



E-ISSN: 2706-8927  
P-ISSN: 2706-8919  
[www.allstudyjournal.com](http://www.allstudyjournal.com)  
IJAAS 2023; 5(2): 24-26  
Received: 24-01-2023  
Accepted: 03-02-2023

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## The time of the throwing arm movement with the pivot foot and its relationship to some kinematic variables of the throwing stage with the achievement of the advanced hammer throwers

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DOI: <https://doi.org/10.33545/27068919.2023.v5.i2a.919>

### Abstract

The importance of the throwing phase and its kinematic variables was addressed, and the importance of the pivot leg movement being synchronized with the aiming arm movement. The movement of the aiming arm with the pivot leg and some kinematic variables for the throwing stage, and the research hypothesized that there was a positive correlation between the movement of the aiming arm with the pivot leg and some kinematic variables for the throwing stage, where the researcher used the descriptive approach to solve this problem and the research sample was the Maysan governorate team for hammer throwing, As for the research tools, they were testing and measuring, as the sample was tested, and after the completion of the main experiment, data were collected using special forms to treat them statistically through the use of appropriate statistical laws. Reaching conclusions, including: (The dynamic synchronization between the throwing arm and the pivot leg has a positive effect on the completion of the hammer throw). In light of this, the researcher recommended the need to pay attention to these kinematic variables and the state of motor synchronization of the hammer thrower.

**Keywords:** Movement, pivot foot, kinematic variables, throwing stage, throwers

### 1. Introductions

The most important stage in the hammer throwing event is the throwing stage, which is determined (from the moment the foot rests in the last step until the moment the hammer comes out of the throwing arm). The throwing stage enables a good and highly effective throwing attempt, and the most important thing that enables the player not to lose the amount of movement achieved through the rotation stage and the intersections stage, which in turn is transmitted from the player's body to the hammer in the throwing stage is the case of synchronization of the moment of movement of the throwing arm with the moment of fulcrum The player made the last step, so it must be known how important it is to the achievement by reaching the nature of its relationship to the achievement, where the player must pull the arm that holds the spear the moment his foot rests on the ground as well as achieve good kinematic variables then he has performed the ideal for this stage and thus Not to lose any amount of the amount of movement that the player achieves before this stage, which in turn must be transmitted from the leg to the torso and then to the throwing arm, and that any delay in a moment is free By kicking the arm at the moment the foot rests or vice versa, the player has lost a large amount of motor momentum that he achieved before the throwing stage. Hence the importance of research in identifying the correlation relationship of the motor synchronization of the throwing arm and the foot of the foot rest in the throwing stage and between achievement and special kinematic variables.

### 1.2 Research Problems

Hammer throw players in Iraq suffer from weakness in achievement when compared to the level of global achievement despite their continuity in the training process and the application of most exercises, which in turn raise the physical level such as strength, speed of throwing and flexibility. Those with advanced achievements, but the difference between the two levels lies in the performance of the most accurate technique for the stages of hammer throwing, especially the throwing stage, as well as focusing on the things that have the most

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positive impact to increase the distance of throwing. Focusing on it during the training process, and the researcher sought to solve this problem by identifying the correlation of the kinetic synchronization of the throwing arm and the foot of the support in the throwing phase, and between the achievement and the special kinematic variables.

### 1.3 Research Objectives

To identify the correlation between the motor synchronization of the throwing arm and the support foot and some kinematic variables of the hammer throw phase and the achievement of the research sample.

### 1.4 Imposing research

There is a positive correlation Between the kinetic synchronization of the throwing arm and the support foot and some kinematic variables for the hammer throwing phase and the achievement of the research sample.

### 1.5 Research areas

- **The human field:** the players of the Maysan governorate team for hammer throwing, which numbered (4) players.
- **Time range:** 1/10/2019 to 1/12/2020.
- **Spatial field:** Scout camp stadium in Maysan Governorate.

## 2. Research methodology and field procedures

### 2.1 Research Methodology

The appropriate approach is one of the most important steps that lead to the success of the research, as the approach depends on the nature of the problem and the goal to be achieved. (Wajih, 1985) Therefore, the researcher used the descriptive approach in the correlational study, which aims to determine the degree of relationship between two or more variables. (Khair El Din, 1999)

### 2.2 Research Community

- Was selected by the intentional method of (4) players representing the Maysan javelin throwing team.
- Means of collecting information, devices used, and research tools:

#### 2.2.1 The means of collecting information and the devices used

- Arabic and foreign sources.
- Personal interviews with experts and specialists.
- Self-observation by the researcher.
- Data dump forms.
- Hammer number (7).
- Casio camera.
- Laptop computer (hp).
- Handy calculator.
- Scale drawing length (1) meter.
- Measuring tape.

#### 2.2.2 Research Tools

Test and measure

#### 2.2.3 Field research procedures

##### 2.2.3.1 Exploratory experience

The researcher conducted the exploratory experiment on Sunday corresponding to 10/27/2019 at four o'clock in the

afternoon and in the scout camp yard in Maysan Governorate, where the number of the sample of the exploratory experiment was from the same research sample and their number was (2) players and the aim of that experiment was It is to identify the obstacles and difficulties that the researcher may encounter during the main experiment and to identify the safety of the devices and tools used in the tests.

### 2.2.4 Research tests

**Kinetic synchronization of the throwing arm and foot support:** It is the time difference between the moment of the first movement of the throwing arm and the moment the front leg foot rests during the throwing phase, noting that the shorter the time difference, the greater the agreement between the throwing arm and the foot foot, and thus the achievement increase.

**Throwing step diameter:** It is the horizontal distance between the point of contact of the back foot with the ground to the point of contact of the front foot with the ground.

**Throwing step time:** It is the time it takes to perform this step.

**Hammer launch angle:** - It is the angle between the velocity vector and the x-axis.

**Achievement:** It is the distance that the hammer travels after leaving the thrower's arm to the point where it falls to the ground.

### 2.2.5 The main experiment

The tests were applied to the research sample on Tuesday 5/11/2019 at four o'clock in the afternoon at the scout camp yard in Maysan Governorate, and after the test was clarified for the research sample, six attempts were given to each player according to the effectiveness law approved in the races in order to Obtaining the achievement and through video imaging of those attempts, the kinematic variables under study were extracted.

### 2.2.6 Videotaping

The filming was done by a (1) Casio camera placed on a tripod at a distance of (5) meters next to the field of the close-up run and on the side close to the aiming arm of the players, noting that all the respondents throw with the right arm, as the camera was placed in the fourth quarter of the approaching distance As the field of photography included the (10 meters) The last is from the distance of the approximate run of (30 meters), and filming the throwing stage for all players, and the height of the camera from the ground was (1.30 meters), as it is perpendicular to the middle of the average rate of the throwing distance for the last five steps. A drawing scale with a length of (1m) was used, and it was photographed at the midpoint of the motor track of the performance, and after all the attempts of the sample were filmed, those video clips were transferred to a hard disk and then to a laptop computer and were analyzed using the (Kinova) program and extracting the variables (step length throwing step, throwing step time, javelin launch speed, javelin launch angle).

## 2.3 Statistical means

The researchers used some laws from the statistical program (SPSS) as follows

- Arithmetic mean

- standard deviation
- simple correlation law (Pearson)

**3. Presentation, analysis and discussion of the results**

**3.1 Presenting and analyzing the results of the tests of the research sample and discussing them**

Presentation and analysis of the results of the descriptive statistics of the motor synchronization difference, kinematic variables, and achievement of the research sample.

**Table 1:** It shows the results of descriptive statistics on the kinematic variables and achievement

T	Variants	The middle	Standard deviation
1	Synchronous difference	03.0	0300
2	Step diameter	1311	0310
3	Step time	0320	0302
4	Departure angle	.2322	1300
5	Achievement	10	1300

**3.2 Presenting and analyzing the results of the correlation between research variables and achievement tests and discussing it**

**Table 2:** Shows the results of the correlation between the difference of motor synchronization and the kinematic variables and achievement

T	Variants	Correlation coefficient	Indication
1	Achievement with Teams Sync	0.92	0000
2	Completion and step diameter	0.95	0000
3	Completion and step time	0.94	0000
4	Completion and starting point	0.95	0000

Significant at the level of significance (0,05) or less and degrees of freedom (22)

By looking at Table (2), we find that The value of the correlation coefficient (t) between achievement And between the kinetic synchronization of the aiming arm with the fulcrum It reached (0.92), with a level of significance (0.00), which is smaller than (0.05), which indicates that the relationship is positive (positive) between the achievement and the movement synchronization of the arm and the pivot leg, that is, the less the time difference between the two movements, there was a development of achievement, and this comes from By not losing the motor momentum that the shooter gains through the previous stages of performance, as this characteristic is important in controlling the final speed through proportionality with the goal of the motor performance of the activity and its path) (Talha, 1994) [7] and that increasing the speed is necessary to obtain the best performance and improve the distance Horizontal hammer. Referring to Table (2), we find that the value of the correlation coefficient between achievement and step length amounted to (0.95) and at a level of significance (0.00), which is less than (0.05), which indicates that the relationship is direct (positive), meaning that every step length is shorter. The player is able to transfer the amount of movement of the two legs to the torso and the throwing arm, which reflects positively on the achievement. It increases the pushing force in the lower part of the body, affecting the force transmitted to the throwing arm) (Qasim, 1991) [4].

As for the value of the correlation coefficient between achievement and step time, it reached (0.94), with a level of significance (0.00), which is less than (0.05), which indicates that there is a direct positive correlation between

step time and achievement, meaning that the less the step time, the greater the speed. Thus, the amount of its movement increases, which reflects positively on the completion distance.

Referring to the above table and observing the value of the correlation coefficient between the completion and the angle of departure, which amounted to (0.95) and at the level of significance (0.00), which is less than (0.05), and therefore the relationship between them is positive (direct), that is, the more the angle increases and approaches the (45) degrees, which led to an increase in the horizontal distance of the hammer This is what the ballistics law says. As (the decrease in the value of the starting angle is at the expense of the starting speed, because whenever there is an increase in the starting speed, this leads to an improvement in the starting angle accompanied by an increase in achievement) (Qasim, 1991) [4]. The departure angle is one of the factors affecting achieving the best horizontal distance (Samir, 1991) [6].

**4. Recommendations and Conclusions**

**4.1 Recommendations**

1. The less the motor time difference between the throwing arm and the support foot during the throwing phase, the more this is reflected positively on the completion distance, and this is evident through the direct correlation between them.
2. The variable length of the step, its time and the angle of departure have a positive effect on achievement through the positive relationship between them.

**4.2 Conclusions**

1. The need to apply harmonious exercises that focus on developing the research variables and linking them to skill, with the use of auxiliary tools to develop compatibility between and during the technical stages of performance.
2. Emphasis on training the technical stages in a manner compatible with the remaining stages, especially the shooting stage, because it is the stage on which the level of achievement depends.

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