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The relationship of some kinematic variables in the last stage (restoring body position or balance) to achievement in the discus throwing event for young

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Abstract
The purpose of this paper is to identifying the values of some kinematic variables for the final stage (restoring body position or balance), and identifying the relationship of some kinematic variables in the final stage (restoring body position or balance) to achievement in the youth discus-throwing event. The researcher used the descriptive approach in the style of studying correlational relationships because it suits the nature of the research problem. The researcher conducted his research on the original research community, which consisted of (6) six players representing Al-Kut Sports Club for the youth category. One of the most important results reached by the researcher is that: It was found that the variable body inclination after throwing was within the normal range, but not at the required level, and it was found that the two variables (the knee flexion angle of the free leg and the hip angle between the thighs during the balancing act for the achievement) were at the required level, and this indicates that the sample had basic knowledge to achieve the mechanical conditions in order to achieve the achievement.

Keywords: Kinematic variables, kinematic analysis, discus throw, balance

Introduction
Biomechanics is considered one of the sciences that deals with the study of movement and is concerned with the development of human motor performance in general and sports performance in particular, through motor analysis, which is one of the basic methods of biomechanics, which makes it easier for the coach to identify strengths and weaknesses through analysis.

Through biomechanical studies conducted on many track and field games and according to the nature of the performance of their activities, as well as working to find the best levels by arriving at the best ways to solve the problems and obstacles that stand in the way of achieving achievement, throwing events come at the forefront of these games, especially the discus throwing event. Which has received interest from researchers who are striving to find ideal models for performing these games.

Hence, the researcher wondered whether there was a positive relationship that might be somewhat significant in their kinematic components and achievement. After polling the opinions of some experts and specialists in this field, he found that a scientific study could be conducted on the nature of the relationship of some kinematic variables for the final stage (restoring the body's position or... Balance) with performance in the discus throwing event in order to benefit from the variables of the discus throwing event, especially the last stage. Hence the importance of research comes in knowing the extent or type of relationship between achievement and the kinematic variables of the stage (recovering body position or balance), which leads to knowing the discus player's ability to perform.

Research problem
Through the researcher's knowledge and follow-up of many local tournaments, he noticed that there is a decline in the level of achievement, and the problem of this may lie in the lack of complete knowledge of all stages of the discus throwing event, especially the last stage (restoring body position or balance), on the part of a mechanic, to help the coach and player in taking the kinematic variables.

This is appropriate for this stage, and this is done by identifying and knowing the nature of the relationship between some kinematic variables and achievement in order to benefit from preparing a physically and skillfully integrated player who can perform the event without any deficiency at any stage and using kinematic variables. Therefore, the researcher sees the urgent need to know the relationship of some kinematic variables for the final stage (Restoring body position or balance) by achieving the discus throwing event for practical and scientific benefit, especially for the youth group.

Research objective
- Identifying the values of some kinematic variables for the final stage (restoring body position or balance).
- Identifying the relationship of some kinematic variables in the final stage (restoring body position or balance) to achievement in the youth discus-throwing event.

Research hypotheses
- There is a significant relationship between some kinematic variables in the final stage (restoring body position or balance) and achievement in the discus-throwing event for young people.

Research fields
- **Human field:** Al-Kut Club players in discus throwing for the youth category for the 2024 season.
- **Time field:** (15/1/2024) to (3/3/2024)
- **Spatial field:** Al-Kut Stadium in Wasit Governorate.

Research methodology and field procedures
Research Methodology: The researcher used the descriptive approach in the style of studying correlational relationships because it suits the nature of the research problem.

Community and sample research: The researcher conducted his research on the original research community, which consisted of (6) six players representing Al-Kut Sports Club for the youth category.

Research tools and devices used
- Testing and measurement.
- Observation.
- Sources: Arab and foreign references and the information network (the Internet).
- Personal interviews.
- Questionnaire.
- A form for recording and transcribing data.
- Computer software.
- 2 kg tablet (2).
- One kg tablet (3) for the purpose of warming up.
- Adhesive tape.

The devices used by the researcher in carrying out his research procedures are
- Video camera type (CASIO-EX-FH20), multi-speed (30-1000) images/second, number (1).
- Linen measuring tape, 50 meters long, one number.
- Camera tripod (1).
- Drawing scale length (1 m).

Research procedures
Research variables: For the purpose of determining the basic kinematic variables that represent the subject of the study, a questionnaire form was prepared by the researcher and distributed to a group of professors specialized in the two subjects (Biomechanics and Athletics), to choose some of them and add what they deem important in this study. Thus, the following variables were chosen in In light of what was agreed upon and according to relative importance, the variables that achieved more than 55% were selected.

Exploratory experience
The researcher conducted the exploratory experiment on 18/1/2024 on a group of players practicing the discus-throwing event who were outside the research community. The aim of the experiment was to identify the following:
1. Placement of cameras and their dimensions to ensure clear vision.
2. Knowledge of the necessary tools and devices.
3. Ensure the suitability of the playground, devices and tools that will be used in the main experiment.
4. Identify the obstacles and difficulties that the researcher and staff may face when conducting the test and how to address or avoid them.
5. The time spent implementing the main test or experiment.

Video photography
In order to determine the kinematic variables that affect achievement and adopt them in the subject of the study, and in order to obtain a scientific formula for studying these variables, the researcher used videography and motion analysis programs, as they are among the important means of discovering errors and controlling the extent to which the levels of technical performance of the shooters converge or diverge.
In order to achieve the purpose sought by the researcher in obtaining variables of importance in the subject of the study, the speed camera was installed on the right side of the thrower (the last stage after throwing), that is, on the side of the throwing hand and perpendicular to the radius of the throwing circle, as this camera records the side clip of the stage of restoring the position. The body or balance, that is, the bends in the body's joints (angles), the angle of inclination of the torso, the angle of the hip joint, and the angle of the knee joint of the free leg during the balance phase.
This camera was fixed on a tripod and at a height of (1 m) measured from the middle of the camera lens to the ground, and a distance of (6 m) measured from the middle of the camera lens to the center of the throwing circle and perpendicular to the center of gravity of the player's body. The researcher also used a drawing scale with a length of (1 m) in nature to be able to Finding the true dimensions and measurements of images during the analysis process.

Measuring kinematic variables
The researcher adopted, through sources, references and previous studies, the method of measuring the variables adopted in the research, obtaining the motor paths of all members of the research community through the actual throwing performance and photographing this performance, and then measuring and calculating the kinematic variables under study, according to the following:
1. **The angle of inclination of the torso after throwing:** It is the angle between the longitudinal line of the torso passing through the center of gravity of the body at the moment of throwing and the vertical line of gravity also passing through the center of gravity of the body to the fulcrum, and it is measured according to the analysis

program (kinovea).

2. **The largest angle of the knee joint of the free leg in the balance stage:** This variable is measured by finding the angle between the femur and the shinbone in the case of maximum extension of the knee in the free leg during the first touch of the ground for the fulcrum leg in the balance phase.
3. **The largest hip angle between the thighs during the first touch of the fulcrum leg with the ground in the balance stage:** This variable is calculated by measuring the angle between the anchor leg and the free leg during the first touch of the ground for the anchor leg in the balance phase.

Main experience

After reviewing the data extracted from the reconnaissance experiment, the researcher conducted the field experiment on 21/1/2024 at Al-Kut Club Stadium, as the time for the filming process and testing procedures was from ten in the morning. After the researcher obtained the measurements and data of the players (height, age, and weight), he conducted the field experiment by giving each player (6) attempts in each event. The first hour included the preparation process, preparation, and installation of the equipment used, as well as the warm-up process for the players, then was followed by the testing process for the discus throwing event, which lasted for (75 minutes) and included giving (6) attempts to each player, interspersed with rest periods between each attempt, ranging from (10-12) Minutes, which is the time it takes for one attempt for all research personnel until it returns to the first player to practice the next throw.

Statistical methods

The search data was processed through the Statistical Package for the Social Sciences (SPSS).

Results and Discussion

Presenting, analyzing and discussing the results of the values of the kinematic variables for the last stage (restoring body position or balance)

Table 1: Shows the values of the arithmetic means and standard deviations for the kinematic variables for the last stage (restoring body position or balance)

No.	Kinematic variables and Achievement	Measuring Unit	Arithmetic Mean	Standard Deviation	Achievement (R) value calculated	(R) Tabular	Type Sig
1	Angle of inclination of the torso after throwing	degree	12.84	3.36	0.660	0.077	Sig
2	Knee angle during balance	degree	128.98	20.08	0.893(**)	0.008	Sig
3	Hip angle between the thighs	degree	89.46	5.79	0.859(*)	0.014	Sig
4	Achievement	meter	31.22	6.84	1	1	Sig

Many of the movements that take place in our daily lives, not just in the sports field, are subject in one way or another to physical foundations that govern the movement of objects, considering that movement is a mutual influence between the forces surrounding the movement, such as ground acceleration, air resistance, and friction, and between the body's own forces, whether this projectile is from Solid objects, such as a disc, or living objects, such as the body of a player during jumping events, are considered a projectile object. The movement of objects is governed by fixed laws that determine the area that the projectile will cross, regardless of the type of activity. We find that the laws that govern the movement of objects that rise or fall vertically from bottom to Upward or from top to bottom, which are called falling objects, differ from the laws that govern the movement of objects that are thrown to cover a horizontal distance, as in a puck, to the farthest distance a player can (Saeb Attiya *et al*., 1991) [1].

According to the data extracted for the sample members and the results of the relationship between the values of the kinematic variables for the stage (recovering body position or balance) and the achievement, the performance and characteristics of the sample differed among themselves in achieving the optimal values of those kinematic variables, especially if we know that the desired goal in all throwing events is to achieve the furthest distance. The throwing distance of the tool from the moment of launch until the moment of landing, which in turn requires the player to take into account the ideal technical characteristics of the skill in all its stages, so that it reflects good investment of mechanical principles.

Regarding the kinematic variables of the stage (recovering body position or balance) that were linked to the achievement of the discus throwing event, the researcher explains that the relationship is positive, as we find that the sample members achieved a variation in the values of the kinematic variables addressed in the subject of the study. The explanation for the significant correlation with the variable of the angle of inclination of the torso after throwing is: "The torso in this case is slightly tilted outward towards the throwing circle and has an actual participation in moving the body after launching". (Najah Mahdi Shalash, Raysan Khuraibet, 1992) [2]. The explanation for the significant correlation of the two variables (the knee flexion angle of the free leg and the hip angle between the thighs during the balancing act) is related to the mechanical law which states that "a moving body continues its movement unless an external force acts on it to stop it". (Zaki Al-Habashi, 1964) [4], this means that these two variables contribute to the process of stability and balance of the body after the throwing stage, to increase the moment of inertia and reduce the angular momentum resulting from the rapid rotation of the body, noting that "the moment of inertia of the entire body is the sum of the inertia of its parts." As we said previously, the nature of the relationship is inverse. Between the moment of inertia and the angular velocity, we find that the rotation of the body that is slightly away from the axis of rotation is greater than the rotation of the body that is very far from the axis of rotation." pointed out (Samir Muslat Al-Hashemi, 1999) [5] pointed out We conclude from all of this that these two variables have a major role in reducing the angular momentum resulting from the body's movement and working to stop or stabilize it. Here it must be kept in mind that the consistency in the bodies of the research community members does not mean that they have the best performance that qualifies them to a distinguished level of achievement that can be matched by the international level without taking into account the correct mechanical conditions that help in the proper application of performance to achieve good

achievement.

Conclusions and Recommendations

Conclusions

Through the results presented above and the researcher's analysis and discussion of those results, he reached the following conclusions

- It was found that the variable body inclination after throwing was within the normal range, but not at the required level.
- It was found that the two variables (the knee flexion angle of the free leg and the hip angle between the thighs during the balancing act for the achievement) were at the required level, and this indicates that the sample had basic knowledge to achieve the mechanical conditions in order to achieve the achievement.
- It was found that there is a high moral relationship between some of the variables under study related to the stage (restoring body position or balance) and achievement.

Recommendations

According to the concluded, the researcher came out with a set of recommendations.

- Emphasis on correcting defects and weaknesses to work to increase the development achieved when performing the operation (restoring body position or balance to the variables (the knee bend angle of the free leg, the hip angle between the thighs, the torso tilt angle) due to the emergence of a significant correlation between these variables and achievement by emphasizing This aspect is in training curricula.
- Emphasis on paying attention to the knee angles of the free leg and the hip angle between the thighs because of the importance of these angles in achieving the ultimate goal of balance.
- Using periodic dynamic analysis to track developments that occur in kinematic variables, and work to strengthen the correct variables and correct defects in some of them by developing the aspects responsible for that variable.
- Paying attention to mechanical factors by developing information on these factors among coaches and players, introducing them to courses in this regard, and training players on them practically, as well as using teaching aids and motion analysis films, especially for discus throwers, to introduce the importance of mechanical aspects and the possibility of exploiting them in other sports fields.
- Conducting similar research that provides significant training indicators for coaches in various types of sporting events, by providing rapid scientific data and equipping coaches with special information related to the type of sporting activities that may be similar in quality of performance, leading to developing achievement in that performance.

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