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The Relationship Between Some Physical Abilities and Some Biomechanical Variables with the Shooting Accuracy in Football

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ABSTRACT

The importance of the study lied in the game of Football and the great development that witnessed these recent years. This development was due to the careful scientific planning and accurate training and other sciences related to sport such as biomechanics. Scoring is one of the skills that can win a game. Thus, the researcher aimed at studying the relationship between some physical abilities and biomechanical variables with the shooting accuracy in football. The problem of the study was the weakness in the precision of the scoring skill on many levels, also found this weakness was caused by a defect in applying the mechanical condition of the skill or a weakness in some physical abilities of this skill. The aims of the study were identify the relationship between the Leg's exploding strength and the accuracy of shooting, speed Strength and the accuracy of shooting and the accuracy of shooting and some biomechanical variables related to the skill.

Keywords: **football, shooting accuracy, biomechanical, physical abilities**

1. Introduction

Football is the most famous and popular sport in the world, It has remarkably evolved for the past couple of decades due to the development of its physical, technical and tactical factors. Football development is a result of more improved training science and modern technologies which contributed in enhancing the players' performance hence the game in terms of quickness, precision in acting under pressure, and resplendent execution even in tough situations. Fitness generally and types of muscle strength particularly are the most Influential factors in the performance in football, where the muscle strength effects in all the football's basic skills and its considered to be the basis for the performance of most important moves with or without the ball. Mastering the skills is the first step for building a good player who can handle all the duties needed in the game such as skillful, planning, defense and offence duties.

Where the aim of the game is to score as many goals as possible in the opposing team's goal, the offence tasks are the most important specially in shooting skill which is the way to achieve the aim of the game. Many Science associated with sport training science contributed in raising the level of the game, such as "Biomechanics" which is the study of the structure and function of biological systems movement by means of the methods of mechanics, kinematics and kinetic analysis. It is evident here the importance of studying the relationship between the physical abilities and Mechanical variables and their effects in the most important skill which is the shooting skill. Having special physical abilities helps the player performing his physical duties to the fullest , it also effects the tactical and technical aspects in applying mechanical condition to specific skill.

Researchers have showed that focusing on weakness and imbalance in any skill is the basis of its development, the discovery of error in performances is the important step to correct this error, these researches also contributed in raising the level of techniques which can be seen in all the sports, especially in football by using many means such as Kinematic analysis that describes the motion of bodies , the technical performance, the right direction path of any technique, and the players application to the mechanical conditions

The researcher -who is a member of the technical staff for the Iraqi National team Under 16 and also a football instructor- noticed a weakness in the Accuracy of the shooting skill on many levels, also found this weakness was caused by a defect in applying the mechanical condition of the skill or a weakness in some physical abilities of this skill. So the researcher decided to study this problem by figuring out the relationship the accuracy in shooting and some physical abilities (explosive strength and speed strength) which directly affect the skill performance also the relationship between the accuracy in shooting skill and some Biomechanical variables related to the skill.

1. 2 Problem of the study

Having special physical abilities helps the player performing his physical duties to the fullest, it also effects the tactical and technical aspects in applying mechanical condition to specific skill. researchers have showed that focusing on weakness and imbalance in any skill is the basis of its development, the discovery of error in performances is the important step to correct this error, these researches also contributed in raising the level of techniques which can be seen in all the sports, especially in football by using many means such as Kinematic analysis that describes the motion of bodies , the technical performance, the right direction path of any technique, and the players application to the mechanical conditions.

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1.3 Aims of the study

- Identify some Biomechanics variables related to the shooting skill of individuals in the research sample.
- Identify the relationship between the Leg's exploding strength and the accuracy of shooting.
- Identify the relationship between Speed Strength and the accuracy of shooting.
- Identify the relationship between the accuracy of shooting and some Biomechanical variables related to the skill.

1.4 Hypotheses of the study

- There is a significant correlation between the Leg's Exploding Strength and the accuracy of shooting.
- There is a significant correlation between the Speed Strength and the accuracy of shooting.
- There is Significant correlation between the accuracy of shooting and some Biomechanical variables related to the skill.

1.5 Fields of the study

1- Subject: Iraqi National team players under-16
2- Duration: from 15-03-2010 till 22-03-2010
3- Place: Al-Sha'ab II Stadium, Baghdad, Iraq

2. Methodology

The researcher used the descriptive method by correlation style which is suitable with the research problem.

2.1 Research Samples

The sample consisted of (22) out of (25) players from the Iraqi National team U-16 were selected intentionally, goalkeepers were excluded, and (6) players were selected randomly by a draw as a surveying sample, the sample represented (64%) of the research community.

2.2 Means of collecting information

• Observation and analysis.
• Books.
• Computer software.
• Personal interviews.
• Test and measurement.

2.3 devices and tools used in the Research

The researcher used computer program (Dartfish) for the kinetic analysis and (SPSS) for Statistical analysis, Camera type (SONY), video type (SONY) and CDs, ropes, Cones, tape measure length (5 meters), a scale length of 1 meter , whistle and standard footballs.

2.4 Field procedures

2.4.1 Identification Biomechanical variables

Through studying resources and references, and identifying expert opinion through personal interviews; the researcher was able to define the Biomechanics variables of the shooting skill at the kicking moment and they were as follows:

- Angle of the ankle of the kicking leg.
- Angle of the knee of the kicking leg.
- Angle of the knee of the supporting leg.
- Inclination of body Angle
- Departure of the ball angle,
- Angular velocity of the kicking leg.
- Peripheral speed of the ankle of kicking leg.

2.4.2 Tests used in the Research

2.4.2.1 Explosive power of the two leg test 1:

Name of test: vertical jump or Sargent Jump test
The objective of the test: measuring the exploding strength of the legs muscles (Lower limb power).

Tools: tape measure length (1.5 m) and width (1 m), magnesium, a registration form.

Procedure: the person stands side on to a wall and reaches up with the hand closest to the wall. Keeping the feet flat on the ground, the point of the fingertips is marked or recorded. This is called the standing reach. The person puts chalk on their fingertips to mark the wall at the height of their jump. The person then stands away from the wall, and jumps vertically as high as possible using both arms and legs to assist in projecting the body upwards. Attempt to touch the wall at the highest point of the jump. The difference in distance between the standing reach height and the jump height is the score rounded to the nearest 1 cm.
Scoring: The jump height is usually recorded as a distance score. The best of 2 attempts is recorded.

Figure (1) shows how to conduct the Vertical Jump Test (Sargent Test)

2.4.2.2 Test of speed strength1:

Test Name: Hopping test for maximum distance in 10 seconds.

The objective of the test: measuring Speed strength of the legs

Tools used: stopwatch, whistle, tape measure, a registration form.

Procedure: the tester stands behind a specific mark on the ground and after hearing the whistle the player start hopping on one leg
Scoring: Record the distance made by the player during the period of (10) seconds and only one attempt.

Figure (2) shows how to conduct the hopping test

2.4.2.3 The accuracy of shooting Test 2:

Name test: shooting to goal divided into graded sections from a distance (11 m).

The objective of the test: Measuring accuracy of shooting.

Tools: a tape measure, football, goal divided by ropes to (9) sections, Cones No. (2)

Performance method: Player stands on a distance (11 m) from the goal and on the signal he starts shooting, as shown in Figure 3.

Scoring: the tester has (3) attempts and the section where the ball reaches is recorded.

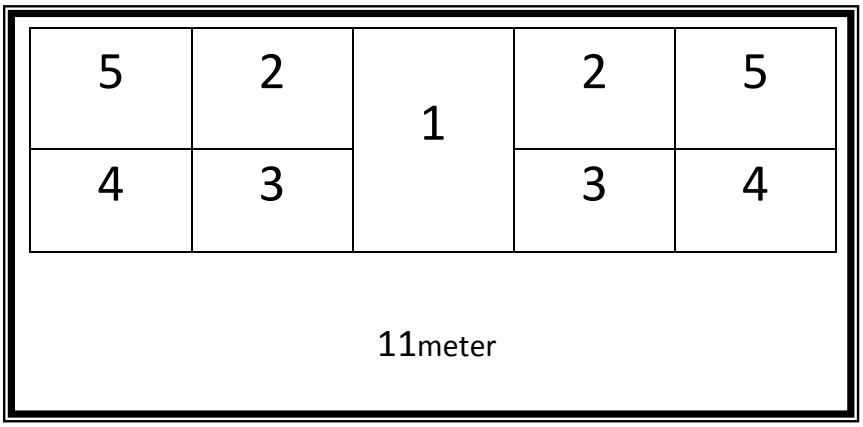

Figure (3) shows the divided goal with its degrees

2.4.3 Pilot study

The experiment exploratory is "hands-on training for the researcher to find out the negatives and positives which he might face during working to avoid them," the researcher conducts the experiment on (6) players representing a sample survey in two days ,on 15/3/2010 explosive strength Test and speed strength were conducted and accuracy of shooting test was conducted and filmed, on 18/3/2011the same tests were conducted to get reliability coefficient of the test. The aim of the experiment was to:

• Identify the tests implementation by the sample.
• Organize the Assistant team's work
• avoid the difficulties and obstacles that may face researcher in the experiment
• Notice the time it takes to conduct tests
• Adjust the angle, lens distance from the player and height of lens from the surface of the earth
• ensure the validity of the camera, the tape, the hardware and tools used
• set up the camera and adjust its final position.

2.4.4 Main experiment

The explosive Strength (vertical jump) test was conducted on 22/3/2010 at 11 am in the international Shaab Stadium after the sample consisting of (16) players was doing warm-up, after adequate rest for the research sample; the accuracy of shooting (shooting to goal divided into graded sections from a distance 11 m) test with video recording of this test in order to obtain values of the Biomechanical variables of the skill. After completion of the warm-up; the players were filmed while performing the shooting test. they were giving in opportunity to do a number of attempts to score before starting the test, and then camera video was installed in the location previously selected at (6 m) from both sides of the ball and on straight line which is the distance between the focus of the lens and the location of the ball in 90 degree angle and (1 m) up from the ground level, both cameras were placed on a tripod to control them.

The use of cameras was to get all the Biomechanical Variables under study for both players left and right footed, as well as the use fee scale (1 m) during filming and the use of analysis which is "sort and classify many information to their main elements then process it statistically or logically in order to summarize result in numeral value that can be interpreted in comparison with an appropriate coefficient from quantitative formulas to other related meanings" In order to get the results of the analysis accurately , advanced computers were used that converted movies recorded on the videos to CDs and thus Biomechanical variables were extracted through analysis program (Dart fish connect), which analyzes sport movements to figures and the results of which can be reached to achieve the objectives of the research

2.5 Statistical methods:

The researched used statistical pouch (SPSS) to extract the following variables:
• Percentage.
• The Average

• Standard deviation.
• Correlation coefficient (Pearson).

3. Results & Discussion

Display the results of accuracy of shooting test and their relation to physical tests results then analyze and discuss them:

Table (1) Shows the mean and standard deviation of the shooting accuracy test and arithmetic means of physical abilities under study with the correlation coefficient and the correlation significance

Technical Variables	A	σ	Unit	Physical variable	A	σ	Unit	Correlation coefficient (Pearson).	Indication
Accuracy of shooting	12.14	1.96	degree	Leg's Explosive Strength	24.39	2.31	cm	0.391	significance
				Leg's Strength Speed	34.16	2.15	m	0.429	significance

As shown from the table (1) The calculated value of the correlation coefficient is greater than the standard value which is (0.360), which indicates significant relationship between the accuracy of shooting and the two physical variables (explosive strength, the Speed Strength).
Researcher attributed the significant relationship between the explosive strength and accuracy of shooting that shooting process needs strength and speed of the legs' muscles performance
The explosive strength is a combination of these two qualities where the explosive power is "the highest dynamic force can be produced by muscle or muscle group as soon as possible and one-time".

The need for strength and speed as separate elements is shown in many situations at the game and as integrated as an explosive force in many situations such as kicking the ball to pass or kicking the ball hard to score or jump to hit the ball in the head."
Researcher attributed the significant relationship between the speed strength and accuracy of shooting that speed strength is the most obvious ability of the football players where the game requires the strength of the performance accompanied by a high frequent moves and speed while kicking the ball.

The football player needs a great physical preparation focusing on speed and strength because speed strength can't be obtained unless there is big muscle building and high speed accompanied by skill proficiency, since that possession of speed Strength for football players is not only important from the physical side but also technically side; " the speed strength linked to the proficiency degree of technical performance"

Display the results of the accuracy of shooting testing and their relationship with Biomechanical variables of the shooting skill, analyze and discuss them:

Table (2) Shows the mean and standard deviation of the shooting accuracy test and Arithmetic means of Biomechanical variables under study with the correlation coefficient and the correlation significance

Technical Variable	A	σ	Unit	Kinematic Variables	Unit	A	σ	Correlation coefficient	Indication
Shooting Accuracy	12.14	1.96	Degree	Angle of kicking leg's ankle	Degree	123.2	7.14	0.838	Significant
				Angle of kicking leg's Knee	Degree	144.8	3.1	0.483	Significant
				Angle of supporting leg's ankle	Degree	142.7	6.13	0.151	Significant
				Inclination of body Angle	Degree	10.38	3.07	0.51	Significant
				Departure of Ball Angle	Degree	9.23	2.04	0.459	Significant
				angular velocity of kicking leg	Degree/sec	812.7	63.87	0.39	Significant
				Peripheral speed of kicking leg's ankle	m/sec	8.77	1.74	0.411	Significant

The calculated value of the correlation coefficient between the accuracy of shooting and Biomechanical variables (angle of the kicking leg's ankle, the angle of the kicking leg's knee, the inclination of body Angle, the departure of ball angle, the angular velocity of the kicking leg, peripheral Velocity of the kicking leg's ankle) is higher than the tabular value (0.360), which proves the significant relationship between these variables and the accuracy of shooting, while the calculated value of variable of angle of the supporting leg's knee is smaller than the tabular value, that proves the random relationship between the variable of angle of the supporting leg's knee and the accuracy of shooting

The researcher attributes the significant relationship between the accuracy of shooting and the angle of the kicking leg's ankle to the significant role of the ankle in the process of kicking the ball as it represents a point of collision with the ball and the ankle should be part of a solid foundation in order to give momentum enough for the start of the ball and the

looseness of the ankle joint will lead to the start of the ball feebly and slowly so the ankle must be tight during the performance of shooting.

The significant relationship between the accuracy of shooting and the angle of the kicking leg's knee is due to this angle contributes significantly to lengthen or shorten the kicking leg which is the rotation radius in the movement of kicking the ball and when it goes up, the amount of peripheral speed increases, which contribute to increase momentum of the kick the bending and extending of the knee joint plays a key role in the mechanical movement of kicking " the purpose of bending the kicking leg from the knee joint is to shorten the length this leg of which represents the radius in angular momentum , for this, the angular velocity of the kicking foot increases whenever length (radius) decreases which means that the angular velocity is inversely proportional to the radius, causing transmission of momentum from the swinging leg on back to the ball in front, which gives in turn acceleration and large amount of movement transmitted to the ball. "

The researcher attributed the significant relationship between the accuracy of shooting and angle of inclination of the body to the important role this angle play in the movement of kicking as the degree of inclination of the body can give a large kinetic energy to the legs which moves to the ball. Therefore, it is clear that the correct position of the body helps the success of shooting skill and this is consistent with what Hussein Mardan and others said, " inclination of body to the back as the body's center of gravity close to the focal point of leg will get the legs kicking the ball to reach the farthest road and more high behind the body this helps to increase the force's values or along the way to accelerate the legs kicking the ball" The researcher believes that the significant relationship between the accuracy of shooting and starting of the ball's angle that this angle is directly linked with the angle of the kicking leg's ankle in addition to the amount and direction of the driving force of the legs on the ball. If this force tends to center of the ball, linear motion will occur. If it goes outside the center of the ball, rotational and linear movement together will occur.

So it became clear that the value of this angle affects the accuracy of the kick and this is consistent with what (Savelsbergh) and (Bootsma) referred to "The way to successful performance requires that the foot that kicks in the right spot will evoke the same force to push the ball and in the right direction." The researcher attributes the significant relationship between the accuracy of shooting and the angular velocity of the kicking leg to the momentum of the kicking leg's movement affects the momentum of the ball's movement thus transmission of strength and speed of the kicking leg to the ball, which affects the trajectory of the ball after starting "

This force transmitted to the ball from the kicking leg must be enough to move the ball along with enough acceleration, because the ball is moving with acceleration directly proportional to the force acting "Also the angular velocity affected by movement of the kicking leg from bending or extending the joints where the decreasing of radius leads to increasing the amount of angular velocity and "this increasing of the radius leads to a reduction of moment of inertia and thereby increase the angular velocity."

The researcher attributes the significant relationship between shooting accuracy and peripheral speed of the kicking leg which is the touchstone and objective indicator for assessing the speed of starting of the ball to the kicking foot which must overcome the inertia of the ball. Therefore, the rapid movement of the kicking foot will affect the speed and direction of starting of the ball, thus affects the accuracy of the shooting. If "We wanted the ball to overcome its inertia , sufficient force should be shed for this purpose and this force should be more economical and very fast because mechanically the strength has a large impact and lead to achieve high-speed and thus leads to get the ball a high momentum at the movement".

Also fully extension of the kicking leg and without bending joints in order to totally benefit from the impact of the principle of lengthening the radius of rotation that increases the peripheral speed of the revolving body which helps to increase the speed of kicking, So we can say that the movement of the kicking leg must be very fast that way speed of the ball is determined. and this is agreed with Uday Gaspe Hassan quoting from (Asami and Nolte) that there is a high correlation between ball's speed and foot's speed and that the latter is an important factor in the effect of mechanical interaction between the speed of the ball and speed of foot and that the latter is an important factor in the mechanical effect of interaction between ball and the kicking foot.

The random relationship between the accuracy of shooting and angle of the supporting leg's knee back is due to the fact that the respondents who are juniors tried to obtain more stability and balance by reducing the values of the angle of the knee joint of the supporting leg in exaggerated way in order to reduce center of gravity of the body thus increases the stability and balance after fatigue, Mahdi Shalash points that " the low center of gravity of the body will lead to more stability and balance to the body.".

4. Conclusion

Physical capabilities clearly contribute to accuracy of the technical performance of football. There is a strong relationship between performance level of muscular strength forms specific to shooting skill and the accuracy this skill. The values of Biomechanical variables under study affect the accuracy of the performance of shooting skill in football. The values of angular and peripheral velocity are affected by extending and bending of joint of the kicking leg's joints (radius) and affect the speed and angle values starting the ball and thus affect the value of testing the accuracy of shooting.

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