

## **Educational program according to contribution Percentage of some kinematic variables to the flat horizontal strike skill as a predictive indication of the accuracy of the technical performance of beginners in field hockey**

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### **introduction:**

At present, biomechanics has become one of the most important sciences in physical education, for its wide use in various fields, but has become the core science of all educational and training processes and irreplaceable, and on the basis of which all the processes are interpreted.

Amal Jaber (2008) (3) states that the main objective of Biomechanics is to achieve performance efficiently and effectively, by knowing the rules and laws of movement correctly.

Mohammed Ahmed Abdullah (2006) indicate that the skill of the flat horizontal strike is of great importance in the resolution of many games by aiming at the goal in certain offensive situations (9: 233)

Through the work of the two researchers teaching the field hockey curriculum, racket games specialization for the fourth year at the Faculty of Physical Education for Girls Zagazig University, noting the difficulty of performance and mastery of skill for the flat horizontal strike, the researchers wanted to identify the rates of contribution of some kinematic variables as a sign to predict the accuracy of aiming as a basis for directing students for optimal performance of the skill on A scientific basis in addition to the ease of monitoring errors and avoidance, especially as this skill includes working on several axes, the horizontal axis, which is the direction of aiming towards the goal, the

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cross-axis controlling rotation and swinging, and the vertical axis special in body Flexion. In addition, as far as the researchers know, no study examined the three-dimensional kinematic analysis of the skill of the horizontal flat stroke.

The aim of the research :

The aim of this research is to make An Educational program according to contribution Percentage of some kinematic variables to the flat horizontal strike skill as a predictive indication of the accuracy of the technical performance of beginners in field hockey

Search inquiries:

1. Is there a correlation between the kinematic variables of the skill of the flat horizontal strike and the accuracy of aiming during the moments of backward swinging and striking?

2 - What are contribution proportions of the of some kinematic variables in the technical performance of the skill of the horizontal flat strike during

the moments of backward swinging and striking?

3. Can predictive equations be obtained in terms of some kinematic variables during the moments of backward swinging and striking of the technical performance accuracy of the skill of the horizontal flat strike?

4- Are there statistically significant differences between the pre and post measurements of the experimental group in the post measurement of the skill of the flat horizontal strike of the beginners?

#### **Research procedures:**

#### **Research Methodology:**

The researchers used the pre and post measurement experimental method for a single experimental group and 3D kinematic analysis using five high-speed cameras and the Simi Motion Analyses computer program

#### **The research sample:**

The research sample was chosen in the deliberate random way represented by (8) female players from the first team of field hockey in Sharqia Sporting Club because of their excellence in performing the skill of the flat horizontal strike.

player performed (3) performance attempts for the

skill in question, and the best attempt was selected according to the aiming test on the goal, making the number of attempts analyzed and subjected to statistical treatments (8) attempts.

### **Homogeneity of the research sample:**

The researchers found the homogeneity of the research sample to ensure that it is free from defects of non-moderate distributions.

### **Kinetic analysis devices and instruments:**

- Advanced computer unit.
- Simi Motion Analysis software.
- 1 calibration box (1 m × 1 m × 1 m)" Calibration 3D".
- (5) high speed video camera from 50 to 250 frames / second Gpro type.
- (5) memory cards (132) GB capacity, San Disk brand.
- Five tripods with water balance

### **Basic study:**

The researchers conducted the basic experiment on Saturday 21/4/2018 at 2 pm at the stadium of the Faculty of Physical Education for Girls, Zagazig University, where the cameras were placed where the distance from the first camera

from the player (5 m) and the height of the camera from the ground (90 cm) with an angle of (90°) The second camera was placed on the same distance and height but on the right side and the camera angle (45 °) while the third camera was placed in the same position as the second camera but on the left side of the player, and an angle of (45°), the fourth camera was placed in the same position as the third camera. And at an angle of (45°), The fifth camera was placed in the same position as the fourth camera at an angle of 45°, camera speed was set to 250 frames / s, where the cameras work with an electronic sync system through a remote control unit ready and calibrated.

### **Kinetic Analysis:**

A total of (8) attempts were analyzed, one attempt per player, using the Simi Motion Analysis software. (18) points were calculated for each player in three axes (vertical, horizontal, transverse) and three speeds (vertical, horizontal, transverse). And three offsets (vertical, horizontal, transverse).

**Educational program:**

The objectives of the program:

In light of the objective of the research and its questions and the results of the 3D kinematic imaging of the the flat horizontal strike was determined the goal of the educational program in teaching the skill of the flat horizontal strike according to some kinematic indicators Determining the content of the program:.

The content of the educational program for this study has been to teach the skill of the flat horizontal strike according to some kinematic indicators derived from the three-dimensional kinematic imaging

Timeline for implementing the program: include (4) weeks by one educational unit per week, and the time of the educational unit was (90) minutes and the daily unit contains (5 m) administrative work, (5 m) warm-up, (5 m) warming up, (70 m) main part, (5 m) closing.

The executive steps of the search experience:

Pre measurement:

Pre measurements were conducted in the flat horizontal strike accuracy test on the experimental research group on Monday, 18 June 2018.

**Basic experiment:**

The educational program applied to the experimental group, from Tuesday, June 19, to Tuesday, July 10, 2018.

**Post measurement:**

on Wednesday, July 11, 2018.

Statistical treatments:

After conducting three-dimensional kinematic analysis of (8) attempts and collecting the results derived from kinetic analysis, the researchers made a correlation coefficient matrix for the highest correlation coefficients between the kinematic variables of the displacements and velocities of the horizontal flat strike during the moments of backward swinging and striking , where the number of scientific coefficients of the correlations Between the kinematic variables and the accuracy of the technical performance of the horizontal flat strike during the moments of backward swinging and striking, where the number of positive correlations () and the number

of negative correlation coefficients ( $r$ ), including ( $r^2$ ) a statistically significant correlation at significance level (0.05) and free degrees (6) and level of significance (0.707) of each other, therefore, the researchers used these statistically significant indicators to conduct the multiple regression analysis of the highest correlation coefficients, in order to identify the contribution rates of of these kinematic indicators of the skill of the flat horizontal strike during backward swing, therefore, It is possible to reach

**I. Presentation and discussion of the results of the first research question:**

predictive mathematical equations based on a scientific basis to be used to predict the skill level of the skill of the horizontal flat strike during the moment of backward swing. The researchers conducted the appropriate statistical treatments to achieve the research goal and answer the inquiries by using Spss software, the following was measured:

Mean, Median, Standard Deviation, Correlation, Skewness, Regression

**Presentation and discussion of the results:**

**Table (1)  
The matrix of the highest coefficients icorrelated between kinematic variables The level of accuracy of the aiming accuracy of the skill of the flat horizontal strike during the moment of backward swing and the moment of striking n = 8**

Moment	Indicator name	Measurement unit	Direction	Mean deviation	Standard deviation	Correlation coefficient	Index order
Backward ward swing moment	Racket Vertical speed	M/S	Reverse	1.02-	2.201	.778	first
	Right knee Vertical speed	M/S	Reverse	.014-	.382	.770	second
	Racket transverse speed	M/S	Direct	6.047-	17.179	.760	third
	Left hand wrist Horizontal speed	M/S	Reverse	6.009	1.344	.707	fourth
	Left foot instep transverse speed	M/S	Reverse	.004-	.092	.749	Fifth
	Racket Vertical speed	M/S	Reverse	3.097-	1.424	.728	sixth

**Follow Table (1)**  
**The matrix of the highest coefficients icorrelated between kinematic variables The level of accuracy of the aiming accuracy of the skill of the flat horizontal strike during the moment of backward swing and the moment of striking n = 8**

Moment	Indicator name	Measurement unit	Direction	Mean deviation	Standard deviation	Correlation coefficient	Index order
Hitting moment	Ball Vertical speed	M/S	Reverse	•••••	•••••	•••••	Seventh
	Left torso Vertical displacement	M/S	Direct	•••••	•••••	•••••	eighth
	Head horizontal speed	M/S	Direct	•••••	•••••	•••••	Ninth
	Left hand transverse speed	M/S	Reverse	•••••	•••••	•••••	first
	Left wrist transverse speed	M/S	Direct	•••••	•••••	•••••	second
	Right knee Vertical speed	M/S	Reverse	•••••	•••••	•••••	third
	Right shoulder Horizontal speed	M/S	Reverse	•••••	•••••	•••••	fourth
	Ball transverse speed	M/S	Reverse	•••••	•••••	•••••	Fifth
	Left elbow transverse speed	M/S	Direct	•••••	•••••	•••••	sixth
Right knee Horizontal speed	M/S	Direct	•••••	•••••	•••••	Seventh	
Left shoulderVertical speed	M/S	Reverse	•••••	•••••	•••••	eighth	

Table value of "R" at significance level of 0.05 and free degrees of 7 = 0.666

It's clear from Table (1) of the correlation coefficient matrix for the highest correlation coefficients between the kinematic variables of the displacements and velocities of the horizontal flat strike during the backward swing moment shows that there are (9) correlation coefficients, of which (3) positive correlation coefficients (positive) and (6) inverse correlation coefficients (negative) The correlation coefficients, the vertical velocity of the racket was The

most relevant indicator of the aiming accuracy of the flat horizontal strike skill, as shown in Table (1) of the correlation coefficient matrix of the highest correlations between the variables and the velocities of the variations of the horizontal flat strike during the backward swing moment there is (8) correlation coefficients of which the number of correlation coefficients (3) of which is Direct (positive) correlation coefficients and (5) inverse (negative) correlation

coefficient the transverse speed of the left hand was the most influential indicator for shooting precision for the horizontal flat skill strike.

Accordingly, the researchers used these statistically significant indicators for the multiple regression analysis of the highest correlation coefficients, in order to determine the contribution rates of these kinematic indicators of the skill of the horizontal flat strike during the moment of backward swing, and it is possible to arrive at predictive mathematical equations based on scientific basis to use in predicting the skill level of The skill of the flat horizontal strike during the moment of backward swing.

**Talha Husam al-Din et al. (2014)** points out that one of the most important motives of biomechanics is to develop and

improve sports performance, especially if performance is the main factor to be addressed by improvement and development, through descriptive analysis of performance (13: 28, 29).

This finding is consistent with the study of Hind Mohammed Abdelaal Elewa (2015)(8), Cristina LÓPEZ & Others (2014)(4), and Randa Shawky El-Sayed (2010)(12) in terms of reaching kinematic indicators contributing to the technical performance of Different field hockey strikes..

**Thus, the answer to the first research question, which states:** "Is there a correlation between the kinematic variables of the skill of the horizontal flat strike and aiming accuracy of the during the moment of backward swinging and striking?"

**II. Presentation and discussion of the results of the second research question:**

**Table (2)**

**Regression analysis of highest kinematic indicators correlated with the aiming accuracy of the flat horizontal strike skill during the moment of back swinging and the moment of striking**

	Kinematic indicators	Mean deviation	Fixed amount	Standard error	"F" value	Regression coefficient			Contribution Ratio
d swinging Moment	Racket Vertical speed	١,٥٠٢-	٢,٣٥١	٣,٣٢٩	٥,٨١٦	-	١,٠٩٧		% ٤٥,٣٨١
	Right knee Vertical speed	٠,٥١٤-	١,٠٧٥	٢,٨٤٩	٥,٧٤٩	-	١,٨٥٣	٣,١٩٨	% ٦٥,٧١١

**Follow Table (2)**  
**Regression analysis of highest kinematic indicators correlated**  
**with the aiming accuracy of the flat horizontal strike skill during**  
**the moment of back swinging and the moment of striking**

	Kinematic indicators	Mean deviation	Fixed amount	Standard error	"F" value	Regression coefficient					Contribution Ratio	
	Racket transverse speed	٦,٥٤٧-	٠,٥١٣	٠,٥١٠	٦,٣٧٧	٣,٢١٩-	١,٨٦--	٠,٣٥٢				% ٧٩,٢٧٩
	Left hand wrist Horizontal speed	٦,٥٥٩	٠,٠٢٠	٠,٩٧٧	٤٣,٢٤٢	٢,٤٢٦	٢,٧٤٤	٠,٢٦٥-	١,١١٣			% ٩٧,٧٤٠
	Left foot instep transverse speed	٠,٠٥٤-	٠,٠٢١	٠,٩٨٩	٢٥,٩٦٧	٢,٤٣١	٢,٦٧٩	٠,٢٦٦-	١,١٠٧	٠,٠٥٩		% ٩٧,٧٤٢
Hitting moment	Racket Vertical speed	٠,٨٩٩-	٣,٧٠٥	٤,٤٣٩	٠,٢٠٨	٠,٣٢٨						% ٦٢,٨٨٠
	Ball Vertical speed	١,٧٢٨	٠,٩٢٣	٢,٦١٥	٧,٣٨٦	٢,٥٦٠	٣,١١٣-					% ٧١,١١٤
	Left torso Vertical displacement	٠,٥٧٨-	٠,٧٢٥	٠,٥٤٢	٧,٣٦٩	٣,١٣٨	٤,٤٠٠-	٢,٦٠٥				% ٨١,٥٥٥
	Head horizontal speed	١,٠٥٦	٠,٠٥٥	٠,٩٧٦	٤٠,٤٤٠	٠,٢٤٧	١,٠٢٠-	١,٨٦٦	٣,٢٩٨			% ٩٧,٥٨٧
	Left hand transverse speed	١,٨٤٨-	٠,٠١٧	٠,٩٩٣	٣٩,٦٩٧	٠,٢٩٠	٠,١٨٦	٠,١١١	٣,٢٢٤	٠,٣٨٠-		% ٩٨,٥١١

It is clear from Table (2) that the vertical speed of the racket is the most important indicator in aiming accuracy of the flat horizontal strike during the moments of backward swinging and striking, which contributed 45.38%. it's also clear from the same table that the transverse speed of the left hand is the most influential in aiming accuracy during striking moment where its contribution rate reached 62.88%.

According to Mohamed Sabry Omar (2002) that biomechanics work to find the art of optimal performance, as a solution to problems related to movement, through the biomechanical characteristics of the motor system of the human body and the technical requirements surrounding it, and he believes that performance art is intended to optimize the mechanical solution to The kinetics problem required to be performed in the best form for



the best results, so to reach objective judgments requires the use of criteria to estimate that value. (10: 80)

This result is consistent with the study of Ehab Hamed Al Barwa, Hossam Hussein Abdel Hakim (2016)(6), Naima Zayed Khalaf, Basma Naeem Mohsen (2016)(11) , and Akram Hussein Gabr (2014) (2) in terms of attribution of kinematic indicators in technical performance. For the skills of various sports activities.

**Thus, the second research question is answered , which states:** "What are the proportions of the contribution of some kinematic variables in the technical performance of the skill of the horizontal flat strike during the moments of backward swinging and striking?"

### **III. Presentation and discussion of the results of the third research question:**

As shown in Table (2) analysis of the regression of the top kinematic indicators correlated with the aiming accuracy of the horizontal flat strike during the moments of backward swinging and striking, from above

**The predictive regression line equation for the first predictive backward swing moment index is:**

$$y = a + (b1 \times x1)$$

Prediction of performance level accuracy =  $2.351 + -1.502 \times -1.097 = 4$  degrees

Where (y) = performance level prediction

(a) = constant (b1) = first regression coefficient (x1) = first average

**- The predictive regression line equation for the second predictive backward swing moment index is :**

$$y = a + b1 \times x1 + b2 \times x2$$

Predicting the level of performance accuracy

$$-3.198 \times -0.514 + -0.853 \times -1.502 + 1.075 = 4 \text{ degrees}$$

**- The predictive regression line equation for the third indicator of the backward swing moment is:**

$$y = a + b1 \times x1 + b2 \times x2 + b3 \times x3$$

Predicting the level of performance accuracy

$$0.35 \times -6.547 + -1.86 \times -0.514 + -3.218 \times -1.502 + 0.513 = 4^\circ$$

**- The predictive regression line equation for the fourth indicator of the backward swing moment is:**

$$y = a + b1 \times x1 + b2 \times x2 + b3 \times x3 + b4 \times x4$$

Predicting the level of performance accuracy

$$1.113 \times 6.559 + -0.265 \times -6.547 + 2.744 \times -0.514 + 2.426 \times -1.502 + 0.02 = 4^\circ$$

**- The predictive regression line equation for the fifth indicator of the striking moment is:**

$$y = a + b1 \times x1 + b2 \times x2 + b3 \times x3 + b4 \times x4 + b5 \times x5$$

Predicting the level of performance accuracy

$$-0.059 \times -0.054 + 1.107 \times 6.559 + -0.266 \times -6.547 + 2.679 \times -0.514 + 2.431 \times -1.502 + 0.021 = 4^\circ$$

**- The predictive regression line equation for the first indicator of the multiplication moment is:**

$$y = a + (b1 \times x1)$$

Where (y) = performance level prediction (a) = constant (b1) = first regression coefficient

Predict the level of performance accuracy = 0.328

$$\times -0.899 + 3.705 = 4^\circ$$

**- The predictive regression line equation for the second indicator of the striking moment is:**

$$y = a + b1 \times x1 + b2 \times x2$$

Predicting the level of performance accuracy

$$-3.113 \times -1.728 + 2.56 \times -0.899 + 0.923 = 4^\circ$$

**- The predictive regression equation for the third indicator of the striking moment is:**

$$y = a + b1 \times x1 + b2 \times x2 + b3 \times x3$$

Predicting the level of performance accuracy

$$2.605 \times -0.578 + -4.4 \times -1.728 + 3.138 \times -0.899 + 0.725 = 4^\circ$$

**- The predictive regression line equation for the fourth indicator of the striking moment is:**

$$y = a + b1 \times x1 + b2 \times x2 + b3 \times x3 + b4 \times x4$$

Predicting the level of performance accuracy

$$3.298 \times 1.056 + 1.866 \times -0.578 + -1.02 \times -1.728 + 0.247 \times -0.899 + 0.55 = 4^\circ$$

**- The predictive regression line equation for the fifth indicator of the striking moment is:**

$$y = a + b1 \times x1 + b2 \times x2 + b3 \times x3 + b4 \times x4 + b5 \times x5$$

Predicting the level of performance accuracy

$$-0.38 \times -1.848 + 3.224 \times 1.056 + 0.111 \times -0.578 + 0.186 \times -1.728 + -0.29 \times -0.899 + 0.017 = 4^\circ$$

**Adel Abdul Basir (2007)** stresses that the benefit of the results of the kinetic analysis of the skill, can't be harnessed only by a good understanding

of the goal of the skill first, and the nature of its performance from a biomechanical point of view, so that a high level of performance can be reached. (1: 145)

**Doaa Hosni Mohamed Shalakany (2017) (5)** in terms of reaching equations that can predict the level of accuracy of skill performance through some kinematic indicators.

**Thus, the third research question has been answered,**

which states: Is it possible to arrive at predictive equations in terms of some of the kinematic variables during the moment of backward swinging and striking of the accuracy of the technical performance of the skill of the horizontal flat strike?

**IV. Presentation and discussion of the results of the fourth research question:**

**Table (3)  
The significance of the differences between the pre and post measurements of the experimental group n = 12**

Variables	measruing unit	Post-measurement		Pre - measurement		Value (T)	Percentage improvement
		∑S	∑A	∑S	∑A		
Test the accuracy the flat horizontal strike	Number	∑.64	∑.91	∑.78	∑.03	*4.18	182.02

T Table value at 0.05 and free grades score 12=2.093 statistically significant at 0.05 level \*

The results of Table (3) Shows statistically significant differences at level 0.05 between the pre and post measurements of the experimental group in the skill of the flat horizontal strike in favor of the post measurement. The two studies attributed this to the fact that the educational program which was prepared

based on the contribution Percentage of some kinematic variables to the flat horizontal strike skill as a predictive indication of the accuracy of the technical performance, which resulted in the identification of the most kinetic indicators associated with the accuracy of the skillful performance of the skill of the

flat horizontal strike, The possibility of building qualitative exercises to teach the skill the flat horizontal strike in accordance with the movement path of the skill performance, which led to the educational program having a more positive and more effective effect in teaching skill.

**Thus, the fourth research question has been answered,** which states: - Are there statistically significant differences between the pre and post measurements of the experimental group in the post measurement of the skill of the flat horizontal strike of the beginners?

#### **Conclusions:**

**In the light of the objectives of the research, the sample and the procedures the researchers deduced the following:**

1. The left instep is the Fulcrum of the racket during the backward swing moment.
- 2 - The player needs a vertical speed in the direction of the ground so that he can reach the ball in the appropriate direction during the moment of backward swing.

3 - The horizontal speed of the left hand wrist during the moment of backward swing is responsible for the process of directing the ball towards the goal.

4 - The player needs a large transverse speed of the left arm during the moment of striking.

5 - The player needs a vertical speed in the direction of the ground to meet the requirements of the most accurate successful performance of the skill of the horizontal strike during the striking moment.

6- The player needs an appropriate transverse ball speed of coming from the passing player during the moment of striking

#### **Recommendations:**

1. Adopt the appropriate method for the physical pattern nature of each player according to the result of the derived predictive equations.
- 2 - The use of qualitative technical analysis of performance in skill performance the analysis.

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