Anthropometric characteristics, somatotyping and body composition of volleyball and basketball players
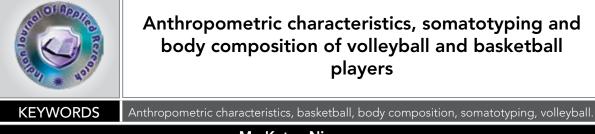
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ABSTRACT *The purpose of the study was to compare the anthropometric characteristics and somatotype of the Guru Nanak Dev University, Amritsar's male basketball players and volleyball players. Sixty three sportspersons (volleyball=36 and basketball=27) of age group 18-25 years were selected from different colleges affiliated to Guru Nanak Dev University, Amritsar, Punjab, India. All the participants' were assessed for height, weight, breadths, girths and skin fold thickness. An independent samples t-test revealed that basketball players had significantly higher height (p<0.01), weight (p<0.01) and body surface area (p<0.01) as compared to volleyball players. The basketball players were also found to have significantly greater biceps (p<0.01) and suprailliac (p<0.01) skin fold thicknesses, calf circumference (p<0.05), percent body fat (p<0.01), total body fat (p<0.01), fat free mass (p<0.05) and endomorphic component (p<0.05) as compared to volleyball players. Volleyball players had significantly greater body density (p<0.01) as compared to basketball players.*

Introduction

Volleyball and basketball are among the world's popular sports, played practically in every nation at varying levels of competence. Successful participation in these sports requires from each player a high level of technical and tactical skills and suitable anthropometric characteristics. All ball games require comprehensive abilities including physical, technical, mental, and tactical abilities. Among them, physical abilities of the players are more important as these have marked effects on the skill of players and the tactics of the teams because ball games require repeated maximum exertion such as dashing and jumping (Tsunawake, 2003). Such physical abilities are important for both volleyball and basketball players to achieve higher levels of performance.

To evaluate these physical abilities, the anthropometric measurements, parameters of the body composition such as the percent body fat (% FAT), fat-free mass (FFM) and Somatotype components are often used. Studies on the physical characteristics of the human body to-date indicate that the morphological characteristics of athletes successful in a specific sport differ in somatic characteristics from the general population. Basketball and volleyball players are typically taller than the players of other games (Rahmawati et.al. 2007). Basketball and volleyball require handling the ball above the head; therefore, having a greater height is an advantage in these sports (Kansal et al., 1986). Higher body mass however, is a hurdle for volleyball players in achieving good jumping height (Bandyopadhyay, 2007). Various researchers suggested that different body size, shape and proportions are beneficial in different physical activities (Malhotra et al., 1972; Kensal et al., 1986; Sidhu et al., 1996).

Several studies on the anthropometric characteristics and somatotype of basketball and volleyball players have been reported in literature (Fleck et al., 1985; Hakkinen, 1993; Hostler et al., 1978; Spence et al., 1980; Wallet et.al., 2005; Apostolicism et al., 2003; Gualdi and Zaccagni, 2001; Pelin et al., 2009; Morques and Marinho, 2009; Gabbett, 2008); however, similar studies in the context of India are limited. The present study has been conducted on Indian university volleyball and basketball players to evaluate their selected physical characteristics along with somatotype thus fills up already existing void of literature in Indian concern.

Objectives of the study

1. To study the anthropometric characteristics and body composition of basketball and volleyball players.
2. To study the body types of the basketball and volleyball players.

Material and methods

The present study was conducted on 63 young male subjects (volleyball =36 and basketball = 27) of age group 18-25 years. The subjects were randomly selected from the different colleges affiliated to Guru Nanak Dev University, Amritsar, and Punjab, India irrespective of their caste, religion, dietary habits and socioeconomic status. 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 anthropometrics rod to the nearest 0.5 cm (HG-72, Nexgen ergonomics, Canada). The weight of subjects was measured by using portable weighing machine to the nearest 0.5kg. Body surface area (BSA) and body mass index (BMI) we recalculated by the following formulae:

BSA (m2) = (Body mass in kg) 0.425 × (Body Height in cm) 0.725 × 0.007184 (Du Bois and Du Bois, 1916) BMI (Kg/m2) = (Body mass in kg)/ (Stature in m2) (Meltzer et al., 1988) Skin fold thickness measurements of the subjects were measured by slim guide skin fold caliper. Girths were taken with the steel tape to the nearest 0.5 cm. Widths of body parts were measured by using sliding caliper with digital readout. Soma to type was determined from the following equations (Heath and Carter, 1990): (I) Endomorphic = - 0.7182 + 0.1451(X) - 0.00068 (X) 2 + 0.0000014 (X) 3

Where

X = sum of supra-spinal, sub scapular and triceps skin fold and corrected for stature by multiplying the sum of skin folds by170.18/Body Height in cm (ii) Mesomorphy = (0.858 X Hummers width) + (0.601 ´ Femur width) + (0.188 X Corrected arm girth) + (0.161 Corrected Calf Girth) - (Body Height X 0.131) + 4.5

Where

Corrected Arm Girth = Arm girth-Biceps skin fold, Corrected Calf Girth = Calf Girth-Calf Skin fold.

(iii) Ectomorphy = (HWR X 0.732)-28.58 [Where HWR = (Body Height in cm)/ (weight in kg) 0.33]

Percentage body fat as estimated from the sum of skin folds was calculated using equations of Sire (1956) and Durnin andWomersley (1974). The regression equations for the prediction of body density from the log of the sum of skin fold 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 and Womersley, 1974)

For 20 to 29 years age group:
Body Density (gm/cc) = 1.1631-0.0632 (X) (Durnin and Womersley, 1974)

Where
 X = log (Biceps + Triceps + Sub scapular + Suprailliac). % Body Fat = [4.95/ Body density-4.5] X 100 (Sire, 1956) Total Body Fat (kg) = (% Body fat/100) ´ Body mass (kg) Lean Body Mass (kg) = Body mass (kg) – Total body fat (kg).

Statistical analyses
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 In,).

Table 1
Physical parameters of the volleyballers and basketballers

Variables	Basketballers (N=27) Mean SD		Volleyballers (N=36) Mean SD		t- Value
Height (cm)	187.44	5.19	183.25	6.15	2.85**
Weight (kg)	79.40	7.70	73.02	7.58	3.28**
BMI	22.63	2.33	21.78	2.35	1.41
BSA	2.04	0.09	1.94	0.94	3.95**

** indicates $p<0.01$.

Table 2
Different skin folds measurements of the volleyballers and basketballers.

Variables	Basketballers (N=27) Mean SD		Volleyballers (N=36) Mean SD		t- Value
Biceps (mm)	4.88	1.25	4.00	1.17	2.89**
Triceps (mm)	7.48	1.31	8.69	3.43	1.37
Subscapular (mm)	12.55	3.04	11.38	3.66	1.34
Suprailliac (mm)	14.77	2.96	9.03	5.45	4.49
Calf (mm)	13.07	3.57	11.19	3.97	1.94

** indicates $p< 0.01$.

Table 3
Diameters and circumferences of the volleyballers and basketballers

Variables	Basketballers (N=27) Mean SD		Volleyballers (N=36) Mean SD		t- Value
Bi-hummers diameter	69.77	3.45	70.45	6.49	0.49
Bi-femur diameter	102.66	5.89	100.03	6.99	1.58
Upper arm circumference	27.00	1.33	26.33	1.88	1.56
Calf circumference	36.66	2.28	35.50	2.10	2.56

* indicates $p< 0.05$.

Table 4
Different components of body composition of the volleyballers and basketballers

Variables	Basketballers (N=27) Mean SD		Volleyballers (N=36) Mean SD		t- Value
Body density	1.062	0.004	1.068	0.009	3.13**
% BF (kg)	15.95	2.12	13.30	4.01	3.10**
TF (kg)	12.67	2.11	9.88	3.75	3.46**
FFM (kg)	66.72	6.59	63.13	5.39	2.37*

* indicates $p < 0.05$. ** indicates $p < 0.01$.

Results:
Table 1 shows the descriptive statistics for physical parameters of volleyball and basketball players. Mean body height of basketball players was significantly higher than those of volleyball players (p<0.01). Basket ballplayers also had significantly greater weight (p<0.01) as compared to volleyball players. No statistically significant difference was observed

between the basketball players and the volleyball players in relation to BMI. BSA was significantly higher in basketball players than those of volleyball players (p<0.01).

 In Table 2 descriptive statistics for skin fold measurement values are depicted. Both biceps (p<0.01) and suprailliac skin folds (p<0.01) measurements were observed to be significantly higher for basketball players than volleyball players. The differences observed between the two groups for triceps, sub scapular and calfskin fold measurement were not statistically significant. Descriptive statistics of diameters and circumferences are shown in Table 3. There was no significant difference between basketball players and volleyball players in bihumerusand bi-femur diameters. Since arm and calf circumference measurements reflect the bone, muscle and fat mass of the limbs, these two variables have also been evaluating. No significant difference was observed in upper arm circumference between the two groups, but calf circumference (p<0.05) was significantly higher for Basketball players when compared to volleyball players.

 Descriptive statistics for different components of body composition are presented in Table 4. Volleyball players were found to have significantly greater body density (p<0.01) when compared to basketball players. The basketball players were observed to have significantly higher percent body fat (p<0.01) and total body fat (p<0.01) when compared to volleyball players. Fat free mass (FFM) was also significantly greater in basket ballplayers (p<0.01) than those of volleyball players. Table 5summarizes the descriptive statistics of the somatotypingcomponents. Endomorphic values of basketball players were significantly higher (p<0.01) than those of volley ballplayers. In relation to mesomorphy and ectomorphy, no significant differences were observed between the two groups.

Table 5
Somatotyping of the volleyballers and basketballers

Variables	Basketballers (N=27) Mean SD		Volleyballers (N=36) Mean SD		t- Value
Endomorph	3.21	0.56	2.68	1.05	2.37
Mesomorphy	2.91	1.14	3.06	1.11	0.51
Ectomorphy	3.40	1.30	3.57	1.41	0.50

* indicates $p < 0.05$.

Discuss:
In the present study the anthropometric characteristics of the athletes have not been evaluated in relation to their performance, but were instead compared with each other. This study indicates the existence of differences among the players of different games. The overall results Show that basketball players were taller and heavier as

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 team. The volleyball players in the present study have greater height and weight than the volleyball players from West Bengal studied by Bandyopadhyay (2007) whereas they are shorter and lighter than their international counterparts (Guild and Mascagni, 2001;Morques and Merino, 2009; Gobbet, 2008).The present data regarding the % fat of the players is approximately accords with the proposal that percentage fat value among basketball and volleyball players should be within the range of 6-15% (Wilmore and Costill,1999).The basketball players in the present study have higher percentage body fat than the elite level Greek basketball players (Sallet et al., 2005) and French professional basketball players (Apostolicism et al., 2003).

The volleyball players have higher body fat percentage than the volleyball players from West Bengal studied by Bandyopadhyay (2007).