Original Article

A study of anthropometric profile of indian inter-university male cricketers

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ABSTRACT

Koley S. A study of anthropometric profile of indian inter-university male cricketers. *J. Hum. Sport Exerc.* Vol. 6, No. 2, pp. 427-435, 2011. The purpose of this study was of two-fold, firstly, to evaluate the anthropometric profile of Indian inter-university cricketers and, secondly, to search the correlations among the anthropometric characteristics studied (if any). To serve this purpose, twelve anthropometric characteristics were taken on purposively selected 98 Indian inter-university (nine Indian universities) male cricketers aged 16-25 years (mean 21.03 years, ± 1.72) participated in the competitions organized in Guru Nanak Dev University, Amritsar, Punjab, India. An adequate number of controls (n = 99, mean age 21.50 years, ± 1.13) were also collected from the same place for comparisons. The findings of the present study indicated statistically significant differences (p≤ 0.05 - 0.000) in weight, BMI, thigh length, total leg length, calf and hip circumferences, percent body fat and back strength between cricketers and controls. Also, significantly positive correlations (p≤ 0.05 - 0.01) were noted among the linear measurements, viz. height, thigh length, lower leg length; and the circumferential measurements, viz. mid thigh circumference, hip circumference and calf circumference in Indian inter-university male cricketers. **Key words**: ANTHROPOMETRIC CHARACTERISTICS, INDIAN INTER-UNIVERSITY MALE CRICKETERS.

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INTRODUCTION

Anthropometry has a rich tradition in sports sciences and sports medicine. Though, in different times, different terms were used like dynamic anthropometry, sports anthropometry, biometry, physiological anthropometry, anthropometrica, kinanthropometry etc. by scientists to establish some relationships between the body structure and the specialized functions required for various tasks (Koley, 2006). In fact, it is well established that each individual is unique. The extent of human variability is so enormous that no two individuals can ever be exactly the same. There are two fundamental causes for this variation. One is the genes inherited from parents and the other is the infinity of environment which acts upon individuals from cradle to grave. Therefore, scientists have always been fascinated by the phenomenon of human variation. In the populations, the law of chance operates as a whole and people in general tend to fall along a curve of normal distribution on all traits (Koley & Sandhu, 2005). With the innumerable variety of human physique, it has become a generalized consideration that some sports events are more suitable to individuals with specific physique than others (Reco-Sanz, 1998; Wilmore & Costill, 1999; Keogh, 1999). 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; Bourgois et al., 2000, 2001; Reilly et al., 2000; Gabbett, 2000; Ackland et al., 2003; Slater et al., 2005). These anthropometric and morphological parameters are the sensitive indicators of physical growth and nutritional status of the athletes for their maximal performances (Wilmore & Costill, 1999; Chatterjee et al., 2006).

Cricket is a field-based popular team game in most Commonwealth countries. In the past, it was played solely within a specific season (winter in Asian countries and summer in western countries). But the game has gained so much popularity in the last few decades that it is now played throughout the year. Cricketers are therefore exposed to more demanding schedules, with longer periods of training and practicing. The increased workload may be one of the contributing factors to the increased incidence of injuries (Davies et al., 2008).

Stretch (1987) reported that provincial and international cricketers had a tall, athletic built, with definite morphological differences existing between batsmen, bowlers and all-rounders. The batsmen tended to be shorter and lighter, although possessing greater relative fat mass than the bowlers. The bowlers were found to be tall, with long legs, broad shoulders and a small amount of fat in the thigh and shoulder regions. The all-rounders had larger girth measurements and less relative fat than the batsmen and bowlers. The other characteristics of the all-rounders were similar to those of the other two groups. Again, studying the physical fitness profile of South African university cricketers, Stretch & Buys (1991) reported that although the cricketers were superior to sedentary subjects in the aspect of physical fitness, with the exception of flexibility, no significant differences existed between the batsmen, bowlers, all-rounders and wicket-keepers. Furthermore, no significant differences existed between the provincial and non-provincial cricketers.

Stuelcken et al. (2007) studied the anthropometric characteristics of elite cricket fast bowlers of Australia considering 7 skinfolds, 7 lengths, 6 breadths and 11 girths measurements and concluded that the male bowlers had larger length, breadth, and girth measurements than their female counterparts.

In Indian context, some literature is available (Kumar et al., 2007; Koley & Yadav, 2009; Koley et al., 2009). Kumar et al. (2007) reported the differences in some anthropometric characteristics between the provinces of Punjab and Uttar Pradesh. Koley & Yadav (2009) and Koley et al. (2009) reported the association of

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handgrip strength with certain anthropometric characteristics in Indian university level cricketers. In fact, university level cricketers usually represent the provincial level competitions and subsequently the national levels. Their standard is superior to the beginners but slightly inferior to the elites. Thus, this stage is the ideal buffer for screening the talents for international competitions.

In different playing positions such as bowling, fielding and batting, a great amount of strength of the back muscles is required. Mechanical factors play an important role in the etiology of degenerative processes and injuries to the lumbar spine. Especially in fast bowling, where a player must absorb vertical and horizontal components of the ground reaction force that are approximately five and two times body weight at front-foot and rear-foot impact respectively, thus, assessment of back strength is essential (Elliott, 2000). The maximum capacity of the back muscles must be known and subsequently muscle endurance, if assessments are to be made of muscle fatigue during playing conditions (Mannion et al., 1999). However, the anatomical and biomechanical structures of the back are extremely complex and consequently, accurately measuring back muscle strength is problematic outside of a research setting.

In the present study, an attempt was made to investigate the anthropometric profile of Indian inter-university male cricketers. Attempt was also made to search any correlations among the anthropometric characteristics studied.

MATERIAL AND METHODS

Subjects
The present cross-sectional study is based on purposively selected 98 Indian inter-university male cricketers aged 16-25 years (mean age 21.03 years, ± 1.72). The competition included nine Indian universities namely, Punjabi University, Patiala, Punjab University, Chandigarh, Guru Nanak Dev University, Amritsar, Punjab Agricultural University, Ludhiana, Kurukshrata University, Kurukshratra, Guru Jambeswar University, Hisar, Jammu University, Jammu, Himachal Pradesh University, Himachal Pradesh and Delhi University, Delhi, and the competition was organized in Guru Nanak Dev University, Amritsar, Punjab, India. An adequate number of controls (n = 99, mean age 21.50 years, ± 1.13) with no particular playing background were also collected from the same place for comparisons. The age of the subjects were recorded from the date of birth registered in their respective institutes. The subjects were divided in such a way that age 16 refers to the individuals aged 15 years and 6 months through 16 years and 5 months and 29 days. The subjects were further subdivided into three age groups, viz. 16 - 18 years, 19 - 21 years and 22 - 25 years for further analyses. A written consent was obtained from the subjects. The data were collected under natural environmental conditions in morning (between 8 AM. to 12 noon). The study was approved by the local ethics committee.

Anthropometric Measurements
Twelve anthropometric characteristics, viz. height, weight, BMI, thigh length, lower leg length, total leg length, mid thigh, calf and hip circumferences, bi-acromial breadth, percent body fat and back strength were taken on each subject using the techniques provided by Lohmann et al. (1988) and were measured in triplicate with the median value used as the criterion.

The height was recorded during inspiration using a stadiometer (Holtain Ltd., Crymych, Dyfed, UK) to the nearest 0.1 cm. The subject was asked to stand erect on the stadiometer with bare foot. The horizontal bar of the stadiometer was placed on the vertex of the subject and the readings were recorded. Weight was measured by digital standing scales (Model DS-410, Seiko, Tokyo, Japan) to the nearest 0.1 kg. The

subject was asked to stand erect on the digital weighing machine with minimum cloths and bare foot. The readings were recorded from the scales of the digital weighing machine. BMI was then calculated using the formula weight (kg)/ height (m)^2. Mid thigh, calf and hip circumferences were measured by a flexible metallic tape (Holtain Ltd) from the right side of the subject. Percent body fat was assessed using skinfold measurements taken from four sites, viz. biceps (over the biceps muscle), triceps (over the triceps muscle), subscapular (below the inferior angle of the scapula) and calf (over the calf muscle) using Harpenden skinfold caliper (Holtain Ltd, Crosswell, Crymych, UK) to the nearest 0.2 mm, and using the equation of Slaughter et al. (1988).

Back strength measurement
Back strength was measured using a back-leg-chest dynamometer. After 3 minutes of independent warm-up, the subject was positioned with body erect and knees bent on the back-leg chest dynamometer so that grasped-hands of the subject rests at proper height. Then straightening the knees and lifting the chain of the dynamometer, pulling force was applied on the handle. The body would be inclined forward at an angle of 60 degrees for the measurement of back strength. The strength of the back muscles was recorded on the dial of the dynamometer at the best of three trials in kg. Thirty seconds time interval was maintained between each back strength testing. The instrument was calibrated prior to use.

Statistical Analysis
Standard descriptive statistics (mean ± standard deviation) were determined for directly measured and derived variables. Student's t-test was used for the comparison of various anthropometric variables between cricketers and controls. One way analysis of variance was tested for the age-wise comparisons of data among Indian inter-university male cricketers and controls, followed by post-hoc Bonferroni test. Pearson's correlation coefficients were applied to establish the relationships among the variables measured. Data were analyzed using SPSS (Statistical Package for Social Science) version 17.0. A 5% level of probability was used to indicate statistical significance.

RESULTS

Descriptive statistics of anthropometric characteristics in cricketers and controls are shown in Table 1. Statistically significant differences (p≤ 0.05 - 0.000) were noted in weight, BMI, thigh length, total leg length, calf and hip circumferences, percent body fat and back strength between cricketers and controls. One way analysis of variance showed significant differences (p≤ 0.01 - 0.000) in all the variables studied (except mid thigh circumference) in cricketers of age groups 16 - 18 years, 19 - 21 years and 22 - 25 years and their respective age group-matched control counterparts (Table 2).

Bivariate correlations of the anthropometric traits were examined in Indian inter-university male cricketers in Table 3. Height has significantly positive correlations (p≤ 0.01) with all the variables studied (except BMI and mid-thigh circumference), weight with all the variables (except thigh length and back strength), BMI with mid-thigh circumference, hip circumference, calf circumference, bi-acromial breadth and percent body fat. Thigh length has significantly positive correlations (p≤ 0.01) only with lower leg length and total leg length. Lower leg length has significantly positive correlated (p≤ 0.05 - 0.01) with total leg length and calf circumference, and negative correlation with percent body fat. Total leg length has significantly negative correlation (p≤ 0.05) only with percent body fat. In circumferential measurements, mid-thigh circumference has significantly positive correlation (p≤ 0.05 - 0.01) with hip circumference, calf circumference, bi-acromial breadth and percent body fat; hip circumference with calf circumference, bi-acromial breadth and percent

body fat; and calf circumference only with bi-acromial breadth. So, significant positive correlations were noted among the linear measurements and the circumferential measurements in the Indian cricketers.

Table 1. *Descriptive statistics of anthropometric characteristics in Indian inter-university male cricketers and controls.*

Variable	Cricketers (n=98)		Controls (n=99)		t-value
	Mean	S.D	Mean	S.D	
Height (cm)	171.0	7.1	172.1	5.19	1.229
Weight (kg)	61.83	9.6	69.93	11.85	5.269***
BMI (kg/m^2)	21.09	2.7	23.57	3.61	5.416***
Thigh length (cm)	51.49	3.3	53.21	4.80	2.912*
Lower leg length (cm)	44.47	2.9	43.68	3.75	1.647
Total leg length (cm)	95.91	5.3	97.51	4.77	2.208*
Mid thigh circumference (cm)	45.79	3.7	46.27	4.67	0.792
Calf circumference (cm)	33.02	2.6	34.52	3.27	3.539***
Biacromial breadth (cm)	43.13	2.6	42.67	2.89	1.153
Hip circumference (cm)	87.32	5.5	92.09	13.58	3.217*
Percent body fat	15.79	3.63	19.11	4.84	5.425***
Back strength (kg)	106.0	23.4	85.07	24.91	6.098***

* Significant at .05 level; *** Significant at .000 level

Table 2. *Age-wise descriptive statistics of anthropometric variables in Indian inter-university male cricketers and controls.*

Variables	16-18 years		19-21 years		22-25 years	
	Cricketers Mean/SD	**Controls** Mean/SD	**Cricketers** Mean/SD	**Controls** Mean/SD	**Cricketers** Mean/SD	**Controls** Mean/SD
Ht (cm)*	167.10±6.40	172.40±5.79	169.30±6.69	173.20±4.15	174.00±6.21	170.80±5.50
Wt (kg)*	54.83±6.29	65.07±12.28	60.21±9.92	71.12±9.92	67.11±8.00	72.20±12.58
BMI (kg/m^2)*	19.63±1.86	21.81±3.52	21.04±3.54	23.70±3.12	22.17±0.03	24.67±3.74
TL (cm)*	51.11±2.79	54.55±4.80	50.91±3.37	53.16±4.54	52.08±3.64	52.32±4.96
LLL (cm)*	43.35±2.74	43.63±3.55	43.91±2.95	44.23±3.75	45.51±2.83	43.17±3.91
TLL (cm)*	94.59±4.96	98.42±5.02	94.24±5.67	98.01±4.60	97.76±4.88	96.39±4.67
MTC (cm)	44.55±3.05	44.88±5.08	46.29±4.13	46.20±4.06	46.24±3.76	47.31±4.79
CC (cm)*	31.75±1.91	34.09±3.20	32.85±2.72	34.68±3.07	33.90±2.67	34.67±3.56
BAB (cm)*	42.54±2.41	42.98±2.37	42.98±3.11	43.53±2.36	43.58±2.50	41.61±3.39
HC (cm)*	84.62±4.66	90.40±12.82	87.26±6.34	93.58±11.66	89.02±5.02	91.84±15.86
BF (%)*	11.42±2.45	13.08±1.67	11.86±2.39	12.91±1.71	10.62±2.89	11.86±1.97
BS (kg)*	103.1±20.33	76.23±22.11	112.14±29.74	85.36±28.67	104.16±20.48	91.00±21.39

*Significant at 0.01-0.000 levels; Ht = Height; Wt = Weight; BMI = Body Mass Index; TL = Thigh length; LLL = Lower leg length; TLL = Total leg length; MTC = Mid-thigh circumference; HC = Hip circumference; CC = Calf circumference; BAB = Bi-acromial breadth; %BF = Percent body fat; BS = Back strength.

Table 3. *Inter-correlation matrix of selected anthropometric characteristics in Indian inter-university male cricketers.*

Variables	Wt (kg)	BMI (kg/m²)	TL (cm)	LLL (cm)	TLL (cm)	MTC (cm)	HC (cm)	CC (cm)	BAB (cm)	%BF (%)	BS (kg)
Ht (cm)	0.57 **	0.04	0.58**	0.69**	0.77**	0.11	0.33**	0.32**	0.36**	-0.04	-0.10
Wt (kg)		0.84**	0.20	0.38**	0.34**	0.64**	0.83**	0.72**	0.45**	0.24*	0.02
BMI (kg/m²)			-0.14	0.01	-0.08	0.70**	0.73**	0.66**	0.32**	0.33**	0.10
TL (cm)				0.37**	0.81**	-0.05	0.06	0.10	0.08	-0.14	-0.05
LLL (cm)					0.78**	-0.01	0.09	0.23*	0.17	-0.21*	-0.03
TLL (cm)						-0.07	0.09	0.19	0.17	-0.25*	-0.04
MTC (cm)							0.80**	0.59**	0.25*	0.44**	-0.01
HC (cm)								0.64**	0.45**	0.43**	-0.02
CC (cm)									0.34**	0.16	0.09
BAB (cm)										0.18	-0.11
BF (%)											-0.02

*Significant at 0.05 level; **Significant at 0.01 level; Ht = Height; Wt = Weight; BMI = Body Mass Index; TL = Thigh length; LLL = Lower leg length; TLL = Total leg length; MTC = Mid-thigh circumference; HC = Hip circumference; CC = Calf circumference; BAB = Bi-acromial breadth; %BF = Percent body fat; BS = Back strength.

DISCUSSION AND CONCLUSIONS

Cricket is a game of endurance, also is played throughout the year. Thus demand of physical fitness of the players is the prime. It is well established that anthropometric analysis of different sports has shown optimum performance appears to have definite physical requirements (Tanner, 1964; Hebbelink et al., 1975; Alexander, 1976, Copley, 1980; Elliot & Smith, 1983; Stretch, 1987, 1991; Claessens et al., 1994; Landers et al., 2000; Slater et al., 2005). In the present study, apart from conventional anthropometric variables, estimation of back strength was done to assess the strength of the back muscles of the cricketers. The findings of the present study indicated greater back strength in cricketers than controls. Greater back strength in cricketers was probably due to the effect of strenuous training program and was useful to generate more forces in them during game. The energy generated in the lower extremities during throwing action gets transferred to the shoulder and ultimately to the ball through kinetic chain. This helps in increasing the force, because lower extremities are larger body parts and generate more energy than the shoulder joint (Kibler, 1998). Due to unavailability of literature related to back strength of cricketers, the present findings were not compared. Statistically, no correlations were found between back strength and any other parameters studied. Indian inter-university cricketers had lesser body weight, circumferential measurements and percent body fat than controls, due to the effect of regular physical exercise. Leaner and circumferential measurements were significantly positively correlated among themselves, showing proper absolute size and shape in them.

When comparisons were made with the findings of Stretch (1987), Indian inter-university cricketers were found to be shorter in height and lighter in weight, having lesser BMI and higher % body fat.

Considering the playing position, Stretch & Buys (1991) reported no significant differences in the height, girth, diameters, and skinfold measurement among batsmen, bowlers and all-rounders. That's why in the present study, playing position-wise data were pooled. This was one of the limitations of the study (players

were not segregated playing position-wise). Instead, the cricketers were divided into three age groups, viz. 16 - 18 years (younger), 19 - 21 years (intermediate) and 22 - 25 years (older). Results suggested that, younger cricketers (age group 16 - 18 years) had lesser mean values for almost all the characteristics studied than the intermediate group (age groups 19 - 21). Physical and physiological maturational factors might be the reason for these differences (considering the age too). Another limitation of the study was the inclusion of only male data. Female data would be considered in future project.

The data presented in the present study carry immense practical application and should be useful in future investigation on player selection, talent identification in cricket and training program development.

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