International Journal of Physical Education, Sports and Health 2020; 7(5): 240-244

P-ISSN: 2394-1685
E-ISSN: 2394-1693
Impact Factor (ISRA): 5.38
IJPESH 2020; 7(5): 240-244

www.kheljournal.com
Received: 13-07-2020
Accepted: 25-08-2020

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Anthropometric profile of district level cricketers of west Bengal

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Abstract
Anthropometric characteristics and somatotype profile give information about basic foundations of an individual concerning the tools of motor ability. Cricket is most popular sports in India yet very few studies have been caried out on specific anthropometric characteristics of the cricketers. Hence, the present study was carried out to explore the specific anthropometric and somatotype characteristics of the cricket players according to their areas of specialization. A total 60 male cricketers with the mean age of 17.58±2.09 yrs were classified into three categories and total 13 Anthropometric components including somatotype profile have been evaluated. Bowlers have greater height, greater arm span for beneficial at time of bowling delivery. The somatotype characteristics of the batsmen are 2.8-3.9-3.3, followed by bowlers (2.8-3.8-3.4) and all-rounders (2.9-3.8-3.5). Overall, these somatotype characteristics of the cricketers possess a meso-ectomorphic physique (2.8-3.8-3.4). The present study highlights that the district level cricketers of West Bengal possess mesomorph physique followed by ectomorph.

Keywords: Anthropometry, Body Structure, Cricketers, Somatotype.

Introduction
The popularity of cricket in India, specifically in West Bengal state has been increased in leaps and bounds, even though the game is not included in the Olympic sports. It is evident that its popularity reaches sky limit in most commonwealth countries. From socioeconomic point of view, Cricket, even being popular in some of the countries, can also be compared not only to soccer, but also to tennis and boxing. Despite the above facts, the scientific studies on cricket are few and far between when compared to soccer, tennis and cricket, where scientific studies are plenty. Unlike other sports, Cricket is being categorized in three main disciplines/events, like 5 days cricket, ODI or one day cricket limited to 50 overs and the latest T20, the 20 over cricket. The demand of each discipline may vary.

Physique or anthropometric profile can be defined as systematic measurements of size, shape and proportion of the human body. Somatotype, the elemental part of physique is the sensitive indicator for sports persons and people from all walks of life regarding their physical growth and nutritional characteristics (Chatterjee *et al*., 2006) [1]. Specific physical characteristics or anthropometric profiles indicate whether an athlete would be suitable for the competition at the highest level in a specific sport (Bryner *et al*, 1997; Johnstone *et al*., 2014 and Pyne *et al*., 2006) [2, 3, and 4].

Cricket is classified into three areas of specializations on the basis of skillsets, like batsmen, bowlers and all-rounders (ICC History of Cricket-wiki.) [5]. in some studies, Wicket-Keepers are also classified as another type of specialization. In this study, the wicketkeepers have been included in batsmen since they are the fielders as well as batsmen (Lemmer, 2011; Ahmed *et al*., 2013) [6, 7].

According to Baskrik *et al*. (1986) [8]. Regular physical activity may bring about changes in body composition and body fat percent. In a study on the physique and body composition of Olympic track and field athletes, Parizkova *et al*. (1968) [9]. Conclude that the athletes are both born and made. “The basic structure” must be presented for the possibility of being an athlete to compete. Proper physique helps the athletes to reach at the top level of success. Mathew *et al*. (1985) [10] suggested that measurement of anthropometric components along with height and age improved the prediction competitive performance in sports. According to Sahu (2015)

[11]. regular physical activity, during childhood, resulted in a favourable influence on the body composition and cardiac endurance. Previous studies by Mathew *et al*. (1985) [10], Stuelcken *et al*. (2007) [12] and Pyne *et al*. (2006) [4] indicate that anthropometric profile including height and weight of elite athletes' play significant role in high performance. Evaluation of these variables projects the quantification of morphological characteristics which can be vital in relating body structure and sports performance of elite athletes (McArdle, Katch, & Katch, 2010; Gibson *et al*., 2018; & Gil *et al*.,2007) [13,14,15] Height is beneficial for bowling like bounce, length in cricket (Johnstone *et al*.,2014) [3]. Regular physical activity alters anthropometric characteristics and the somatotypes of children (Shukla *et al*., 2009 and Baskrik *et al*., 1986) [8, 16]. On the basis of previous literature, anthropometric characteristics of an individual suggests an important role in any sports including cricket. This may be brought about by the fact that anthropometric characteristics of the cricketers are scanty in World literature.

Hence, the present study has been carried out to explore
i) The anthropometric characteristics of the cricketers according to their skillset of specializations.
ii) The somatotype profile of the cricketers with areas of specializations
iii) The differences, if any, according to the specializations, since, there are little bit of deviations in training the batsmen, bowlers and all-rounders.

Methodology

Total 60 district level male cricketers of West Bengal with the mean age of 17.58±2.09 years participated in this study, with areas of specialization groups as batsmen (N=20), bowlers (N=20) and all-rounders (N=20). The volunteers who participated in district tournament with a training age of minimum two years were selected for the study from two major clubs where the top district level players of West Bengal come for training. The present study was approved by the Institute's ethical committee.
All the volunteers have been invited and informed about the study and written consent was obtained. The data were collected under natural atmosphere in morning session between 7 am. To 11 am. A total of 13 physical and anthropometric components were measured following methodology of ISAK guideline (Table 1) [17]. All data measured in triplicate with the median score used for the calculation by the same researcher, who holds an ISAK level 1 accreditation.

Body mass and standing height were taken by Dr. Trust (USA) (Model: Absolute Handy) electronic personal weighing scale and stadiometer (Vittico) respectively with accuracy of 100 g and 0.1 cm. All skinfold thickness was measured using the Harpenden (Baty International) skin fold callipers-CE 0120 with 0.2 mm accuracy. Length and circumference were assessed by Anthropometric Tape (Cescorf-2m) of 1 mm accuracy. Sliding calliper was used for bone breadth with accuracy of 1 mm. All the measurements were taken from right side of the volunteer body. BMI of the collected data (table no.2) is calculated by weight in kg/height in mt^2 and percentage of fat was done by Durnin and Womersley prediction equation, 1974 ;[{ percentage of fat=Intercept-(slope x log(X))} where X =sum of four skinfolds (biceps, triceps, subscapular and supraillica)] according age factor [20]. BMR was predicted from 66+ (13.7 x body mass, kg) + (5.0 x stature, cm)-(6.8 x age, y) [13].
The Heath-Carter formula [17, 21] has been used for somatotype calculation and somatochart preparation. The formulae are as follows:

A. Endomorphic component

$= -0.7182 + 0.1451 \times \sum SF - 0.00068 \times \sum SF^2 + 0.0000014 \times \sum SF^3$
$\sum SF$ = (sum of skinfold thickness of triceps brachii, subscapular, and superior iliac) × [170.18/height (cm)]
This is called height corrected endomorphy.

B. Mesomorphic component

= 0.858 × breadth of bi-epicondylar humerus + 0.601 × breadth of bi-epicondylar femur + 0.188 × corrected girth of upper arm + 0.161 × corrected girth of calf − height × 0.131+ 4.5 Corrected value is [value − (1/10 skinfold thickness)]

C. Ectomorphic component

The ectomorphic component is the difference according to the value of the height-weight ratio (HWR, HWR = height / 3 √weight) is also known as Ponderal index (PI).
HWR ≥ 40.75 = 0.732 × HWR − 28.58
38.25 < HWR < 40.75 = 0.463 × HWR − 17.63
HWR ≤ 38.25 = 0.1(or recorded as ½)

The formula marked on the somatotype chart (2-D) is as follows:
X = Ectomorphic component − Endomorphic component
Y = 2 × Mesomorphic component − (Endomorphic component + Ectomorphic component)

Table 1: Anthropometric variables of the cricketers

Sl. No.	Variables	Equipment	Measuring units
1	Body Weight	Weighing scale	Kilogram
2	Standing Height	Stadiometer	Centimetres
3	Biceps skin fold	Harpenden (Baty International) skin fold callipers-CE 0120	Millimetres
4	Triceps skin fold		
5	Subscapular skin fold		
6	Suprailiac skin fold		
7	Medial calf skin fold		
8	Humerus breadth	Moore and Wright (MEB-528)	Centimetres
9	Femur breadth		
10	Upper Arm Circumference	Anthropometric Tape (Cescorf-2m)	
11	Maximum Calf Circumference		
12	Leg Length		
13	Arm Span		

Statistical Analysis

Statistical analyses were done by using Gnumeric Spreadsheet. Anderson-Darling Normality Test was done to understand the distribution pattern and according to the nature of the distribution pattern, one way ANOVA was applied for determination of level of significance. The level of significance has been fixed at p = 0.05.

Results

The basic physical characteristics of three group volunteers are shown in Table 2. Data are represented as Mean ± SD.

Table 2: Basic physical characteristics of the cricketers according to their specialization (Mean ± SD).

Variables	Batsman	Bowler	All rounder	Total
No. of Volunteers	20	20	20	60
Age (years)	18.05±2.44	17.50±1.64	17.20±2.12	17.58±2.09
Height(cm)	164.96±6.49	167.28±6.29	161.32±7.43	164.52±7.09
Weight(kg)	54.52±6.48	57.25±9.03	51.92±12.80	54.56±9.87
Body Fat (%)	12.90±3.81	13.54±4.16	12.96±5.59	13.13±4.52
BMI	20.12±1.95	20.41±2.78	19.78±3.81	20.07±2.91
BMR	1514.12±103.55	1567.73±141.91	1466.88±195.56	1516.51±154.85

BMI: body mass index, BMR: basal metabolic rate. *Significant at p<0.05

Descriptive statistics of anthropometric characteristics of cricketers are presented in Table 2. Height, Weight and percentage of body fat of bowlers are relatively higher than their other counterparts, but not significantly. Other physical characteristics are almost similar. Average BMI of all cricketers is around 20 and specific groups are comparable to the total group. No significant differences do exist among three specialized groups.

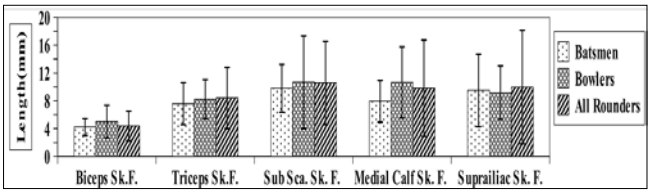

Fig 1: Graphical representation of skinfold variables.

It is observed that there is no significant difference among three groups in skinfold thickness from fig. no 1. The mean and SD values of five skinfold thicknesses do not differ significantly.

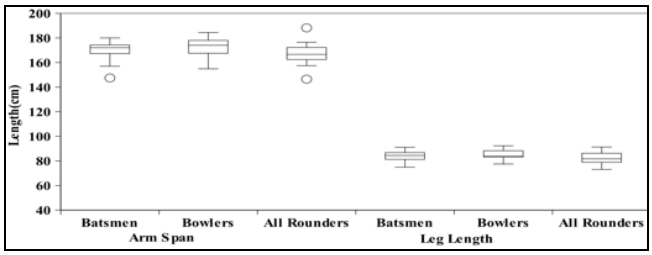

Fig 2: Boxplot of Arm Span and Leg Length of the cricketers according to their specialization.

Figure 2 reveals that arm span have outlier in both side of all-rounder and batsman only for negative side. The leg length data are gathered into the interquartile range for all groups. It is observed that no significant differences exist among the three specialization groups.

Table 3: Specific Anthropometric characteristics of the cricketers according to specialization displays in the bellow noted table (Mean ± SD).

No.	Anthropometric parameters	Batsmen	Bowlers	All-rounders	Total Cricketers
1.	Lean body mass (kg)	47.39±4.95	49.29±6.59	44.61±8.09	47.10±6.84
2.	Humerus Breadth (cm)	6.53±.24	6.49±.32	6.6±.68	6.54±.05
3.	Femur Breadth (cm)	9.17±.48	9.23±.49	8.81±.81	9.07±.63
4.	Upper Arm Circumference (cm)	25.65±2.15	26.78±2.41	24.98±3.47	25.8±2.79
5.	Maximum Calf Circumference (cm)	32.00±2.03	33.32±3.06	31.72±3.31	32.68±2.89
6.	Arm Span (cm)	170.04±8.04	172.47±7.60	167.14±8.63	169.88±8.26
7.	Leg Length (cm)	83.93±4.27	85.16±4.18	81.92±5.17	83.67±4.68

*Significant at p<0.05

Table 3 illustrates data about other physical components. Lean body mass, upper arm circumferences, maximum calf conferences, arm span and leg length of the bowlers are highest followed by the batsmen and the all-rounders, but no significant differences exist among them.

Table 4: Somatotype characteristics of the cricketers according to specialization displays in the bellow noted table.

Variables	No. of Volunteers	Endomorphy	Mesomorphy	Ectomorphy	X	Y
All Cricketers	60	2.84±1.34	3.82±1.00	3.38±1.26	0.52±2.48	1.43±2.54
Batsman	20	2.76±1.17	3.87±0.78	3.33±1.13	0.57±2.18	1.64±2.06
Bowler	20	2.84±1.15	3.77±1.10	3.35±1.33	0.51±2.56	1.35±2.95
All Rounder	20	2.93±1.68	3.81±1.13	3.45±1.38	0.48±3.03	1.29±2.65

*Significant at p<0.05

Table no. 4 shows that Mesomorph component of all groups are relatively dominating. The endomorph component is low and mesomorph component is high for three groups of the cricketers, indicating a meso-ectomorphic physique, although no significant difference has been displayed among these their specialised groups.

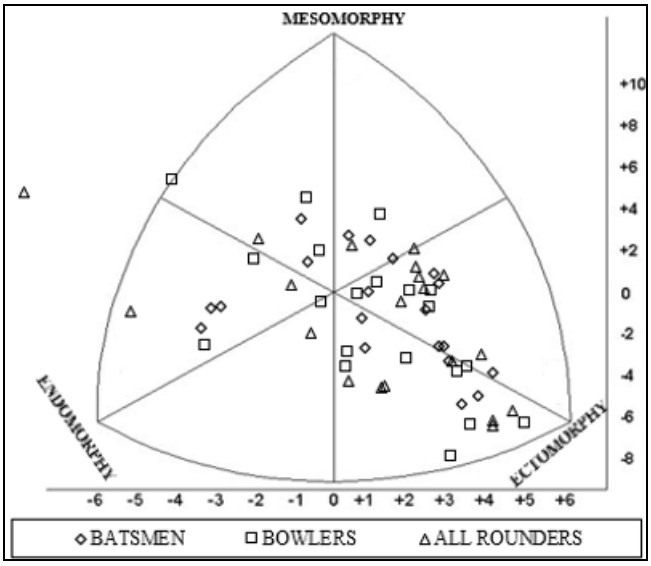

Fig 3: Graphical representation of Somatotype of three different specialization in cricket.

Figure 3 reveals somatotype plotting of all cricketers studied here. Scattered plotting has been found in the somatochart. Maximum data are at the centre of the somatochart, but some are scattered. Despite of the normality of the data, some are scattered in the chart. Most of the data represent the mesomorph and ectomorph areas and less in endomorph mesomorph ares of the Heath Carter somatochart.

Figure 4 illustrate the somatotype plotting of the batsmen (2.8 – 3.9 – 3.3), the bowlers (2.8 – 3.8 – 3.4) and all-rounders (2.9 – 3.8 – 3.5). The overall characteristics of cricketers represent the average plotting in the somatochart with less endomorphic characteristics. All of them possess a meso-ectomorphic physique.

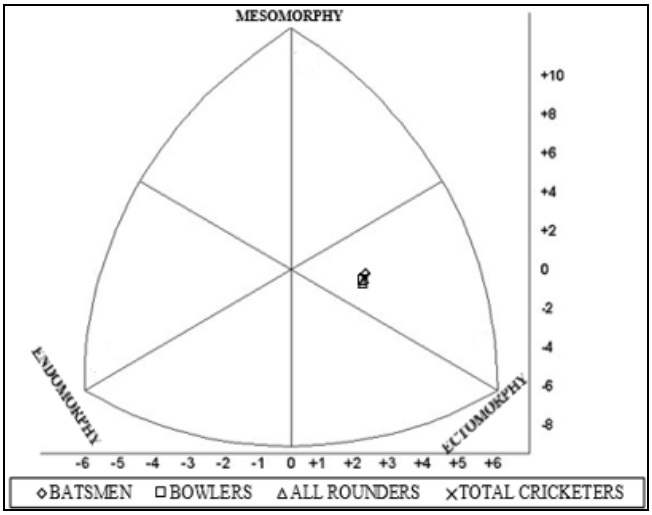

Fig 4: Graphical representation of Somatotype of different specialization in cricket.

Discussions

Anthropometric profile, like physiological profile, reflects the physical ability of a sports person. In our present study, average height, B.M.I. of the bowlers are higher than that of batsmen and all-rounders. These findings also supported the observations by Koley *et al*. (2012) [18] and Lamani (2016) [19] on district level and Goa state level players. Physique or Anthropometry is related to function. Adaptation of the physiological systems take place in different ways depending on the training and activity in that sports. For example, the physiological adaptations are different in marathoners than their badminton counterparts. Similarly, the anthropometry, the structure or the somatotype characteristics differ between a marathoner and a badminton player. Height is beneficial for bowling like bounce, length and better BMI helps to generate the maximum force during delivery of the bowling. It is observed that mesomorph component of all the specialized groups are relatively higher than the ectomorph and endomorph components, indicating that the district level cricketers in this study possess a meso-ectomorphic physique. A longer arm span in cricket is important in fielding as well as in pace bowling. In our study, the arm span of the cricketers is comparable with those of inter-district level cricketers of Punjab (Koley *et al*, 2012) [18], but lower than elite Australian cricketers (Stuelcken *et al*, 2007) [12]. All-rounders in the present study, have relatively greater humerus breadth then the batsmen and bowlers. It indicates that maximum power originating from elbow joint, is utilised during bowling and application force of the drive at batting in game and during fielding. This may be due to the training characteristics of these players. Average femur breadth of bowler has comparatively high and help to generate strength from surface and maintain the balance during bowling action. Bowlers have maximum Arm Span area that helps to create maximum range of motion during pace bowling and also a special advantage in fielding. It is also an advantage to keep a great impact in bowling delivery and maintaining good line and length (spot to spot) during bowling. In addition, Bowlers have also greater leg length that support to maintain balance and organise the total stability and maintaining the maximum performance over the year.

No significant differences exist among endo, meso and ectomorphy components of the present district level cricketers of West Bengal. Mesomorph component is high followed by ectomorph and endomorph. The bowlers, batsmen and allrounders possess a meso-ectomorphic physique. On the other hand, the inter-university level cricketers of Uttarpradesh (Singh and Singh, 2015) [22] possess an ecto-mesomorphic physique where the ectomorph components dominate over meso and endomorph components. The Australian fast bowlers exhibited a somatotype profile of 2.4-5.2-2.4 reflecting a meso-ectomorphic physique (Stuelcken *et al*, 2007) [12]. Most of the previous studies revealed that pace bowlers dominated in mesomorph components and our study also supports the previous findings. The elite group of hockey players also exhibit a meso-ectomorphic physique at all the positions (Holway and Seara, 2011) [23]. Moreover, somatotype of the sports persons depends on ethnicity and racial characteristics besides the training adaptations and even a review has been published on ethnicity and success in cricket (Dutton and Lynn, 2015) [24].

In our study, batsman have highest mesomorph components, may be for greater balance, power and strength to help maximum score by hitting boundaries, scoring runs. Even the bowlers and all-rounders also indicate a mesomorph physique, suggesting more muscularity. These somatotype characteristics of present district level cricketers and in other studies indicate a mesomorph physique followed by ectomorph and endomorph.

Conclusions

Hence, the present study highlights that the anthropometry characteristics like somatotype, leg length and arm span may be given a special look in identifying future cricket talent.

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