International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

Anthropometric Variables and Physical Fitness Characteristics in Female Cricket Players of Maharashtra and Punjab: A Comparative Study

Aterah Tahoor[1], Shyamal Koley[2]

[1]MYAS GNDU, Department of Sports Science and Medicine, Guru Nanak Dev University, Amritsar - 143005, Punjab, India
[2]Department of Physiotherapy, Guru Nanak Dev University, Amritsar - 143005, Punjab, India

Corresponding Author: Shyamal Koley

ABSTRACT

Introduction: Cricket is a popular team game in most Commonwealth countries. Anthropometric dimensions and morphological characteristics play an important role in determining the success of an athlete. Information regarding the correlations of handgrip strength with body composition components in Indian elite female cricketers is scanty. Thus, the present study was planned.
Method: A total of 79 state female cricketers (39 Maharashtra players and 40 Punjab players) of age group 18-25 years were selected purposively from various cricket academies of Maharashtra and Punjab. Seven anthropometric variables, such as, height, weight, BMI, hand length, hand breadth, upper arm circumference and percent body fat, and three physical fitness tests i.e. dominant handgrip strength, non-dominant handgrip strength and Illinois agility test were measured on each subject using standard technique.
Results: Significant differences ($p<0.004$-0.001) were noted in non-dominant handgrip strength, upper arm circumference, percent body fat between the cricketers of Maharashtra and Punjab states. The dominant handgrip strength had significant positive correlations ($p<0.021$-0.003) with non-dominant handgrip, height, BMI, hand length and percent lean body mass in pooled cricketers. The non-dominant handgrip strength had significant positive correlations ($p<0.004$-0.001) with height, weight, BMI, hand length and percent lean body mass and significant negative correlation ($p<0.002$) with Illinois agility test in pooled cricketers. The Illinois agility test had significant negative correlation ($p<0.001$) with percent lean body mass in pooled cricketers.
Conclusion: It may be concluded that non-dominant handgrip strength showed a positive correlation with selected anthropometric variables. Similarly, Illinois agility test showed negative correlations with selected anthropometric variables.
Key Words: Female cricketers. Anthropometric variables. Physical fitness characteristics.

INTRODUCTION

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. [1]

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. [2-4] 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. [5-10] These anthropometric and morphological parameters are the sensitive indicators of physical growth and nutritional status of the athletes for their maximal performances. [3, 11]

Research findings are available relating to the anthropometric variables and performance tests in cricketers. [12-19] Not many references are available relating to the female cricketers. Thus, in the present study, an attempt has been made to investigate the anthropometric profile of female cricketers of Maharashtra and Punjab state in India and to search any correlations of selected anthropometric variables with performance tests.

MATERIALS AND METHODS

Subjects

The present cross-sectional study is based on purposively selected 79 female state cricketers (39 Maharashtra players and 40 Punjab players) aged 18–25 years. The subjects were divided in such a way that age 18 refers to the individuals aged 17 years and 6 months through 18 years and 5 months and 29 days. 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 Institutional ethics committee.

Anthropometric Measurements

Seven anthropometric variables, such as, height, weight, BMI, hand length, hand breadth, upper arm circumference and percent body fat were taken on each subject using the techniques provided by Lohman et al. [20] 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. Weight was measured by digital standing scales (Model DS-410, Seiko, Tokyo, Japan) to the nearest 0.1 kg. BMI was then calculated using the formula weight (kg)/height^2 (m) ^{2}. Hand length and breadth was measured by sliding calliper in cm. Upper arm circumference was measured by a flexible metallic tape (Holtain Ltd) from the right side of the subject. Percent body fat was assessed using BMI after Durnin and Womersley: [21]

Percent body fat:

Females (17-68 years) = 1.37 X BMI - 3.47

Males (17-68 years) = 1.34 X BMI - 12.47.

Physical Fitness Tests

Three physical fitness tests such as, dominant handgrip strength, non-dominant handgrip strength and Illinois agility test were measured on each subject using standard techniques.

Handgrip Strength Measurement

The handgrip strength measurement (both dominant and non-dominant) was done using a standard adjustable digital handgrip dynamometer (Takei Scientific Instruments Co., LTD, Japan) at standing position with shoulder adducted and neutrally rotated and elbow in full extension. The dynamometer was held freely without support, not touching the subject's trunk. The subjects were asked to exert maximum force on the dynamometer thrice by their hands and the maximum value in kilograms was recorded. Handgrip dynamometer was calibrated before each assessment. Thirty seconds time interval was maintained between each handgrip strength testing.

Illinois Agility Test

Illinois agility test was done on a flat non-slip surface using 8 cones, a stopwatch and an assistant. The length of course was 10 meters and the width (distance between the start and finish points) was 5 meters. On an athletics track, 5 lanes can be used. 4 cones can be used to mark the start, finish and two turning points. Each cone in centre spaced 3.3 meters apart at beginning of the circuit. When counted in sprint as fast as the cricketer can through the circuit following

the path indicated. Results were recorded in seconds.

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 Maharashtra and Punjab female cricketers. 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 20.0. A 5% level of probability was used to indicate statistical significance.

RESULTS

Table 1 showed the descriptive statistics of seven anthropometric variables and three physical fitness tests in Maharashtra and Punjab female cricket players. Maharashtra players had higher mean values in weight (53.07 kg), hand length (18.39 cm), hand breadth (8.81 cm) and upper arm circumference (26.63 cm) as compared to Punjab cricketers (53.06 kg, 18.31 cm, 8.51 cm and 26.41 cm respectively). Whereas, Punjab cricketers had higher mean values in dominant handgrip strength (27.09 kg), non-dominant handgrip strength (25.71 kg), height (157.40 cm), BMI (21.68 kg/m^2), percent body fat (26.28 %) and Illinois agility test (17.90 sec) than Maharashtra cricketers (27.09 kg, 25.71 kg, 157.40 cm, 21.64 kg/m^2, 26.23 % and 17.59 sec. respectively). However, statistically significant differences (p< 0.004–0.001) were found only in dominant handgrip strength and hand breadth between the female cricket players of Maharashtra and Punjab.

The correlation coefficients of dominant handgrip strength with selected anthropometric variables and physical fitness tests in female cricketers of Maharashtra and Punjab states were shown in Table 2. In Maharashtra players, statistically significant positive correlations (p<0.011-0.001) of dominant handgrip were found with non-dominant handgrip strength, weight, hand breadth and upper arm circumference, whereas statistically significant negative correlation (p<0.05) was found with percent body fat. In Punjab players, statistically significant positive correlations (p<0.017-0.001) of dominant handgrip were found with non-dominant handgrip strength, height, weight, BMI, hand length and upper arm circumference, whereas statistically significant negative correlation (p<0.008) was found with percent body fat. In pooled cricketers, statistically significant positive correlations (p<0.004-0.001) of dominant handgrip strength were found with non-dominant handgrip strength, height, weight, BMI, hand length and upper arm circumference, whereas statistically significant negative correlation (p<0.002) was found with percent body fat.

Table 1: Descriptive statistics of selected anthropometric variables and physical fitness tests in cricketers of Maharashtra and Punjab

Variables	MFCP (n = 39)		PFCP (n = 40)		t-value	p-value
	Mean	SD	Mean	SD		
DHGS (kg)	24.11	3.30	27.09	4.37	3.40	**<0.001**
NDHGS (kg)	23.78	4.06	25.71	4.49	1.00	0.49
HT (cm)	156.32	4.85	157.40	6.51	0.832	0.408
WT (kg)	53.07	8.40	53.06	8.53	0.478	0.634
BMI (kg/m^2)	21.64	3.20	21.68	2.51	0.060	0.952
HL (cm)	18.39	0.943	18.31	1.85	0.239	0.812
HB (cm)	8.81	0.465	8.51	0.469	2.93	**<0.004**
UAC (cm)	26.63	2.53	26.41	2.56	0.391	0.697
% BF	26.23	4.39	26.28	3.44	0.060	0.952
IAT (sec.)	17.59	1.247	17.90	1.35	1.05	0.296

MFCP = Maharashtra female cricket players, PFCP = Punjab female cricket players, DHGS = dominant handgrip strength, NDHGS = non-dominant handgrip strength, HT = height, WT = weight, BMI = body mass index, HL = hand length, HB = hand breadth, UAC = upper arm circumference, %BF = percent body fat, %LBM = percent lean body mass and IAT = Illinois agility test.

Table 3 showed the correlation coefficients of non-dominant handgrip strength with selected anthropometric variables and physical fitness test in female cricketers of Maharashtra and Punjab states. In Maharashtra players, statistically significant positive correlation ($p<0.036$) of non-dominant handgrip strength was found with upper arm circumference. In Punjab players, statistically significant positive correlations ($p<0.004$-0.001) of non-dominant handgrip strength were found with height, weight, BMI, hand length and upper arm circumference, whereas statistically significant negative correlation ($p<0.004$) was found with percent body fat. In pooled cricketers, statistically significant positive correlations ($p<0.002$-0.001) of non-dominant handgrip strength were found with height, weight, BMI, hand length and upper arm circumference, whereas statistically significant negative correlation ($p<0.002$) was found with percent body fat.

Table 2: Correlation coefficients of dominant handgrip strength with selected anthropometric variables and physical fitness tests in cricketers of Maharashtra and Punjab

Variables	MFCP (n= 39)		PFCP (n= 40)		Combined	
	r-value	p-value	r-value	p-value	r-value	p-value
NDHGS (kg)	0.696	**<0.001**	0.887	**<0.001**	0.805	**<0.001**
HT (cm)	0.196	0.231	0.580	**<0.001**	0.445	**<0.001**
WT (kg)	0.401	**<0.011**	0.589	**<0.001**	0.499	**<0.001**
BMI (kg/m^2)	0.311	0.54	0.411	**<0.008**	0.334	**<0.002**
HL (cm)	0.277	0.088	0.370	**<0.017**	0.320	**<0.004**
HB (cm)	0.437	**<0.005**	0.121	0.451	0.105	0.352
UAC (cm)	0.431	**<0.006**	0.485	**<0.001**	0.417	**<0.001**
% BF	-0.311	**<0.050**	-0.411	**<0.008**	-0.334	**<0.002**
IAT (sec.)	-0.106	0.521	0.014	0.932	0.003	0.981

Table 3: Correlation coefficients of non-dominant handgrip with selected anthropometric variables and physical fitness tests in cricketers of Maharashtra and Punjab

Variables	MFCP		PFCP		Combined	
	r-value	p-value	r-value	p-value	r-value	p-value
HT (cm)	0.200	0.222	0.597	**<0.001**	0.448	**<0.001**
WT (kg)	0.372	0.020	0.627	**<0.001**	0.511	**<0.001**
BMI (kg/m^2)	0.269	0.097	0.438	**<0.004**	0.341	**<0.002**
HL (cm)	0.158	0.338	0.530	**<0.001**	0.351	**<0.001**
HB (cm)	0.224	0.170	0.192	0.228	0.121	0.284
UAC (cm)	0.338	**<0.036**	0.503	**<0.001**	0.410	**<0.001**
% BF	-0.269	0.097	-0.438	**<0.004**	-0.341	**<0.002**
IAT (sec.)	-0.149	0.365	0.110	0.494	0.015	0.894

Table 4: Correlation coefficients of Illinois agility test with selected anthropometric variables in cricketers of Maharashtra and Punjab

Variables	MFCP		PFCP		Combined	
	r-value	p-value	r-value	p-value	r-value	p-value
HT (cm)	-0.009	0.956	0.051	0.753	0.034	0.764
WT (kg)	0.102	0.538	0.095	0.556	0.103	0.363
BMI (kg/m^2)	0.107	0.516	0.051	0.751	0.082	0.470
HL (cm)	-0.215	0.189	0.207	0.194	0.001	0.995
HB (cm)	-0.003	0.984	-0.386	**<0.013**	-0.224	**<0.046**
UAC (cm)	0.076	0.643	0.078	0.629	0.075	0.150
% BF	-0.107	0.516	-0.051	0.751	-0.028	0.470

The correlation coefficients of Illinois agility test with selected anthropometric variables in female cricketers of Maharashtra and Punjab were shown in table 4. In Punjab players, Illinois agility test had negative correlation ($p<0.013$) with hand breadth. In pooled cricket players also, Illinois agility test had negative correlation ($p<0.046$) with hand breadth.

DISCUSSION

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. [22-23,12,24-25,10] In the present study, apart from

conventional anthropometric variables, estimation of handgrip strength was done to assess the overall body strength of the female cricketers. The findings of the present study indicated significantly greater handgrip strength in female cricketers of Punjab than their Maharashtra controls. These differences were probably, due to genetic and environmental factors. Physical and physiological maturational factors might also be the reason for these differences. Statistically, significant correlations were found between handgrip strength (both dominant and non-dominant) with selected anthropometric variables both in cricketers of Maharashtra and Punjab. In fact, right dominant handgrip strength was reported to be correlated with weight. [26] Tsuji et al. [27] were in the opinion that grip strength was one of the determinant factors of radial bone mineral density in the dominant forearm of young college athletes. Ducher et al. [28] found that forearm bone mineral content adjusted to lean tissue mass or grip strength was higher on the dominant side, suggesting that tennis playing exerted a direct effect on bone. Pugh et al. [29] observed that handgrip strength correlated with throwing speed in experienced pitchers. Though, earlier, in 2001, they showed no significant relationship among the strength variables and ball speed during the tennis serve. More studies are required to validate the data.

Considering the playing position, Stretch and Buys [13] reported no significant differences in the height, girth, diameters, and skinfold measurements 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). Another limitation of the study was the inclusion of only female data. Male data would be considered in future project.

CONCLUSION

It might be concluded from the present study that female cricketers of Punjab had significantly greater handgrip (dominant) strength than the female cricketers of Maharashtra. In female cricketers (both of Maharashtra and Punjab), dominant and non-dominant handgrip strength had significantly positive correlations with majority of anthropometric variables studied. The findings of the present study have immense practical application in identification of talent with reference to their particular anthropometric parameters in female cricketers. It would be helpful in terms of optimizing training programs specific to the requirement of game of cricket and would be helpful to keep the injury of the players at bay.

REFERENCES

1. Davies R, du-Randt R, Venter D, Stretch R. Cricket: Nature and incidence of fast-bowling injuries at an elite, junior level and associated risk factors. South African Journal of Sports Medicine 2008; 20(4): 115-118.
2. Rico-Sanz J. Body composition and nutritional assessments in soccer. International Journal of Sport Nutrition 1998; 8: 113–123.
3. Wilmore JH, Costill DL. Physiology of Sports and Exercise. 2nd ed. Human Kinetics, Champaign. 1999; pp. 490–507.
4. Keogh J. The use of physical fitness scores and anthropometric data to predict selection in an elite under-18 Australian Rules football team. Journal of Sport Science and Medicine 1999; 2: 125–133.
5. Claessens AL, Efevre J, Beunen G, Malina RM. The contribution of anthropometric characteristics to performance scores in elite female gymnasts. Journal of Sports Medicine and Physical Fitness 1999; 39: 355-360.
6. Bourgois J, Albrecht L, Claessens JV, Renaat P, Renterghem BV, Thomis M, Janssens M, Loos R, Lefevre J. Anthropometric characteristics of elite male junior rowers. British Journal of Sports Medicine 2000; 34: 213-216.
7. Reilly T, Bangsbo J, Franks A. Anthropometric and physiological predispositions for elite soccer. Journal of Sports Science 2000; 18(9): 669-83.
8. Gabbet TJ. Physiological and anthropometric characteristics amateur rugby players. British Journal of Sports Medicine 2000; 34: 303-307.

9. Ackland TR, Ong KB, Kerr DA, Ridge B. Morphological characteristics of Olympic sprint canoe and kayak paddlers. Journal of Science and Medicine in Sport 2003; 6: 285-294.
10. Slater GJ, Rice AJ, Mujika I, Hahn AG, Sharp K, Jenkins DG. Physique traits of lightweight rowers and their relationship to competitive success. British Journal of Sports Medicine 2005; 39: 736-741.
11. Chatterjee S, Chatterjee P, Bandyopadhyay A. Skinfold thickness, body fat percentage and body mass index in obese and non-obese Indian boys. Asia Pacific Journal of Clinical Nutrition 2006; 15: 232–235.
12. Stretch RA. Anthropometric profile of first-class cricketers. South African Journal for Research in Sport, Physical Education and Recreation 1987; 10(1): 65-75.
13. Stretch RA, Buys FJ. Anthropometric profile and body composition changes in first-class cricketers. South African Journal for Research in Sport, Physical Education and Recreation 1991; 14 (2): 57-64.
14. Stuelcken M, Pyne D, Sinclair P. Anthropometric characteristics of elite cricket fast bowlers. Journal of Sports Sciences 2007; 25(14): 1587-1597.
15. Elliott B. Back injuries and the fast bowlers in cricket. Journal of Sports Sciences 2000; 18: 983-991.
16. Mannion AF, Adams MA, Cooper RG, Dolan P. Prediction of maximal back muscle strength from indices of body mass and fat-free body mass. Rheumatology 1999; 38: 652-655.
17. Kumar A, Koley S, Sandhu JS. Anthropometric and physiological relationship of cricketers. Research Bi-Annual for Movement 2007; 23(2): 34-45.
18. Koley S, Yadav MK. An association of handgrip strength with some anthropometric variables in Indian cricket players. Facta Universitatis, Series: Physical Education and Sports 2009; 7(2): 113-123.
19. Koley S, Yadav MK, Sandhu JS. Estimation of handgrip strength and its association with some anthropometric traits in cricketers of Amritsar, Punjab, India. Internet Journal of Biological Anthropology 2009; 3(1).
20. Lohman TG, Roche AF, Martorell R. Anthropometric Standardization Reference Mannual. Chicago, Human Kinetics Book. 1988.
21. Durnin J, Womersley J. Body fat assessed from total body density and its estimation from skinfold thickness: Measurements on 481 men and women aged from 16 to 72 Years. British Journal of Nutrition 1974; 32(1): 77-97.
22. Tanner JM. The Physique of the Olympic Athlete. London: George Allen and Unwin. 1964.
23. Hebblink M, Carter L, De-Gray A. Body build and somatotype of Olympic swimmers, divers and waterpolo players. In L. Liwillie and J.P. Clarys (eds.), Swimming II. Baltimore: University Park Press. 1975.
24. Claessens AL, Hlatky S, Lefevre J, Holdhaus H. The role of anthropometric characteristics in modern pentathlon performance in female athletes. Journal of Sports Sciences 1994; 12: 391-401.
25. Landers GJ, Blanksby BA, Ackland TR, Smith D. Morphology and performance of world championship triathletes. Annals of Human Biology 2000; 27: 387-400.
26. Aghazadeh F, Lee K, Waikar A. Impact of anthropometric and personal variables on grip strength. J Hum Ergol 1993; 22(2): 75-81.
27. Tsuji S, Tsunoda N, Yata H, Katsukawa F, Onishi S, Yamazaki H. Relation between grip strength and radial bone mineral density in young athletes. Archives of Physical Medicine and Rehabilitation 1995; 76 (3): 234-238.
28. Ducher G, Jaffre C, Arlettaz A, Benhamou CL, Courteix D. Effects of long-term tennis playing on the muscle-bone relationship in the dominant and non-dominant forearms. Canadian Journal of Applied Physiology 2005; 30 (1): 3-17.
29. Pugh SF, Kovaleski JE, Heitman RJ. Upper and lower body strength in relation to ball speed during a serve by male collegiate tennis players. Perceptual Motor Skills 2003; 97(3): 867-872.

How to cite this article: Tahoor A, Koley S. Anthropometric variables and physical fitness characteristics in female cricket players of Maharashtra and Punjab: a comparative study. Int J Health Sci Res. 2019; 9(3):1-6.

******