



E-ISSN: 2707-7020
P-ISSN: 2707-7012
JSSN 2023; 4(1): 08-14
Received: 04-01-2023
Accepted: 22-01-2023

Ahmed Hanoon Khanjar
Assistant Professor, College of
Physical Education and Sport
Sciences/ University of Misan,
Iraq

Applying exercises according to the mass moment of inertia and its impact on some types of strength and achievement for long jumpers

Ahmed Hanoon Khanjar

DOI: <https://dx.doi.org/10.33545/27077012.2023.v4.i1a.137>

Abstract

Remarkable scientific progress in the field of jumping, especially in recent years, was touched upon, and the focus was on training by changing the positions of the body and its parts during flight in the broad jump, as the researcher believes that the use of this method may affect the development of the special strength of the players in the broad jump, which is reflected On the development of the level of the stages of the performance of the broad jump on the development of the special character of the players, and the effectiveness of the broad jump is one of the athletics activities that depend directly on strength and speed at the same time, and the researcher dealt with the aspect of strength by changing the position of the player's body in order to achieve the integrated conditions for performance that will inevitably enhance the achievement What is good for him is that strength training by changing the position of the body and overcoming resistance by using auxiliary means, means that have not been confirmed according to the mechanical principles in the field of training for broad jump players in strength training in athletics, so the researcher believes that this topic is a scientific problem that can be addressed and studied. The aim of the research is to identify the impact of training according to this method in the positive development of the value of the moment of inertia for each stage of the broad jump, and the research hypothesized that there are statistically significant differences between the pre and post-tests in the value of the moment of inertia for each stage of the broad jump in the two research groups, which included This section presents the results that were reached from the pre and post tests, which were applied to the research sample, and scientific results were reached and then discussed. The level of technical performance (technique) developed in the experimental group in the post tests after using the exercises, which indicated the effectiveness of these exercises. In achieving a good level of motor cohesion, no improvement was shown in the technical level in the control group. The conclusions of the research came, and this means the effectiveness of the impact of exercises according to the principle of the body's moment of inertia in the development of transport between the different parts of the body.

Keywords: Exercises, mass moment, inertia, strength, jumpers

Introduction

Moment of inertia is one of the mechanical laws that can be invoked Especially from the field point of view In the field of learning movements and in sports training, as it is a measure of the resistance shown by the body in its rotational movement through the relationship between the mass of the rotating body and a square after its center of gravity from the axis of rotation and the possibility of controlling these two factors (mass and distance) when applying these rotational movements, especially when performing jumping movements that contain Many secondary rotational movements that occur in different parts of the body (arms, legs, and torso), whether these jumps are on the ground with body weight, or on barriers of different heights, or on trays, or boxes, in addition to that the body, when resting on the ground, is one of the bodies that rotates in At this moment, it is possible to control the distances of the body parts from the axis of rotation (the fulcrum), and thus the individual can increase the moment of inertia of his body or part of his body through the increase in the resistance to inertia arising from the spacing of the body parts from the axis of rotation (joints) in proportion. With the square of the distance of this spacing, and on the other hand, it is also possible to control the weight of the body by adding mass to that body or its parts, such as a weighted belt, for example, which can increase the value of the moment of inertia of that body during Performing various jumping movements according to the law

Corresponding Author:
Ahmed Hanoon Khanjar
Assistant Professor, College of
Physical Education and Sport
Sciences/ University of Misan,
Iraq

of the moment of inertia, and the importance of the research in identifying the application of jumping exercises by controlling the dimensions and angles of the body when using the principle of moments of inertia when training broad jump players and to clarify the role of these exercises according to this principle in developing types of strength for beginners from Long jumpers.

Research problem

The researcher turned to one of the activities of athletics, which is the long jump, in which the integration of the motor and technical performance is achieved according to the direction of the angles that occur to the joints of the body during the performance of the jump, and these angles are what determine the radii of the body on the grounds that all parts of the body are linked and that the correct application of this Angles help the jumper to control the moments of inertia, whether for the body or its parts, which is considered a force resisting movement when its value is increased through the undesirable increase in the lengths of these parts. And the instantaneous force exerted when supporting the back and front in each stage of the rise of the three stages, according to the mechanical foundations of the possibility of achieving the integrated conditions of performance, which the researcher believes will enhance the good achievement of the triple jumper, in order to identify the effect of changing body positions when different strength exercises with body weight Or against relative resistance, in developing the level of technical performance and achievement as well as the development of achieving the three stages of the triple jump and enhancing the training aspect that has the best effect on the development of this level despite the modest level in achieving this effectiveness.

Research aims

1. Identifying the effect of exercises on the principle of the moment of inertia of body parts in developing some cores of strength and achievement for long jump players.
2. Recognition Evolution of the level of moment of inertia for each stage of the jump.

Research assumes

1. There are statistically significant differences between the results of the pre and post-tests in the types of strength tests in the experimental and control groups.
2. There are statistically significant differences between the achievement results in the two groups in the pre and post-tests.
3. There are statistically significant differences between the pre and post-tests in the value of the moment of inertia for each jump stage in the two research groups.

Research areas

The human field: Education students in Maysan Governorate

Time range: From 1/8/3/2022 to 11/7/2022

Spatial field: Scout camp in Maysan Governorate.

Research methodology

The researcher adopted the experimental research approach as it is compatible with solving the problem to be researched

and because it is one of the important means to reach reliable knowledge.

Research sample

The research sample was chosen randomly, and they are a group of middle school students, with a total of (12). Students were divided into two groups (control) and (experimental) by drawing lots (and in order to return the differences to the experimental factor, the experimental and control groups must be completely equivalent in all conditions except for the experimental variable that affects the experimental group) (Thouqan, 1988) ^[13]. The researcher conducted the equality of the members of the two groups in the variables of height, age, weight, and achievement in the long jump.

Research devices and means of collecting information

The researcher used a number of devices and tools to obtain the results of the research, as well as the use of means of collecting information for the research.

Means of collecting information

1. Arab and foreign sources and the international information network (the Internet).
2. Personal interviews.
3. Observation and experimentation.
4. Tests and measurements.
5. Experimental group.

Used tools and devices

1. Medical scale for measuring weight.
2. Electronic stopwatch (2)
3. Pentium 4 electronic calculator.
4. Laser discs.
5. Panasonic video camera with a speed of 30 frames per second
6. Videotape size (8) mm.
7. Barriers and ramps (of different heights). Number (10).
8. A weighted torso jacket and a weighted belt for the two legs, number 9.
9. 30 m long tape measure.
10. Drawing scale (1 metre).

Field research procedures

Determine the tests

A set of tests was identified in order to evaluate the special types of strength for the long jumper for beginners, as well as the achievement test for the long jump. Five tests were identified as follows:

1. Testing the explosive strength of the two men: (Ali, 2004).
2. Testing the strength characteristic of the speed of the two legs:
3. The long jump test of approach (achievement):

Exploratory experience

The researcher conducted an exploratory experiment on 03/02/2022 on a sample of (2) students before conducting his research in order to choose the research methods and tools, and in the light of this experience, the researcher developed the training curriculum trying to avoid Errors and obstacles that you may encounter when implementing the curriculum, or ensure the validity of the tests and their

suitability for the research sample in terms of their performance and the availability of their tools.

Video imaging was conducted on the reconnaissance experiment group, in order to know the position of the camera, the angles and heights of the position of the camera, and the dimensions, in order to obtain a correct imaging through which the movement can be analyzed, and to know the extent to which the moment of inertia can be measured, as it was found that the best point in the motor path is the measurement of inertia. The self-portrait is the midpoint of the movement path, and thus the camera has been installed so as to give full clarity of the jumper's movement path from the point of ascent to the moment of landing at the point.

Pre-tests

The researcher conducted the pre- tests on 3/23/2022. In the scout camp stadium on the research sample, the tests were tested according to the following sequence:

1. Testing the explosive strength of the two men: (Ali, 2004).
2. Testing the strength characteristic of the speed of the two legs:
3. The long jump test of approach (achievement):
4. A rest period of (10 minutes) was given between tests.

Videotaping and measuring the variable moment of inertia

The researcher filmed the members of the research sample (the experimental and control groups) from the moment of rising to the moment of landing in the hole through a video camera fixed vertically at a point located in the middle of the motor performance of the long jumper, which was 4.50 meters away from the rise board, and the camera was far from the middle of the field. The performance is a distance of (18.16), and the height of the camera lens from the ground is (1.23 m). The scale drawing was photographed at the previous midpoint, and because more than one camera was not obtained, one camera was used.

After completing the filming, the researcher cut the film through the electronic calculator using the program (Auto cad) in order to extract the moments of inertia for each leg during the jumping phase, after extracting the lengths of the two legs (Naq) at the middle of the locomotive path through a program dedicated to measuring distances by electronic

calculator. And after extracting the length of each leg during the performance through computer analysis Then calculate the moment of inertia for each man in the jumping stage after extracting the man's mass, which represents 16.1% of the total body mass, and by knowing the total body mass, the real man 's mass was extracted.

Training Curriculum

The exercises were applied on 3/25/2022 at the rate of three units per week for Sundays, Tuesdays and Thursdays. The exercises were complemented by using the law of the moment of inertia, by emphasizing increasing the radii of the legs to the highest possible value while performing jumping movements and reducing this value to the lowest possible amount on the other hand. Weights were used at a rate of (4-8%) of the weight of the man and added to the legs and torso according to the same principle (moment of inertia = mass x height squared) and invested in developing and developing the special strength of the research sample in the long jump where the jumper can get A positive training effect by increasing the burden on him through jumping exercises using the means as well as the relative weights added to the leg and arm during training, and the time for applying the exercises took (35 minutes), which is the main part, and the implementation of the training curriculum prescribed in the research plan took a period of 8 weeks at the rate of three training units In a week, 24 training modules were carried out.

Post - tests

The researcher conducted post-tests on his research sample (the experimental and control groups) on 5/15/20 22 the same way he used in the pre-tests, after completing the prescribed period of the experiment, which lasted 8 weeks, and the researcher was keen to find all the conditions for the pre-tests and their requirements when conducting Post-tests in terms of time, place and means of testing.

Statistical means: The following statistical methods were used

1. Arithmetic mean.
2. Standard deviation.
3. T for differences between pre-correlated samples.
4. Measure the rate of development.
5. T for equal independent samples.

Presentation and analysis of the results of the explosive power of the two research groups

Table 1: Explosive power results

The test	The group	Tribal		After me		Values T	Indication
		-Q	±p	-Q	±p		
Long jump from standing	Experimental	2.5 2 _	0.1 9	2. 8 9	0.12	14.2 2	D
	Control	2.5 5 _	0.15	2. 8 1	0.14	3. 8 4	D

*Tabular value (2.10) at a degree of freedom (9) and a significance level of 0.05.

It is noted from the results (T) in Table (1) to find the differences between the results of the pre and post tests for the experimental and control groups, and that there are significant differences in favor of the post-test in the explosive force test for both groups.

The emergence of significant differences between the results of the pre and post-tests indicates that the strength development exercises according to the moments of the body's shortcomings have helped to harness the strength of

the muscles in line with the motor path of the body's center of gravity, and in a way that enhances obtaining the least possible resistance in the body if the body angles are large Which inevitably increases the body's resistance to the movement of the moment of inertia. Therefore, the exercises conducted by the members of the experimental group, in which the researcher focused on taking the appropriate angles during the performance and emphasizing them during the training, which helped the members of this group control

the movement of their bodies during the performance of strength training, whose paths were similar to the paths of the long jump. The development of the explosive force, one of its types, came in line with the performance required for the jumper to implement it, while the control group members had a development in the results of the post-test,

relatively better than the results of the pre-test, and the researcher attributes this development to the exercises practiced by the members of the control group within the training units, which It helped in the relative development of explosive power.

Presenting and analyzing the results of the strength test characterized by speed for the two research groups

Table 2: Speed characteristic strength test results

The test	The group	Tribal		After me		Values T	Indication
		- Q	±p	- Q	±p		
Distinctive strength with speed	Experimental	6.82	0.75	8.93	0.72	2.22	D
	control	6.96	0.68	6.80	0.99	2.69	D

*Tabular value (2.10) at 9 degrees of freedom and a significance level of 0.05

It is noted from the results (T) in Table (2) to find the differences between the results of the pre and post tests for the experimental and control groups, and that there are significant differences in favor of the posttest in the explosive force test for both groups.

The value of (T) calculated for the experimental group was much greater than the same value for the control group, and this means that the level of progression was faster and better than the level of strength characterized by speed, and that the body's resistance to rotational movements arising from the movements of the legs and movements of the arms during training had a positive effect on the development of this Strength when performing jumping exercises, as well as its positive effect in taking the right positions and angles when doing these exercises.

It was achieved when performing this physical test, which is directly related to the long jump technique, which enhanced the increase in the angular velocity of the two legs, and this increase in the angular velocity affected the increase in the linear velocity of the center of gravity of the body, given that the angular velocity is related to the linear (circumferential) velocity if this is related The speed of a rotating body (Talha, 1998) [12].

As for the results of the control group, the continuous training on the triple jump technique, which was practiced by the members of this group during the practical lessons, affected a certain percentage of the development of strength, as the performance of the long jump is in itself an exercise for the development of strength distinguished by speed, and this is what gives an effect that causes the development of achievement in this test.

Presentation and analysis of the results of the moment of inertia test for each stage of the two research groups

Table 3: The results of the moment of inertia test for the jump stage

Groups	Stage	Tribal		After me		T calculated	Indication
		s	±p	s	±p		
Experimental group	Bounce	0.9	0.033	0.065	0.020	9.80	D
Control group	Bounce	0.116	0.027	0.11	0.018	0.172	Non d

*Tabular value (2.10) at 9 degrees of freedom and a significance level of 0.05

It is noted from the results (T) in Table (3) to find the differences between the results of the pre and post tests for the experimental and control groups, and that there are significant differences in favor of the post-test in the moment of inertia test for the jumping stage of the experimental group, and there are no significant differences for the control group.

The moment of inertia of the jumping stage has been developed by decreasing the value of this moment in the post-tests, which was obtained through kinematic analysis using video imaging at three barriers in the flight path of the jumper's center of gravity, as this torque value represented the middle value between these values. On the basis of these values, the amount of change in the value of the moment of inertia of the man during the jump is identified, as the improvement and development appears clear in the results of the experimental group in the post-tests as a result of the emphasis on controlling the angles of the man during the application of exercises related to strength, and this is what

affected the achievement of positive results in this The variable in the jump phase.

The researcher believes that with the rest of the variables remaining almost constant, etc., the emphasis on exerting a greater force with an increase or decrease in the length of the radius of rotation in which the leg moves is the distance between the axis of rotation and the full point, it is possible to increase or decrease the resistance, which is represented by the moment of inertia ($p s y = KN^2$) and this principle will help to develop the necessary force to overcome this shortcoming, and at the same time increase the angular velocity at the expense of decreasing the radius of rotation or increase the radius of rotation at the expense of decreasing the angular velocity and both things work to increase the circumferential velocity of the center of gravity of the body because This center refers to the jumper's entire body, and increasing this speed affects the movement of the performer.

Presenting and analyzing the results of the (achievement) test for the two research groups

Table 4: Achievement test results for the two research groups

The test	The group	Tribal		After me		Values T	Indication
		Q -	±p	Q -	±p		
Achievement	Experimental	0 4.5	5 0.3	6 8 .4	5 0.4	8.59	D
	Control	0 4.6	0.26	4.68	0.24	3.75	D

*Tabular value (2.10) at a degree of freedom (9) and a level of significance (0.05)

It is noted from the results (T) in Table (4) to find the differences between the results of the pre and post tests for the experimental and control groups, and that there are significant differences in favor of the posttest in the explosive force test for both groups.

Some researchers point out that the emphasis on the stages of motor performance of the long jump, which included the vocabulary of the proposed training curriculum, which adopted the moment of inertia index in training, facilitated the processes of getting up and controlling body movements during flight at each stage, which helped to coordinate and stabilize the path of body movement, achieving momentum Circular at every moment of the landing and lifting moments for each stage, and this worked to develop the necessary push for the joints of the working legs and achieve the correct swing, whether for the second leg or the pusher, as this process helped to generate an explosive thrust movement during the second swing to get up. And this worked to develop all stages of performance to achieve a good distance from the jump and better than in the control group.

Presenting and analyzing the results of the long jump from stability

Table 5: Explosive strength test

Control		Experimental		T value	Tabular	Indication
s	±p	s	±p			
2. 8 1	0.14	2. 8 9	0.12	6,65	2.0 2 _	D

*Tabular value at (18) degrees of freedom and a significance level of 0.05

It is noted from the results (T) in Table (5) to find the differences between the results of the post and experimental tests for the experimental and control groups, and that there are significant differences in favor of the experimental group in the explosive force test for both groups.

The significant difference that appeared between the results of the arithmetic medians of the post-tests between the control and experimental groups and in favor of the experimental group in the results of the long jump from stability indicates the development of the special strength of the muscles of the legs of the experimental group and in a better way than the development of the members of the control group, and the occurrence of this difference came as a result of exposure of the group members The experimental vocabulary of the training curriculum that was applied to them, which was adopted in the formulation of the training vocabulary on the principle of the moment of inertia, as this principle increased the control of the height of the center of gravity of the body, which means controlling the angles required to be achieved in the joints of the body during the preparatory situation for the performance of the long jump of stability, which helped it To achieve the required push and to achieve the appropriate height according to the

amount of this force, which provided the opportunity for the jumper to take the correct positions for these individuals when flying, and what is commensurate with the goal and path of the motor performance. This is in addition to the nature of the performance in this test, in which the jumper takes the correct technical performance to achieve this goal.

Presentation of the speed test results

Table 6: Speed strength test

Control		Experimental		T value	Tabular	Indication
s	±p	s	±p			
6.80 _ _	0.9 9 _	8. 9 3	0.7 2 _	13. 2 2	2.0 2 _	D

18 degrees of freedom

It is noted from the results of (T) in Table (6) to find the differences between the results of the post and post tests for the experimental and control groups, and that there are significant differences in favor of the experimental group in the test of strength characterized by speed for both groups.

It is noted that there is a remarkable progress in the completion of the strength test characterized by speed in favor of the post-test of the experimental group and better than the arithmetic mean of the same test for the control group, and the researcher believes that although this test indicates the development of the special strength (characterized by speed) of the performance of the muscles of the legs that are actually applied The technical performance of the long jump, but it shows that the contribution is clear, as well as the development of the technical performance as a result of the application of special strength exercises within the body's moment of inertia index, and this is the reason for the development of the results of this test for the experimental group better than the control group.

The experimental group was characterized by high levels of special strength, which necessitated the jumper to achieve a greater distance to fly for each stage of this test by coordinating the movements of getting up and making the movement continue with the least possible resistance to the inertia of the body, as when jumping, the reaction must be greater than the weight body, which causes its acceleration to be larger (Cpopel, 1982) [4].

Presenting the results of the moments of inertia of the two research groups

Table 7: The results of the moment of inertia between the two research groups

Stage	Control		Experimental		T value	Tabular	Indication
	s	±p	s	±p			
Al Wathba	1 0.1 8	0.01	65 0.0	20 0.0	3 2 .9	2.02	D

*The tabular value is at the level of significance (0.05), 18 degrees of freedom

It is noted from the results (T) in Table (7) to find the differences between the results of the post and experimental tests for the two experimental and control groups, and that there are significant differences in favor of the experimental group in the moment of inertia test for both groups.

Executing the lift at each landing and rising process leads to a rotational movement of the body at the moment of lifting and the parts of the body at the moment of lifting and flight, and this requires greater force to increase the length of the radius of rotation in which the arm and leg of the crane move at the moment of getting up, and the length of the radius of rotation (in terms of reducing From it) when flying to overcome the resisting force and increase its angular velocity, which will inevitably increase the linear velocity of the body, since the angular velocity of the body parts is inversely proportional to the length of the radius. This is what happened to the members of the experimental group when applying the motor performance of the stages of jumping, and this was evident from the comparison of the arithmetic circles with the arithmetic circles of the control group, which did not show any development in the principle of the moment of inertia.

Displaying the results of the (achievement) of the two research groups

Table 8: Achievement results

Control		Experimental		T value	Tabular	Indication
s	±p	s	±p			
4.68	0.24	4.86	0.45	7.84	2.02	D

18 degrees of freedom

It is noted from the results (T) in Table (7) to find the differences between the results of the post and post tests for the experimental and control groups, and that there are significant differences in favor of the experimental group in the achievement test for both groups.

long jump of the experimental group in the post-test is a clear evidence of the level of progress achieved in the level of special muscle strength and the level of movements of body parts for the moment of each rise and flight, which is proportional to the amount of force produced by the muscles exerting effort against the earth's gravity and the angles of muscle tension that have been achieved. The best angular muscle moments of these joints during the performance, this is what happened to the members of the experimental group when applying the long jump, and since the torque is the product of the force as an amount in the vertical dimension (the moment arm), it is possible to increase or decrease the length of the moment arm or the amount of force, so if the force Small and the torque distance is relatively small, the torque output is small, but if a larger weight and a longer torque distance are used, the value of the angular moment will be large, and this is the true principle adopted by the vocabulary of this training curriculum that the researcher used on the members of the experimental group and the reason for the development and achievement of integration in performance by exploiting The principle of the moment of inertia as an assisting force in the integration of long jump performance.

Conclusions

The optimal distribution of the jump stage in the post-tests meant that there is an optimal distribution of the time

periods, and the possibility of distributing the force over the stages of this movement in proportion to the role of each stage in the motor performance and the role of force in this movement. Stage, and this is what happened in the results of the body's inertia moments during the application of the stages of motor performance on the experimental group in a good way and distinct from what appeared from the same results in the control group.

The possibility of the emergence of good reactions regarding synchronization in the movements of the physical tests of the special strength that were adopted in the research, as the kinetic reactions in the lower parts of the body were matched by other kinetic reactions in the upper limb, in order to achieve the principle of preserving the angular momentum that emerged from the succession of the work of each of the two men trunk and arms when performing the technical stages of each of the special tests.

Recommendations

1. Emphasis on the principle of the moment of inertia (as a special force) to develop both the strength and the kinetic paths of long jumpers.
2. Reliance on the tests that were used in the research is an indicator of the development of the strength of the long jump performance.
3. Emphasis must be placed on taking appropriate angles in parts of the body during the performance of the long jump, whether in tests or competitions.
4. Generalizing training curricula according to other mechanical indicators that reveal poor performance in the physical properties responsible for that performance.

References

1. Abdul Karim Al-Taei. A proposed training device for the development of special strength and the impact of the performance of some grips in the ground struggle in Roman wrestling, (Master's thesis, College of Physical Education - University of Baghdad.
2. Bruggemann GP, *et al.* Biomechanical Research Project Athens 1997, Firma Druckpunkt Offset; c1997.
3. Bullard & Knth Dlop jumping as Atraining method for jumping ability IAAF aval. 1995 May;3.
4. Cpopel, Glassow, Kinesology, London, Mosb, Com; c1982.
5. Frank Abdul Karim. Biomechanical analysis of some variables of triple jump performance and its impact on the development of achievement, unpublished doctoral thesis, College of Physical Education - University of Baghdad; c1997.
6. Gamal Aladdin. Characteristics or indicators of inertia, theories and applications, a scientific journal specialized in physical education research, published periodically by the Faculty of Physical Education, Alexandria; c1999.
7. Jassim Muhammad Al-Khalidi, The effect of developing special strength by using different tools in achieving the effectiveness of javelin throwing, (Master thesis, College of Physical Education - University of Baghdad; c1998.
8. Peter CL Thompson. Introduction to Training Theories, translated by the Regional Development Center in Cairo, Development Regional Center, Cairo; c1996.

9. Risan Khraibet, Applications in Physiology and Sports Training, Baghdad, Nour Medical Preparation Office; c1995.
10. Sareeh Abdul Karim, documented lecture for doctoral students / College of Physical Education / University of Baghdad; c2004.
11. Sareeh Abdul Karim, Talib Faisal, Arena and Field Games, 1st Edition, Baghdad, University House for Printing, Publishing and Translation; c2001.
12. Talha Hosam El-Din, Biomechanics Theoretical and Applied Foundations, Dar Al-Fikr Al-Arabi, Cairo; c1993.
13. Thouqan Obeidat. Others: Scientific research is understood, its tools and methods (Amman Dar Al-Fikr, Publishing and Distribution; c1988.