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# *Analysis of the relationship between the characteristics of the force-time curve and scoring accuracy in football using the inner foot*

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## *ABSTRACT*

This research aims to study the relationship between strength and time curves and the accuracy of the internal scoring skill with the foot in football players. A sample of players with different training levels was selected, who underwent accurate biokinematic tests to measure strength and time during the implementation of the scoring skill. The accuracy of scoring was also evaluated through the number of successful goals compared to the number of attempts, the researcher used the descriptive approach to suit the nature of the research and chose the research sample, namely the 8 players of Nasiriyah Football Club, and During the results of the research, the researcher concluded that there is a significant correlation between the speed of time force generation during the implementation of the skill of internal scoring with the foot and the accuracy of shooting in football players, where improving the timing of the application of force leads to an increase in performance accuracy, as well as concluded that players with more regular and balanced strength curves achieve higher scoring accuracy compared to unstable curves, which confirms the importance of training to coordinate the force within the appropriate time to improve the scoring skill The most important recommendations that came out of the researcher is to encourage coaches to integrate biokinetic analysis of strength and time curves within the technical performance evaluations of players, with the aim of early detection of weaknesses and the design of individual training plans aimed at improving scoring accuracy.

## 1- Definition of research:

### 1-1 Introduction to the research and its importance:

Football is one of the most diverse and integrated team games in physical, skill and mental abilities, as it depends mainly on the performance of players for many basic skills, most notably the scoring skill, which represents the decisive point in the results of matches, and even constitutes the ultimate goal for any team during the competition. Because scoring is a clear indicator of the effectiveness of offensive performance, it has received wide attention in the fields of training and scientific research, in an effort to understand its components and improve its results accurately and effectively.

Biomechanically, scoring skill requires a high coordination between the muscular force directed towards the ball, the motor speed gained during the execution of the skill, along with precise control of balance and directing the foot towards the goal. Many studies have shown that the mere fact that a player has high muscle strength does not guarantee scoring accuracy, unless this force is synchronized with the ideal timing of movement, i.e. within an appropriate force-time curve that takes into account the sequence, speed and balance of motor performance.

The force–time curve is one of the most important quantitative indicators used in biokinetic analysis of motor performance, as it expresses the dynamic relationship between the amount of force exerted and the time spent on producing it. By studying this curve, it is possible to determine how efficiently the player uses his muscular energy at the right moment, which is reflected in the effectiveness and accuracy of the skill executed, especially in explosive movements such as scoring in football.

Hence, the importance of this study, which aims to explore the relationship between the characteristics of the strength and time curve and the accuracy of the internal scoring skill with the foot of football players, because of the crucial importance of this skill in the course of play and winning, and because of the measurement of this relationship of a major role in the development of skill performance through accurate scientific guidance for training programs.

### 1-2 Research problem:

The skill of internal scoring with foot is one of the basic and decisive skills in the game of football, because of its direct impact on deciding the results of matches and achieving victory. Although there is a great emphasis on developing this skill through technical training, field observation and practical analysis of player performance indicate a clear variation in the level of scoring accuracy, even among players with similar levels of muscle strength.

This discrepancy reflects the existence of other factors affecting the quality of performance, not only the amount of force exerted, but also the timing of its application and how it is distributed during the stages of movement. The force-time curve is one of the important biokinematic indicators that express the efficiency of the interaction between force and time in skill performance, as it contributes to clarifying the player's ability to produce strength at the optimal moment that serves the skill goal, which is accuracy in scoring.

Hence, the problem of this research arises in the need to study and analyze the relationship between the curves of strength and time and the accuracy of the performance of the internal scoring skill with the foot of football players, in order to reach a deeper understanding of how to improve this skill through objective quantitative measures that contribute to the development of technical and physical performance in an integrated manner.

**1.3 Research objectives**

1- Identify the relationship between strength and time curves and the accuracy of the internal scoring skill with the foot of football players.

**1-4 Force search**

1- There are significant statistical differences between the strength and time curves and the accuracy of the internal scoring skill with the foot of football players.

**1-5 Research Areas:**

**1-5-1 human field:** players Nasiriyah football club.

**1-5-2 Time Range:** 20/2/2025 to 25/4/2025

**1-5-3 Spatial field:** Nasiriyah Football Club Stadium.

**2- Research Methodology and Field Procedures:**

**2.1 Research Methodology:**

The researcher chose the descriptive approach (in terms of correlational relationships) because it is the most appropriate method to solve the research problem.

**2.2 Research community and sample:**

The objectives set by the researcher and the procedures used in the research are what determine the nature of the sample that he will choose, and therefore the researcher has determined the research community in a deliberate way, and they

represent the players of Al-Nasiriyah Football Club in Dhi Qar Governorate, who number (8) players, who represent 33.33% of the original community of 24 players.

Table (1) shows the specifications of the research sample in chronological age, training age, mass, height, arithmetic mean, standard deviation and coefficient of variation

| Coefficient of variation | Standard deviatio | Arithmetic mean | Unit of measurement | Measurements | t |
|---|---|---|---|---|---|
| 0.84% | 2.46 | 290.22 | month | Chronological age | 1 |
| 3.87% | 3.43 | 88.54 | month | Training age | 2 |
| 3.63% | 2.66 | 73.09 | kg | Mass | 3 |
| 2.66% | 4.74 | 177.95 | poison | Length | 4 |

**2-3 Means, tools and devices used:**

✓ **Means of collecting information:**

⊙ Arab and foreign sources.
⊙ Personal Interviews
⊙ Experimentation.
⊙ Testing and measurement.

✓ **Tools and devices used:**

⊙ Tape measure .
⊙ Japanese-made whistle.
⊙Japanese-made SONY video camera with a frequency speed of 25 images / second.
⊙ Medical scale.
⊙ Swedish-made force measuring platform
⊙Japanese-made manual calculator (CASIO).
⊙A Irish-made Dell Ci7 laptop.
⊙ 2 DVDs.
⊙ Football field .
⊙ Legal balls number (10).
⊙ 5 cm wide adhesive tape and stationery.
⊙ Casio electronic stopwatch .

**2-4 Field Research Procedures:**

**2-4-1 test accuracy scoring football:**

Scoring towards a goal divided into squares:

- Test objective: measuring scoring accuracy towards the goal

- Used tools:

• Bar to set scoring area .

• Legal soccer goal.

• Football field.

• Number of footballs(5))

- Performance method:

(5) balls are placed on the penalty line, which is 18 yards away from the goal line and the distance between one ball and another (1) yard, where the player scores in the areas marked by the test and according to its importance and difficulty and sequentially the ball after the other, provided that the test is done from the running position.

- How to register:

The number of injuries that enter the goals set by both sides is calculated so that the scores of each of the five balls are calculated as follows:

Each ball is calculated with the points specified for the calculated area, taking into account that in the event that the ball touches the bar, it is calculated for the highest area according to the numbered areas, and zero when it goes out outside the goal limits.

5 degrees to zone 5

4 degrees to zone 4

3 degrees to zone 3

2 degrees to zone 2

One degree to zone 1

Zero outside the goal limits

**2.4.2 Biokintic variables:**

**1- Variable maximum strength moment of contact:** It is the largest value recorded on the curve at the stage of the first push.

**2- Variable time to reach maximum contact moment: The** time taken for the closest fraction of a second from the moment of contact with the platform was obtained until the maximum force was recorded in the first thrust stage.

**2.5 Main experience:**

The post-tests of the research sample were conducted on 2/3/2025 (in the Nasiriyah Football Club) and to ensure the readiness of the devices and tools used, the main experiment was launched, which aims to study the relationship between strength and time curves and the accuracy of the internal scoring skill with the foot of football players. A set of rigorous methodological procedures were followed to ensure accurate and reliable data were collected that reflected the actual performance of the participants.

The test venue is equipped, the ergonomics are set to be stable, and all technical devices and equipment, including force meters, high-precision motion capture devices, and performance timing systems, are configured to ensure that all relevant variables are accurately recorded.

Each player carried out the skill of internal scoring with the foot according to the prepared protocol, where a specific number of attempts were determined for each participant to ensure adequate representation of the performance, while giving appropriate breaks between attempts to avoid physical exhaustion that may affect the measurement results during implementation,biokinetic data that includes strength and time curves were recorded, using dedicated devices, in addition to measuring scoring accuracy by recording the number of successful goals compared to shooting attempts, taking into account the scoring angle and the distance to the target.

After completing the data collection, it was reviewed and revised to ensure that it is free of errors and anomalous data, in preparation for analysis using appropriate statistical methods that allow understanding the relationship between the studied variables, and deducing the extent to which power and time curves affect the accuracy of scoring skill.

**2.6 Statistical means:**

The researcher used statistical methods that helped in processing the results and testing of research hypotheses through the use of the statistical bag (IBM SPSS Statistics 24), which are:

- Percentage .
- Arithmetic mean **.**
- Standard deviation .
- Coefficient of variation.

- Pearson's correlation coefficient .

**3- Presentation, analysis and discussion of results:**

**3-1 Presentation and discussion of the results of the strength and time curves and the accuracy of the football scoring skill using the inner foot**

**3.1.1: shows the arithmetic mean and standard deviation and the value of (t) calculated for the variables of strength, time and accuracy of the skill of scoring in football.**

| Statistical significance | Value (t) | | Aiming accuracy | | | | Unit of measurement | Data / Variables |
|---|---|---|---|---|---|---|---|---|
| | | | on | Going to | on | Going to | | |
| Moral | 0.02 | 0.82 | 1.12 | 11.22 | 8.50 | 920.33 | n | Power curve |
| Moral | 0.01 | 0.88 | 1.12 | 11.22 | 0.102 | 0.050 | Sek | Time curve |

The results of the study dealt with the relationship between strength and time curves and the accuracy of the internal scoring skill with the foot of football players, where the data showed a positive moral correlation between some indicators of the strength and time curve and scoring accuracy, which confirms the vital role played by the biokinematic dynamics of strength in improving the quality of skill performance.

The results indicated that players who showed a higher ability to produce power more quickly during the shooting phase, specifically within the optimal time range, achieved better scoring accuracy compared to their teammates who took longer to generate the required force. This is consistent with biomechanical concepts that emphasize the importance of timing the application of force to achieve the highest accuracy in explosive movements such as scoring. The precise timing of the force allows for better control of the direction and speed of the ball, increasing the chances of scoring a goal.

The data also showed clear differences in the shape of the power curve between high-precision players and those with low accuracy, as the curve of the more accurate players was characterized by a sharp increase in strength over a short time, followed by relative stabilization of the power level until the movement was completed. In contrast, players with lower accuracy had a more dispersed curve with fluctuations in strength during execution, indicating poor force coordination and proper timing of movement.

This disparity clearly reflects the importance of training that focuses on improving the speed of force generation and organizing it within the appropriate time of movement,

not just increasing muscle strength. Delays in applying force or distributing it unevenly can lead to poor ball control, thereby reducing scoring accuracy. Hence the crucial role of strength and time curve analysis as a diagnostic tool that helps trainers accurately identify individual strengths and weaknesses, enabling the design of more specialized and effective training programs.

Moreover, these findings are consistent with several recent studies that confirm the close relationship between the biokinematic properties of explosive movements and the quality of skill performance in various sports, including football. Focusing on improving the timeliness of force application as well as its amount is one of the main pillars for improving motor skills that require precision and speed of execution.

In light of these results, it is recommended to include special exercises aimed at increasing the speed of power-generation and regulating its timing in the training programs of football players, while making use of biokinematic measurement techniques to monitor performance development objectively and accurately. This data can also be used to guide players towards optimal performance, especially in situations that require accurate and rapid corrections under match pressure.

## 4 Conclusions and recommendations

### 4.1 Conclusions

Based on the findings of the research results, and the accompanying statistical treatments, discussion and extrapolation within the limits of the research sample and its nature, the researcher was able to reach the following conclusions:

1- There is a significant correlation between the speed of time force generation during the implementation of the internal scoring skill with the foot and the accuracy of shooting in football players, where improving the timing of the application of force increases the accuracy of performance.
2- Players with more uniform and balanced power curves achieve higher scoring accuracy compared to unstable curves, underscoring the importance of training in force coordination within the right time to improve scoring skill.

### 4.2 Recommendations:

1- Encourage coaches to integrate biokinetic analysis of strength and time curves into player technical performance evaluations, with the aim of early detection of weaknesses and the design of individual training plans aimed at improving scoring accuracy.
2- Providing specialized workshops and training courses for training staff to introduce them to the importance of biomechanical factors in developing football skills, especially the impact of force timing on shooting accuracy.
3- Introducing parallel exercises aimed at improving muscle stability and motor flexibility that contribute to achieving the stability of strength and time curves

during the implementation of the scoring skill, which increases the efficiency of performance in actual matches.

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