Anthropometric Assessment Of Fast Bowlers And Its Correlation With Throwing Performance

Dr. Ajit Dabholkar*, Dr. Bhavi Ghelani**

*Head Of The Department Of Sports Physiotherapy, **MPT (Sports Physiotherapy), School of Physiotherapy, D.Y.Patil University, Nerul, Navi Mumbai: 400706, Maharashtra, India

Abstract: Background: Anthropometric characteristics (AC) have revealed correlation between body structure physical characteristics and sport capabilities. The purpose of this study was to find the correlation between the AC & throwing performance (TP) in fast bowlers (FB) & to predict if specific variables in AC affect TP. Objectives: To determine AC in FB, Assess TP in fast bowlers, to correlate the AC with the TP and to predict if the AC affects the TP. Material And Methods: 50 FB with Mean age of 23 ±3.11 years & 9±4.33 years of playing experience were evaluated on AC like Height (Ht), Weight (Wt), Fat%, BMI, Linear and Girth measurements of upper & lower limb, Skinfold measurements, Back strength (BS) and TP. Result: Ht ($p \leq 0.030$) and BS ($p \leq 0.045$) show a positive significant correlation. BMI, Fat%, Biceps, Triceps, Subscapular, Supraspinale, Abdomen, Thigh, Mid-Calf, thigh girth, calf girth show negative significant correlation with the TP of fast bowlers. The total r^2 value of all the anthropometric variables is 75% of variance with the TP in fast bowlers. Conclusion: Ht shows positive correlation whereas BMI, Fat %, Lean body mass, Skinfold measurement, Thigh, calf girth shows negative correlation in fast bowlers performance. There is 75% of variance with the Throwing performance in fast bowlers with regards to the parameters mentioned above. [Dabholkar A Natl J Integr Res Med, 2020; 11(4):55-60]

Key Words: Anthropometry, Back strength, Cricket, Fast bowlers, throwing performance.

Author for correspondence: Dr. Bhavi Ghelani, A/601, kukreja palace, Vallabhbaug lane, Ghatkopar (East) Mumbai-400075 E-Mail: bhavi5.bg@gmail.com Mobile: 9870252539

Introduction: Nowadays cricketers are exposed to more demanding schedules, with longer periods of training and practicing[1]. Anthropometric parameters are a set of non-invasive, quantitative technique for determining a human size, shape, proportion, composition by measuring, recording, and analysing specific dimension of the body.

Anthropometry has a rich custom in sports sciences and sports medicine. Though, in diverse times, different terms were used like dynamic anthropometry, sports anthropometry, biometry, physiological anthropometry, anthropometrical, kinanthropometry etc by scientists to create some relationships between the body structure and the specialized functions required for various tasks [2]. The study of 'Body Types' has a significant place in the field of sports. Anthropometric measurement has revealed correlation between body structure physical characteristics and sport capabilities. In all the games, height, weight, and other anthropometric variables play a vital role in the player's performance. The physical structure, especially the height and arm length, have definite and decisive advantage in many games.

Similarly, segmental length of individual body parts, the arm length specifically, is of considerable advantage in selected events in athletics and in certain games. At present, sportsman for superior performance in any sports is selected on the basis of physical structure and body size. Structural measurement include anthropometric measurement which consist of objective measurement of structures such as height,weight,width,depth and the circumference of the various parts of the body[3].

Detailed anthropometric data on the proportions of different body compartments (muscle mass, fat mass, bone mass) is available for a number of sports,[4] but this information is lacking in cricket. Given that body size affects overarm throwing performance,[5] we were interested in identifying relationships between various anthropometric measurements and throwing performance in fast bowlers. Thus this gives us the insight to identify relationships between various anthropometric measurements and throwing performance in fast bowlers.

Material & Methods: All the subjects were explained the purpose of the study and written consent was taken from all of them prior to their assessment. Patients meeting the inclusion criteria were selected. Proforma was filled by interviewing the subjects which included the demographic characteristics.

Subjects: This study was carried out on 50 male A division club level, state and national fast bowlers with a minimum playing experience of 5 years from the following cricket clubs.

Study Setting: D.Y.Patil Sports Academy(Nerul, Navi Mumbai),M.I.G Cricket Club (BKC) Karnataka Sporting Association (Churchgate, Cross Maidan), Achievers Academy (Tilak Nagar), Chembur Gymkhana (Chembur),Central Railways, Parsee Gymkhana.

Participants were selected in the age group of 20-30 years. Fast bowlers with any history of musculoskeletal injury to the upper and lower limb in the past 6 months were excluded.

Method: Demographic data was documented of all the participants. The anthropometric data i.e. (height, weight, linear measurements and girth measurements were measured according to the International Standards for Anthropometric Assessment (ISAK)[6].

Skin folds were evaluated by Lafayette skin fold II caliper. The skin folds of biceps, triceps, subscapular, Supraspinale, abdomen, thigh and mid-calf was measured[6].

B.M.I was measured, fat percent, lean body mass was calculated using Omron body fat analyzer[7].
Back strength was measured using a Back-leg-chest dynamometer [8].The throwing performance was obtained by Modified Functional Throwing Performance test[9].

Data Analysis: To find out correlation between Independent Variables (Height, Weight, BMI, fat percentage, Linear measurements, Girth measurements, Skinfold measurements and Back strength) and Dependent Variable (Throwing performance), Pearson's correlation was done since the data was normally distributed therefore parametric test were used. Regression equation was established for predicting Dependent Variable on the basis of Independent Variables. Statistics were calculated using the SPSS version 21.0.

Level of significance was set at less than or equal to 0.05.

Results: Height ($p \leq 0.030$) and back strength ($p \leq 0.045$) showed a positive significant correlation. Weight($p \leq 0.05$) ,BMI($p \leq 0.000$),Fat percent($p \leq 0.001$),Biceps ($p \leq 0.000$), Triceps($p \leq 0.009$), Subscapular ($p \leq 0.007$), Supraspinale ($p \leq 0.003$), Abdomen ($p \leq 0.000$) ,Thigh($p \leq 0.001$) ,Mid-Calf ($p \leq 0.001$), thigh girth ($p \leq 0.02$),calf girth($p \leq 0.03$) showed a negative significant correlation with the throwing performance of fast bowlers. The r^2 values for Height(0.093), BMI(0.228),Biceps(0.284),Triceps(0.134),Subscapular(0.144),Supraspinale(0.170),Abdomen(0.288), Thigh(0.203) and Mid-Calf(0.194),Thigh girth (0.180),Calf girth(0.156) and Back strength (0.081).

The total r^2 value of all the anthropometric variables is 75% of variance with the throwing performance in fast bowlers.

Table No 1: Correlation Of Individual Anthropometric Variables With The Throwing Performance

Parameters	R value	P value
Height	0.305	0.033*
BMI	0.729	0.000***
Fat Percent	-0.468	0.001**
Shoulder Width	0.729	0.000***
Forearm Length	0.047	0.747
Mid-Thigh Length	0.254	0.075
Foreleg Length	0.107	0.460
Thigh Girth	-0.424	0.002**
Leg Girth	-0.417	0.003**
Biceps	-0.533	0.000***
Triceps	-0.368	0.009**
Subscapular	-0.379	0.007**
Supraspinale	-0.412	0.003**
Abdominal	-0.537	0.000***
Thigh Skinfold	-0.451	0.001**
Mid-Calf Skinfold	-0.440	0.001**
Back Strength	0.285	0.045*

Inference:*significant,**very significant, ***extremely significant.

Table No 2: Regression Analysis Of The Anthropometric Variables And Throwing Performance

Parameters	R Value	R^2 Value
Height	0.305	0.093
BMI	0.478	0.228
Shoulder Width	0.729	0.531
Thigh Girth	0.424	0.180
Leg Girth	0.417	0.174
Biceps	0.533	0.284
Triceps	0.366	0.134
Subscapular	0.379	0.144
Supraspinale	0.412	0.170
Abdominal	0.537	0.288
Thigh Skinfold	0.451	0.203
Mid-Calf Skinfold	0.440	0.194
Back Strength	0.285	0.081

Table No 3: Total Regression Of All Anthropometric Variables With Throwing Performance

Parameter	R Value	R^2 Value
Total	0.871	0.759

Discussion: According to Table No 1 there is a positive significant correlation between the height and the throwing performance with $p \leq 0.033$ stating that more the height better the performance. It predicts that fast bowlers with tall stature would perform better. The mean height of the bowlers in this study was 1.78±4.29. Within the fast bowling population, at a fundamental level, fast bowlers' possess a tall stature ranging between 1.83m – 1.92 m and 1.87m – 1.93m in cricketers of UK and Australia respectively[10,11].

A tall stature for fast bowlers could be perceived as a positive variable in terms of delivery release angle, bounce of ball from the pitch and maybe force production[12, 13, 14].

According to Table No 1 there is a significant positive correlation of shoulder width with the throwing performance ($p \leq 0.000$). Stating that larger the torso better the performance. Portus et al (2000) stated that a bowler with a larger and leaner upper torso bowled faster than those with a smaller and less lean upper torso it could be that the bowlers with a larger torso also approached the bowling crease faster giving them a speed leverage advantage[15].

According to the Table No 1 there is a negative significant correlation between the BMI,Fat percentage, Biceps skinfold, Triceps skinfold, Subscapular skinfold, Supraspinale skinfold, Abdomen skinfold, Thigh skinfold,Mid-Calf skinfold and the throwing performance in bowlers stating that higher the fat in the body lesser the performance. Biceps and abdomen are extremely significant with the throwing performance.

According to Table No 2 the r^2 values of BMI, Biceps, Triceps, Subscapular, Supraspinale, Abdomen, Thigh and Mid-Calf show highest variance in abdomen and biceps of 28% .

Glazier et al (2000) hypothesized that a lean and muscular physique in the fast bowlers is optimal for high ball release velocity. This physique included a greater percentage of type II (fast twitch) muscle fibers[16]. The enzyme that promotes rapid release of energy from the energy systems is two to three times more in fast twitch fibers than slow twitch fibers. Type II fibers have intermittent resistance to fatigue allowing the player for more number of spell of bowling without fatigue and also helps in sustaining anaerobic activity[17].

Noakes et al (2000) also suggested that superior genetic endowment may be more important than physical training in determining who is going to be able to achieve greatest ball release velocities[18].

According to Table No 1 there is a positive correlation of the forearm, mid-thigh and leg length show with the throwing performance stating that longer the length better is the performance but with no statistical significance. The finding that arm length was one of the multiple independent predictors of peak bowling speed in the senior bowlers confirms previous findings that this measure is an important determinant of bowling speed[4,19]. The body length helps an individual to gain more speed while bowling and has been established that attainment of such characteristics helps the cricketers to perform better during competition.

According to studies, when an athlete has increased segmental body length measurements, he/she can throw the ball with higher velocity. The combination of a longer humerus and a higher angular velocity results in higher linear ball velocity[20,21,22]. Mechanically, an increase of a rotation radius should cause a proportional increase of the force applied to the ball, and consequently an increase of the ball's linear velocity. During an overarm throw, the movement's rotation axis is consisted from the arm's longitudinal axis[23]. Reasonably; an overall longer limb has a positive effect on ball release velocity. Conflicting results to this study were found by Jöris et al who did not find any correlation between ball velocity and segmental body lengths. They claim that athletes with short segmental body measurements are capable to reach high throwing performance levels as a result of a more efficient energy transition[24].

Loram et al (2005) and Wormgoor et al (2010) however, reported that in their study, longer limb lengths did not contribute to higher ball release speeds, based on their results it was concluded

that such factors are not of only importance but other factors like skill ,experience, training also contributes in a bowlers performance[25,26].

According to the Table No 1 there is a significant negative correlation between the thigh, calf girth and the throwing performance of the bowlers.Stuelcken et al (2007) found that male fast bowlers possessed large calf girths and arm girths[27]. 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 generates more energy than other parts of the body[28]. Lesser the fat and more the muscle mass better the performance.

According to the Table No 1 there is a positive significant correlation between back strength and the throwing performance. According to Table No 2 the r^2 values are 0.081.Trunk stability is also assessed in cricket fast bowlers because of the notion that a strong and stable mid-torso region is fundamental for efficient technique, force production, accuracy and injury prevention[28,12]. It could also be argued that a stronger midsection enables a front-on orientation to be maintained more easily through the delivery stride and, therefore, reduces shoulder counter-rotation.

Evidence was forthcoming to suggest that increased shoulder counter-rotation may be one of many factors affecting bowling accuracy, particularly in the later stages of a bowling spell. A possible explanation for this may be that counter-rotation of the shoulders affects the stability of the head and upper body, resulting in difficulties in keeping the eyes on the target, in the development of efficient upper body technique and, ultimately, in achieving better accuracy[12].Tanner et al (1964) found that anthropometrical measures are able to distinguish between successful and non-successful athletes although recent research has failed to replicate this finding[29] .It appears that determinants of excellence must go beyond the physique of the athlete. This inability of anthropometrical measures to classify an athlete's event has also been reported in gymnastics[30].

Interestingly, within the Training of Young British Athletes (TOYA) study, the number of hours trained per week was found to be a better predictor of performance for both swimmers and gymnasts than physique[31].

Although, it has been highlighted that the contribution of physique to success is likely to be greater, many examples exist of individuals who have excelled without the anthropometrical and physical profile perceived necessary to succeed. Pietro Mennea held the 200m-world record for 17 years from 1979 to 1996. However, as a youth he was given little hope since it was believed that he did not have the required physique. Apparently, dedication and training were the key factors in his outstanding success[32].

So, the comparatively close relationship that was established between a fast bowlers anthropometric characteristics and their throwing performance has resulted in the belief, that profiling young children on anthropometrical and throwing performance will enable the talent identification of the individuals who have the potential to be successful in a specific event[30].

Though we found significant correlation and 75% variance between anthropometric variables and the throwing performance of fast bowlers as shown in table no 3, we believe that nature (anthropometric profile) along with nurture (skill, training and years of experience) plays an important role in predicting a successful performance of a fast bowler. To make the reading more accurate motion capture camera can be used for assessing the throwing performance which was not used, X ray could have been used for determining the bone length and Lunar iDXA could be used for measuring the bone length.

For the further research directions sophisticated machines can be used for measuring bone length i.e. lunar iDXA , X-rays can be used for measuring appropriate bone length, throwing performance could be analyzed by motion capture camera for more accurate analysis, Ball throwing velocity can be analyzed using a radar gun.

Conclusion: Height has a significant positive correlation on a fast bowlers throwing performance. Weight, BMI, Fat percentage, Lean body mass, Skinfold measurement (Biceps, Triceps, Subscapular, Supraspinale, Abdomen, Thigh and Mid-Calf) has a significant negative correlation on a fast bowler's performance. Thigh and calf girth shows negative significant

correlation on a fast bowler's performance. Back strength shows positive significant correlation on a fast bowler's performance. Height, Weight, BMI, Fat percentage, Lean body mass, Skinfold measurement (Biceps, Triceps, Subscapular, Supraspinale, Abdomen, Thigh and Mid-Calf), linear measurements, Girth measurements and back strength predicts 75% of variance with the throwing performance in fast bowlers.

Clinical Implications: The study highlights the importance of anthropometric measurements and its influence on bowling performance. Height, Back strength are crucial in bowling performance. The various anthropometric parameters need to be assessed routinely in novice bowlers and screen them for bowling performance.

Acknowledgements: I thank my Director Dr Unnati Pandit who supported me in this study for necessary permissions. I also like to thank DYPSA, Nerul for their support and cooperation in evaluation of bowlers. Also sincere thanks to all the participants for their time and willingness to participate in this study.

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Conflict of interest: None

Funding: None

Cite this Article as: Dabholkar A, Ghelani B. Anthropometric Assessment Of Fast Bowlers And Its Correlation With Throwing Performance. Natl J Integr Res Med 2020; Vol.11(4): 55-60