Original Study

Relationship between Anthropometric Parameters and Throwing Velocity among Male Undergraduate College Students: A Cross-Sectional Study

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Abstract

Background: For any persons to have an effective throw, it needs the maximum speed at which the ball is released, as well as precision targeting. Specific body types and throwing velocity can have a correlation which can be measured by anthropometric measurements and contrasted with the velocity thrown by individuals. This study is aimed to assess the relation between anthropometric parameters and throwing velocity.

Material & Method: It is a cross-sectional study conducted among 60 undergraduate male students aged 18-25 yrs at Yenepoya Physiotherapy College. The participants were included in present study after obtaining the informed consent. The study was approved by ethics committee of Yenepoya University. The participants were included in present study after obtaining the informed consent. The study was approved by ethics committee of university. Male undergraduate students aged between 18-25 yrs were included in present study. BUSHNELL radar device was used for evaluation of throwing velocity. ISAK protocol was used to evaluate the participant's anthropometric parameters.

Result: Among baseline parameters, age shows a positive correlation, in the age group 18-25 years. Weight and BMI shows a negative correlation. There is a positive correlation between the shoulder internal and external rotation strength and throwing velocity. The skinfold thickness of biceps, triceps, forearm, subscapularis, iliac crest, abdomen, and front thigh showed a negative coreelation with p value <0.05.

Conclusion: This study concludes that, with the exception of age, weight, BMI, internal and external rotator strength of the shoulder, skin fold thickness, middle thigh girth, acromio-radial length, and femoral width, none of the other anthropometric parameters had a significant relationship with the velocity of throwing among male undergraduates.

Keywords: *Bushnell Radar, Throwing Velocity, Anthropometry, ISAK, Skinfold.*

Introduction

Throwing involves launching an object into flight using either one or both arms. There are different types of throwing and not all of the sports are the same. There is side arm and overhead throwing. Throwing in a competitive handball team is considered one of the most important technical skills.[1] Throwing efficiency can be calculated in different ways, but throwing velocity is the most common measurement. The maximum voluntary speed is required for proper throw execution.[2,3] Throwing speed is an important aspect that we can alter. It has an effect on the game's achievements. So a player should throw with his maximum velocity. This speed is an essential aspect of success, since the faster the ball is thrown, the less time-keeper and defenders have to save the shot.[4]

Throwing is the sequential movement of the body from the larger, slower moving trunk to the quicker,

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distal movements of the comparatively smaller segments of the hand and neck. The highest speed of ball release in combination with targeting accuracy is required for an effective throw. So some aspects of the player's body type may affect throwing velocity.[5]

Anthropometric parameters can be used to measure this association of body type with the throwing velocity. Anthropometry is the science of the measurement of human bodies and their parts. The anthropometric parameters are calculated using the International Society for the Advancement of Kineanthropometry (ISAK) protocol. A weighing machine, a stadiometer, a skin fold caliper and a measuring tape can be used to measure it.[6]

The throwing velocity can be determined with a radar device that operates with the concept of Doppler Effect. There should be a correct alignment when dealing with radar gun. It has a cosine effect, that is, if the target is in the radar gun's direct line, the calculated speed will be correct. With increased angle of incidence, the accuracy will decrease.[7]

A pilot study was done by limiting all the previously said limitations. In this study it was noted that only the skinfold thickness was giving a statistically significant correlation with throwing velocity. However, we were not able to measure appropriately the muscle strength by using hand held dynamometer especially for wrist, ankle and trunk muscles. So, the present study will be an extension of the pilot study done earlier. In this a pressure biofeedback unit will be used to measure the above-mentioned muscle strength. So, a better conclusion may be made on the relationship between anthropometric parameters and throwing velocity.

Present study aimed to assess the relation between anthropometric parameters and throwing velocity which is estimated by correlating anthropometric measurements with throwing velocity.

Material & Method

It is a cross-sectional study conducted among 60 undergraduate male students aged 18-25 years at Yenepoya Physiotherapy College. The participants were included in present study after obtaining the informed consent. The study was approved by ethics committee of Yenepoya University. Male undergraduate students aged between 18-25 years were included in present study. The students with any musculoskeletal, neurological and cardiovascular condition or any other pathological condition contraindicating exercise participation and those who actively participated in sports in last 6 months were excluded.

Evaluation of throwing velocity was measured by a BUSHNELL[7] radar device. Radar device was placed perpendicular in direction to player. The Throw took place in a length of normal cricket pitch i.e.; 66 feet. The Radar gun was placed behind the throwers crease. The participants were wearing sleeveless t-shirt. They were asked to perform overhead throw with their maximum velocity. All the participants were using the same tennis ball for the trail. Prior to the throw a 10-minute standardized warm up was given. For better results, 3 throws were given to each participant. There was 20 second rest between each throw. Average of three throws was analyzed.

Anthropometry evaluation was done by using ISAK protocol.[9] Following 24 parameters were chosen. Basic parameter: Height (measured by a stadiometre in cm), Weight (measured by a weighing scale in kg); Skin folds (Measured using skin fold caliper) – Biceps, Triceps, Subscapularis, Forearm, Iliac crest, Abdominal, Front thigh, Medial calf; Girths – Arm (relaxed), Arm (flexed and tensed), Forearm, Wrist, Chest (mesosternal), Thigh, Calf; Length – Acromione – radiale, Radiale – stylion, Distylion – dactylion, Trochanterion – tibiallaterale, Tibia laterale – sphyriontibiale; Breadth – Humerus, Femur; Manual Muscle Testing: evaluated by handheld dynamometer (except wrist, ankle and trunk muscles), wrist, ankle and trunk muscles measured using pressure biofeedback unit.; Range of Motion: Using goniometry; Grip strength: Using hand grip dynamometer

All the collected data were expressed in terms of mean and SD. The strength of association between the variables was assessed using Pearson's correlation. a p-value <0.05 was considered statistically significant. The data entry was done in Microsoft excel sheet and statistical analysis using the SPSS v21 operating on windows 10.

Result

Total of 60 male undergraduate students were

included in present study who fulfilled inclusion criteria and consented. The mean age of the students was 21.43±2.40, BMI of 21.90±3.77 and other demographic physical parameters as in Table 1.

Table 1. Demographic details of the included participants

Baseline data	Mean±SD
Age (years)	21.43±2.40
Height (cm)	173.28±5.4
Weight (kg)	65.9±12.71
BMI (kg/m2)	21.90±3.77
Arm span (cm)	173.63±5.65
Grip strength (kg)	36.85±4.66
Throwing velocity	83.88±10.08

Table 2. Parameters having significant correlation with throwing velocity.

Parameters	Mean	SD	Pearson Correlation	P Value
Skinfold (In mm)				
Biceps	4.22	3.63	-.419*	.021
Triceps	9.39	5.81	-.363*	.049
Subscapularis	10.56	5.82	-.577*	.001
Forearm	5.12	4.11	-.400*	.029
Illiac crest	15.02	9.14	-.533*	.002
Abdomen	20.04	10.42	-.480*	.007
Front thigh	13.70	8.86	-.501*	.005
Medial calf	7.84	5.76	-.267	.154
Right shoulder muscle strength (In Kgs)				
Internal rotators	23.4	3.67	0.308	0.017
External rotators	21.72	3.08	0.325	0.011
Girth (in cm)				
Right Midthigh girth	47.49	4.64	-0.286	0.027
Length (in cm)				
Right Acromion-Radiale	30.57	1.87	-0.341	0.008
Breadth (in cm)				
Femur	9.67	.70	-0.283	0.028

Among baseline parameters age shows a positive correlation (r = 0.339, p value = 0.008), in the age group 18-25 years. Weight (r = -0.405, p value = 0.001) and BMI (r = -0.387, p value = 0.002) shows a negative correlation. The skinfold thickness of biceps, triceps, forearm, subscapularis, iliac crest, abdomen, and front thigh showed a pearsons correlation of -0.294, -0.287, -0.318, -0.431, -0.366, -0.291, and -0.319 respectively with a significance value less than 0.05. There is a positive correlation between the shoulder internal (r = 0.308, p value = 0.017) and external rotators (r = 0.325, p value = 0.011) strength and throwing velocity. The right side midthigh girth, Acromione- Radiale length, femoral breadth shows a negative correlation with throwing velocity with p value <0.05 (Table 2).

Discussion

The present study was done by correlating 24 anthropometric parameters to the throwing velocity to find the relationship between anthropometric parameter and throwing velocity among male undergraduate college students. The participants of the study were 60 male undergraduate college students aged between 18 to 25 years. ISAK protocol was used for measuring anthropometric parameters and throwing velocity was evaluated using a radar device.

A pilot study was done prior on 30 male undergraduate college students aged between 18 to 25 years, and found that except in skin fold thickness none of the other anthropometric parameters had a relation with the throwing velocity among male undergraduate college students. The present study was done by limiting all the limitation of previous pilot study and the results are in agreement with the pilot study, and we got some other important parameters which will influence the throwing velocity.

Among baseline parameters age shows a positive correlation (r = 0.339, p value = 0.008), so as age increases the throwing velocity also increases in the age group 18-25 years. Weight (r = -0.405, p value = 0.001) and BMI (r = -0.387, p value = 0.002) shows a negative correlation. The BMI has an adverse effect on throwing performance, which is if the BMI is more, the throwing velocity will be less and vice versa. So this result affirms the findings of the previous pilot study.

Throwing is subdivided into (1) windup phase, (2) late cocking phase and (3) arm acceleration phase.[10] Shoulder external rotators are at their peak activity in late cocking phase to externally rotate the arm concentrically and shoulder internal rotators are at their greatest activity in arm acceleration phase of throwing.[11]The present study conforms to these statements. There is a positive correlation between the shoulder internal (r = 0.308, p value = 0.017) and external rotators (r = 0.325, p value = 0.011) strength [Table 2] and throwing velocity. These findings may be useful for bowlers as they can perform the throw well if they have good shoulder internal and external rotators strength. A training program of a player who wants to improve their throwing velocity may set exercises concentrating more on strengthening of shoulder musculature.

A Negative association was found between skinfold thickness and throwing velocity. That is; for an individual with minimal skinfold thickness has more throwing velocity and vice versa. Biceps, triceps, forearm, subscapularis, iliac crest, belly, and front thigh skin thickness showed a pearson correlation of -0.294, -0.287, -0.318, -0.431, -0.366, -0.291, and -0.319, respectively and the significance value was less than 0.05, while the medial calf displayed a pearson correlation of -0.234 with a real value greater than 0.05 [Table 2]. These results may be beneficial for players as they can perform the throw well if their body has less fat.

We found significant correlations between BMI, and weight with throwing velocity, these results are different from those reported by Ferragut C et al. They found that body mass aspects are not related to throwing velocity. [8] However, our results are in line with Ferragut C et al in relation with femoral breadth and throwing velocity. Ferragut C et al. took all parameters from ISAK protocol except skinfold. But in this study skinfold was included which showed a significant correlation with throwing velocity.

A study by Pyne DB et al. concluded that growth and maturation primarily account for greater peak bowling speed in senior fast bowlers compared with their junior counterparts.[12] The present study is in agreement with the result of this study in case of age because we also got that as age increases from 18 to 25 years, the throwing velocity also increases.

Limitation: It was done in the southern zone of India and may not be generalized to the population based on the north as there may be some effect of the geographical area on the individual body type.

Conclusion

There is a significant association between age, weight, BMI, internal and external rotator strength of the shoulder, skin fold thickness, middle thigh girth, acromio-radial length, and femoral breadth and throwing velocity; no other anthropometric parameters relate to throwing velocity. Provides a highlight for coaches and players to include training sessions that are helpful in reducing skin fold thickness, thereby reducing weight and BMI, and to include training sessions on reinforcing shoulder muscles, particularly internal and external rotators, in order for the player to maintain or improve their throw performance.

Funding: Self

Conflict of Interest: Nil

Ethical Clearance- Yenepoya University Ethics Committee

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