

# Accuracy-Velocity Relationship and Physical Characteristics in Cricket Ball Throwing

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**Abstract.** It is widely accepted and has been documented that velocity has influence on throwing accuracy negatively or positively. However, no published researches have been documented, identifying the velocity and accuracy throwing skill in cricket. Thus, the study was designed to assess the relationship between segmental lengths, accuracy, and velocity of cricket ball throwing ability of cricket players. The ex-post-facto design was used to form the samples as, 10 junior and 10 senior cricket players. The age of the junior players were between 14- 18 years, while that of the senior players were above 18 years of age. The physical characteristics of height (Mean: 169.4-172.4cm), weight (57.8-61.3), segmental length (25.54-38.48). Ten attempts for each throwing techniques (under-arm; side-arm and over-head throws) were recorded using Sony DV cameras in a field setting with (1/2000 shutter speed and at 30-60fps). The cameras were set-up on a rigid tripod and secured to the floor in the location. First camera was located to obtain maximum accuracy and second camera located to view the throwing performances, at given specified distance in the reconstruction of the two dimensional co-ordinate. The location of camera were chosen so that the optical axes of camera intersected perpendicularly to the designated plane. The accuracy of throwing performances were considered in identify the footage for addition and were subjected to analysis. Only one successful and one unsuccessful performance were considered from ten attempts. The statistical analysis revealed no insignificant differences in the throwing accuracy and velocity of the ball and no significant relationship between the upper and lower body segments of the junior and senior cricket players. These indicate that there is no particular body segment that contributes to throwing ability independently. Therefore there is a need for the cricket players to improve on their throwing skills through specialized practice for different throws, through a well harnessed daily programme. Also, coaches need to study each players throwing mechanics in order to correct, where necessary, for better throwing performances.

**Key word:** Biomechanics, 2D analysis, velocity, accuracy and segment.

## 1. Introduction

Cricket is one of the most popular sports in India. It is a game played by both males and females across many age groups and levels of participation from recreational to professional sports. In India, the game also is played at all levels from amateur to professional competitions. India has been adequately represented at both levels, from intercollegiate to world championship, in both junior and senior men and women categories.

Thy physical characteristics of a person, like body shape or proportion impose constraints upon his/her capacity for sport performance (Agbonjimi, 1995; Oranugo, 1997). Hirashima et al., (2002) have cited that sequential muscle activity and its functional role in the upper extremity and trunk during the throwing. The physical characteristics of thrower have long been associated with success or failure in sport competition. According to Reilly et al (1997) physique and body composition either greatly limit or in some instances predispose an individual's successful participation in one activity or the other. Robert et al., (1991) contented on Individual differences and segment interactions in ball velocity and throwing accuracy. Cricket is a game in which body weight, height, long limbs are pre-requisites and require specific body types and proportions for positional plays (Okuneye and Osman, 1996; Ackland et.al (1997). This research was therefore conducted to find out the relationship between lengths of different body segments and ball velocity and throwing accuracy of cricket players and the differences between the junior and senior cricket players in these variables.

## 2. Methodology

Twenty participant (10 junior and 10 senior), male cricketer of State and National level players volunteered to participate as subject in the study. The age of junior players were 14-18 year of age and senior player were above 18 years of age. The physical characteristics, weight in kilograms, body segmental length were measured in centimeters. The averages of physical characteristics of the subjects were: 57.8 - 61.3 kg body weight, 169.4 - 172.4 cm height, 16.62 - 23.50 years and segmental length 25.54 - 38.48. Ten attempts for each (Under arm, Side arm and Over head throws) were taken by the players, and the number of successful throw at the stump from 20 meter given target was recorded using two Canon SF 10 video camera in the field setting (1/2000 shutter speed and at 60 fps), were positioned such that their optical axes intersected at an angle of approximately 90°.

The camera was set-up on a rigid tripod and secure to the floor in the location. The accuracy of throwing performances was considered in identifying the footage for addition and was subjected to analysis. Only one successful and one unsuccessful performance were considered from ten attempts, video recording was loaded into the researcher personal computer (PC) for trial identification. The identified trials were played with the help of Silicon Coach pro 7 software to make separate clip for each player for separate throwing skill for analysis of ball velocity and accuracy of throws.

## 3. Results

The general purpose of this study was to determine if a common intersegmental coordinative pattern existed between over head throw, with the hopes of being able to make every throw look the same. Both qualitative and quantitative measures were used for data analysis.

Table 1 Body Lengths of (Batsman (B), Medium Fast Bowler (F) and Spin Bowler (S)) the Junior and Senior cricket players.

Variable	Team	N	B	F	S	Df	f. value
Upper arm	J	10	31.41	29.87	30.25	9	0.473
	S	10	31.40	32.83	33.87	9	2.649
Lower arm	J	10	25.12	24.00	25.50	9	1.136
	S	10	25.50	27.67	25.12	9	6.645*
Hand	J	10	20.17	20.13	19.37	9	0.421
	S	10	17.50	21.08	19.42	9	7.848*
Thigh length	J	10	49.58	49.12	52.00	9	0.367
	S	10	48.50	44.41	50.25	9	1.880
Lower leg	J	10	41.54	42.37	43.12	9	0.473
	S	10	39.27	45.33	42.87	9	2.996
Foot	J	10	23.96	24.37	25.00	9	1.892
	S	10	24.82	26.92	23.50	9	2.295

Junior (J): B=6; F=2; S=2 Senior (S) B=5; F=3; S=2

\* =significant at 0.05 level Tab f.<sub>0.05</sub> (2, 7) =4.74

Table-1 that there is insignificant difference between junior player (batsman, medium fast bowler and spinner) in their upper arm, lower arm, hand, thigh length, lower leg and foot length and upper arm, thigh length, lower leg and foot length of senior players as the obtain F-value is less than the tabulated  $F_{0.05}=4.74$ . Only significant differences are cited between senior (batsman, medium fast bowler and spinner) players in their hand and thigh length as the obtain F-value is much more than tabulated  $F_{0.05}=4.74$ .

Table 2. Performance differenceS between junior and senior cricket players in different throws.

Variable	Group	Numbers	Mean	S.D	df	't' value
Under-arm	J	10	2.70	1.15	18	0.691
	S	10	2.30	1.41		
Side-arm	J	10	3.20	1.47	18	-0.660
	S	10	3.70	1.88		
Over-head	J	10	3.80	1.47	18	-2.342
	S	10	5.40	1.57		

J= Junior S = Senior S.D= Standard Deviation

Tab  $t_{0.05} (18) = 2.101$  \*Significance at 0.05 levels.

The analysis of data table-2 that there is a no significant difference between senior and junior cricket player in their under arm, side arm and over head successful cricket ball throws as obtain 't' ratio is less than the required 't' value of 2.101.

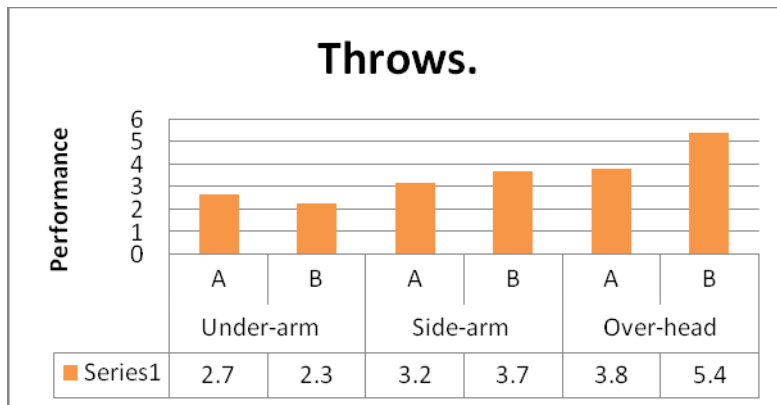


Fig.1: Graphical representation of successful throwing performance of junior and senior cricket players.

Table 3: Relationship between Segmental Lengths and throwing Ability.

Variable	Team	N	Mean	S.D	UA'r'	r <sup>2</sup>	SA'r'	r <sup>2</sup>	OH'r'	r <sup>2</sup>
Upper arm	J	10	30.87	2.06	-0.41	0.17	0.60	0.36	-0.64	0.41
	S	10	32.33	1.59	0.26	0.07	0.03	0.00	0.22	0.05
Lower arm	J	10	24.97	1.08	-0.74	0.55	-0.24	0.06	-0.16	0.03
	S	10	26.08	1.37	-0.36	0.13	0.39	0.15	0.35	0.12
Hand	J	10	20.00	1.01	-0.45	0.20	-0.04	0.00	-0.37	0.14
	S	10	18.96	1.99	-0.33	0.11	0.46	0.21	0.63*	0.40*
Thigh length	J	10	49.97	3.52	-0.29	0.08	0.39	0.15	-0.47	0.22
	S	10	47.63	3.93	0.03	0.00	-0.50	0.25	-0.46	0.21
Lower leg	J	10	42.02	1.95	-0.41	0.17	0.02	0.00	-0.22	0.05
	S	10	41.81	4.16	0.04	0.00	0.36	0.13	0.56	0.31
Foot	J	10	24.25	0.73	-0.13	0.02	-0.08	0.00	-0.26	0.07
	S	10	25.19	2.07	-0.55	0.03	0.25	0.06	0.19	0.04

(p>r) J and S =0.632 UA-under arm SA- Side arm OH- over head throw.

\* =significant at 0.05 level

Table3. Display relationship between segmental length and throwing ability. This study showed that insignificant relationship in the all body length of junior players, while only significant relationship was found in the hand length and over head throws of the senior players.

Table 4. Relationship between Successful and unsuccessful throwing velocity of the junior players.

Variable	N	Group	Mean	S.D	r
Under-arm	10	S	81.58	27.20	0.005*
	10	U	98.08	17.95	
Side-arm	10	S	102.70	34.25	0.291*
	10	U	115.74	15.39	

<b>Over-head</b>	<b>10</b>	<b>S</b>	<b>119.27</b>	<b>11.91</b>	<b>0.154*</b>
	<b>10</b>	<b>U</b>	<b>127.30</b>	<b>13.14</b>	

Tab. (0.05) A and B =0.81

X-Mean S.D- Standard deviation S = Successful throws U = Un-Successful throws

(N) = Number of throws \*= is not relationship at 0.05 level of confident.

Table-4 cited that insignificant relationship between the velocity and accuracy of the throwing of the junior cricket players in their under-arm, side-arm and over-head throws.

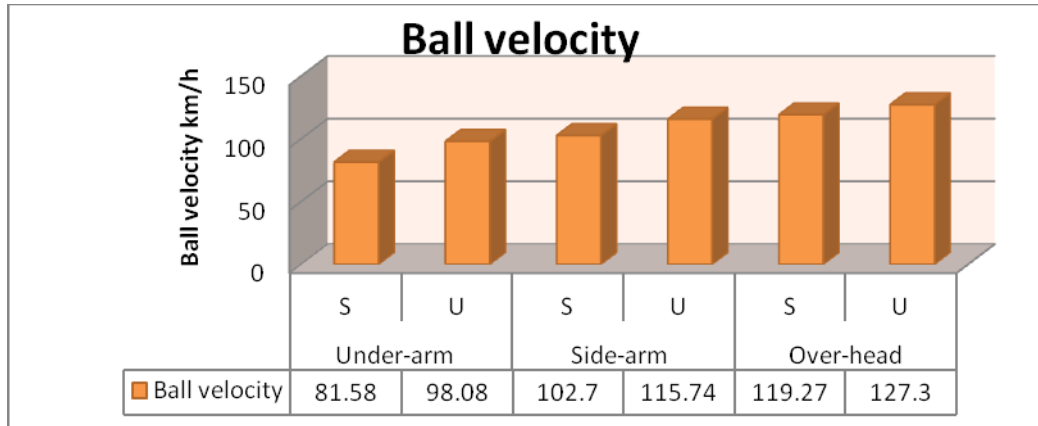


Fig.2: Graphical representation of Successful and unsuccessful throwing velocity of the junior cricket players.

Table 5. Relationship between Successful and unsuccessful throwing velocity of the Senior Cricket players.

Variable	N	Group	Mean	S.D	r
<b>Under-arm</b>	<b>10</b>	<b>S</b>	<b>91.65</b>	<b>16.94</b>	<b>-0.018*</b>
	<b>10</b>	<b>U</b>	<b>98.52</b>	<b>21.48</b>	
<b>Side-arm</b>	<b>10</b>	<b>S</b>	<b>127.79</b>	<b>24.79</b>	<b>0.081*</b>
	<b>10</b>	<b>U</b>	<b>138.45</b>	<b>13.17</b>	
<b>Over-head</b>	<b>10</b>	<b>S</b>	<b>146.40</b>	<b>19.28</b>	<b>0.032*</b>
	<b>10</b>	<b>U</b>	<b>142.98</b>	<b>20.03</b>	

R.tab(0.05)S and U =0.81

S.D- Standard deviation S = Successful throws U = Un-Successful throws

(N) = Number of throws \*= is not Significant at 0.05 level of confident.

Table-5 cited that there was insignificant relationship between the velocity and accuracy of the throwing of the senior cricket players in their under-arm, side-arm and over-head throws; even senior player perform high velocity of the throwing ball as compare junior cricket players which was expected.

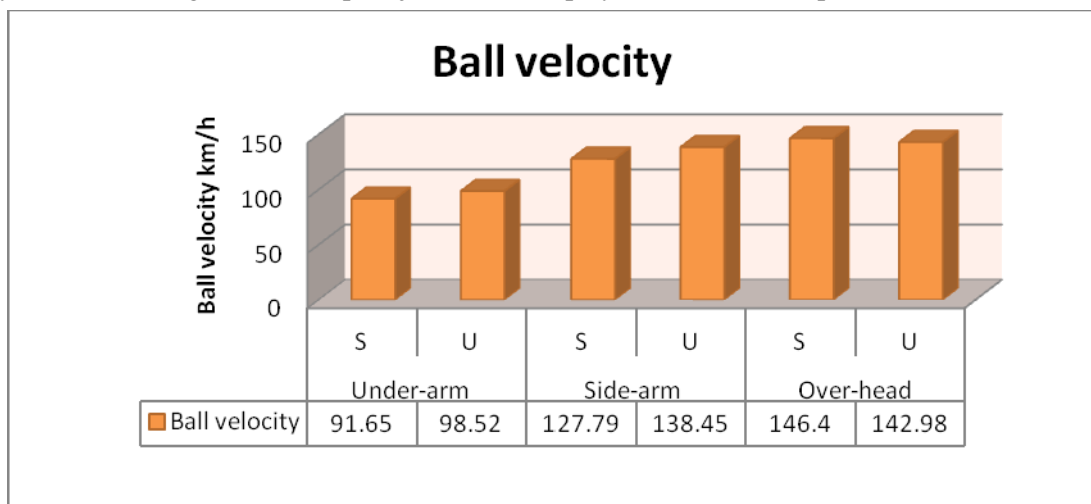


Fig.3: Graphical representation of Successful and unsuccessful throwing velocity of the senior cricket players.

#### 4. Discussion:

The results showed the significant difference between the batsman, medium fast bowlers and spinner bowlers of the teams whereas it exists in the inter-position differences. Significant differences were also found in the forearm and hand length especially between the batsman and medium fast bowlers including spinners of the senior players, while no significant differences existed in the upper arm, lower arm, hand lengths, thigh length, lower leg length and foot length of the batsmen, medium fast bowlers and spinner players of the junior players. Interdisciplinary aspect of this study shows that Ackland et., al (1997) found clear differences in the cricket throws absolute between batsmen, medium fast bowlers and spinner exhibited some similarities for upper body dimensions as found in this study. The Mean difference of throwing velocity in successful and unsuccessful throws cited was negative relationship between the velocity and accuracy of the throwing cricket players (Junior and Senior) in their under-arm, side-arm and over-head throws. The throwing accuracy will be decrease with the increase of ball velocity. This is an indication that there was no major or distinct contribution of each segment singly, but all collectively functioned together to produce the throws with other factors constant. According to Fox and Matthew (1981), it is the arrangement of the bones and muscles together that determine the mechanical effects; thus, making shooting a sequential action in which all body parts contribute for success. This is accomplished through experience which puts the senior cricket team at an advantage over the junior players. Hudson (1982) added that the search for the determinant of success is compounded by the nature of throwing which allows for endless combinations of segmental contributions in conjunction with numerous angles and velocities which can result in shots which directly or indirectly fall through the stumps. Therefore, smooth integration of body segments is of paramount importance to throwing accuracy at the stumps. They explained that the roles of each position within the team were considered to rationalize their findings, with the tallest and heaviest players mainly the medium fast bowlers, senior batsman heaviest than the spinners, junior batsman heaviest than the spinners, and no significant differences in between spinner and batsman height so also in the present study. In Hayes' (1989) study, he found that in throwing, the lower body was the main contributor at the end of the propulsion phase, the forearms' contribution increased and finally just before release, and the hand provided the major contribution. He concluded that coordination of the body segments is an important element in throwing ability in any games and sports. Therefore, more time must be spent in practice of throwing for improvement and optimal performance.

#### 5. Conclusion:

The senior players who are the major focus for this study discriminated distinctly from the junior players in their body weight, height and body length ratios, and throwing ability. It was found that velocity of the ball lead to throwing accuracy, no single body segment independently lead to throwing accuracy but the integration of the whole body segments and ball velocity positively and negatively lead to throwing accuracy. Skillful performance characteristics of throwing therefore must include efficient motion through well-coordinated body segments, proper timing and good muscular control.

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