

EVALUATION OF ANTHROPOMETRIC CHARACTERISTICS, BODY COMPOSITION AND SOMATOTYPING OF HANDBALL AND BASKETBALL PLAYERS

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The identification of physical characteristics in a sport modality contributes to its success and enables to spot differences among athletes of different modalities, which is of great interest to both sport coaches and scientists. Sports performance is based on a complex and intricate diversity of variables, which include physical (general and specific conditions), psychological (personality and motivation) and body (body morphology, anthropometry and body composition) factors. The relationship between morphological variables and sports performance is the object of study of anthropometry and is an important element to be analyzed. Basketball and handball are most popular sports in the world, played practically in every nation at varying levels of competence.

Successful participation in these sports requires a high level of technical and tactical skills as well as suitable anthropometric characteristics from each player. All ball games require not only technical and tactical skills, but also a great deal of comprehensive abilities including physical, technical and mental 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. To achieve higher levels of performance both handball and basketball players need such physical abilities. 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 handball players are typically taller than the other game players (Rahmawati et al., 2007). Basketball and handball 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 handball players in achieving good jumping height (Bandyopadhyay, 2007). Various researchers suggested that different body size, shape and proportions are beneficial in different

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physical activities (Kansal et al., 1986). Several studies on the anthropometric characteristics and somatotype of basketball and handball have been reported in literature (Fleck et al., 1985; Hakkinen, 1993; Hosler et al., 1978; Apostolidis et al., 2003; Gualdi and Zaccagni, 2001.)

Objectives of the study

The aim of this study was to investigate the anthropometric characteristics, body composition and body types of basketball and handball players and also evaluate their selected physical characteristics.

Methodology

The present study was conducted on 63 young male subjects. Out of this there were 36 handball and 27 basketball players. The subjects were of age group 18-25 years and were randomly selected from different colleges affiliated to CSJM University, Kanpur, irrespective of their caste, religion, dietary habits and socio-economic status. The age of the subjects was calculated from their date of birth as recorded in their respective institute. Weight of the subjects was measured by using digital weighing machine to the nearest 0.5 kg. Height of the subjects was measured with stadiometer to the nearest 0.5 cm. Body Surface Area (BSA) and Body Mass Index (BMI) were calculated by using the following formulae:

Body surface area (m^2) = (Body mass in kg) $0.425 \times$ (Body Height in cm) 0.725×0.007184 (DuBois and DuBois, 1916)

Body mass index (Kg/m^2) = (Body mass in kg) / (Stature in m^2) Skin fold thickness measurements of the subjects was measured by slim guide skin fold caliper. Girths were taken with the Gulic tape to the nearest 0.5 cm. Widths of body parts were measured by using Harpendon caliper. Somatotype was determined from the following equations (Heath and Carter, 1990)

1. **Endomorphy** = $0.1451x - 0.00068x^2 + 0.0000014x^3 - 0.7182$ where, x = the sum of triceps, subscapular and supraspinale skin folds.
2. **Mesomorphy** = $0.858(A) + 0.601(B) + 0.188(C) + 0.161(D) - 0.131(E) + 4.5$ where,
 A = Humerus breadth (cm)
 B = Femur breadth (cm)
 C = Corrected arm girth [Arm-girth (cm) - (Triceps SF (mm)/10)]
 D = Corrected calf girth [Calf girth (cm) - medial calf SF (mm)/10]
 E = height (cm)

3. **Ectomorphy** = Height (cms) $\times$ Weight (kgs) - 0.333

Percentage body fat estimated from the sum of skin folds was calculated using equations of Siri (1956) and Durnin and Womersley (1974).

% Body Fat = $[4.95 / \text{Body density} - 4.5] \times 100$ (Siri, 1956)

Total Body Fat (kg) = (% Body fat/100) $\times$ Body mass (kg)

Lean Body Mass (kg) = Body mass (kg) - Total body fat (kg)

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, $X = \log (\text{Biceps} + \text{Triceps} + \text{Subscapular} + \text{Suprailiac})$.

Statistical analyses

Values obtained after measurement are presented as mean values and SD. Independent samples T - tests was 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. Physical Parameters of the Handball and Basketball Players:

Variables	Basketball		Handball		T-Value
	Mean	SD	Mean	SD	
Height(CM)	183.44	5.19	181.25	6.15	2.85*
Weight(KG)	69.40	7.70	65.02	7.58	3.28*
BMI	22.62	2.33	21.78	2.35	1.41
BSA	2.04	0.09	1.94	0.10	3.95*

(* Indicates $P < 0.05$)

The descriptive statistics for physical parameters of handball and basketball players has been shown in Table1. Observation of the table reveals that mean body height of basketball players was significantly higher than those of handball players ($p < 0.05$). Basketball players also had significantly greater weight ($p < 0.05$) as compared to volleyball players. No statistically significant difference was observed between the basketball players and the handball players in relation to BMI. BSA was significantly higher in basketball players than those of handball players ($p < 0.05$).

Table 2. Different skin folds measurements of the Handball and Basketball Players.

Variables	Basketball		Handball		T-Value
	Mean	SD	Mean	SD	
Biceps(MM)	4.88	1.25	4.00	1.17	2.89*
Triceps(MM)	7.48	1.31	8.69	3.43	1.73
Sub Scapular(MM)	12.55	3.04	11.38	3.66	1.34
Suprailiac(MM)	14.77	2.96	9.03	5.45	4.94*
Calf(MM)	13.07	3.57	11.19	3.97	1.94

(* Indicates $P < 0.05$)

The descriptive statistics for skin fold measurement values have been depicted in Table 2. Perusal of table-2 indicates that both biceps ($p < 0.05$) and suprailliac skin folds ($p < 0.05$) measurements were observed to be significantly higher in basketball players than handball players. The differences observed between the two groups for triceps, subscapular and calf skin fold measurement were not statistically significant.

Table 3. Breadth & Girths measurements of the Handball and Basketball Players.

Variables	Basketball		Handball		T-Value
	Mean	SD	Mean	SD	
Bi-Humerous Breadth	69.77	3.45	70.45	6.49	0.49
Bi-Femur Breadth	102.66	5.89	100.03	6.99	1.58
Upper arm Girth	27.00	1.33	26.33	1.88	1.56
Cal Girth	36.66	2.28	35.50	2.10	2.09*

(*Indicates $P < 0.05$)

In table-3 descriptive statistics of diameters and circumferences have been shown. The perusal of the table establishes that there exists no significant difference between basketball players and handball players in bi-humerus and 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 evaluated. 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 handball players.

Table 4. Body Compositions of the Handball and Basketball Players.

Variables	Basketball		Handball		T-Value
	Mean	SD	Mean	SD	
Body Density	1.062	0.004	1.068	0.009	3.13*
Percentage of Body fat(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 $P < 0.05$)

Perusal of table-4 indicates that handball players were found to have significantly greater body density ($p < 0.05$) as compared to basketball players. The basketball players were observed to have significantly higher percent body fat ($p < 0.05$) and total body fat ($p < 0.05$) when compared to handball players. Fat free mass (FFM) was also significantly greater in basketball players ($p < 0.05$) than those of handball players.

Table 5. Somatotyping Handball and Basketball Players

Variables	Basketball		Handball		T-Value
	Mean	SD	Mean	SD	
Endomorphy	3.21	0.15	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 $P < 0.05$

Observation of table-5 depicts that the basketball players were more endomorphic as compared to handball players. The difference was found to be significant at .05 level. In relation to mesomorphy and ectomorphy, no significant difference was observed between the two groups.

Discussion

The primary aim of this study was to examine the anthropometric characteristics, body composition, and body types of basketball and handball players. 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 compared to the handball players. Similar findings were found in the studies on Turkish male athletes (Pelin et al., 2007) and Malaysian male athletes (Nudri et al., 1996) which reported that the height of basketball players was greater when compared to other sports groups.

The basketball players were also reported to have greater body fat percentage, skin fold measurements, FFM and endomorphic component as compared to handball players. These results show that basketball players were taller, heavier and fatter as compared to their counterparts. On average, the basketball players of the present study are considerably taller and heavier than the State level players studied by Sodhi (1976) and top ranking Indian basketball players (Sodhi, 1980). On the other hand, they are considerably shorter and lighter when compared to their international counterparts (Sallet et al., 2005; Apostolidis et al., 2003). Because basketball and handball require handling the ball above the head, having a greater height is an advantage in basketball and handball games (Kansal et al., 1986). Lower height of Indian basketball players might be one of the reasons for their dismal performances at the international level. In handball, 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 handball players in the present study have greater height and weight than the Handball players from West Bengal studied by Bandhopadhyay (2007) whereas they are shorter and lighter than their international counterparts (Gualdi

and Zaccagni, 2001; Morques and Marinho, 2009; Gabbett, 2008).

The present data regarding the percentage fat of the players approximately accords with the proposal that percentage fat value among basketball and handball players should be within the range of 6-15% (Wilmore and Costill, 1999).

The handball players have higher body fat percentage than the handball players from West Bengal studied by Bandyopadhyay (2007). 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 (Apostolidis et al., 2003). An increased body fat will be detrimental in handball and basketball because in these sports, the body is moved against the gravity (e.g. handball spiking, blocking) or propelled horizontally (as in basketball) and the additional body fat adds to the weight of the body without contributing to its force production or energy producing capabilities.

Higher fat free mass was reported among the overseas players than the Indian handball and basketball players who will therefore achieve better performance. Greater fat content and lower FFM among Indian handball and basketball players act as a hindrance in their performance.

Conclusion

From this study we have to know that there were significant differences in most of the anthropometric characteristics between the handball players and basketball players. On average, compared to the handball players, basketball players were taller and heavier. The basketball players also had higher body surface area, calf circumference and FFM than the handball players. When compared to handball players the percentage body fat, biceps and suprailiac skin folds, total body fat and endomorphy were also higher in basketball players whereas the body density was greater among the handball players. It is thus concluded that, in most of the parameters there were significant differences between basketball and handball players. The basketball players showed better anthropometric measurements and somatotyping scores.

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