

The Relationship between Body Composition and Jumping Performance of Volleyball Players

Hakan Acar¹, Nebahat Eler¹

¹Department of Physical Education and Sport, Zonguldak Bülent Ecevit University, Zonguldak, Turkey

Correspondence: Nebahat Eler Department of Physical Education and Sport, Zonguldak Bülent Ecevit University, Zonguldak, Turkey.

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Abstract

Body composition and the skill of jumping are very important for high physical performance in volleyball. The purpose of this study is to analyze the relationship between body composition and jumping performance in female volleyball players aged 14-17. 74 female volleyball players volunteered to participate in the study. The height, body weight, body mass index, body fat percentage, body muscle mass and trunk fat percentage measurements were taken and the vertical jump and standing long jump tests were applied. The data were evaluated with the SPSS 16 statistical software program, the Pearson Correlation test was done for the statistical analysis and the significance level was determined as $p < 0.05$. The athletes' vertical jump and standing long jump values were found statistically to have a negative relationship with height, body fat percentage, body muscle mass and body fat percentage, whereas a positive relationship was found between vertical jump and standing long jump values and body weight ($p < 0.05$). As a result, it was determined that body composition in volleyball players affects jumping performance.

Keywords: jumping performance, body composition, volleyball

1. Introduction

There is clear scientific evidence of a strong relationship between morphological characteristics and the chosen sport (Eston & Reilly, 2009). Depending on the athletes' sports branch, their physical conditions, body compositions and technical tactic capacities affect their performance (Aytekin, 2007). Each sports branch has its own needs and each athlete should have unique anthropometrical characteristic and a body composition for his/her own sports discipline (Massuçá & Fragoso, 2011). There are numerous body composition components in sports. For instance, height, weight, body fat, fat free mass, muscle mass, total body water, etc. However, the most important components in all sports branches is body fat because each characteristic has a great relationship with body fat such as agility, power, speed, flexibility, explosive power and jumping skills (Aytekin, 2007).

Volleyball is a sports branch which requires advanced physical fitness and anthropometrical characteristics (Göral et al., 2009). Volleyball is a sport in which the most prominent body characteristic, besides physical abilities such as agility, reaction speed, movement speed, or aerobic and alactic power, is longitudinality (Palao et al., 2014).

In general, volleyball players have a body height which is higher than average, a thin shape, endurance, power and the skill of jumping (Malousaris et al., 2008; Carvajal et al., 2012). The anthropometrical characteristics and jumping skill of volleyball players are the most important factors in the success of their team in terms of performance (Clarke, 1975). Besides high technical and tactical skills, suitable anthropometrical characteristics and body composition is need in volleyball. It has been determined that, being successful in the volleyball branch is directly related to power (vertical jump) which is one of the basic motor functions, speed, flexibility and low body fat percentage (Şimşek et al., 2007; Ivanović, 2009; Koç et al., 2010; Con et al., 2012).

In block and spike movements, jumping too high is important in the success. Jumping power is defined as the athlete's jumping as much as possible from far from the vertical and/or jumping high in the vertical position. As for the jumping movement, it is seen that the flexor and extensor muscles in the lower extremity are effective (Şimşek et al., 2007). In volleyball, being tall and having the skill of jumping high are needed for the block and spike movements. Body fat percentage affects the skill of jumping (Aytekin, 2007).

Anthropometrical measurements are important in the estimation of physical and physiological performances. The weight, fat and muscle mass of athletes are important factors which affect in particular jumping performance (Moncef et al., 2012). Anthropometric profiling and physical performance testing, including different approaches to body composition comparisons and somatotyping, have been widely used as talent identification and recruitment tools and training program bases for varying competitive levels in many countries which has led to more internationally - competitive volleyball teams (Valleser et al., 2018). In general, low body fat is preferred for high physical performance in volleyball (Heyward & Stolorczyk 1996). The most effective criterion in determining performance in sports is body height and body weight. Body height and body weight are among the anthropometrical prerequisites which are needed in the selection athletes and their development (Sevim, 2002; Savaş & Uğraş 2004). Therefore, it is highly important to deal with body composition and the skill of jumping which are very important in especially volleyball together. The purpose of this study is to analyze the relationship between body composition and jumping performance in female volleyball players aged 14-17.

2. Method

Athletes from Ankaragücü, Devlet Hava Limanı Meydanları, Karayolları and Gazi sports clubs among the junior varsity category in the city of Ankara participated voluntarily in the study.

The body height of the athletes was measured with a height scale with 0.01 mm sensitivity and body composition (Body Mass Index ($\text{kg} \cdot \text{m}^2$), Body Fat (%), Body fat percentage (%), trunk estimated muscle mass (kg) were measured with Tanita (BC - 418) body analysis device.

In the standing long jump test, the athletes jumped forward twice from the starting point on two feet and the longest distance after the jump was recorded as cm.

The vertical jump test was measured with Takei jump meter; it was attached to the abdominal area of the athletes and the athletes were asked to jump vertically on both feet within a certain area and to fall to another area leaving their arms free. This was repeated twice and the highest value was recorded as cm.

In the analysis of the data, the SPSS 16 software was used and the Pearson Correlation test was done ($p < 0.05$).

3. Results

The age average of the participants was determined as 14.8 ± 1.0 years, their sports age average as 4.7 ± 2.1 years, body height average as 170.3 ± 6.7 cm and body weight average as 59.1 ± 8.3 kg.

Table 1. Some demographical characteristics of the athletes

	n	Average	SS
Age (years)	74	14.8	1.0
Body height (cm)	74	170.3	6.7
Body weight (kg)	74	59.1	8.3
Sports age (years)	74	4.7	2.1

Table 2. The measurement values of the participants

	n	Average	SS
Vertical jump (cm)	74	32.5	3.9
Standing long jump (cm)	74	174.9	17.8
Body Mass Index ($\text{kg} \cdot \text{m}^2$)	74	20.3	2.2
Fat percentage (%)	74	23.6	3.8
Trunk fat percentage (%)	74	18.4	5.0
Trunk estimated muscle mass (kg)	74	24.9	3.0

The vertical jump average of the athletes was determined as 32.5 ± 3.9 cm and their standing long jump average as 174.9 ± 17.8 cm. The body mass index of the participants was determined as 20.3 ± 2.2 kg / m^2 , body fat percentage as 23.6 ± 3.8 %, trunk fat percentage as 18.4 ± 5.0 % and their trunk estimated muscle mass as 24.9 ± 3.0 kg.

Table 3. Comparison of the athletes' body composition and jumping performance

	Height	Weight	Body index mass	Fat %	Trunk muscle mass	Trunk fat %
Vertical jump (cm)	r -0.183 p 0.041 *	0.1518 0.045 *	-0.0575 0.283	-0.2759 0.036 *	0.1883 0.044 *	-0.1927 0.037 *
Standing long jump (cm)	r -0.213 p 0.039 *	0.2428 0.033 *	-0.30783 0.291	-0.4724 0.000 *	0.1220 0.043 *	-0.3349 0.023 *

A statistically negative relationship between the athletes' vertical jump and standing long jump values and body height, body fat percentage, trunk muscle mass and trunk fat percentage, whereas a positive relationship was found between their vertical jump and standing long jump values and body weight ($p < 0.05$).

4. Discussion

As a result of the measurements taken in the presented study, a statistically negative relationship between the athletes' vertical jump and standing long jump values and body height, body fat percentage, trunk muscle mass and trunk fat percentage, whereas a positive relationship was found between their vertical jump and standing long jump values and body weight ($p < 0.05$). Aslan et al., (2011) determined a correlation between body weight and standing long jump. Şimşek et al. (2007), in their study in which they analyzed the effect of knee muscle strength on jumping performance, they determined that there is a significant relationship between body weight and jumping performance in 1st league volleyball players. Aouichaoui et al. (2014), in their study on puberty period athletes, determined a negative correlation between vertical jump performance and body weight, height and body mass index. Moncef et al. (2012) determined a negative correlation between body weight and jumping performance in elite male handball players. Almuzaini (2007), stated that there is correlation between body height and body weight and vertical jump. Günay et al. (1994) stated that there is correlation between body weight and strength, vertical jump, flexibility and anaerobic strength.

Białoskórska et al. (2016), determined a significant correlation between the vertical jump skills and body compositions of volleyball players and determined a positive relationship between vertical jump height and all body muscle mass and determined a negative relationship between body fat percentage and body mass index. Silvestre et al. (2006) determined a strong correlation between body composition and vertical jump and Ostojic et al. (2006) determined a strong correlation between body composition and anaerobic strength. Şimşek et al. (2005) determined a negative correlation between body weight and jumping.

Crawford (1996), stated that body measurements play an important role in the performance of humans and people with greater body measurements have more strength and maximum anaerobic strength. Markovic and Jaric (2007) stated in their study involving 159 participants that while body weight affects strength and anaerobic strength in a positive manner, it affects vertical jump height in a negative manner. Copić et al. (2014), in their study on athletes, determined that the higher the body fat percentage, the lower the vertical jump height. Vuleta et al. (2016) stated that the skill of jumping determines the level difference between volleyball players. Nikolaidis (2013) stated that high fat percentages negatively affect the productivity of volleyball players.

In the light of the results in the literature, it can be stated that the skill of jumping and body fat percentage are the most important determinants of performance in volleyball players. Our study supports the current information. In our study, it was determined that body composition affects jumping performance as well. It is quite important for the targeted performance to determine these characteristics in young volleyball players in order to be able to identify and increase their skill at early ages and take precautions and carry out activities to develop their skill. Coaches and trainers who will be working in this area, it will be beneficial to take these measurements at early ages and determine them. Coaches should also do regular follow-up of their athletes and make it possible for measurements to be taken and tests to be conducted in regular intervals in this area.

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