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Dr. Sukhwinder Singh
Assistant Professor, Department of Physical Education, Mata Sahib Kaur Girls College, Talwandi Bhai (Ferozepur), Punjab (India).

Correspondence
Dr. Sukhwinder Singh
Assistant Professor, Department of Physical Education, Mata Sahib Kaur Girls College, Talwandi Bhai (Ferozepur), Punjab (India)

Relationship between selected anthropometric variables and performance of volleyball players

Dr. Sukhwinder Singh

Abstract
The present investigation finds the relationship between selected Anthropometric variables and performance of university level Volleyball Players. For the purpose of the study, thirty (N=30) volleyball players were selected as subjects from the North Zone Inter-University Volleyball Tournament. The selected Anthropometric measurements were taken with the help of vernier calipers and lange's skinfold calipers. The performance of the subjects was measured in terms of Spiking ability of the players during the match. Product moment method for inter-correlation was applied for analysis of data. The body diameters i.e. biacromial, bicristal and elbow diameters have been found to possess positive and significant (p<0.01) correlation with the performance at 0.01, and body diameters Femur Bicondylar, Wrist and Ankle have been found to statistically insignificant (p>0.05) correlation with the performance. The skinfold measurements i.e. subscapular and suprailiac have been found to possess positive and significant (p<0.01) correlation with the performances at 0.01, biceps, and calf skinfold measurements have been found to possess positive and significant (p<0.05) correlation with the performances at 0.05. Triceps and thigh skinfold measurements have been found to statistically insignificant (p>0.05) correlation with the performance. It can be concluded from the findings of the present study that body diameters biacromial, bicristal, and elbow and; subscapular, suprailiac biceps, and calf skinfold measurements contribute significantly in Volleyball performance.

Keywords: Spiking ability; Anthropometric variables; skinfold measurements and body diameters.

1. Introduction
Anthropometric measurements are widely used to assess and predict performance in various sports. Anthropometric measurements and morphological characteristics play an important role in determining the success of a sportsperson (Wilmore & Costill, 1999; Keogh, 1999) [22, 13]. An athlete's anthropometric and physical characteristics may represent important prerequisites for successful participation in any given sport (Gualdi-Russo & zaccagni, 2001) [9] Indeed, it can be assumed that an athlete's anthropometric characteristics can in some way influence his/her level of performance, at the same time helping to determine a suitable physique for a certain sport (Carter & Health, 1990) [4]. It has been well established that specific physical characteristics or anthropometric profiles indicate whether the player would be suitable for the competition at the highest level in a specific sport (Claessens *et al*., 1999; Reilly *et al*., 2000; Gabbett, 2000; Slater *et al*., 2005) [6, 15, 7, 17].
Sports play a very prominent role in the modern society. It is important to individuals, a group, a nation and indeed the world. Throughout the world, sport has a popular appeal among people of all ages and both sexes. (Uppal, 1992) [20]
At present, the sports competitions are highly competitive and challenging. Human beings by nature are competitive and ambitious for their excellence in all athletic performance. Every sportsman or nation wants to show their supremacy by challenging other nations by showing dominance and supremacy in sporting performance in international competitions. Thus this challenge stimulates, inspires and motivates all the nations to sweat and strive to run faster, jump higher, throw faster and exhibit greater strength, endurance and skills in present competitive sports world. This can only be possible through scientific, systematic and planned sports training as well as channelizing them into appropriate games and sports by finding out their potentialities. (Carl E. Karfs and Daniel D. Aruheim, (1969) [3].
Volleyball players require well-developed muscular strength, power and endurance, speed,

agility, and flexibility, and have a high level of jumping ability, fast reaction time and swift movements (She 1999) [16]. Lower body power, speed, and agility are important indicators of volleyball performance (Vescovi & Mcguigan, 2008) [21]. Volleyball requires athletes to be explosive in the lower limbs; this is especially emphasized in the front row hitting positions when attacking on offense or blocking ondefense. Vertical jump emphasizes lower body power, and it is known that Power = (Force x Distance)/Time. Vertical jump is an anaerobic explosive movement that requires recruitment of the highest threshold motor units (Amasay, 2008) [1].

Vertical jump is a major determinant of volleyball performance and many researchers have studied different aspects of vertical jumping. According to Gutierrez & Marcos (2009) [10], the factors that affect vertical jump are height reached by the center of gravity, time required for execution, and the spatial orientation of the corporal segments. The research by Japan Volleyball Association demonstrated the significant correlation between the vertical jumping index and the competitive ability of the volleyball players. It was found that the jumping ability had a positive correlation with the number of spiking, and the total success rates of spiking, blocking and serving in a game (Tian. 2006) [19]

Body mass correlates well to muscle size and power in elite athletes. It has been reported that Katoly index correlates well to the quantity and strength of muscles (Gai & Li, 2002) [8]. Arm span and standing reach height have also been suggested as essential factors for higher spiking and blocking (Zeng. 1992) [23]. Arm span is closely related to most of the volleyball techniques, especially in attacking. To make full use of the spiking speed of a waving arm, a long arm is an advantage. Jin and colleagues suggested that standing reach height should be used as an essential criterion in recruitment of volley ball players (Jin *et al*., 2007) [11]. The length of the arm span of elite volleyball players has been found to be approximately 5 cm longer than his/her height. The arm span and the standing reach height are found to be closely related (Zeng, 1992) [23].

The studies on the morphological aspects of volleyballers have revealed that the body mass and height of the players bear high relationship. A study on the Western Australian Mean and Women volleyball player's has found out that performance in this game betters with an increase in height and body musculature. The height of a volleyball player has been considered as the most important per-requisite and positive pre-disposition for better performance (Kansal *et al.,* 1983, Bale, 1986) [12, 2]. After studying the available literature in the field Investigator conducted the study to determine the relationship of selected body diameters and skinfold measurements with Volleyball performance of

2. Methodology

2.1. Sample

Sample consists of thirty (N=30) Volleyball players as subjects from the North-Zone Inter-University Tournament. Their age ranged between 18 to 28 years. They were purposively selected to act as subjects.

2.2. Criterion Measures

The body diameters i.e. biacromial, femur bicondylar, elbow, wrist and ankle with anthropometer compass and vernier calipers,

The skinfold measurement i.e. triceps, biceps, subscapular, surailiac, thigh and calf were taken with the help of Lange's Skinfold calipers.

The performance of the volleyball players were measured in terms of Spiking ability of the volleyball players during the match.

2.3. Statistical Analysis

To determine the relationships, Pearson's Product moment method for inter-correlation was applied and the alpha level was set at 0.05.

3. Results

The results of the study are given below in the following Tables:

Table 1: Significance of Correlations of Body diameters with spiking performance (volleyball)

S. No.	Variables Correlated with Performance	Coefficient of Correlation 'r'
1.	Biacromial	.64**
2.	Bicristal	.50**
3.	Femur Bicondylar	.21
4.	Elbow	.65**
5.	Wrist	.34
6.	Ankle	.32

** Significant at 0.01 level

N = 30; r. 05 (28) = 0.36; r. 01 (28) = 0.46

Table–1 indicated that the spiking performance has positive and significant (p<0.01) correlation with biacromial, bicristal and elbow diameters at 0.01 level. Other diameters have positive but statistically insignificant (p>0.05) correlations with the volleyball performance. It suggests that these significantly correlated circumferences contribute positively towards spiking performance.

Table 2: Significance of Correlations of Skinfold Measurements with spiking performance (Volleyball)

S. No.	Variables Correlated with Performance	Coefficient of Correlation 'r'
1.	Biceps	.39*
2.	Triceps	.19
3.	Subscapular	.54**
4.	Suprailiac	.47**
5.	Thigh	.17
6.	Calf	.37*

* Significant at 0.05 level

** Significant at 0.01 level

N = 30; r. 05 (28) = 0.36; r. 01 (28) = 0.46

Table–2 shows that the spiking performance has been found to possess positive and significant correlations with biceps, subscapular, suprailiac and calf skinfold measurements at 0.05 and 0.01 levels respectively, whereas other skinfold variables have positive but statistically insignificant (p>0.05) correlations with Spiking performance in volleyball.

4. Discussion

The results of the study clearly show that the spiking performance (volleyball) is significantly and positively related to Body diameters in biacromial, bicristal and Humerus biepicondylar diameters provide greater coupling and leverage action which is useful in better spiking performance in volleyball. So, these diameters contribute to the volleyball performance. The body diameters i.e. biacromial, bicristal and elbow diameters have been found to possess positive and significant (p<0.01) correlation with the performance at 0.01, and body diameters Femur Bicondylar, Wrist and Ankle have been found to statistically insignificant (p>0.05) correlation with the performance.

The skinfold measurements i.e. subscapular and suprailiac have been found to possess positive and significant (p<0.01) correlation with the performances at 0.01, biceps, and calf skinfold measurements have been found to possess positive and significant (p<0.05) correlation with the performances at 0.05. Triceps and thigh skinfold measurements have been found to statistically insignificant (p>0.05) correlation with the performance. It can be concluded from the findings of the present study that body diameters biacromial, bicristal, and elbow and; subscapular, suprailiac biceps, and calf skinfold measurements contribute significantly in Volleyball performance.

Out of the skinfold measurements, biceps, subscapular, suprailiac and calf skinfolds are positively and significantly correlated with the spiking. This indicated that with the development of the amount of subcutaneous tisues of these muscles increase the cotractile power of the muscles and hence contribute positively to the spiking performance.

The findings of the study are in complete agreement with the results of the earlier studies reported by Pere *et al* (1954) [14], Tanner (1964) [18] and Chauhan (1986) [5] etc.

5. Conclusion

It is concluded from the above findings that Biacromail, bicristal and elbow diameters possess positive and significant correlations with the performance in volleyball. Among skinfold measurements, biceps, subscapular, suprailiac and calf skinfolds have positive and significant correlations with performance in volleyball.

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