



## A Comparative Analytical Study of Some Biomechanical Variables and Their Relationship to The Accuracy of The Performance of Shooting Skill from High Jumping in The Weak and Strong Leg the Players for Youth Handball

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### Abstract

The research aims to identify the most important variables affecting Shooting Skill from High Jumping and compare them for the two legs the weak and strong, where the researchers adopted the descriptive method, and the sample was chosen by the intentional method, which consists of (3) players from the Iraqi Sports Army Club, where these variables were studied and their impact on The accuracy of aiming at the two men, and the researchers concluded that most of the players have more accuracy in aiming at the strong leg than at the weak leg, which leads to the loss of many real opportunities during the match because of the players changing the situation or wasting the available opportunity when the position of correction is an opportunity for the weak leg.

**Keywords:** physical education, sports performance, biomechanics, handball.

### Introduction

Sports sciences have witnessed significant and rapid progress in recent times, owing to their reliance on scientific methods and the correct approach in analyzing errors and implementing appropriate solutions. This has been achieved through the application of modern research and scientific experiments in the field of sports (Youssef, 2022). Thanks to this scientific approach, sports sciences have achieved advanced results and set new records in various events and competitions (Ali, 2022). (Mohammed, 2017).



Handball is considered one of the team sports that has been significantly influenced by the advancement of various sciences, such as sports coaching, sports physiology, biomechanics, and sports psychology. The impact of these sciences has been evident in the development of both the skill level and physical performance of handball players (Abbaas, 2019).

The shooting skill of jumping high is one of the most important basic skills on which the performance of the handball team depends and achieving a high technical level, thanks to this skill, players can reach the goal better and increase the chances of shooting at the goal with greater accuracy and strength (algaith, and falh, 2018).

Where shooting from distant areas in the handball game requires high skill from the players in the back line where they face multiple challenges and the importance of aiming accuracy lies as it is the decisive factor for the success of shooting due to the presence of opposing defenders and the goalkeeper in front of the aiming player and the aiming player must have special specifications to achieve successful shooting from distant areas where he should have a skillful performance, excellent jumping power and high aiming accuracy as the success of the player in the implementation of basic offensive skills depends not only on the development of physical and skill abilities, but goes beyond that to take into account the distinctive mechanical aspects of performance (Obaid,2021).(Al-Rubaie, 2020).

Kinesthetic analysis of events plays a significant role in revealing small details and subtleties in sports performance. Researchers and trainers can use this analysis to detect performance weaknesses and identify appropriate solutions using mechanical and training principles (Abed al minaam, 2020).

In this regard, Fathi Ahmed Hadi (2010) points out that in the handball game, techniques and skills depend mainly on several elements, including speed when starting, running and sudden standing are considered basic in the game, and it also requires good behavior and the use of leg harmoniously to implement deception and maneuver movements. Therefore, the player needs strong and agile legs in movement and mobility. In addition, it requires muscular and nervous compatibility as it controls the stability of the player's body smoothly and easily. These elements help players to implement game techniques efficiently and accurately, and significantly affect their overall performance.



According to Khaled Hamouda and Ashraf Kamel (2014), the performance of handball players depends on the interaction and coordination of movements, skills involved in posture and strategy. Players have to choose the right skills based on the right timing, in response to the speed of movement of competitors and teammates and handball performance requires the ability to change the player's behavior and adjust it in accordance with changing situations during the competition, without the need to form static behavioral patterns.

In the study (AL-Kayyat, 2019), the researcher used the descriptive method by survey method and correlations to suit the nature of the research and its goals, where the research community consists of (10) excellent handball clubs for the season (2018-2019), and after applying the test procedures for the accuracy of the shooting skill of high jump for backline handball players, the results showed that the skill of jumping high with two legs to reach the highest.

Handball is considered one of the distinctive games with advanced offensive skills, as it requires high abilities in performance control due to the difficulty of the situations that players face in implementing those skills that are considered Open skills, which further complicates their correct application during those situations. Among these skills, the skill of aiming from jumping comes to the forefront of importance, as you face complex situations due to the presence of defenders and the goalkeeper, in addition to team-mates, and in the event that the defenders force the attacking player to move away from his original position on the field during the attack, it is difficult for the aiming player to raise the supporting leg to successfully execute the shot. these cases are the most complex that the player faces during the shot, therefore, this usually requires the presence of players with high specifications in their ability to control, especially since the time period available for decision-making and implementation is very short. The lack of accurate information that identifies the most important biomechanical variables that affect accuracy can cause both coaches and players to be distracted and based on the researchers' follow-up of previous studies and matches of the Iraqi Handball League, they noticed a weakness in the ability of players to raise the supporting leg during shooting. Therefore, the researchers tried to identify the most important of these variables.



Based on these studies and the conclusions derived from them, appropriate exercises and training methods are identified that contribute to the development of the ideal technique for high-level players, and through the foregoing, the importance of research is shown by studying some biomechanical variables and their impact on strong leg and weak leg because of their importance to accurately perform the skill and achieve the scorer in the match.

### **Material & methods**

The researchers used the descriptive survey method to analyze a sample of the Iraqi Army Club for youth handball (3) players as shown in Table 1. The researchers have used the following means and tools:

1. force measuring platform
2. Kenova program
3. questionnaire form
4. SPSS program

#### ***Force measurement platform:***

It is a sensitive electronic electric balance that has the ability to measure vertical (Fy), horizontal (Fx) and deep (Fz) force as well as the sum (FR). the platform responds to the amount of change in the acceleration of the body in contact with it according to Newton's third law (for each reaction, the reaction is equal in magnitude and opposite in direction). the work of the platform in measuring the force amounts is based on Newton's second law  $F = m \cdot a$  and the results appear in two axes, one horizontal, represented by time, and the other vertical, represented by force in units of Newton.

#### ***The purpose of using force measuring pads :***

- 1-recording the force in a unit of time to measure the force used in sports performance
- 2-identification of sports injuries in walking and jogging
- 3-giving biomechanical feedback
- 4-development of kinematic and comparative models



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8-development of kinematic and comparative modeling.

The platform was placed 7 meters from the goal line, where the player, while performing the test, takes three steps, then jumps off the platform and shoots at the goal.

### ***The main experience:***

The main experiment was conducted on 20-06-2023 on the court of the Iraqi Army Club for youth handball and the shooting test of high jump was applied as follows:

The goal of the test: to measure the accuracy of aiming from a high jump in a handball.

### ***The tools used:***

- Handball court.
- Handball goal.
- Number of handballs(8)
- Number of precision squares (4) measurement (60 cm X 60 cm).
- Tape measure.
- Registration form.

### **Method of performance:**

The tester stands holding the ball in the designated place where the tester performs dribbling and then takes three steps according to the law and then jumps to the top forward to perform the shooting skill, where he starts the shooting process on the corner in the goal, and each player is given (8) attempts, and the tester performs all attempts without legal errors, taking into account the performance (Allawi, 2001).

Recording:

1. The tester gives two degrees to the ball entering the accuracy squares.
2. The tester gives one score to the ball that hits the precision squares.



3. The tester gives a zero if the ball hits the post, crossbar or goes out of bounds on goal.

### *Statistical analysis*

The researchers used the SPSS statistical bag version (23) for the variables extracted in the research.

### **Results**

After the researcher has conducted the tests on the research sample, the results are displayed after taking their statistical values in tables, and it is of great importance because it is an illustrative tool for research and then it will be discussed, and in order for the research to appear more clearly, the results will be presented and discussed successively for the variables studied.

Table (1) Arithmetic means of the results of the players in the shooting accuracy test of the high jump

T	Players	Entities	
		Strong Leg	Weak Leg
1	First Player	9	6
2	Second Player	12	6
3	Third Player	9	3

1. View the results of correlation relationships of biomechanical variables with the skill of shooting from high jump:

1.1. View the results of correlation relationships of biomechanical variables with the shooting skill of jumping high in the strong leg.



Table (2) correlation coefficient of biomechanical variables with strong leg shooting skill

No	Biomechanical variables	Unit of measurement	Shooting skill from jumping					
			mean	Standard deviation	Correlation coefficient	(sig)	Relationship direction	Contribution Percentage
1	resultant momentum	Kg. M/Sec	193.13	3.26	0.739	0.26	Positive strong	0.55
2	maximum strength	Newton	641	40.87	0.941	0.23	Positive strong	0.89
3	Maximum strength time	Sec	0.03	0.00	0.724	0.27	Positive strong	0.52
4	Contact time	Sec	0.38	0.05	0.933	0.07	Positive strong	0.87

Note:  $1 \leq 0.5$  strong a positive relationship /  $0.5 \leq 0$  weak a positive relationship /  $0 \leq 0.5$  weak inverse relationship /  $0.5 \leq 1$  - strong inverse relationship.

1.2. View the results of correlation relationships of biomechanical variables with the shooting skill of jumping high in the weak leg.

Table (3) correlation coefficient of biomechanical variables with weak leg shooting skill

No	Biomechanical variables	Unit of measurement	Shooting skill from jumping					
			mean	Standard deviation	Correlation coefficient	(sig)	Relationship direction	Contribution Percentage
1	resultant momentum	Kg. M/Sec	182.72	15.81	0.625	0.43	Positive strong	0.39
2	maximum strength	Newton	415	30.4	0.746	0.250	Positive strong	0.56
3	Maximum strength time	Sec	0.05	0.00	0.637	0.43	Positive strong	0.41
4	Contact time	Sec	0.39	0.07	0.315	0.68	Positive weak	0.10

2. Discussion the results of correlation relationships of biomechanical variables with the shooting skill of jumping high in the strong leg.



2.1 Discuss the results of the resultant momentum in the accuracy of the shooting skill of high jump.

From Table (2), we note that there is a statistically significant correlation between the resultant momentum and the accuracy of the shooting skill from jumping high with a strong leg. the correlation coefficient reached (0.739) with a contribution percentage of (0.55) and the standard deviation reached (3.26) while the Sig score reached (0.26) and the mean reached (193.13).

From Table (3), we note that there is a statistically significant correlation between the resulting momentum and the accuracy of the shooting skill from jumping high with a weak leg. the correlation coefficient was (0.625) with a contribution percentage of (0.39), the standard deviation was (15.81), while the Sig score was (0.43) and the mean was (182.72).

The researcher attributes this Positive strong relationship to the amount of the maximum force of the leg, as it reached (641) Newton for the strong leg and (415) Newton for the weak leg, as the kinetic resultant momentum is related to Newton's second law, and the change in momentum is proportional to the amount of force acting on the body, as the momentum depends on the mass of the body (Peter, 2005): The acceleration of an object is directly proportional to the net force exerted and inversely proportional to the object's mass.  $F = m \cdot a$

2.2. Discuss the results of the maximum strength in the accuracy of the shooting skill of high jump.

From Table (2), we note that there is a statistically significant correlation between the maximum strength and the accuracy of the shooting skill from jumping high with a strong leg. the correlation coefficient reached (0.941) with a contribution percentage of (0.89) and the standard deviation reached (40.87) while the Sig score reached (0.23) and the mean reached (641).

From Table (3), we note that there is a statistically significant correlation between the maximum strength and the accuracy of the shooting skill from jumping high with a weak leg. the correlation coefficient was (0.746) with a contribution percentage of (0.56), the standard deviation was (30.4), while the Sig score was (0.250) and the mean was (415).





The researcher attributes this strong positive relationship to the fact that the amount of mechanical force exerted by the player greatly affects the maximum strength and that the attempt to move large blocks is the amount of maximum strength She is the most important in the success (Peter, 2005). It increases the speed of the player to reach the highest possible point and leads to a reduction in movement Time based on Newton's third law, "For every action there is a reaction that is equal in strength and opposite in direction." where muscle strength is the basis in achieving and producing speed (Hussein, 1987). And that the athlete during the push-up phase needs all the muscle fibers (slow and fast), and also relates to Newton's second law "The acceleration of an object as produced by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object" (Riewoldt, 2015).

### 2.3. Discuss the results of the Maximum strength time in the accuracy of the shooting skill of high jump.

From Table (2), we note that there is a statistically significant correlation between the maximum strength time and the accuracy of the shooting skill from jumping high with a strong leg. the correlation coefficient reached (0.724) with a contribution percentage of (0.52) and the standard deviation reached (0.00) while the Sig score reached (0.27) and the mean reached (0.03).

And through Table (2) we note that the strong leg got the least strength time compared to the weak leg, The researcher attributes this to the fact that the strong leg achieved a large amount of maximum strength, reaching (641) Newtons, Also, as in Table (3), the best strength is achieved by achieving maximum strength in the least time (Pozzi, 2017).

From Table (3), we note that there is a statistically significant correlation between the maximum strength time and the accuracy of the shooting skill from jumping high with a weak leg. the correlation coefficient was (0.637) with a contribution percentage of (0.41), the standard deviation was (0.00), while the Sig score was (0.43) and the mean was (0.05).

### 2.4. Discuss the results of Contact time in the accuracy of the shooting skill of high jump.



From Table (2), we note that there is a statistically significant correlation between the Contact time and the accuracy of the shooting skill from jumping high with a strong leg. the correlation coefficient reached (0.933) with a contribution percentage of (0.87) and the standard deviation reached (0.05) while the Sig score reached (0.07) and the mean reached (0.38).

From Table (3), we note that there is a statistically significant correlation between the Contact time and the accuracy of the shooting skill from jumping high with a weak leg. the correlation coefficient was (0.315) with a contribution percentage of (0.10), the standard deviation was (0.07), while the Sig score was (0.68) and the mean was (0.39).

The researcher attributes that the player obtained the lowest or highest contact time as a maximum strength he has, which amounted to (641) Newton for the strong leg and (415) Newton for the weak leg, as in Table (2), (3) Because " the less time the leg takes on the ground, the less speed loss during the performance (Peter, 2005).

## Discussion

The superiority of shooting from jumping with a strong man over a weak man is natural due to the natural mechanism of using the man opposite to the throwing arm, which gives a greater preparatory range and helps increase the force resulting from jumping and kinetic transfer from the man and torso, and then aiming from the arm .it confirms (Fadhli, 2011) that the goal of preparing to shoot from jumping with the man opposite to the throwing arm, as in handball, is to increase the range of motion, which helps increase speed and momentum of the body. The reliance of the players on the strong man by always aiming, as well as the concentration of trainers in their training units to perform the skill of aiming at the strong man constantly, which helps in its development and then its superiority. Physiologists have confirmed that part of the activities become involuntary and the motor system in the brain may be affected by these activities as a result of continuous exercise and motor repetition, and the athlete acquires a high degree of mastery.

The researchers attribute the lack of use of the weak man in the performance of the skill of aiming from jumping for many reasons, including the failure of coaches to urge their players to train using other types of aiming from jumping and their dependence on the opposite man in the performance of the skill, which makes it easier



for the defender to carry out his defensive duty by reading the opponent's mind and anticipating his movement and then the correct move and counter the attack and the failure of the aiming process.

Biomechanical research and studies aim to achieve what is known as the ideal technique, which is a complex process that requires the use of the potential and motor abilities of the players optimally. The ideal technique aims to achieve optimal performance by analyzing the interrelation between the biomechanical structure of performance and the various forms of exercise and training methods used (hossameddin, 1997).

The study of this relationship contributes to the selection of the most suitable exercises for high-level players and the emphasis is placed on the analysis of the motor structure of optimal performance and the identification of factors influencing its achievement (Abdulkareem, 2020).

## Conclusions

In light of the statistical values that have appeared and through the data that have been processed, and commenting on these values, the researchers relied on a set of conclusions, which are as follows:

1. the results recorded statistical values that have a heterogeneous correlation with the accuracy of the performance of the shooting skill of high jump.
2. it is not necessary to use the maximum amount of force to achieve the best accuracy, sometimes this amount negatively affects the body's posture and balance and thus its impact on the accuracy of skill performance, so the study showed that the use of appropriate amounts always and access to the mechanism in performance is what enables the player to provide the best results.
3. most of the variables that have been measured are variables that overlap with each other, and each variable has its own effect on the other variables, so the process of developing any variable contributes to the development of other variables Thus developing the accuracy of the skill performance.

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