International Journal for Research in Applied Sciences and Biotechnology

ISSN: 2349-8889
Volume-9, Issue-2(March2022)

www.ijrasb.com

https://doi.org/10.31033/ijrasb.9.2.6

Anthropometric Prediction of Ball Velocity Among Medium Pace Bowlers in Cricket

Pushpendra Narvariya[1] and Joseph Singh[2]
[1]Department of Sports Biomechanics, Lakshmibai National Institute of Physical Education, India
[2]Department of Sports Biomechanics, Lakshmibai National Institute of Physical Education, India

[1]Corresponding Author: pushpendranarvariya@gmail.com

ABSTRACT

The aim of this study was to predict the ball velocity on the basis of anthropometric variables of male division level cricket bowlers.

Materials and methods: A total of 08 medium pace bowlers (mean ± standard deviation; age= 20.2±2.09 years; height= 172±3.65cms.) who participated in recent Gwalior division cricket competition were selected for the study. For anthropometric variables following measurements were conducted: standing height, upper arm length, lower arm length, palm length, upper leg length, lower leg length. Ball velocity was measured with a doppler radar gun. The stepwise multiple regression was conducted to predict the ball velocity of medium pace bowlers based on selected anthropometric variables.

Results: The results suggest that lower arm length and ball velocity had a significant relationship (r = 0.780; p 0.001). In addition, a prediction model (Ball velocity = 76.601+1.507 [lower arm length]) with an R2 value of 0.608 was developed, with lower arm length being the only predictor.

Conclusion: This also signifies that there may be other factors that contributes to the ball velocity such as strength of shoulders, run-up speed, kinematic variables, or kinetic variables. Therefore, future researches should focus on all those parameters that were not included in this study.

Keywords- Anthropometric variables, Velocity of the ball, Cricket.

I. INTRODUCTION

The game of cricket is not only about scoring runs; it's also about defending them. The best way to defend any score is to dismiss the batsman, which is exactly what the bowlers do (Tyagi., 2012). Fast bowlers are attracting increased interest in cricket research because successful performance is linked to teams that include these higher 'rated' individuals. (R. Portus et al., 2000, Stuelcken et al., 2007, Woolmer et al.,2008). Many different factors influence bowling in cricket (for example, technique, physical fitness, psychological skills, and social factors), particularly when fast bowling is considered (Stockill and Barlett, 1992).

When it comes to medium pace bowling, ball release speed plays a key role in minimizing the amount of time it takes for the batsman to analyze the ball's path and decide which stroke to play. Various past studies have attempted to identify those components of fast bowling technique that are related to ball release speed in order to understand how certain bowlers are able to release the ball at greater pace than others (Worthington et al., 2013).

For cricket teams to perform well, bowlers should be able to bowl with high ball release speeds (R. Portus et al., 2000).Fast bowling ability can either help the team by dismissing opponents or reduce the opposition's scoring ability. Previous research studies have suggested that fast bowling is critical to the success of any bowling team (Bartlett et al., 1996; Elliott et al., 1986; Glazier et al., 2000; Hanley et al., 2005; Loram et al., 2005; Portus et al., 2004; Salter et al, 2007; Stockhill & Bartlett, 1994). The capacity of a bowler to achieve a higher ball velocity has been linked to a specific bowling action (Bartlett et al, 1996; Elliot et al., 1986; Glazier et al., 2000; Hanley et al., 2005; Loram et al., 2005; Portus et al., 2004; Salter et al, 2007; Stockhill & Barlett, 1994).

Anthropometric measurements, which consist of objective measurements of structures such as height, weight, width, depth, and the circumference of various parts of the body, are included in structural measurement. Many studies have suggested that the ability of a pace bowler to achieve faster ball release speeds has been related to a bowler's anthropometry. (S. Glazier et al., 2000, Loram et al., 2005, R. Portus et al., 2000, Pyne et al., 2006, Stockill N et al., 1994).

A sportsman's performance is affected by a variety of things. In many sports and activities, anthropometric and physical qualities have the potential for placement and are desirable prerequisites for performance excellence. An athlete's success is largely determined by his or her anthropometric dimensions and morphological traits. In pace bowlers, the anthropometric dimensions play an important role in determining ball release speed. (Rico-Sanz, 1998, Wilmore et al., 1999).

II. AIM OF STUDY

The aim of the present study was to predict the ball velocity on the basis of anthropometric variables of male division level cricket bowlers. It was hypothesized

that there will be significant prediction of ball velocity of medium pace bowlers on the basis of selected anthropometric variables.

III. MATERIALS AND METHODS

Study participants

For this study a total of eight right arm medium pace bowlers (mean ± standard deviation; age= 20.2±2.09 years; height= 172±3.65cms.) who participated in recent Gwalior division cricket competition were selected. All subjects reportedly had a good level of playing experience. The subjects were physically active and no injuries were reported.

Variables

Dependent variable: Ball velocity

The ball velocity was measured using a radar gun, placed in front of the bowling pitch (Figure 1). In this study to measure the speed of the bowler the researcher used a speed gun, as speed also plays a vital role in managing the accuracy of a bowler. With good speed and good accuracy, a fast bowler could be very lethal for the batsman to face.

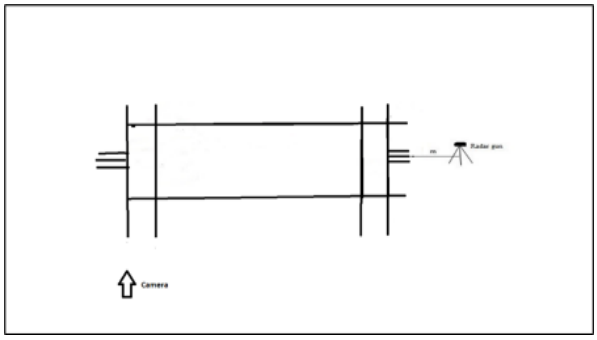

Figure 1: Set up for placement of radar gun and camera during bowling

Independent Variables:

- Anthropometric variables
- Standing height,
- Upper arm length,
- Lower arm length,
- Palm length,
- Upper leg length,
- Lower leg length and
- Ball velocity of the ball.

Criterion measure

- Anthropometric variables were measured by using the anthropometric kit in centimeters.
- Velocity of ball was measured by Doppler radar gun in km/h.

Procedure for Collection of Data

Before the start of data collection, the subjects were well explained about the whole administration of the test in details so that full co-operation from their side could be ensured which also made the data more reliable.

A total of 08 medium-pace bowlers were chosen to fulfill the purpose of the study. Thereafter the selected ten subjects were asked to fill up the consent form and anthropometric measurements of the selected sites were measured using the anthropometric kit available in the sports biomechanics laboratory. Later, each of the bowlers bowled six legal deliveries. The delivery with the maximum ball velocity was considered for the analysis. It was ensured that the bowlers must bowl as they were bowling in a match situation to obtain a data as reliable as possible. The standard cricket leather ball was used for the purpose of the study.

To measure the speed the scholar was standing on the opposite end of the crease, i.e., the batting end with the speed gun named Bushnell Speed Gun in hand, the speed gun was pointing towards the path and line of the ball, as the subjects bowled the deliveries the trigger was squeezed so that the speed could be marked on the gun. The speed was noted in Km/hr with 0.96 was the reliability.

Reliability

There were many sophisticated instruments used for the purpose of the study such as speed gun (i.e., radar gun), and anthropometric kit. All the instruments were purchased and procured from standard firms and were considered to be reliable. In addition, the data showed no fluctuation when taken in different parameters using the same instruments.

Statistical technique

Data were analysed using IBM SPSS (Version 20.0.0) and presented as Mean ± SD. Shapiro–Wilk test approved the normality of the data. The stepwise multiple regressionwas conducted to predict the ball velocity of medium pace bowlers based on selected anthropometric variables. For testing the hypothesis, the level of significance was set at 0.05.

IV. RESULTS

Anthropometric variables on ball velocity

In this sub-section, the influence of anthropometric variables on ball velocity has been presented.

Table 1: Mean and standard deviation of ball velocity and anthropometric variables

Variables	Mean	SD	N
Ball Velocity (Km/hour)	117.00	1.92	8
Height (Cm.)	175.25	2.39	8
Upper Arm Length (Cm.)	28.18	1.33	8
Lower Arm Length (Cm.)	26.81	0.99	8
Palm Length (Cm.)	11.06	0.32	8
Upper Leg Length (Cm.)	41.62	3.25	8
Lower Leg Length (Cm.)	37.93	1.26	8

Table 1 indicates the value of Mean and SD of each selected anthropometric variables (Mean ± SD;

standing height= 175.25±2.39, upper arm length= 28.18±1.33, lower arm length= 26.81±0.99, palm length= 11.06±0.32, upper leg length= 41.62±3.25, lower leg length= 37.93±1.26) and ball velocity= 117.00±1.92 of medium pace bowlers.

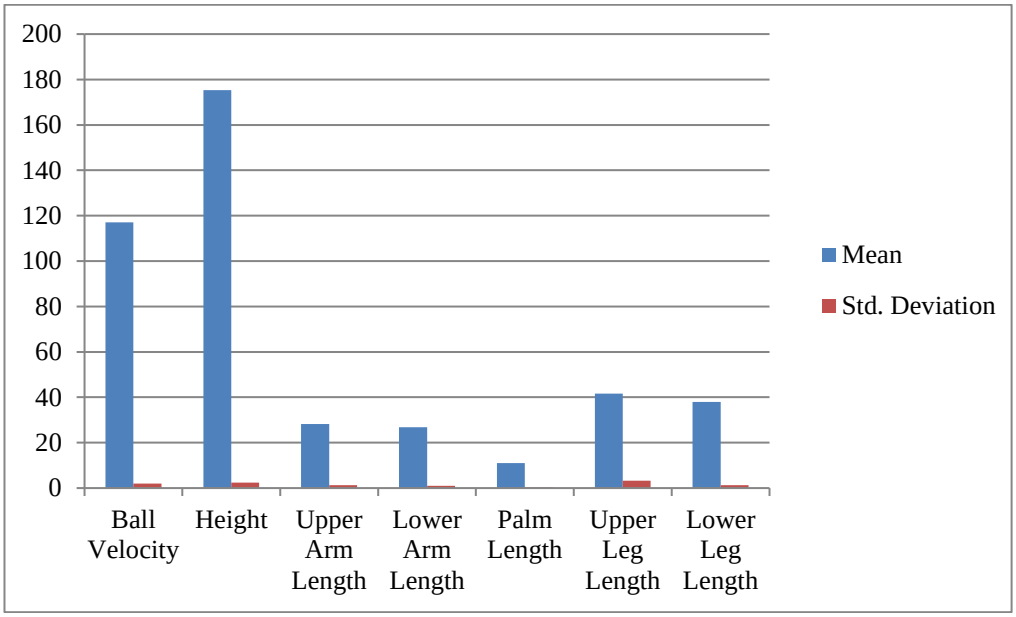

Figure 2: Graphical representation of descriptive statistics ball velocity and anthropometric variables

Table 2: Correlation coefficient (r) of ball velocity and anthropometric variable

	Ball Velocity	Height	Upper Arm Length	Lower Arm Length	Palm Length	Upper Leg Length	Lower Leg Length
Ball Velocity	1	-.140	-.472	.780*	-.347	.364	.059
Height		1	-.308	.142	-.117	.715*	.844**
Upper Arm Length			1	-.318	.052	-.326	-.034
Lower Arm Length				1	-.293	.568	.272
Palm Length					1	-.453	-.341
Upper Leg Length						1	.712*
Lower Leg Length							1

**. Correlation is significant at the 0.05 level (2-tailed).*

From the above table no 2, for two tailed test, at 0.05 level the value of correlation coefficient required for its significance is 0.706. Thus having values more than 0.706 are significant at 0.05 level.

The correlation between the selected anthropometric variables and ball velocity can be observed. The above table show positive significant relationship between ball velocity and lower arm length, height and upper arm length and also shows relationship between upper leg length and lower leg length.

Table 3: Model Summary along with the value of R, R2 and adjusted R square

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.780[a]	0.608	0.543	1.302	0.608	9.325	1	6	0.022

a. Predictors: (Constant), Lower Arm Length

Table 3 shows regression model, The R^2 value for this model is 0.608, which is the highest; thus, this model will be used to develop the regression equation. Table 4 shows that in this model, one independent variable, lower arm length has been identified; thus, the regression equation will be developed using only this variable. Since the R^2 for this model is 0.608, this independent variable explains 60.8 percent of the variability in medium pace bowlers' ball velocity. It follows that for medium-pace bowlers, this model is ideal for estimating ball velocity.

Table 4: ANOVA showing F values for the model

Model		Sum of Squares	df	Mean Square	F	p-value
	Regression	15.821	1	15.821	9.325	.022[b]
	Residual	10.179	6	1.697		
	Total	26.000	7			

a. Dependent Variable: Ball Velocity

b. Predictors: (Constant), Lower Arm Length

Table 4 shows F value for this model. Since this model's F value is quite high and significant ($p<0.05$), it is possible to conclude that the selected model is highly efficient.

Table 5: Regression coefficients of anthropometric variables in model along with their t values and partial correlations

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	**(Constant)**	76.601	13.238		5.787	.001			
	Lower Arm Length	1.507	.493	.780	3.054	.022	.780	.780	.780

a. Dependent Variable: Ball Velocity

Table 5 shows regression coefficient in this model. The t value for regression coefficient lower arm length is significant in this model because the significance value (p value) associated with it is less than 0.05. Thus, it can be concluded that the variable lower arm length of medium-pace bowlers explains a significant portion of the variation in ball velocity. The greater the absolute value of the Beta coefficient, the greater its contribution to the model. Thus, lower arm length is the most important predictor in this model.

***Regression equation*:**

The regression equation can be developed using the regression coefficient (B) of the model shown in Table 5, which is as follows:

Ball velocity= 76.601+1.507× (lower arm length)

To conclude, the above regression equation is quite reliable; as the R^2 value is 0.608.Because the F value for this regression model is highly significant, the model is reliable. At the same time, the regression coefficient in this model is highly significant; thus, it may be interpreted that the variable chosen in the model, namely lower arm length, is quite appropriate in estimating the ball velocity of medium pace bowlers.

V. DISCUSSION

On the basis of the findings it may be concluded that lower arm length and ball velocity have a significant relationship (r = 0.780; p 0.001). In addition, a prediction model (Ball velocity = 76.601+1.507 [lower arm length]) with an R^2 value of 0.608 was developed, with lower arm length being the only predictor.

The results of this study indicate that when bowling at a medium pace, the lower arm length has a significant effect on ball velocity. The fact that the bowling arm is used as a lever (i.e., third class lever) to release the ball during medium pace bowing in cricket may be one of the reasons for this finding. The lower arm functions as a third-class lever (also known as a speed lever), with the force applied to the ball to be thrown. So that, the longer the lever's arm length, the more force that can be applied to the ball. As a result of the increased force production, the ball velocity increases, as velocity is proportional to the force applied.

VI. CONCLUSION

Lower arm length was found to be only variable that is included in the regression model for the present

study but it does not mean that the other variables are not contributing at all. They might influence the performance in some other way but are not selected for the present model. Lower arm length explains 60.8 % of the variability in medium pace bowlers' ball velocity that means the regression model is ideal for estimating ball velocity and good enough to generalize.

Acknowledgment

The author wants to acknowledge Dr. Rohit Kumar Thapa and Dr. Ravi Sharma for their valuable suggestions, help and support and all the participants who participated in this study.

Conflict of interest

The authors declare that there are no conflict of interest.

REFERENCES

[1] Bartlett, R. M., Stockill, N. P., Elliott, B. C., & Burnett, A. F. (1996). The biomechanics of fast bowling in men's cricket: A review. *Journal of Sports Sciences*, 14, 403–424.

[2] Elliott, B. C., Foster, D. H., & Grey, S. (1986). Biomechanical and physical factors influencing fast bowling. *Australian Journal of Sport and Medicine in Sport*, 18, 16–21.

[3] Glazier, P. S., Paradisis, G. P., & Cooper, S. (2000). Anthropometric and kinematic influences on releases speed in men's fastmedium bowling. *Journal of Sports Sciences*, 18, 1013–1021.

[4] Hanley, B., Lloyd, R., & Bissas, A. (2005). Relationship between ball release velocity and kinematic variables in fast bowling in cricket. *Journal of Sports Sciences*, 23, 112–113.

[5] Loram, L. C., McKinon, W., Wormgoor, S., Rogers, G. G., Nowak, I., & Harden, L. M. (2005). The determinants of ball release speed in schoolboy fast-medium bowlers in cricket. *Journal of Sports Medicine and Physical Fitness*, 45, 483–490.

[6] Portus, M., Mason, B., Elliott, B., Pfitzner, M., & Done, R. (2004). Technique factors related to trunk injuries and ball release speed in high performance cricket fast bowlers. *Sports Biomechanics*, 3, 263–283.

[7] Pyne, D., Duthie, G., Saunders, P., Petersen, C., & Portus, M. (2006). Anthropometric And Strength Correlates Of Fast Bowling Speed In Junior And Senior Cricketers. *Journal Of Strength And Conditioning Research*, *20*(3), 620-626. https://doi.org/10.1519/00124278-200608000-00025

[8] R. Portus, M., Sinclair, P., Burke, S., Moore, D., & Farhart, P. (2000). Cricket fast bowling performance and technique and the influence of selected physical factors during an 8-over spell. *Journal Of Sports Sciences*, *18*(12), 999-1011. https://doi.org/10.1080/026404100446801

[9] Rico-Sanz, J. (1998). Body Composition and Nutritional Assessments in Soccer. *International Journal Of Sport Nutrition*, *8*(2), 113-123. https://doi.org/10.1123/ijsn.8.2.113

[10] Salter, C. W., Sinclair, P. J., & Portus, M. R. (2007). The associations between fast bowling technique and ball release speed: A pilot study of the within-bowler and between-bowler approaches. *Journal of Sports Sciences*, 25, 1279–1285

[11] Stockill, N., & Bartlett, R. M. (1994). An investigation into the important determinants of ball release speed in junior and senior international cricket bowlers. *Journal of Sports Sciences*, 12, 177–178.

[12] Stockill, N.P. and Bartlett, R.M. (1992). A three-dimensional cinematographical analysis of the techniques of Inter- national and English county cricket fast bowlers. *In Proceedings of the Xth Symposium of the International Society of Biomechanics in Sports* (edited by R. Rodano, G. Ferringo and G.C. Santambrogio), pp. 52±55. Milan: Edi Ermes.

[13] Stuelcken, M., Pyne, D., & Sinclair, P. (2007). Anthropometric characteristics of elite cricket fast bowlers. *Journal Of Sports Sciences*, *25*(14), 1587-1597. https://doi.org/10.1080/02640410701275185

[14] Tyagi A. (2012). Cricket Skills & Rules. New Delhi: *Khel Sahitya Kendra*.

[15] Wilmore J, Costill D. (1999). Physiology of Sports and Exercise. *Champaign: Human Kinetics.*

[16] Woolmer B, Noakes T, Moffett H (2008). Bob Woolmer's art and science of cricket. Cape Town: Struik.

[17] Worthington, P., King, M., & Ranson, C. (2013). Relationships Between Fast Bowling Technique and Ball Release Speed in Cricket. *Journal Of Applied Biomechanics*, *29*(1), 78-84. https://doi.org/10.1123/jab.29.1.78