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Effect Of Body Size And Gender On Drag-Flick Performance In Field Hockey: A Study On National Elite Players

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Abstract

The purpose of this study was to measure the effect of body size, gender, and their interaction on the ball velocity of the drag-flick performance of Pakistani elite field hockey players. Sixteen elite players (male=8, female=8) from recognized National Hockey Clubs were selected and their drag flick performance was recorded through the VICON motion capturing system. Descriptive statistics, general linear model (univariate), and factor analysis were used for statistical analysis. The average ball velocities of the male and female players were 21.31±3.20 m/s and 15.01±3.75 m/s, respectively. The body size explained 22.4% and gender explained 52.5% variability in the ball velocity of the drag-flick. The gender, body size, and their interaction had a significant ($p<0.05$) effect on the ball velocity. It was concluded that gender had a significant effect on the ball velocity even after controlling the effect of body size. Players should synchronize their body size in an optimum way to attain high ball velocity in drag-flick performance.

Keywords: Hockey; Drag-flick; Ball velocity; Gender; Body size

1. Introduction

It is established that the player's body size which is composed of age, height, and weight has a significant effect on physical performance. It was (Campos et al., 2009) reported that a heightened player performed better in physical activities significantly. Research outcomes showed that the taller female tennis players achieved a high average speed of serve (Sanchez-Pay et al., 2019).

Achievements in games have a straight relationship with specific anthropometric factors and body composition (Carter & Heath, 1990). In Field Hockey and soccer games, Goalkeepers had significantly higher body height while Defenders had significantly larger body weight as compared to the players who played as Mid Fielders and Attackers (Gjonbalaj et al., 2018).

Physiological attributes like body fat, reaction time, cardiovascular efficiency, and vital capacity are considered when picking field hockey players (Verma, 2014), and the said physical factors are highly associated with the body size (Kukolj et al., 2003). The research suggested

that there should be specific anthropometric factors for the players who played in different positions on the team (Rienzi et al., 2000; Gil et al., 2007). Similarly, several studies (Fidelix et al., 2014; Hailu et al., 2016; Ibrahim et al., 2017; Gontarev et al., 2016) confirmed that the specific anthropometric factors were differed according to the player's position in which he played.

Field hockey has several segments, but the penalty corner is the most vital part which is considered an excellent chance to score a goal. This part contains three applications such as push-in, stop, and drag-flick. Drag-flick is the most significant part of the penalty corner and it has a strong association with goal-scoring (Ladru et al., 2019). Therefore, the drag-flick is known as the largest goal-scoring technique in the penalty corner in field hockey (Bari et al., 2014).

The drag-flick performance needs strong body fitness, skills, and kinematic techniques (Sharma et al., 2012). Several studies have been found on the relationship of kinematical factors with the ball velocity of the drag-flick in the Field Hockey (Ladru et al., 2019; Eskiyecek et al., 2018; Ibrahim et al., 2016). In these previous studies, the kinematical data along with ball speed of the national and international drag-flickers (Lopez-de-Subijana et al., 2010) were observed and it was found that the kinematical factors had a significant association with drag flick performance. A radar gun was used to compute the ball velocity of the drag-flick. 2D and 3D biomechanical analyses of the drag-flick performance have also been carried out by the researchers (Eskiyecek et al., 2018; Ibrahim et al., 2016) to measure the different factors of the drag-flick such as the ball velocity, drag length, drag velocity, angles of body parts with high-speed cameras and computer software (Eskiyecek et al., 2018).

Similarly, age, weight, height and gender of the drag-flickers can affect the drag-flick performance (Verma, 2014). The body movements of the flickers had been evaluated to improve their performance in competitions. Many studies were conducted to find out the effect of age, weight, height and gender on the performance in any sports (Gjonbalaj et al., 2018; Hailu et al., 2016; Gil et al., 2007).

Although the effect of body size has been examined in several sports for a long time, no work has been carried out to analyze the effect of body size on the ball velocity of penalty corner drag-flick in Field Hockey. Drag flick is a complex skill and a few players have mastered this technique, but this technique does make a huge difference in winning the match. Therefore, the current study was designed to measure the effect of body size and gender on drag flick performance and it was hypothesized that gender and body size might a significant effect on the ball velocity in drag-flick performance.

2. Methods

2.1. Participants

The research work was carried out in the Biomechanical Laboratory of Lahore University of Management Sciences, Lahore, where players were from well-known hockey clubs in Punjab, Pakistan. The sample contained 16 (male=8, female=8) young hockey players who were playing in their clubs as drag-flickers, their ages were from 15 to 21 years and they had at least 1-year of playing experience at the national or international level. Each player performed 4

drag-flicks; therefore, 64 drag-flicks were used for analysis.

2.2. Measures

3D video graphics methodology was used to obtain the ball velocity along with kinematical factors of the drag-flick through the VICON motion capturing system in the Biomechanics Laboratory at Lahore University of Management Sciences (LUMS), Lahore. All players performed drag-flicks with their standardized sticks, in proper kits after proper warm-up. A single field hockey ball with the reflector was used. MATLAB software was used for data capturing, labeling, and filtering. All drag-flicks were performed with a stationary ball position. The ball velocity was computed based on the distance and time of the ball from releasing point (hockey stick) to reach the goal post. The height and weight of the players were measured manually through standardized devices; age was taken as the player reported. The ball velocity was considered as a response variable while gender and body size were treated as independent variables.

2.3. Statistical Analysis

Descriptive statistics were used to explore the study variables; factor analysis was carried out to generate a single factor (body size) from age, weight, and height; a general linear model (univariate analysis of covariance) was performed to measure the effect of body size, gender and their interaction on the ball velocity. Kolmogorov and Shapiro's tests were applied for data normality. The level of significance was accepted at $p \leq 0.05$.

3. Results

The mean ages of the female and male players were 19.63 ± 1.90 and 20.25 ± 0.80 years, respectively; the mean weight of the female players was 49.00 ± 4.19 kg while the weight of male players was 66.38 ± 4.92 kg; the mean height of the female players was 149.91± 8.23 cm while the height of the male players was 163.19 ± 7.57 cm and the average ball velocities of the female and male players were 15.10 ± 3.75 and 21.31 ±3.20 respectively, as shown in Table 1. It's a clear indication that male players had achieved high ball velocity in drag flick as compared to the ball velocity of female players.

The basic hypothesis of this study was that male players had high ball velocity in drag flick performance as compared to the ball velocity of female players. Simply, it looked due to the bigger body size of male players in general. If body size is in control, then check whether the male has still high ball velocity than female players or not. For this purpose, analysis of covariance (ANCOVA) was applied to measure the effect of gender on the ball velocity of the drag flick by using body size as a covariate variable under the assumption of homogeneity. A single covariate (body size) was extracted based on three indicators like age, weight, and height by using the factor analysis and the results are listed in Tables 2 & 3.

The test of homogeneity indicated that there was a statistically insignificant difference between the variances of both the groups, which means both groups had homogenous variances as shown by Levene's test in Table 4. In the same table the eta squared value showed that pretty big (52.5%) variability in ball velocity of the drag flick can be explained by the gender and 22.4% variability can also be explained by the body size. The overall model explained 54%

variability in ball velocity of drag-flick performance of Pakistani elite hockey players. It was concluded that gender had a significant effect on ball velocity even after controlling the body size effect and it was noted that body size itself had a significant effect on the ball velocity.

Table 5 shows the results of the univariate analysis of covariance with the interaction (gender*body size) effect. The gender, body size, and interaction had a statistically significant effect on ball velocity. Eta squared value showed that 44% variability in ball velocity can be explained by the gender, only 7% variability can be explained by the body size and 15% of the variability can be explained by interaction effect. The overall model explained 61% variability in ball velocity of drag-flick performance.

Table 1 Gender Wise Mean and Standard Deviation (SD) of the Age, Height, Weight, and Ball Velocity

Gender	Variables	n	Mean	SD
Female	Age (Year)	8	19.63	2.00
	Height (m)	8	149.91	8.66
	Weight (kg)	8	49.00	4.41
	Ball Velocity (m/s)*	8	15.10	3.75
Male	Age (Year)	8	20.25	0.85
	Height (m)	8	163.19	7.96
	Weight (kg)	8	66.38	5.17
	Ball Velocity (m/s)*	8	21.31	3.20

**Data of 64 drag-flicks were analyzed*

Table 2 Communalities and Component Matric in Factor Analysis

Communalities			Component Matrix
Factors	Initial	Extraction	Component 1
Height (m)	1.000	.794	.891
Age (Year)	1.000	.602	.776
Weight (kg)	1.000	.772	.879
Extraction Method: Principal Component Analysis, Extraction Method: Principal Component			

Table 3 Total Variance Explained in Factor Analysis

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %

1. Body Size	2.17	72.30	72.30	2.17	72.30	72.30
2	0.55	18.40	90.70			
3	0.28	9.30	100.00			

Table 4 Univariate Analysis of Variance With Out Interaction Effect: Tests of Between-Subjects Effects

Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**p**	**Partial Eta Squared**
Corrected Model	815.47*	2	408	36	0.000	0.542
Intercept	21205.91	1	21,206	1,880	0.000	0.969
Body Size	198.40	1	198	18	0.000	0.224
Gender	760.19	1	760	67	0.000	0.525
Error	688.12	61	11			
Levene's Test of Equality		**F**	**df1**	**df2**	**p**	
of Error Variance		0.73	1	62	0.397	
*R Squared = 0.54, Dependent Variable: Ball Velocity						

Table 5 Univariate Analysis of Variance with Interaction Effect: Tests of Between-Subjects Effects

Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**p**	**Partial Eta Squared**
Corrected Model	920.10*	3	307	32	.000	.612
Intercept	7,662.34	1	7,662	788	.000	.929
Gender	455.15	1	455	47	.000	.438
Body Size	45.16	1	45	5	.035	.072
Gender * Body Size	104.64	1	105	11	.002	.152
Error	583.48	60	10			
Levene's Test of Equality		**F**	**df1**	**df2**	**p**	
of Error Variance		0.80	1	62	0.375	
*R Squared = 0.61, Dependent Variable: Ball Velocity						

4. Discussion

The purpose of the study was to find out the effect of body size and gender on ball velocity in the drag-flick performance of Pakistani elite hockey players. It was observed that body size and gender had a significant effect on ball velocity. It was also found that gender had still a significant effect even after controlling the effect of body size. The interaction of gender and body size had also a statistically significant effect on ball velocity. The study explored that the player's age, height, and weight were the significant covariates of the gender in the drag-flick performance in the penalty corner.

Verma (2014) reported that age, weight, height, and gender of the players affected the drag-flick performance. Similarly, several studies (Gjonbalaj et al., 2018; Hailu et al., 2016; Gil et al., 2007) reported the significant effect of age, weight, height, and gender on the performance in any sports. The current study evaluated that the body size (a component) had a positive and significant effect on drag-flick performance.

Rai (2017) indicated that leg and palm length had significant while arm length, weight, and height had an insignificant relationship with hockey performance for female national junior hockey players of Gwalior. In contrast, this study showed that body size (a factor of age, height & weight) had a positive and significant effect on drag flick performance in the Field Hockey.

Sanchez-Pay et al., (2019) found that there was a significant effect of the height of the tennis female player on the speed of the ball during service performance in Wimbledon. Similarly, the researcher found that the larger the player's body size, the higher the ball speed in drag-flick performance in Field Hockey.

5. Conclusion

It was assumed that male hockey players could achieve higher ball velocity in penalty corner drag-flick performance than the ball velocity of female players due to their larger body size or body composition. It was concluded that body size and gender had a significant effect on ball velocity in drag-flick performance. It was found that gender had a significant effect on ball velocity even after controlling the effect of body size. Further, it was also concluded that not only gender and body size but their interaction had also a significant effect on ball velocity. Thus, the players of Field Hockey can achieve high ball velocity in penalty drag-flick performance through the optimum utilization of their body size.

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