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Analytical study of the predictive value of achievement as a function of the achieved velocity of linear and angular body parts for the stage of throwing and starting position and javelin throwing accomplishment

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Abstract

The importance of the research came through emphasizing an important variable, which is the speed the shooter acquires for his body parts during approaching and speed in the final stage of throwing. In it, and to identify the influencing relationship between the values of the achieved velocity of the body parts (linear and angular) to place the throwing effectiveness of the javelin and the completion of the research sample, and the researchers used the descriptive approach by the method of the relational and surveying relationship to suit its nature of the research The research was carried out in an intentional way, and the number was (6) players from the Diyala Club for the sports season (2018-2019) and they were under (18) years old. The research procedures included conducting imaging and extracting the variables that included (the linear velocity of the body parts of the hip, shoulder, elbow , The spear) and the angular velocity of each (the stem and the aiming arm), the field application was conducted to conduct the main experiment on the research sample on Tuesday, 10/12/2019, in light of the achieved results, the results showed a high correlation and impact force between the achieved speed of body parts (Linear and angular) for the throwing phase and the javelin throw for the youth.

Keywords: *angular body, javelin, throwing effectiveness*

I. Introduction:

Athletics witnessed a rapid and effective development during the past years, and this development appeared as an actual result of the development of the mathematical sciences associated with sports training, and the science of biomechanical kinematic analysis had an effective contribution to diagnosing the strengths and weaknesses

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affecting skill performance. Athletics activities require special physical and movement capabilities, in which performance must be at the highest level of control for their own biomechanical variables, including the effectiveness of javelin throwing.

The analysis of the effectiveness of the javelin throw through the extraction of biomechanical variables (kinematic and kinetic), which can be obtained by using modern laboratory devices, which gives very accurate numerical connotations for all that is recorded of motor performance, so the purpose of the kinematic analysis is not to know the areas of weakness in technical performance only But strengthening areas of strength as well, to improve overall performance.

The aim of the javelin throwing activity is to obtain the farthest possible distance for the javelin according to the legal conditions of the event, and on this basis we find that the goal of this activity from a mechanical point of view is achieved through the foundations that deal with the objects thrown at an angle with the horizontal line, namely (the speed of launch and the angle of departure And the height of the starting point) and other mechanical variables, whether kinematic or kinetic, which in turn affect those variables that determine the throwing distance of the projectile in the air.

As the shooter must be concerned with the speed achieved by the parts of his body, which helps to achieve the digital achievement of horizontal and vertical projections, and this attention should be through developing muscle reflexes, developing a reaction from the ground and forward, and paying attention to the technical rules of effectiveness as well as the foundations of correct running and what must be done during the stage The last throwing that relates to the concepts of (thrust force, linear and angular momentum, force moment, fulcrum moments, and moment of inertia (Stasjuk, 29,1994)).

As an important variable must be emphasized, which is the speed that the shooter gains during approaching and the speed in the last stage of the last (five steps) throwing and throwing, as the shooter must continue at the same speed and not lose a large part of it, as the shooter must combine the running motion with setting up a position The body to take the throwing position, in other words, that the shooter maintains the same amount of movement (kinetic momentum) (mass x velocity) and the least loss of momentum between the approach and throwing stage (Saeb Al-Obaidi and others: 81: 1991).

Hence the importance of the research through its study of the biomechanical variables affecting the most important stages of the javelin's performance, which is the throwing position and in numerical connotations through three-dimensional imaging and for both types of biomechanical variables (kinematic and kinetic), which will reveal to us the strengths and weaknesses in the technical performance of the event and then Providing technical directions to the trainer through which they can improve the digital level (achievement) of the research sample.

Through the researcher's observation of the effectiveness of javelin throwing and his knowledge of a set of previous research and studies, as well as his follow-up of many local championships in the field of javelin throwing effectiveness, he noticed that there is a weakness in achievement at the local level compared to Arab, Asian or global numbers, and the reason for this may be that they lose a distance During the throwing as a result of the poor

investment of the biomechanical variables by the shooters, especially in the shooting position, which is one of the main factors that help in the success of this effectiveness and also their lack of using the latest means that help to determine the values of these biomechanical variables very accurately, and here lies the problem of the research, so he decided The researcher study this problem by studying the achieved velocity of body parts, whether (linear or angle) for the throwing and throwing position and its relationship to the achievement of javelin throwing for youth.

The study aims to identify the values of velocity achieved for parts of the body (linear and angle) for the throwing position for the effectiveness of throwing the javelin for the research sample and to diagnose the areas of strength and weakness in them and to identify the influential relationship between the values of velocity achieved for parts of the body (linear and angle) for the throwing position for the effectiveness of the javelin throw and the achievement of the research sample

The researcher also assumes that there is a statistically significant correlation and impact force between the velocity values achieved for parts of the body (linear and angle) for the throwing position for the effectiveness of the javelin throw and the achievement of the research sample.

II. Research Methodology:

The researcher used the descriptive approach using the correlational and survey method for its relevance to the nature of the research.

The research sample:

Research sample: The research sample was deliberately selected and there were (6) players from Diyala club for the sports season (2018-2019) and their ages were under (18) years old. Training using the torsion factor, as (± 3) indicates the presence of homogeneity between the sample members.

Field research variables and procedures: -

The imaging procedures, tests and measurements used in the research included, and for the purpose of controlling the search variables to be extracted using kinematic analysis techniques were used as one command to extract biomechanical variables from fast cameras, as the camera speed reached (120-1200 images / s), and the camera was used quickly (210 images). The camera was placed from the right side of the throw to extract the variables around the horizontal axis of the athlete for the preliminary and final stage of the javelin. The camera was installed on a tripod and the height of the center of the lens was (1.20) m from the center of the camera focus from the ground at a distance of (12.30 m) These specifications gave a clear picture of the measurements under study, and Figure (19) shows the specifications, all the attempts were filmed, and the variables under investigation were extracted after analyzing the best distance according to the kinetic analysis program (Kinovea-0,8.27.

Variables under consideration:

1. The velocity of the object by approaching (the last step): The distance of the last step was measured and its time was measured directly by the computer, and the velocity was extracted from the law (x = m / n). (Yasser Najah and Mohsen: 2015: 93).

2. The velocity of the hip joint at the starting stage: - The linear distance traveled by the right hip joint was measured from the moment of the thrust position (force position), the moment of the paired fulcrum when the support foot touched the ground to the moment when the spear was launched and this distance was divided by its time (unit of measurement m / W).

3. The shoulder joint velocity at the starting stage: - The linear distance traveled by the right shoulder joint was measured from the moment of the thrust position (force position), the moment of the marital focal point when the support foot touches the ground to the moment when the spear is launched and this distance is divided by its time (unit of measurement m / W).

4. Elbow joint velocity at the starting stage: - The linear distance traveled by the right elbow joint was measured from the moment of the thrust position (force position), the moment of the paired fulcrum when the support foot touched the ground to the moment when the spear was launched and this distance was divided by its time (unit of measurement m / W).

5. The speed of the spear at the starting stage: - The distance traveled by the hand and the spear was measured from the moment of the thrust position (force position), the moment of the pairing focal point when the support foot touched the ground to the moment when the spear was launched, and this distance was divided by its time (unit of measurement m / s)

6. The angular velocity of the trunk: - The number of degrees traveled by the trunk was measured by measuring the angular difference of the hip angle formed between the trunk line (from the point of the shoulder joint to the point of the hip joint) and the thigh line (from the point of the hip joint to the point of the knee joint) at the moment of placing the push (Force position) and between the moment of pair focalization when the front foot touches the ground to the moment when the spear is launched, and these degrees are divided by its time (unit of measure is degree / s). (Al-Janabi: 73: 2018).

7. The angular velocity of the aiming arm: - The number of degrees traveled by the aiming arm was measured by measuring the angular difference of the shoulder angle formed between the torso line (from the shoulder joint point to the hip joint point) and the connecting line (from the shoulder joint point to the wrist joint point) moment The thrust position (force position) during the moment of the thrust position (force position) between the moment of the pair focal when touching the ground foot and the moment when the javelin is launched, and these degrees are divided by its time (unit of measure degree / s).

Main experience:

After ensuring the safety and correctness of all the implemented procedures and including the scientific conditions, field application was made to the research sample on Tuesday 10/12/2019 after installing the camera on the points identified in the exploratory experiment, after which a kinematic analysis was performed and the results were recorded in forms prepared for this purpose And conducting the appropriate statistical operations.

III. Presentation, analysis and discussion of results:

Presenting, analyzing and discussing the results of the correlations between the variables of velocity and achievement.

Table (1) shows the statistical description of the variables of velocity and achievement of javelin throwers.

Variables	Skewness	Std. Deviation	Median	Std. Error of Mean	Mean
Achievement	**0.260**	**3.746**	**59.675**	**1.324**	**59.703**
Crosshair step speed	**0.424**	**0.909**	**5.080**	**0.321**	**5.240**
Speed last step	**0.293**	**0.813**	**6.240**	**0.288**	**6.395**
The speed of the hip joint at the starting stage	**-0.633**	**0.548**	**3.320**	**0.194**	**3.054**
Shoulder joint velocity at the launch stage	**0.211**	**0.523**	**6.150**	**0.185**	**6.119**
Elbow joint velocity at the launch stage	**0.003**	**0.892**	**11.660**	**0.315**	**11.664**
Spear speed at cruising stage	**0.708**	**1.429**	**21.020**	**0.505**	**21.123**
The trunk's angular velocity	**0.259**	**46.857**	**680.000**	**16.566**	**679.875**
The angular velocity of the aiming arm elbow	**0.059**	**156.686**	**1751.000**	**55.397**	**1737.500**

Table (1) shows the descriptive statistics of achievement and time variables for the javelin throwers, as there are very important indicators that we can infer the moderation of the research sample on the standard error curve (kaus), which is that all the values of the arithmetic mean were greater than the values of the standard deviations in addition to the value of the standard error that It is the second indication of moderation, but the most important and finally the values of the torsion modulus, which ranged between (± 2).

Table (2) shows the arithmetic mean, standard deviations, correlation coefficient, error rate of achievement, and velocity variables for javelin throwers.

Variables	Mean	Std. Deviation	Pearson Correlation	Sig. (2-tailed)
Crosshair step speed	59.703	3.746	0	0
Speed last step	5.240	0.909	-.775-*	0.024
The speed of the hip joint at the starting stage	6.395	0.813	0.609	0.109
Shoulder joint velocity at the launch stage	3.054	0.548	0.173	0.683
Elbow joint velocity at the launch stage	6.119	0.523	-0.688	0.059
Spear speed at cruising stage	11.664	0.892	-0.576	0.135
The trunk's angular velocity	21.123	1.429	0.074	0.861
The angular velocity of the aiming arm elbow	679.875	46.857	-0.324	0.434

Table (2) shows the values of the descriptive statistics of the research sample and the simple correlation coefficient between the variables of velocity and achievement for the javelin players as it was found that there was one correlation coefficient that was significant, which is a variable of the speed of the intersection step, where the error rate was less than the level of significance (0.05). The non-significance between achievement and other velocity variables for javelin players was (7) variables as their error percentage was greater than the significance level (0.05).

Table (3) shows the multiple correlation coefficient, the assignment factor, and the standard error of the estimation of the velocity and achievement variables for javelin players.

Variables	B	Std. Error	T	Sig.
Achievement	130.071	4.729	27.508	.000
Crosshair step speed	-3.192	.053	-59.877	.000
Speed last step	-1.031	.170	-6.068	.001
The speed of the hip joint at the starting stage	-.421	.108	-3.879	.006
Shoulder joint velocity at the launch stage	-3.414	.209	-16.331	.000
Elbow joint velocity at the launch stage	-.968	.114	-8.467	.000
Spear speed at cruising stage	-.420	.062	-6.735	.000
The trunk's angular velocity	-.018	.001	-12.578	.000
The angular velocity of the aiming arm elbow	.004	.001	6.560	.000

It is evident from Table (3) that there are clear implications for the significance, as all error rate values appeared less than the significance level (0.05), and this indicates the presence of the strong effect that appeared between the achievement and the velocity variables of the javelin players.

As it is noticed through the tables above that there is a significant correlation between the speed of approach and achievement, the increase in the approaching speed in the last steps means that the archer acquires more momentum and kinetic energy, and it also works on the acquisition of parts of the body more speed, whether linear or angle, and transfer it to the spear and obtain speed A great launch, so the launch speed of the spear is the result of the speed gained by the archer by approaching in addition to the angular velocity of the parts of the body, as he confirms (Qasim Hussein: 393: 1998) that the effective and rapid action of the two men leads to a shortage of the focal point or contact with the ground, which helps to give the body speed And hasten enough to approach.

This helped the body acquire the speed of movement of the skill, as the reason for this is that the player tends to obtain the largest linear momentum and maintain it with the least possible loss during launch, which helps to achieve a starting velocity that effectively contributes to achieving the good horizontal distance.

It is also noted that there is a direct correlation and impact force between the linear velocity of the body parts for each of (the hip, shoulder, elbow, and spear) and achievement, as the movement in the body parts must be in harmony and according to the positions taken by the body and its parts during these stages, as it should be The movement of the javelin during the performance must be interconnected with all its apparent parts in order for the main goal of the performance to be to obtain the highest linear velocity of the object and its parts during the performance stages, so that this speed can be transmitted as a kinetic momentum (mass x velocity) between the stages of the body parts in a high smooth manner and achieve Best conditions during performance. (Shalash: 184: 1988)

And (1987,46, David A. Dainty & Robert) add that the increase in the level of velocity of body parts leads to an increase in the speed of departure, and that the forces affect in one way or another in the rest of the other variables, and this means that there is a good exchange of influence between the internal and external forces, which Affects the final path of the center of gravity of the body and the path of the center of gravity of the tool, which has its effect in achieving the correct motor performance with high flow and achieving a base that achieves a high movement balance for the player and is required to ensure the continuation of speed in the parts of the body under consideration, and this indicates the integration of thrust in the working joints of the body and thus The starting speed of the tool is high.

It is also noticed from Table (12) that there are significant differences in the angular velocity of the trunk and the aiming arm and the achievement. The researcher believes that the development of the strength of the muscle groups working with performance achieves an evolution in the biomechanical variables associated with the same performance and this was shown through the development of the velocity angle of the trunk and the aiming arm. Which occurs in angular velocity means that the object acquires more angular momentum of the stem and the thrust arm is transferred to the spear through the law of angular momentum: -

(Angular momentum = mass of segment x N x 2 x angular velocity)

Since the mass and lengths of the body parts are fixed, the angular velocity is the variable, so an increase in the angular velocity of any part of the body gives an increase in the angular momentum of that body, and the increase in the angular momentum of the trunk and the aiming arm the moment before the launch of the spear causes the spear to obtain a large linear momentum The moment of launch and after the launch, then the angular momentum is proportional to the linear momentum (the mass of the object x its velocity), so the more angular momentum increases, this is a sufficient reason for increasing the linear momentum of the object during rotation with relative stability in the length of that body, as this is explained by Through the following equation: - (Al-Fadhli: 118: 2010)

Angular momentum = mass of segment x N x 2 x Linear velocity / N (linear velocity = x g x N)

Angular momentum = mass x r x linear velocity

Since (mass x linear velocity) = linear momentum

Then angular momentum = linear momentum x n

(James He, 2007, 57) mentions the need to increase the angular velocity of body parts in order to increase the velocity of the vector firing of the tool, especially in projectile activities, as he stresses the need for "the athlete to rely on the preceding rotational motion to obtain a high starting velocity, based on the relationship Between the circumferential vector velocity and the rotational velocity (peripheral velocity = angular velocity x radius).

The researcher believes that an increase in the level of speed of body parts and the momentary velocity of departure affects in one way or another on the rest of the other variables, and this means that there is an exchange of influence between the internal and external forces that affect the final path of the center of gravity of the body and the center of gravity of the tool which has an effect in achieving the correct motor performance smoothly High and achieve a base that achieves a high movement balance for the player to ensure the continuation of speed in the parts of the body, and this indicates the integration of thrust in the working joints and muscles of the body and the launch at high speed to achieve the required digital level. (David Dainty and Norman, 46,1987)).

IV. Conclusions and recommendations

In light of the results achieved, the results showed that there is a high correlation and impact strength between the velocity of the body parts (linear and angle) of the throwing stage and the achievement of the javelin throwing for the youth. The coaches and those interested in this activity have to be in order for the main goal of the performance to be to obtain the highest linear velocity and angle of the body and its parts during the performance stages so that this speed can be transmitted as a movement quantity to the spear at the moment of launch. The strength of body parts and thus obtain a high speed for these parts, whether linear or angular.

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