

A comparative study of somatic traits and body composition between volleyball players and controls

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Abstract

The purpose of the study was to compare the somatic traits and body composition between volleyball players and controls. 48 young male subjects (volleyball players: N= 24 & controls: N= 24) of age group 18-25 years were randomly selected from the different colleges affiliated to Guru Nanak Dev University, Amritsar, Punjab, India. All the participants were assessed for height, weight, breadths, girths and skinfold thickness. The independent samples t-test revealed that volleyball players had significantly higher height ($p<0.05$), as compared to controls. The volleyball players were also found to have significantly greater lean body mass ($p<0.01$) and ectomorphic component ($p<0.05$) as compared to controls. Controls had significantly greater percent body fat and total body fat ($p<0.05$) as compared to volleyball players. The volleyball players of this study were found to have higher percentage body fat with lower body height and body weight than their international counterparts. Further investigations are needed on above studied variables along with fitness and physiological variables to assess relationship among them and with performance in volleyball. The findings of the present study might be useful in future investigation on player selection, talent identification in the game of volleyball and its training programme development.

Keywords: Somatic traits, volleyball, sports, India, body fat.

Introduction

Millions of people play volleyball across the world. In many countries, it has been ranked as one of the top-level competitive sport. FIVB (Federation of international de volleyball) is the largest sports organization in the world with 220 affiliated member countries. Volleyball belongs to sport activities in which morphological conditions of its participants influence the level of sport performance. It was established that volleyball players compared to most other athletes have distinctive anthropomorphological characteristics (Jankovic & Marelic, 1995; Ercolessi, 1999; Ugarkovic, 2004). Volleyball is a fast playing game. It is a sport involving short and intensive physical efforts during training and competition (Driss *et al.*, 1998). Volleyball player's fitness relies on their force, power output and jumping ability (Smith *et al.*, 1992). To evaluate these physical characteristics, the anthropometric measurements, parameters of the body composition such as the percent body fat (% fat) and lean body mass (LBM) and somatotype components are often used. Sports performance is based in a complex and intricate diversity of variables which include physical, physiological, psychological and morphological and body type (somatic traits & body composition) factors. Volleyball players must have great physical conditions especially related to somatic traits and body composition. Studies on the physical characteristics of the human body to-date indicate that the morphological characteristics of athletes play vital role in success in a specific sport. Body height, being the most characteristic trait of volleyball players is significantly conditioned genetically (Milicerowa, 1973). External factors including training and starting loads do not influence this variable (Zatsiorski, 1995; Zaporozanow & Sozanski, 1997). Higher body mass however, is a hurdle for volleyball players in achieving good jumping height (Bandyopadhyay, 2007).

Somatic conditions are necessary to attain top sports level have to be brought about in a long and time-consuming process of selection whereas the harmony of somatic traits and other elements specific for volleyball is developed during many years of training (Socha, 2001). In volleyball there is a net between the courts. Net height is 2.43 m in males and 2.24 m in females. So it requires being tall and having a high jumping ability. Examinations showed that body fat affects the jumping ability. Various researchers suggested that different body size, shape and proportions are beneficial in different physical activities (Malhotra *et al.*, 1972; Kansal *et al.*, 1986; Sidhu *et al.*, 1996). The present study, therefore, has been conducted on Indian university volleyball players and controls to evaluate their somatic traits and body composition.

Material and methods

Sample: The present study was conducted on 48 young male subjects (volleyball players: N=24 & controls: N=24) of 18-25 years age. The subjects were randomly selected from the different colleges affiliated to Guru Nanak Dev University, Amritsar, Punjab, India. A written consent was obtained from the subjects. The study was approved by the local ethical committee.

Anthropometric measurements: The age of each subject was calculated from the date of birth as recorded in his institute. The height of the subjects was measured with anthropometric rod to the nearest 0.5 cm. The weight of subjects was measured by using portable weighing machine to the nearest 0.5 kg. Skinfold thickness measurements of the subjects were measured by Slim guide skinfold caliper to the nearest 0.1 mm. Girths were taken with the steel tape to the nearest 0.5 cm. Widths of body parts were measured by using digital caliper.

Table 1. Mean values & standard deviations of somatic traits of volleyball players & controls.

Variables	Volleyball players (N=24)		Controls (N=24)		t-value
	Mean	SD	Mean	SD	
Height (cm)	182.71	6.36	172.16	4.507	6.62**
Body weight (kg)	71.37	5.22	70.62	6.22	0.45
Endomorphy	2.46	0.85	3.66	1.05	4.32**
Mesomorphy	4.28	1.13	3.25	0.99	3.37**
Ectomorphy	3.69	1.38	1.99	0.94	4.98**

**Significant at .01 level.

Table 2. Mean values & standard deviations of body composition of volleyball players & controls.

Variables	Volleyball players (N=24)		Controls (N=24)		t-value
	Mean	SD	Mean	SD	
Total body fat (kg)	9.02	2.91	11.56	3.00	2.96**
Lean body mass (kg)	62.34	3.88	59.06	4.81	2.60*
% Body fat	12.52	3.34	16.25	3.43	3.80**
Body mass index (BMI)	21.45	2.12	23.84	2.04	3.96**

* Significant at .01 level; **Significant at .05 level.

Somatotype was determined from the following equations (Heath & Carter, 1990):

1. Endomorphy = $- 0.7182 + 0.1451(X) - 0.00068 (X)^2 + 0.000014 (X)^3$ (Where X = sum of supra-spinale, subcapular and triceps skinfold and corrected for stature by multiplying the sum of skinfolds by 170.18/body height in cm).
2. Mesomorphy = $(0.858 \times \text{humerus width}) + (0.601 \times \text{femur width}) + (0.188 \times \text{corrected arm girth}) + (0.161 \times \text{corrected calf girth}) - (\text{body height} \times 0.131) + 4.5$. (Where corrected arm girth = arm girth-biceps skinfold, corrected calf girth = calf girth-calf skinfold).
3. Ectomorphy = $(\text{HWR} \times 0.732) - 28.58$ (Where HWR = (body height in cm) / (weight in kg)^{1/3}).

Body fat (%) as estimated from the sum of skinfolds was calculated using equations of Siri (1956) and Durnin and Womersley (1974). The regression equations for the prediction of body density from the log of the sum of skinfold thickness at four sites in mm are as follows:

For 17 to 19 years age group: Body Density (gm/cc) = $1.1620 - 0.0630 (X)$ (Durnin & Womersley, 1974).

For 20 to 29 years age group: Body Density (gm/cc) = $1.1631 - 0.0632 (X)$ (Durnin & Womersley, 1974) Where X = log (biceps+triceps +subcapular +suprailliac).

% body fat = $(4.95 / \text{body density} - 4.5) \times 100$ (Siri, 1956)

Total body fat (kg) = $(\% \text{ body fat} / 100) \times \text{body mass (kg)}$

Lean body mass (kg) = $\text{body mass (kg)} - \text{total body fat (kg)}$

BMI (Kg/m^2) = $(\text{body mass in Kg}) / (\text{Stature in meters})^2$ (Meltzer *et al.*, 1988).

Statistical analysis: Values are presented as mean values and SD. Independent samples t tests were used to test if population means estimated by two independent samples differed significantly. Data was analyzed using SPSS

version 16.0 (Statistical package for the social sciences, version 16.0, SSPS Inc, Chicago, IL, USA).

Results

Table 1 shows mean and standard deviation of somatic traits between volleyball players and control group. In case of body weight difference between volleyball players and control group are found to be non significant. Volleyball players significantly possess greater stature ($p < 0.01$) than controls. The result revealed that volleyball players were found to possess significantly low endomorphic ($p < 0.01$) rating but high rating of mesomorphic ($p < 0.01$) and ectomorphic ($p < 0.01$) components. It is evident from Table 2 that volleyball players have significantly greater values in percentage of lean body mass than the control group. The lean body mass contribute relatively more to body weight than body fat in volleyball players. Their training has resulted in muscular development in the volleyball which is supported by the fact that sufficiently the volleyball players have significantly lesser % body fat ($p < 0.01$) and BMI ($p < 0.01$) than the controls.

Discussion

In the present study the somatic traits and body composition of the volleyball players and controls have been evaluated and compared with each other. This study indicates the existence of differences among the volleyball players and controls. The overall results show that volleyball players were taller as compared to the controls. Sandhu (1993) also observed that volleyball players, in each age group are significantly taller than controls with tendency to be more toward ectomorphy. In volleyball, teams compete by manipulating skills of spiking and blocking high above the head. Therefore, the presence of tall players is an indispensable factor in the success of a volleyball team. The volleyball players in the present study have greater height and percentage of lean body mass than the controls. It is important to highlight that there were no significant differences in body weight between volleyball players and controls. The volleyball players also reported to have greater values in lean body mass than the control group. According to Parizkova (1977), LBM compared to total BW is closely related to physiological parameters such as oxygen consumption, cardiac output, vital capacity, etc. According to the study of Bandyopadhyay (2007) volleyball players show significantly higher LBM values than the non-sporting population. This parameter, including all body tissues except for fat deposits, is considered a major precondition for a good performance in volleyball. The volleyball players in the present study have greater height and percentage of lean body mass than the volleyballers from West Bengal studied by Bandyopadhyay (2007) whereas they are shorter and lighter than their international counterparts (Gualdi-Russo & Zaccagni, 2001; Gabbett, 2008; Morques & Marinho, 2009). The somatotyping scores of volleyball players in the present study are 2.4-4.2-3.6 and they are reported as mesomorph-ectomorph.

These results are not in agreement with those of Gualdi-Russo and Zaccagni (2001) who reported volleyball players as balanced mesomorphs. On the other hand, the somatic traits scores of volleyball players in the present study are in conformity with Indonesian volleyball players showed the mesomorph-ectomorph somatotype with a somatotype score of 2.4-3.5-3.7 (Rahmawati *et al.*, 2007). The observations in the present investigation reflected higher fatness among non-sportspersons than sportspersons. In addition, according to body mass index (BMI) results strongly suggest that the controls had greater amount of body fat mass compared to volleyball players. Based on the results of the present study, we highlight somatic traits and body composition characteristics of volleyball players as compare to controls. In volleyball game, anthropometric characteristics, somatic traits, body composition together with physiological, technical, and psychological variables account for performance or selection of athletes.

Conclusion

There were significant differences in somatic traits and body composition between the volleyball players and controls. The volleyball players were significantly taller and had less amount of subcutaneous tissue with more ectomorphic component than the controls. The volleyball players also had higher lean body mass than the controls. The % body fat and total body fat were also lesser in volleyball players. More data would be helpful on the above studied variables along with fitness and physiological variables to assess relationship among them and with performance in volleyball.

Practical applications

The data presented here will serve as reference for the somatic traits and body composition for university level volleyball players. The present study will help coaches to understand the somatic traits and body composition characteristics for selecting volleyball players.

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