RESEARCH ARTICLE

Study Of the Relationship Between Some Kinematic Variables (The Angle OfThe Player's Torso and the Angle of the Ball's Trajectory Toward the Goal) In the Skill of Shooting Fixed Balls in Football

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ABSTRACT

The study aimed to identify the values of certain kinematic variables that characterize the performance of the skill of shooting at the goal in soccer (the angle of the torso at the moment of kicking the ball, the angle of the ball's trajectory toward the goal), in addition to determining the relationship between these variables that characterize this skill. We used a descriptive approach in this study because it fits the nature of the research. The study sample included 12 players from the Abou Al-Hassan Youth Sports Team in Chlef (CRBA for the 2024-2025 sports year). In order to determine the values of these variables, we used Warner Nelson's goal accuracy test, and to analyze the players' skill performance, We used a Sony video camera at 50 frames per second.. To analyze the results statistically, we relied on the following statistical methods (arithmetic mean, standard deviation, Pearson's correlation coefficient). We found that there is a statistically significant correlation between the angle of the torso at the moment of striking the ball and the angle of its trajectory in the performance of the skill of shooting at the goal for the research sample.

Keywords: Shooting, kinematics, Football.

1. INTRODUCTION

The skill of shooting at goal from set pieces is not an easy one; it takes a long time to acquire and requires training based on sound principles, especially if we take into account the use of good methods of measurement and analysis of the technical errors that players make during performance. Computer analysis is of great importance in the process of analysing players' technical performance and then developing possible mechanisms, means and methods after identifying the mechanical variables to reach the best level of skill, especially when we know that only 9% of free kicks were successful for the teams participating in the 2024 Africa Cup of Nations in Côte d'Ivoire, with the exception of Equatorial Guinea (100%) and Cape Verde (50%) of the available opportunities (Sports Base 2024). Given the failure of some players in the national championship to perform due to fear of missing the opportunity, which leads to the loss of almost certain goals in front of the goal, this study was conducted to identify and analyse the most important basic kinematic variables that characterise this skill in order to determine and identify the ideal kinematic values for performance and then work on improving and developing the skill to achieve high accuracy, especially in light of the availability and presence of important elements such as appropriate physical measurements and good mechanical skill performance (body and ball angles). This leads us to ask the following question: Is there a correlation between the angle of the torso and the angle of the ball's trajectory when performing the skill of shooting fixed balls in football ?

2.Hypothesis: There is a statistically significant relationship between the angle of the torso and the angle of the ball's trajectory when performing the skill of shooting fixed balls at goal in football that is illustrated in the research sample.

3.Research objectives:

-To learn about the values of some kinematic variables of body parts and the ball when performing the skill of shooting at the goal in football.

-To learn about the correlation between the angle of the torso and the angle of the ball's trajectory when performing the skill of shooting fixed balls at the goal in football.

4. Search Terms:

4.1 -Shooting at the goal :

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4.2 -Kinematics:

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5. Research methods

5.1 Research methodology:

The researchers in this study used a descriptive methodology in the form of correlational studies, as this was appropriate for the nature of the research.

5.2 The Research sample:

The research sample consisted of 12 players from the Abou El-Hassan Chlef youth sports team who were included in the study and who are active in the province of Chlef. The sample constituted 50% of the 24 players who make up the team as a whole.

5.2 Research areas:

-Human resources: Midfielders of the Abou El-Hassan Chlef youth sports team, 2024–2025 season.

-Time frame: 6 March 2025.

-Location: Martyr Bassam Mohammed Abou Al-Hassan Stadium, Chlef.

6. Homogeneity and equivalence of the research sample.

Table 1. shows the homogeneity and equivalence of the research sample.

Variables	Arithmetic mean	Standard deviation	Torsion coefficient
Mass	64.91	8.42	1.24
length	176.5	4.40	1.39
age	17.66	0.88	0.79

Source: The Researcher

A sample that is homogeneous in weight, height and age, as the torsion coefficient value is limited to (± 3).

7.Means of collecting information:

1- Arabic and foreign sources and references.

2- Tests and measurements.

3- A Japanese-made SONY video camera with a frame rate of 50 frames per second.

4- Toshiba computer.

5- Measuring tape.

6- Electronic scale.

7- 1-metre ruler.

8- Regulation football pitch.

9- Five footballs.

10- Kinovea 0.9.5 sports motion analysis software installed on a computer.

11- Test used to measure shooting accuracy towards the goal.

8. - Shooting accuracy test: 'Warner Nelson's suggestion'.

Goal height, we name each section Method: We divide the goal into 06 sections using ropes along the length -with the letters A, B, C, D, E, and F, where the division is as follows along the length of the goal.

Section 1: 'A' is 2 m long and 1.22 m high.

Section 2: 'B' is 3 m long and 1.22 m high.

Section 3: 'C' is 2 m long and 1.22 m high.

Section 4: 'D' is 2 m long and 1.22 m high.

Section 5: 'E' Length: 3 m Height: 1.22 m

Section 6: 'F' Length: 2 m Height: 1.22 m

- How to conduct the test: The player shoots 5 stationary balls towards the goal with extreme accuracy from outside the 18-metre area, as shown in Figure 01.

- Test objective: Each player attempts to score within the frame (A, D, C, and F) and thus obtain a perfect score.

In section (b, e), obtain half the score.

In order for the player to achieve the highest score and the highest number of points, they must shoot within the frames (a, c, d, and e) to guarantee 20 points, which is the full score.
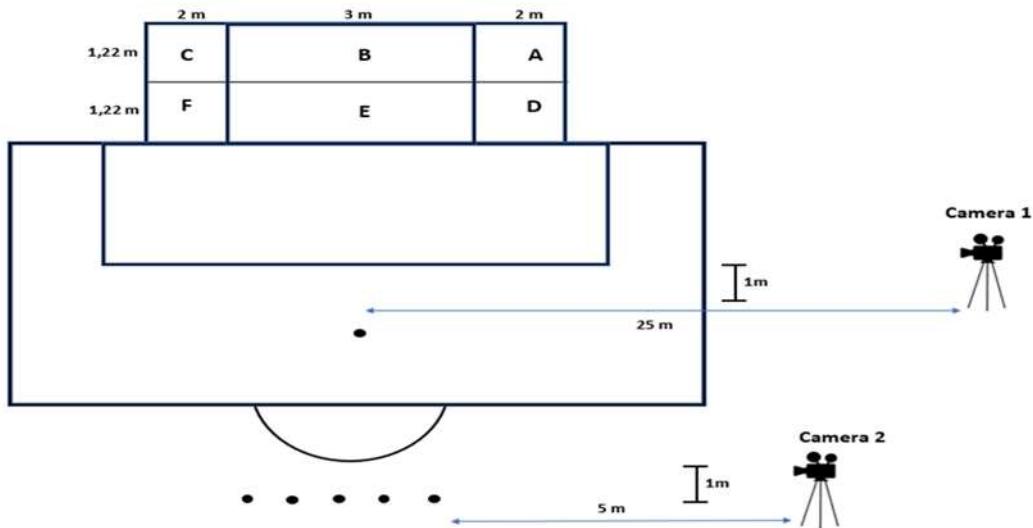

Figure 1 shows a diagram of the rope test performance for measuring accuracy.

9.Exploratory study:

1-Ensure that the equipment used is in good working order.

2- Determine the dimensions and heights that indicate where the camera should be placed.

3- Identify potential obstacles that may hinder the final experiment.

4- Distribute the work among the support team.

10.The main experiment:

The main experiment was conducted at the same stadium and at the same time, at 5 p.m. on 06/03/2025 .

There were a total of 60 attempts, with 5 attempts per player.

10.1 Video recording process:

We used a Sony video camera (50 frames per second) positioned 1.25 meters above the ground and 5.5 meters to the right of the player, which allowed us to film all stages of the technical performance of the skill. The researcher also used a 1-metre ruler placed between the camera and the player.

10.2 Kinematics variables:

--Angle of trunk inclination at the moment of striking the ball: This is the angle between the horizontal line parallel to the ground from the hip joint and the line passing through the trunk, measured from the front at the moment of first contact between the striking foot and the ball..

-Ball launch angle: The angle between the line passing through the center of the ball and the horizontal line on the ground.
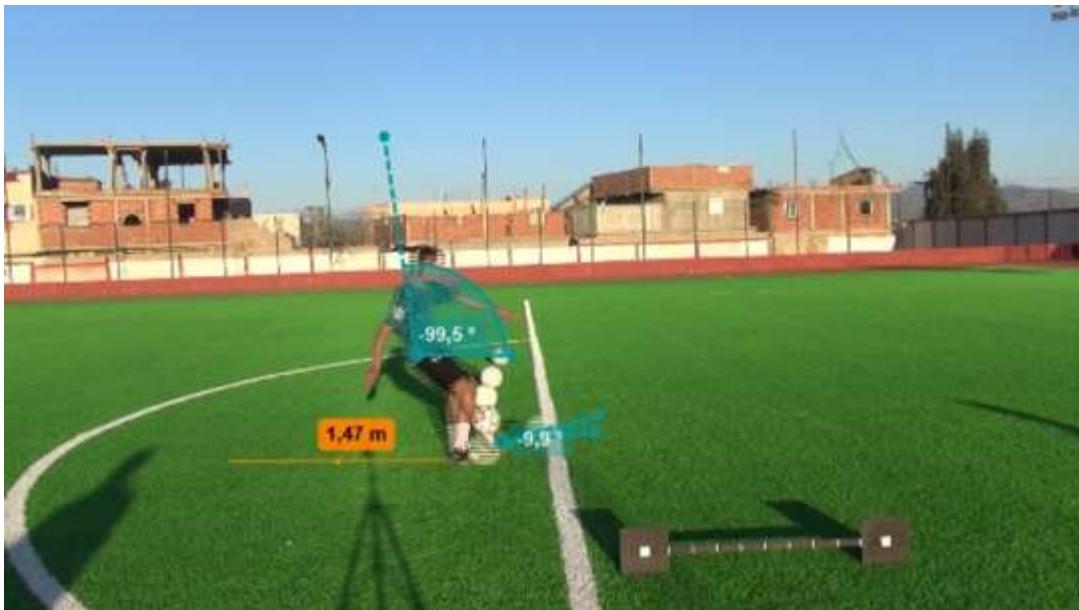
Source: The Researcher

Image No. (1) shows the angle at which the ball is kicked and the angle of the torso's inclination at the moment of kicking the ball.

11. Statistical methods:

-The data was statistically processed using the Statistical Package for the Social Sciences (SPSS) programme through the following applications:

-Arithmetic mean.

-Standard deviation.

-Pearson's correlation coefficient.

12. Presentation, analysis and discussion of results.

Presentation and discussion of the results of the relationship between kinematic variables in the performance of the skill of shooting at goal.

Table 1. shows the correlation between the kinematic variables studied.

Angle of trunk inclination at the moment of ball contact		Ball launch angle		Calculated value of r	sig	Significance
M	S	M	S	-0.697*	0.01	sig
98.79	0.49	9.12	0.31			

(*) Significant at the 0.01 level

Source: The Researcher

13. Interpretation and discussion of results:

The table above shows that the arithmetic mean value of the trunk angle at the moment of ball impact was (98.79), with a standard deviation of (0.49). while the arithmetic mean of the ball launch angle was (9.12) with a standard deviation of (0.31). The correlation coefficient was (-0.697*) indicating a significant correlation between the two research variables.

The relationship between the angle of the torso's inclination at the moment of hitting the ball and the angle of the ball's trajectory was due to the fact that the backward inclination of the torso provides an accelerated path for the striker's foot, so that it meets the ball at its lowest point, providing a mechanical path in the correct direction. whereas when the torso is extended backwards, the direction of the ball's movement is upwards, as confirmed by Thamer and Wathiq (1972). The movement of the torso depends on the height of the ball's arc; for ground balls, the torso must be bent forwards, and for high balls, the torso must be bent backwards.

Angles contribute to muscle response speed by adopting the correct angles in performance to suit athletic effectiveness, especially in scoring skills. Angles achieve balance during performance, as the angle of the torso's inclination has a fundamental relationship with controlling the speed, direction, and angle of the ball's flight (Ahmed Saleh, 2011).

As pointed out by (Hikmat Al-Mudhkhuri, 2017) that one of the requirements for shooting at the goal with the speed that achieves scoring accuracy is that the player must lean his torso slightly

backwards in line with the angle of the knee joint of the supporting leg and maintain a state of mechanical balance that enhances the skill of shooting (scoring) with high accuracy towards the goal in football.

Lees, Asai, Anderson, Nunome, &Sterzing (2010) also point out that the knee of the supporting leg bends to 26 degrees when the foot touches the ground in order to absorb the impact of landing and provide dynamic stability for the athlete.

Finally, the results of our study were consistent with the conclusion of PRASSAS, S.G (1990) that the angle of inclination of the body is related to the degree of elevation or depression of the angle of departure of the ball.

14. Conclusions

The research concluded the following:

-There is a statistically significant correlation between the angle of the torso's inclination at the moment of striking the ball and the angle of its trajectory towards the goal in the performance of the scoring skill in football for the research sample.

-The inclination of the torso controls the trajectory of the ball towards the goal.

15. Recommendations:

-Emphasise teaching and developing accurate and fast goal scoring.

-Work on giving players fluidity and flexibility in their goal scoring skills in front of goal and help them reach a stage of automatic performance.

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