weight were measured in the laboratory with the subject dressed in light clothing. Height was measured to the nearest 0.1 cm using a fixed stadiometer and weight was measured to the nearest 0.1 kg with a standard scale using a portable balance. Body mass index (BMI) was calculated as body mass in kilograms divided by height in meters squared (kg/m²). Skinfolds (mm) were measured at six sites using: triceps skinfold thickness, forearm skinfold thickness, thigh skinfold thickness, calf skinfold thickness, chest skinfold thickness and abdominal skinfold thickness, using a skinfold caliper. Each individual measurement and the sum of the six measurements were used for analysis. The circumferences of the upper and lower arm, and upper and lower leg were measured (cm), as well as the following diameters to the nearest 0.1 cm: elbow diameter, wrist diameter, knee diameter, ankle diameter, upper arm diameter, forearm diameter, thigh diameter, and calf diameter. To reduce measurement variation, the same investigator examined all subjects.

The data obtained in the research were processed using the application statistics program SPSS 10.0 adjusted for the use on personal computers. The descriptive statistics were expressed as mean (SD) for each variable. Analysis of variance (ANOVA) and LSD Post Hoc test were carried out to detect the effects for each type of sport (basketball or volleyball) on each variable: body height, body weight, body mass index (BMI), and muscle, bone and fat content of the body, as well as to control it by sedentary subjects. The significance was set at an alpha level of 0.05.
RESULTS

The anthropometric characteristics of the respondents are shown in Table 1. There was no significant difference in body mass index among the groups, while a significant difference was found for body height (F=36.64), body weight (F=5.05) and all contents of body among the groups: muscle (F=8.23), bone (F=5.12) and fat (F=13.14).

![Table 1: Descriptive data and ANOVA](https://example.com/table1.png)

The significant differences of anthropometric characteristics among particular sports are shown in Table 2. The LSD Post Hoc test indicates that basketball and volleyball players were significantly taller than the respondents of control group were, while there was no difference between the subjects of control group and volleyball players. On the other hand, the bone content in the body of the subjects in control group was significantly lower than that of basketball players while there was no any difference in other cases. Lastly, the fat content in the body of the respond-

![Table 2: LSD Post Hoc test](https://example.com/table2.png)
nets in control group was significantly higher than that of all other subjects, while there was no difference between basketball and volleyball players.

**DISCUSSION AND CONCLUSION**

The results in this pilot study support previous investigations indicating a strong difference regarding the body height among the athletes in these two sports and the respondents from the control group that represent general population (Gaurav, Singh, & Singh, 2010) and confirm the well-known axiom that selection is the only reason that can explain the observed difference. However, much more important finding regarding the body height is the fact that there was no significant difference among elite basketball and volleyball players. This finding indicates that there are no specific demands regarding the body height between these two sports. Therefore, basketball and volleyball players tend to be tall athletes because their players handling a ball above their heads (cited in Gaurav et al., 2010) and their height helps them to reach toward the basket or the top of the net as well as defend the ball against the opponents. Taller player in basketball have an advantage because the ball has to pass shorter distance to the basket, as well as they start out closer to the rebound and their ability to jump much higher than their opponents, give them a chance to block their shoots. From the other side, taller player in volleyball have an advantage because they can easier control both, defensive and offensive actions over the top of the net. Thus, selection criteria can explain the observed results, as there has been a tendency to recruit the tallest children in both sports. However, extra talented short players, especially those with a high vertical jump, shall also be selected and play a significant role in both sports disciplines. This conclusion can confirm the fact that male college and professional basketball and volleyball players, even the shortest players, are usually above average in height compare to the general population. For example, the average height of professional basketball players in 2007 to 2008 season, according to available data from NBA.com, was 200.6 centimetres. From the other side, the average heights of the national basketball teams participants in the 2008 Olympic Games in Beijing, according to available data from official website, were following: USA (196.2 cm), Brazil (194.3 cm), Russia (200.3 cm) and Italy (198.5 cm). This proves that the players from our basketball and volleyball premier league are tall enough and they don’t lag behind the top World players. However, this is not surprise, as it is well known that the density of very tall subjects appears to be characteristic of the people from this area, since 28% of people from general population were measured 190 centimetres or more in body height (Pineu et al., 2005). Therefore, this fact may give coaches from Dinaric Alps better working knowledge of this particular group of athletes and suggest them to follow recent selection process methods and to be more careful during the recruitment as they have very tall population in general (Pineu et al., 2005) which confirms so high score of the subject from control group (183.72 cm). Furthermore, it is interesting that basketball and volleyball players were almost equally tall, while their body weight was not significantly different, but basketball players were almost 7 kilograms on average heavier than volleyball players were and this could be very interesting for the discussion. We expected that most high-level players of these sports would be taller and heavier than subject of general population. However, basketball players were significantly heavier than the subjects of control group were, while there was no difference between the weight of basketball and volleyball players, as well as the subjects of control group and volleyball players. The reason we have such heavier players in basketball has to do with the fact that the average size of the basketball players has increased dramatically in the past 20-30 years, while the volleyball did not require it too much. Therefore, this could be a function of better nutrition, especially in professional basketball leagues, partly due to the use of nutritional supplements as well as anabolic steroids etc. From the other side, the body mass index of all three groups did not show any significant differences and it is in the area of normal weight according to the established literature.

Indeed, we found that muscle content of basketball players were significantly higher than volleyball players and the respondents, while bone content of basketball players were significantly higher only than the respondents. According to the discussion regarding the differences of body
weight among all three groups, this was expectable that basketball players have higher percent of muscle content, while it is interesting that volleyball players and the respondents did not show any differences, although volleyball requires much more physical activities than control subjects do. From the other side, the range of the percent of bone content among all three groups is not too wide. Nevertheless, there is a significant difference between basketball players and control subjects. Moreover, it is well known that low body fat is desirable for high physical performance in all sports. Therefore, the low percent of fat content in the body of our basketball and volleyball players and significantly lower than the percent of fat content in the body of control subject showed that our players have high physical performance. However, it is very important to remind that athletes in elite team sports such as basketball and volleyball need a determined body fat percentage to perform well enough and achieve their full playing potential. The NSCA indicates that body fat percentages vary from less than 7 percent to 17 percent among the male athletes, depending on the sports discipline. However, we would like to stress that these are just guidelines and the athlete would work together with their coaches and their personal physician to determine the individual body fat percentage to enhance their physical abilities and their health.

This study suggests that basketball and volleyball decreased percent of fat content if we compare it to control group. On the other hand, this study also suggests that the muscle content of basketball players seems to be explained by a greater percent compared to the volleyball players and subjects of control respondents, while the differences in the bone content are logical consequences. Lastly, the part attributed to the body weight could be the main causes of nutritional habits.

**LITERATURE**


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**COMPARATIVE STUDY OF ANTHROPOMETRIC...**

**RATIONALE**

The purpose of this study is to determine the anthropometric characteristics and body composition of basketball guards and forwards and to compare them.

The study includes 59 males divided into three groups: 14 guards, 14 forwards, and 31 healthy individuals not interested in sport. The anthropometric measurements required for the calculation of body composition variables were taken from each participant using standardized methods described in the literature. The data were analyzed using SPSS and descriptive statistics were presented as the arithmetic mean ± standard deviation (Mean ± SD) for each variable. ANOVA and LSD post hoc tests were used to determine the effects of each sport group. The results indicated a significant difference in body mass index between the groups, while a significant difference was observed for height, body weight, and body composition components: muscular, fat, and fat-free mass.

**Keywords:** sport, high level, youth, basketball, volleyball