

Correlations of Anthropometric Measurement and Handgrip Strength between Collegiate Cricket Fast and Spin Bowlers

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Abstract

Background: More dimensions in anthropometric variables and dominance of the hand aid in bowler's success and is easier for coaches/teams to pick and hire on the basis of fast and spin bowlers. Little is known to date on the relationship between anthropometric measures and handgrip power in collegiate bowlers. Present study is an attempt to quantify the handgrip power of collegiate male cricketers, and to explore its correlations with some selected anthropometric variables.

Methods: Forty fast and 37 spin bowlers, aged between 20-25 years (mean age= 22.7±1.2 years) were selected from match practice group of different colleges in Rahata taluka, Maharashtra. Body height and mass were measured to calculate body mass index. Handgrip strength was measured with standard dynamometer. Statistical analysis was carried out for each variable and independent *t*-test was used to analyze differences between the two groups. Pearson's correlation coefficient test was done to obtain relationship between handgrip strength and selected anthropomorphic variables. The significance was set at 0.05.

Conclusion: Anthropometric variables were directly related to handgrip strength among bowlers in this study. Forearm lengths of spinners were longer than fast bowlers. Handgrip strength was more in dominant hand and spinners had more handgrip strength than fast bowlers. These parameters will help in future for talent identification in handgrip-related sports and/or clinical settings.

Keywords: Anthropometry, dynamometer, hand grip strength, male bowler, cricket.

Introduction

Cricket is one of the oldest organized sports but very few scientific studies are documented¹⁻⁴. It is a popular field-based team sports, in terms of participants, spectators and publicity, with the display of an array of skills during batting or bowling⁵⁻⁷. In sports, the optimal success tends to have definite physical parameters such as height, weight, and physical fitness variables like speed, agility and flexibility⁸⁻¹². Cricketers are also exposed to more stringent practices, that involves extensive stretches of preparation and training¹³, this massive workload is the foremost negative factor contributes to an increase in the incidence of injuries¹⁴⁻¹⁷. For a variety

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of sports and other fields, it has been well established that specific anthropometric profiles specify whether the player would be suitable for the competition at the highest level¹⁸⁻²⁰, however this knowledge is lacking in cricket.

Anthropometric measurements are useful for providing an important role in identification of talents²¹. Cricket is focused on specific abilities such as catching, batting, and bowling. Bowling is a combination of running, leaping, swinging, stopping, and using hand grip and strength to deliver a ball through vertical rotations of the hand²². Cricket player's anthropometry and hand grip strength (HGS) are critical to their success since they are tall and muscular²³. It, as such supremacy, is important in deciding the player's power values²⁴. For a positive score, a player with a bigger hand and better grip strength helps in simple ball gripping as well as stronger basic hand movements²⁵. Very little is being done before for classifying cricketers based on physical and anthropometrical demands of cricket especially in India. Only limited studies are available on the morphological and anthropometric features and handgrip ability of cricket players²⁶⁻²⁹. Hand length, hand weight, forearm length, arm length, upper extremity length, and hand grip power are measured in this study to analyze the players based on selection in collegiate fast bowlers and spin bowlers, as this can help players to perform better at higher levels of cricket.

Material and Methods

Source of Data: Male cricketers were selected from different colleges selected from match practice group of Rahata taluka, Ahmednagar, Maharashtra, India.

Study setting: The study was conducted in the department of Orthopaedic Physiotherapy, Dr. APJ Abdul Kalam College of Physiotherapy, Loni, Ahmednagar, Maharashtra.

Type of Data: Quantitative data.

Sampling Method: Simple Random Sampling.

Sample size: Total number of participants in this study was 100, of which 77 were analyzed (fast-bowlers n=40, spin-bowlers n=37), while 23 samples could not be assessed due to the Covid-19 pandemic and the participant's inability to partake.

Method of collection of data: Data was collected by the primary investigator.

Study Duration: 2 years.

Equipments used: Handgrip dynamometer, Measuring tape, Stadiometer, Weighing scale.

Materials used: Participant's consent and information forms, Inform consent form, Data collection form, Evaluation chart, Screening form, Pen and pencil.

Selection Criteria:

- **Inclusion criteria:** Healthy, physically active participants of 20-25 years old college level male cricket bowlers willing to participate and to submit written informed consent form.

- **Exclusion criteria:** Participants with any genetic, psychological, neurological or chronic diseases affecting hand function and anthropometric measurements and also with recent injuries and fractures.

- **Variables/Outcome Measures:** Height, Weight, body mass index (BMI), hand width, hand length, forearm length, arm length, upper extremity length, hand grip strength (HGS).

Procedure: Ethical committee approval (Ref. No.- PIMS/CPT/IEC/2020/76) was taken from the Institutional Ethical Committee. Participants were included in the study according to the inclusion and exclusion criteria after explaining to them about the nature of the study, duration of intervention in the language best understood by them. They were encouraged to clarify any queries regarding the study. After obtaining a written consent form, demographic data were collected, assessed and participants were subsequently allocated into two groups based on the

method of convenience sampling. Participant's height (m) and weight (kg) were measured using stadiometer and analog weighing scale respectively. Measurements of anthropometric variables (hand width, hand length, forearm length, arm length, upper extremity length) and the HGS was carried out using measuring tape (Fig. No.1) and the hand dynamometer respectively.

Data analysis:

Standard descriptive statistics (mean ± standard deviation) were determined for directly measured and derived variables. The data showed normal distribution encouraging using parametric statistics.

Data were compared for statistical significance using Student's *t*-test. The significance level for all statistical analyses was $p < 0.05$.

Pearson's correlation coefficients were used at 5% ($p, 0.05$) and 1% ($p, 0.001$) level of significance to establish the correlations of dominant and non-dominant HGS with other variables in fast and spin bowlers.

Photographs were taken using camera of OnePlus8T phone. Figure was made by Adobe

Photoshop CS4 programme.

Data were analyzed with SYSTAT software (made by Crane's software, Bangalore) version-12; a licensed copy.

Findings and Discussion

The main objectives of the study was to analyze hand anthropometry and HGS, and to correlate them among collegiate level fast and spin bowlers. As a result, we will be able to learn more about the success of players and in preventing sports accidents. Hand length, hand width, forearm length, arm length, upper extremity length (Fig. No.1), and HGS were measured to evaluate bowlers, as this can help players to perform better at higher levels of cricket. The demographic variables such as age, height weight and BMI were examined between the two groups, and found that they were comparable among fast and spin bowlers (Table No.1). Anthropometric studies in many other sports documented that optimal success tends to have definite physical parameters and physical fitness⁹⁻¹². Also earlier studies advocated that the height and arm length of the bowler was critical for bowling speed, as height is directly proportional to the projectile and

boosts angular velocity and enhances ball velocity³⁰⁻³¹.

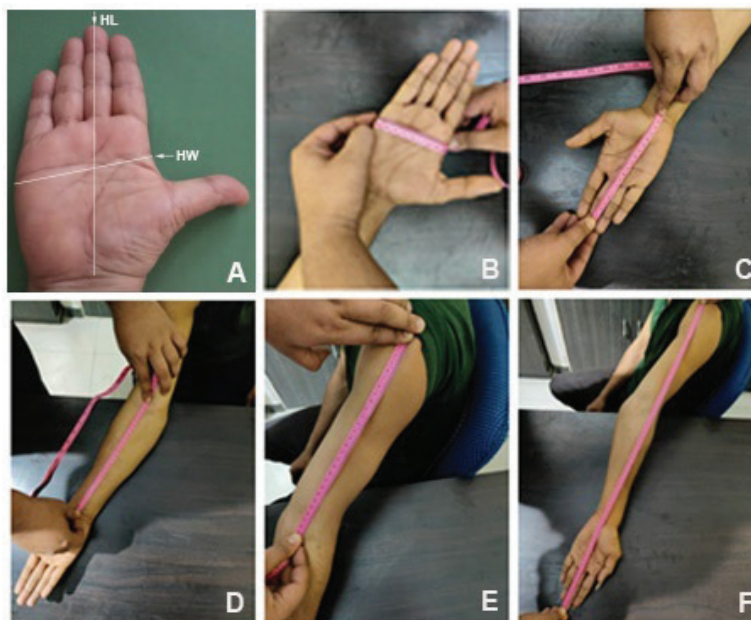


Fig. No. 1: Measurement of hand anthropometric variables using measuring tape

Interpretation: **A:** hand length (HL) and hand width (HW) demarcations. **B:** hand width. **C:** hand length. **D:** forearm length. **E:** arm length. **F:** upper extremity length.

Table No. 1: Demographic characteristics of collegiate cricket bowlers.

Demographic characteristics	Fast bowler (n= 40)	Spin bowler (n= 37)	p value
	Mean ± SD	Mean ± SD	
Age (years)	22.60 ± 1.20	22.8 ± 1.23	0.51
Height (m)	1.76 ± 0.05	1.77 ± 0.05	0.61
Weight (kg)	75.03 ± 4.50	74.68 ± 4.80	0.75
BMI (kg/m ²)	24.2 ± 0.10	23.9 ± 1.20	0.21

kg: kilograms; m: meters; m²: square meters; SD: standard deviation.

Except for the forearm length, rest of the anthropometric variable measurements were insignificant among fast and spin bowlers (Table No.2). Forearms of fast bowler were significantly smaller than that of spin bowler; $p < 0.05$ and $p = 0.01$ for the right and left forearms respectively (Table

No.2, marked #). Earlier reports have suggested that, longer arm length was an essential factor to generate greater speed and the cricket ball travels larger distance, because longer lever increases the ball release velocity, thus has an added advantage in bowling performance³²⁻³⁴.

Table No. 2: Anthropometric measurements of collegiate cricket bowlers.

Anthropometric measurement (cm)	Fast bowlers (n=40)	Spin bowlers (n=37)	p value
	Mean ± SD	Mean ± SD	
Right hand width	10.53 ± 0.85	10.41 ± 0.80	0.53
Left hand width	10.53 ± 0.85	10.38 ± 0.79	0.44
Right hand length	16.45 ± 1.36	16.65 ± 1.30	0.51
Left hand length	16.40 ± 1.34	16.65 ± 1.30	0.41
Right forearm length #	25.95 ± 1.36	26.54 ± 1.10	0.04*
Left forearm length #	25.78 ± 1.40	26.51 ± 1.07	0.01*
Right arm length	28.10 ± 1.24	28.35 ± 1.09	0.35
Left arm length	28.00 ± 1.30	28.27 ± 1.10	0.33
Right upper extremity length	70.40 ± 3.73	71.40 ± 3.30	0.22
Left upper extremity length	70.10 ± 3.69	71.35 ± 3.33	0.12

cm: centimeters; SD: standard deviation.

Table No. 3: Hand grip strength (HGS) of collegiate bowlers (Pooled Data).

Dynamometer HGS (kg)	Right hand	Left hand	p value
	Mean \pm SD	Mean \pm SD	
Right hand fast bowler (n=35)	42.03 \pm 4.44	33.89 \pm 4.55	0.001**
Right hand spin bowler (n=32)	43.68 \pm 2.84	36.94 \pm 3.09	0.001**
Left hand fast bowler (n=5)	35.20 \pm 5.81	43.60 \pm 4.72	0.01*
Left hand spin bowler (n=5)	39.40 \pm 3.44	44.20 \pm 2.49	0.001**

kg: kilograms; SD: standard deviation.

Anthropometric variables are directly related to HGS among bowlers. Majority of the fast bowlers (35 out of 40) and spin bowlers (32 out of 37) analyzed were right hand dominated, only 5 in each group were left hand dominating bowlers. We compared the HGS of right hand vs. left hand of right handed pace and spin bowlers. Irrespective of type of bowler, our data showed that the dominating right hand showed

significantly more HGS than the non-dominant left hand (Table No.3). Though the sample size of left hand dominating bowlers were small (n=5 in each group), the HGS measured was significantly higher for the bowling left hand than the non bowling right hand (Table No.3). HGS data of fast bowlers against spin bowlers showed that, former had significantly less HGS than the later (Table No.4, pooled data).

Table No. 4: Hand grip strength (HGS) of collegiate bowlers (Pooled Data).

Handgrip strength (HGS) (kg)	Fast bowlers (n=40)	Spin bowlers (n=37)	p value
	Mean \pm SD	Mean \pm SD	
Right hand	41.18 \pm 5.08	43.16 \pm 3.24	0.043*
Left hand	35.10 \pm 5.56	38.27 \pm 4.34	0.01*

kg: kilograms; SD: standard deviation.

Cricket player's HGS and anthropometric factors have a strong correlation and are critical to their achievement since they are tall and well-built³³. It, as such supremacy was important in deciding the player's power values. For a positive score, a player

with a bigger hand and better grip strength helps in simple ball gripping as well as stronger basic hand movements^{34,35}. The non-dominant hand has less grip strength than the dominant hand, making it harder for the player to understand. This would be a disadvantage during bowler's selection, resulting in bad results and consistency. More dimensions in the

anthropometric variables and dominance of the hand aid in the bowler’s success. As a result, it is easier for coaches and teams to pick bowlers and hire on the basis of fast bowlers and spin bowlers.

Hardly any research has been conducted to date on the inter co-relationship between anthropometric measures and HGS in collegiate level fast and spin bowlers. Based on height, the longer the player’s hand length, arm length, and upper extremity length, the stronger the player’s hand grip and power to bowl spin

or fast³⁵. Also, longer limbs will have more muscle mass to exert energy and augment pace bowling ability³⁵. We tried to express the degree and direction of linear association between HGS and anthropometric variables and our data showed a strong correlation which was given in Table Nos. 5 and 6. The HGS of both hands showed positive (p<0.05) correlation with height, weight and BMI of fast (Table Nos. 5) and spin (Table Nos. 6) bowlers. Similarly, hand and arm anthropometric variables also showed significant positive correlation with each other.

Table No. 5: Inter-correlation matrix of HGS and anthropometric variables among collegiate cricket fast bowlers (Karl Pearson’s correlation) (r) value

Weight	BMI	RHHW	LHHW	RHHL	LHHL	RHFL	LHFL	RHAL	LHAL	RHUEL	LHUEL	RHGS	LHGS
Height	0.786*	-0.269**	0.856*	0.844*	0.379*	0.374*	0.507*	0.514*	0.572*	0.538*	0.564*	0.538*	0.538*
0.181*							0.445*						
Weight	-	0.383*	0.766*	0.742*	0.441*	0.397*	0.487*	0.632*	0.554*	0.426*	0.558*	0.573*	0.573*
0.225*							0.444*						
BMI	-	-	-0.105**	-0.105**	-0.184**	-0.198**	0.011*	0.022*	-0.009**	-0.050**	-0.060*	-0.080**	-0.080**
0.166*							0.024*						
RHHW	-	-	-	-	0.481*	0.495*	0.603*	0.641*	0.683*	0.652*	0.671*	0.656*	0.656*
0.068*							0.522*						
LHHW	-	-	-	-	0.481*	0.495*	0.603*	0.641*	0.683*	0.652*	0.671*	0.656*	0.656*
0.068*							0.522*						
RHHL	-	-	-	-	-	0.987*	0.778*	0.753*	0.660*	0.623*	0.648*	0.664*	0.664*
-0.131**							0.238*						
LHHL	-	-	-	-	-	-	0.761*	0.781*	0.675*	0.632*	0.667*	0.687*	0.687*
-0.162**							0.209*						
RHFL	-	-	-	-	-	-	-	0.675*	0.662*	0.635*	0.645*	0.629*	0.629*
0.429*								0.429*					
LHFL	-	-	-	-	-	-	-	-	0.621*	0.699*	0.674*	0.642*	0.642*
0.472*									0.447*				
RHAL	-	-	-	-	-	-	-	-	-	0.687*	0.663*	0.675**	0.675**
0.405*													
LHAL	-	-	-	-	-	-	-	-	-	-	0.698*	0.635*	0.635*
0.404*													
RHUEL	-	-	-	-	-	-	-	-	-	-	-	0.665*	0.665*
0.413*													
LHUEL	-	-	-	-	-	-	-	-	-	-	-	-	-
0.422*													
RHGS	-	-	-	-	-	-	-	-	-	-	-	-	-
LHGS	-	-	-	-	-	-	-	-	-	-	-	-	-

* **positive correlation** i.e. as the value of one variable increased so does the value of the other variable increased.

** **negative correlation** i.e. as the value of one variable increased so does the value of the other variable decreased.

BMI: body mass index; HGS: hand grip strength; LHAL: left hand arm length; LHFL: left hand forearm length; LHGS: left hand grip strength; LHHL: left hand hand length; LHHW: left hand hand width; LHUEL: left hand upper extremity length; RHAL: right hand arm length; RHFL: right hand forearm length; RHGS: right hand grip strength; RHHL: right hand hand length; RHHW: right hand hand width; RHUEL: right hand upper extremity length.

Table No. 6: Inter-correlation matrix of HGS and anthropometric variables among collegiate cricket spin bowlers (Karl Pearson’s correlation) (r) value

Weight	BMI	RHHW	LHHW	RHHL	LHHL	RHFL	LHFL	RHAL	LHAL	RHUEL	LHUEL	RHGS	LHGS
Height	0.710*	-0.281**	0.822*	0.808*	0.312*	0.322*	0.492*	0.502*	0.524*	0.515*	0.553*	0.515*	0.142*
Weight	-	0.324*	0.741*	0.735*	0.428*	0.391*	0.477*	0.636*	0.556*	0.418*	0.563*	0.423*	0.192*
BMI	-	-	-	-0.112**	-0.125**	-0.169**	-0.187**	0.012*	0.037*	-0.007**	-0.051**	0.057*	-0.074**
RHHW	-	-	-	-	0.423*	0.464*	0.599*	0.631*	0.663*	0.661*	0.663*	0.663*	0.065*
LHHW	-	-	-	-	0.434*	0.497*	0.599*	0.643*	0.663*	0.661*	0.663*	0.615*	0.065*
RHHL	-	-	-	-	-	0.947*	0.761*	0.742*	0.648*	0.615*	0.614*	0.652*	-0.127**
LHHL	-	-	-	-	-	-	0.750*	0.762*	0.666*	0.645*	0.648*	0.667*	-0.153**
RHFL	-	-	-	-	-	-	-	0.685*	0.652*	0.630*	0.632*	0.618*	0.413*
LHFL	-	-	-	-	-	-	-	-	0.607*	0.677*	0.655*	0.637*	0.470*
RHAL	-	-	-	-	-	-	-	-	-	0.632*	0.652*	0.667**	0.415*
LHAL	-	-	-	-	-	-	-	-	-	-	0.675*	0.624*	0.416*
RHUEL	-	-	-	-	-	-	-	-	-	-	-	0.658*	0.403*
LHUEL	-	-	-	-	-	-	-	-	-	-	-	-	0.417*
RHGS	-	-	-	-	-	-	-	-	-	-	-	-	-
LHGS	-	-	-	-	-	-	-	-	-	-	-	-	-

* **positive correlation** i.e. as the value of one variable increased so does the value of the other variable increased.

** **negative correlation** i.e. as the value of one variable increased so does the value of the other variable decreased.

BMI: body mass index; HGS: hand grip strength; LHAL: left hand arm length; LHFL: left hand forearm length; LHGS: left hand grip strength; LHHL: left hand hand length; LHHW: left hand hand width; LHUEL: left hand upper extremity length; RHAL: right hand arm length; RHFL: right hand forearm

length; RHGS: right hand grip strength; RHHL: right hand hand length; RHHW: right hand hand width; RHUEL: right hand upper extremity length.

Conclusion

As very few studies are reported in connection with hand anthropometry data at college level cricket in developing countries, the present study made an effort to analyze hand anthropometry data of male collegiate cricket bowlers. Due to ongoing Covid-19 pandemic, the sample size was small, still we observed a significant correlation between HGS and some selected anthropometric variables among collegiate cricket fast as well as spin bowlers. More research on bowlers of different age groups and ranks is needed to establish detailed guidance for coaches and teams to pick bowlers and hire on the basis of fast bowlers and spin bowlers. The information provided in this analysis has a wide range of practical applications as it will help players in selecting a bowling style based on their characterized skill and anthropometry and aid in future for talent identification, players selection, talent recognition as well as in designing training protocols in the field of cricket.

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