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An Analytical Study of Some Biomechanical Variables of Scoring Skill from the (6m) and (10m) Regions and Their Relationship with Accuracy in Futsal

Zainab Mustafa Dhanoun[1] **Salma Nizar Yahya**[2]

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ABSTRACT

The study aimed to identify the following:

1- Identifying the values of some of the biomechanical variables of scoring from the penalty marks (6) and (10) meters in futsal for the Department of Physical Education and Sport Sciences.
2- Identifying the Differences of Some Biomechanical Variables for Scoring from the Penalty Marks (6) Meters and (10) Meters in Futsal for the Department of Physical Education and Sport Sciences.
3- Identifying the Relationship of Some Biomechanical Variables for Scoring from the Penalty Marks (6) Meters and (10) Meters in Futsal for the Department of Physical Education and Sport Sciences.

The study also imposed to:

1- The existence of significant differences for some of the biokinematic variables of the penalty marks (6) meters and (10) meters in futsal for the Department of Physical Education and Sport Sciences.
2- There is a significant relationship for some of the biokinematic variables of the penalty marks (6) meters and (10) meters in futsal for the Department of Physical Education and Sport Sciences.

The research population included seven (7) female students who were selected by the deliberate method, and after conducting the exploratory experiment, the researchers conducted the main experiment on five female students who are good at scoring in the game of futsal and the researchers concluded:

1- There were no significant differences in the angles of the joints of the body parts in most of the variables of scoring accuracy for the areas of (6) meters and (10) meters.
2- There is a significant correlation between the variable of horizontal and vertical displacement, the sum of the displacement and the accuracy of scoring from an area of (6) meters.
3- There is a significant correlation between the variable of horizontal velocity, vertical velocity, total velocity, and scoring accuracy for (10) meters.

Hence, the researchers recommended:

1- Emphasizing the study of the positive results of biomechanical variables to benefit from them in football training and education processes.
2- Intensifying training on penalty kicks (6) meters and (10) meters in the training units.

1- Introduction to the research

1-1 Introduction and Importance of Research

Football enjoys a large fan base and wide attention by specialists, followers and those interested in this game all over the world, due to its excitement and suspense, as well as the ease of practicing it and the simplicity of its capabilities, which is one of the reasons that worked to spread and practice it in a large way, and due to this spread, other similar games have emerged from it, the most important of which is futsal

The development of the field of physical education is north of all sciences related to the field of sports, and one of these sciences is the science of biomechanics in Riyadh, through which it began to develop the basic skills of various sports by knowing the best motor paths and shortening the time and effort in the process of sports training and the effectiveness of futsal football. (Al-Shahat, 1997, 16)

One of the activities that benefited from the science of sports biomechanics is to identify the appropriate conditions for the performance of its basic skills through kinetic analysis and results that give clear images through mechanical variables about the skill performance of the player or player and after the threat in the football pentathlon, which is the culmination of the efforts made by the members of one team by scoring winning points over the opposing team, which is one of the most effective and highly achievable basic skills, and the goal of the game, whether scoring from balls The most important of these shots is the penalty kick (10) meters, which leads directly towards the goal without the presence of a blocking wall, it is one of the most important fixed cases that occur in futsal matches, the performance of the shot from the penalty mark (10) meters must be in a way that ensures that the player executing the kick plays the ball so that it is difficult for the goalkeeper to block it or remove it in The study of sports movement scientifically requires knowing the laws and mechanical factors affecting the motor performance of sports games in an analytical way for the purpose of raising and improving the level of sports performance. (Kunzeh, (1980, p. 33)

Kinetic analysis depends on the study of movement and its scientific analysis by dividing it into its components to identify the variables and factors that affect it in both the negative and positive aspects, and this requires having the appropriate experience in the foundations, laws and concepts of biomechanics, which is considered a basis in entering and entering the science of kinetic analysis of skilled motor performances in various games and competitions for the purpose of overcoming mistakes, enhancing strengths, and reaching the ideal and exemplary performance as much as possible. Specific questions in this area.... Is the force used enough? Is the range of motion appropriate? Is the sequence of movement sections proportional to the requirements for the implementation of the movement? And do we hit the ball with speed and perfect angle? What are the ideal and economic laws, variables, and mechanical foundations for motor performance (Al-Mazkhoury, 2016 , pp. 2,3)

Thus, it achieves two main goals, the first of which is economy in movement, and the second is the optimal performance that achieves the best results, as well as giving a greater opportunity to absorb and master the skill by the practitioners, and on this basis, taking into account the rules and mechanical conditions for the performance of the penalty kick (6) and (10) meters in several forms, which are represented in the balance of the player at the moment of focus, the speed of the leg's striking fan, the force of the foot hitting the ball, the point where the force is focused on the ball, the angle of the start of the ball, and the position of the man's knee on top of the ball. The moment of hitting it and others will lead to the same desired results, which is successful scoring,

and hence the importance of research lies in trying to find the best solutions to reach the player to the optimal motor path, by studying the biomechanical variables of one of the most important skills of the game of futsal football, which is the skill of scoring from the penalty mark (6) and (10) meters during the analysis of the performance of his scoring skill, as well as identifying the optimal mechanical positions of the man striking and the ball to reach the best appropriate scoring methods through the process of Biomechanical analysis The skill of penalty kicking (6) and (10) meters is one of the basic skills in futsal football and in order to improve it in a way that is appropriate to the size of the few opportunities available to the players during the match, so it has become necessary for coaches and players in general to focus in their training on mastering these skills correctly and the optimal performance appropriately, due to the small goal and the proximity of the performance distance in order to reach the optimal way to hit the ball in its various forms to achieve the best accuracy that requires study. External Shape According to its mechanical description, the researchers decided to study this problem using the kinetic analysis of the performance of this skill from the penalty mark (6) and (10) meters for the purpose of identifying the correct mechanical foundations that lead to a high level of accuracy when executing this strike to reach the best suitable ways to perform this strike, and the difference in the area of the target and the distance of the strike requires the player to take positions in her body that are mechanically compatible with its angle, speed and direction of the ball. (Al-Badrani and Amin, 2022, 96)

1.2 Research Problem

The game of football is one of the games that is characterized during its performance by different skills and sudden circumstances during the performance of the match, as the scoring skills are characterized by difficulty, especially when it is through movement. Through the investigation of many experts and follow-up, it was observed that there are many weaknesses, especially during the process of scoring from the movement, by wasting many opportunities available to them. One of these studies is to benefit from this analysis in determining the correct mechanical foundations and rules with the aim of evaluating and analyzing in the implementation and performance of these strikes because of their impact on achieving the success of the scoring accuracy process of female students in the futsal lesson and qualifying them to play in futsal teams, and to achieve the best accuracy requires studying its external form according to its mechanical description and linking it with the research variables to reach the errors and weaknesses of the striking foot during the scoring process from the stability of the football Halls for female students of the Department of Physical Education and Sport Sciences at the College of Education for Girls.

1-3 Research Objectives:

1- Identifying the values of some of the biomechanical variables of scoring from the penalty marks (6) and (10) meters in futsal for the Department of Physical Education and Sport Sciences.
2- Identifying the Differences of Some Biomechanical Variables for Scoring from the Penalty Marks (6) Meters and (10) Meters in Futsal for the Department of Physical Education and Sport Sciences.
3- Identifying the Relationship of Some Biomechanical Variables for Scoring from the Penalty Marks (6) Meters and (10) Meters in Futsal for the Department of Physical Education and Sport Sciences.

1-4 Research Hypotheses

1- The existence of significant differences for some of the biokinematic variables of the penalty marks (6) meters and (10) meters in futsal for the Department of Physical Education and Sport Sciences.
2- There is a significant relationship for some of the biokinematic variables of the penalty marks (6) meters and (10) meters in futsal for the Department of Physical Education and Sport Sciences.

1.5 Research Areas

1- Human Field: Students of the Department of Physical Education and Sport Sciences at the College of Education for Girls, University of Mosul.
2- Temporal Domain: From 11/2/2025 to 13/2/2025.
3- Spatial Field: The indoor playground of the Department of Physical Education and Sport Sciences at the College of Education for Girls/University of Mosul.

2. Research Procedures

2-1 Research Methodology

The researchers used the descriptive method to analyze the nature and problem of the research.

2.2 Research population and sample

The research population included some female students of the fourth stage who are proficient in futsal in the Department of Physical Education and Sport Sciences at the College of Education for Girls / University of Mosul for the academic year (2024-2025). The number of (7) female students, (5) students were selected by the deliberate method who are good at scoring well, and Table (1) represents the specifications of the research sample.

Table (1) shows the statistical description of the research sample

Age (Year)	Length (cm)	Mass (kg)	Variables / Name	t
24	173	63	1	1
22	158	69	2	2
24	167	63	3	3
24	158	66	4	4
22	161	48	5	5
24	156	53	6	6
24	169	66	7	7
23,42	163,14	61	Going to	
0,975	6,517	7,659	±	
4,165	12,556	3,994	Kh%	

From Table (1), it is clear that the coefficient of difference is less than (30%) and this indicates the homogeneity of the research sample in the physical specifications, as the coefficient of difference is less than (30) indicating the homogeneity of the research sample. (Al-Tikriti and Al-Obaidi, (1999, p. 243)

2.3 Data collection methods

The researchers used (content analysis of scientific sources, Internet information network, testing and measurement, and technical scientific observation) to collect data.

2.4 Scientific and technical observation

The researchers used the scientific observation through the use of a video camera number (1) and the speed of the camera was (120 frames/second) placed on the right side and at a distance of (6) meters, and the height of the photographic lens from the focus of the lens to the ground was (1) meters.

2.5 Testing

- Test: Scoring from Fixed on Six Divisions:

- Objective of the test: To measure the accuracy of scoring from set pieces on six divisions of five-a-side soccer players.
- Tools used: Football five-a-side balls, football five-a-side goal.
- Performance method: The laboratory aims (12) balls from a distance of (10) meters on the divisions drawn on the target, whose dimensions as in Figure (1) from a distance of (6) meters and from a distance of (10) meters, the laboratories aim the balls at the divisions in sequence from (1-6) and repeat the sequence again.
- Exam Conditions:

* Scoring must be from the starting line.
* The tester is free to use either foot in scoring and on any part of the foot.

- Registration:

* The tester is awarded a score of (1) if the ball touches the required division or its lines.
* The tester is awarded a zero if the ball does not touch the required division or any of the other divisions or outside it, or the ball is rolling on the ground during the scoring process.
* The total score of the test is (12) marks.

- Number of attempts: Laboratories have two attempts that count as the best attempt. As in Figure

2.6 Tools and Software Used in Research

- Futsal pitch.
- Futsal legal balls.
- Device (iPhone pro max13)
- Camera holder.
- A football goal.
- Colored adhesives.
- Strips to identify areas of accuracy on the target.
- LENOVO laptop).
- Format Factory
- Kinovea Program
- ACD See Manager
- Paint Program

2.6 Research Experiments

2.6.1 Exploratory experiment

The reconnaissance experiment was conducted on (11/2/2025) in the sports hall stadium of the College of Education for Girls at twelve o'clock in the afternoon, to prepare the requirements for all the experiment and to determine the location of the camera from the scoring area and its height to cover the entire path of movement, the extent of the validity and clarity of the photography, the amount of lighting in the field, and the determination of the penalty areas (6) and (10) meters, as well as determining the areas of scoring accuracy by placing a set of strips inside the goal and each area with a specific number for it, in addition to training a team Work on the filming and recording process. After determining the full measurements, the two researchers, together with the assistant team of Appendix (1),

conducted the reconnaissance experiment on two students from the research population for the purpose of determining the field of photography completely by conducting three attempts of scoring from an area of (6) meters, as well as three attempts from a point of (10) meters for each student, as well as determining the accuracy of each of the three attempts to score.

2.6.2 Main experience

After reviewing the data from the exploratory experiment, the two researchers conducted the main experiment on the research sample, which are (5) female students from the fourth stage, at twelve o'clock in the afternoon on 13/2/2025 in the closed sports hall of the College of Education for Girls and in the presence of the assistant work team, and after preparing the requirements for the experiment on the previous day, The camera is 5 meters away and 108 cm high, and on the right side, and use a scale with a length of (1) meters. The research teamphotographed the scale as it was placed on the location of the penalty areas (6) and (10) meters, as shown in Figure (2) and Figure (3), then the assistant work team performed all tests on the five female students by giving three attempts to score for each student on an area of (6) meters, as well as three attempts to score on an area of (10) meters, the failed attempts of scoring were neglected, as well as recording the accuracy of scoring each attempt by giving a number in certain areas within the goal According to the standardized test.

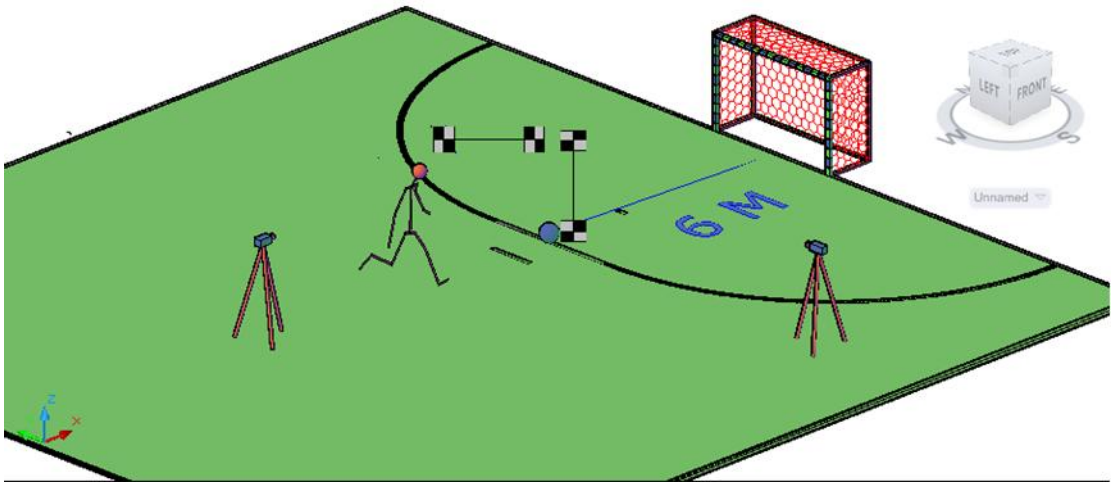

Figure (1)

The location of the cameras and the drawing scale during the performance of the penalty kick experiment shows (6) meters

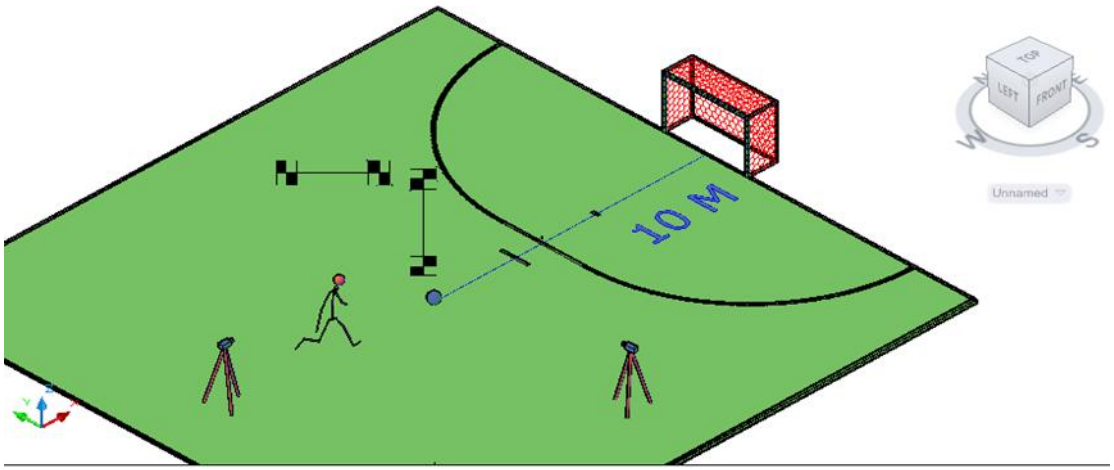

Figure (1)

The location of the cameras and the scale show the performance of the penalty (10) meter experiment

2-7 Research Variables:

- Time.
- Vertical displacement of the main stage
- Horizontal displacement of the main stage
- The result of the displacement of the main stage
- Horizontal speed of the main stage
- Vertical speed of the main stage
- Speed Outcome for the Main Stage

2-8 Statistical Methods

1- Arithmetic mean
2- Standard deviation
3- Divergence coefficient
4- T.test
5- Correlation coefficient (Pearson)

The data were statistically processed using the SPSS statistical package as well as the extracted mechanical laws.

3. Discussionand discussion of the results

3.1 Presentation, analysis and discussion of the results

3.1.1 Present, analyze and discuss the differences between the scoring accuracy of the 6 meters and 10 meters for futsal football.

Table (2)

Statistical description of the differences between the scoring accuracy of the (6) meter and (10) meter futsal areas

Calculated value (v)	Standard deviation	Arithmetic mean	Statistical Milestones / Area
-0,418	1,923	6,200	First penalty (6) m
	2,949	6,800	Second penalty (10) m

*Significant at an error ratio ≤ 0.05 against a degree of freedom (4). The tabular value of t (2.13)

Table (2) shows that there are no significant differences between the scoring accuracy from the areas of (6) meters and (10) meters, as the calculated values of (t) were (-0.418), which is smaller than the tabular value of (t) of (2.13) and at an error ratio of ≤ 0.05, and in front of the degree of freedom (4).

3.1.2 Presentation and analysis of the results of the association between biokinematic variables and scoring accuracy

Table (3)
Statistical description of the variables of displacement, horizontal and vertical velocity and the result of scoring from two (6) meter zones in futsal

T Probability	T Calculated	Standard deviation	Arithmetic mean	Variables
0,184	-0,705	1,553	40,026	Horizontal displacement of the main stage
0,287	0,598	0,104	6,668	Vertical displacement of the main stage
0,184	-0,704	1,518	40,578	The result of the displacement of the main stage
0,183	-0,705	2,157	55,591	Horizontal speed of the main stage
0,290	0,595	0,144	9,258	Vertical speed of the main stage
0,185	-0,704	2,109	56,357	Speed Outcome for the Main Stage

* A significant correlation at an error ratio of ≤ 0.05 against the degree of freedom (4) and the tabular value of t (0.3473)

The table showed that there is a significant correlation between the horizontal displacement and the vertical displacement and the result of the displacement and the accuracy of scoring from the area of (6) meters, as well as there is a correlation between both the horizontal speed and the vertical speed and the sum of the speed and the accuracy of scoring from the area of (6) meters, because each of the calculated values of t is greater than the probability values of t.

The researcher attributes the reason for this to the fact that the path of the object in the player's movement when taking the penalty kick for the main stage is largely horizontal, which in turn represents the great value of the displacement product for this stage, according to the equation: (the sum of the displacement) (^{2} = (horizontal displacement) ^{2}+ (vertical displacement) ^{2}

Any increase in the horizontal displacement of the main stage leads to an increase in the sum of the displacement of the stage itself, as well as this increase in the sum of the displacement of the main stage will lead to an increase in the horizontal velocity and the sum of the speed of the same stage because the displacement is directly proportional to the speed as explained by the researcher earlier. (1995,349, (Hall

Also, for the horizontal and vertical speed and the sum of the speed, there is a significant correlation between the accuracy of scoring from an area of (6) meters, in order to proportionate

the speed directly to the distance, i.e. the greater the distance, the greater the speed and vice versa, and according to the following equation: Speed = distance / time (Al-Hashimi, 1988, 85)

Table (4)

Statistical Description of the Variables of Displacement and Horizontal and Vertical Velocity and the Result of Scoring from Two (10) Meters in Futsal

T Probability	T Calculated	Standard deviation	Arithmetic mean	Variables
0,917	0,066	1,660	60,724	**Horizontal displacement of the main stage**
0,347	0,540	0,356	5,534	**Vertical displacement of the main stage**
0,903	0,076	1,633	60,977	**The result of the displacement of the main stage**
0,917	0,065	2,442	89,299	**Horizontal speed of the main stage**
0,347	0,541	0,524	8,137	**Vertical speed of the main stage**
0,903	0,076	2,402	89,671	**Speed Outcome for the Main Stage**

* A significant correlation at an error ratio of ≤ 0.05 against the degree of freedom (4) and the tabular value of t (0.3473)

- **From Table (4)**

It was found that there is a correlation between both the vertical displacement and the accuracy of scoring from an area of (10) meters, where the calculated t-value was (0.540), which is greater than the tabular t-value of (0.3473) at the error ratio of ≤ (0.05) in front of the degree of freedom (4). Also, there is a significant correlation between both the vertical velocity and the scoring accuracy from the (10) meter-area, where the calculated t-value was (0.541), which is greater than the tabular t-value of (0.3473) at the error ratio ≤of (0.05). In front of a degree of freedom (4).

This is what the researchers have previously mentioned about the direct relationship between displacement and velocity. There is a significant correlation between the accuracy of scoring from an area of (10) meters only between the vertical displacement and the accuracy of scoring, and between the vertical speed and the accuracy of scoring, in order to proportionate the speed directly to the distance, i.e. the greater the distance, the greater the speed and vice versa.

4- Conclusions and recommendations

4.1 Conclusions

After reviewing, analyzing and discussing the results of the research, the researcher reached the following conclusions:

1- There were no significant differences in the angles of the joints of the body parts in most of the variables of scoring accuracy for the areas of (6) meters and (10) meters.

2- There is a significant correlation between the variable of horizontal and vertical displacement, the sum of the displacement and the accuracy of scoring from an area of (6) meters.
3- There is a significant correlation between the variable of horizontal velocity, vertical velocity, total velocity, and scoring accuracy for (10) meters.

4.2 Recommendations

1- Emphasizing the study of the positive results of biomechanical variables to benefit from them in football training and education processes.
2- Intensifying training on penalty kicks (6) meters and (10) meters in the training units.

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Attachment (1)
Names of the Assistant Staff

Jurisdiction	College	Name	
Biomechanics	College of Education for Girls	Prof. Dr. Alaa El-Din Faisal Khattab	**1**
Biomechanics	Faculty of Physical Education and Sport Sciences	Assoc. Prof. Dr. Mohamed Saad	**2**
Biomechanics	College of Education for Girls	Eng. Dr. Zainab Mustafa Thannoun	**3**

Researcher	College of Education for Girls	Mrs. Salma Nizar Yahya	**4**
Student	College of Education for Girls	Rahma Nashwan	**5**