



## THE EFFECT OF PLYOMETRIC TRAINING ON DEVELOPING THE SPEED-SPECIFIC STRENGTH OF THE UPPER AND LOWER LIMB MUSCLES AND THE ACHIEVEMENT OF YOUNG JAVELIN THROWERS

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### Abstract.

The investigation aims to develop a training curriculum using the plyometric method, by studying the effect of the curriculum designed by the researcher. The researcher employed the experimental method using the equivalent groups approach to fit the research into study. The investigation's sample included young athletes participating in the Popular Mobilization Club's Track and Field Program. The researcher intended the sample to be selected deliberately, as the sample size was 4 players who were divided into two groups that were similar with regard to the studied variables (age, weight, height). Each group had two participants. Homogeneity and equivalency were employed on the studied population.

**Keywords:** Speed-distinguished strength, plyometric, javelin throw.

### Introduction

#### 1- Introduction and importance of research

Muscular strength is the most significant component of physical fitness, its importance is derived from the performance of athletic competitions and it ensures that the individual reaches the greatest degree of success [1]. Using the scientific method of surveying specialized literature that describes the components of physical fitness, including the opinions of 30 scientists, it was discovered that muscular strength is the first component of physical fitness.

Other scientists believe that "any motion that a person makes has a resistance to that motion, specifically athletes who participate in sports and activities against a significant amount of resistance, this is attributed to the fact that strength is a vital component and has an effective role in the rest of the physical qualities that the athlete needs." [2]

As the attribute of speed is one of the fundamental components of muscular strength, it's also considered an intrinsic component of special physical fitness, as it has a significant role in the effectiveness of javelin throwing; it's considered to be one of the most important factors in determining whether or not a person will achieve their goal.

#### 2- Research problem:

Plyometric training is considered paramount to the development of explosive power, it is additionally considered essential to the performance of most athletes. Through the researcher's understanding of the field of training, he observed the lack of many areas of training curriculum in Iraq, specifically in the special preparation segment, this segment requires a coach to develop and improve the special physical attributes in accordance with modern scientific methods in order to increase the players' capabilities and to achieve significant results.



### 3- Research objectives:

- 1- Design a training curriculum using the plyometric training method.
- 2- Identify the effect of the training curriculum.
- 4- Research hypotheses: There is a significant difference between the pre- and post-tests for each of the two experimental groups and in favor of the post-tests for the research variables.

### 5- Research areas:

1. Human field: Al-Hashd Club players, youth category
2. Time field 4/1/2023 to 6/15/2023
3. Spatial field: Youth and Sports Stadium in Baghdad

### Definition of terms:

\* Power characterized by speed: (The ability of the nervous system to overcome resistances that require a high degree of speed of muscle contractions) [4]

\* Plyometric: (A training method that can improve jumping and running ability through repeated jumping exercises.) [5].

### 2- Research methodology and field procedures

#### 2-1 Research methodology

The researcher employed the experimental method with a method of two equal groups (control and experimental) that fit the research under consideration, the experimental method is primarily intended to discover the connections between factors (variables) that comprise a specific phenomenon. [6].

#### 2-2 Research sample:

The researcher utilized the experimental method with a design that comprised of two equal groups (control and experimental) that concurred with the research under consideration. The experimental method is primarily intended to uncover the connections between components (variables) that comprise a particular phenomenon.

Table (1)

shows the homogeneity of the sample in the variables (chronological age, height and weight)

twisting	The mediator	a	s	Variables	
3.01	17	0.81	17.68	Chronological age (years)	1
0.50	177	5.98	175.09	Height (cm)	2
0.78	74	6.98	73.05	Weight (kg)	3

Through Table (1) we understand the degree to which the research sample is affected by the three variables. Table (2) shows that the individuals of the two groups have no significant differences in regards to age or height, which implies that the two groups are equivalent. Table (2) illustrates the average numbers, standard deviation and the t value associated with the control and experimental groups in regards to the variables

T value	Control	Experimental	Variables	
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Tabular	Calculated	a	s	a	s		
2.05	0.05	0.91	17.60	0.77	17.90	Age	1
	0.63	5.70	175.1	6.25	1718.2	Height	2
	0.62	7.60	73.9	7.50	72.4	the weight	3

\* The tabulated t-value at 22 degrees of freedom and a significance level of 0.05 = 2.05

**2-3 Devices and tools used:** The tests and measurements used in this research were identified and specified by analyzing previous sources and studies as well as references and scientific sources. The most important of these devices and tools are:

(Questionnaire forms, Restameter, Medical scale, Measuring tape).

#### 2-4 Tests

The researcher surveyed the opinions of a group of experts\* in this field about the most important tests for measuring strength characterized by speed. The opin Power tests characterized by speed:

- 1- News of the vertical jump from a standstill
- 2- News of the long jump from a standstill
- 3- News of throwing a 4 kg iron ball forward
- 4- News of throwing a 4 kg iron ball backward
- 5- Throwing a javelin from intersections (half towers).
- 6- Throwing a javelin (full performance).

**2-5 Exploratory experiment:** The researcher conducted an exploratory experiment on 4/3/2023 on a small sample of two players from outside the research sample. The researcher's goal from the exploratory experiment was to identify

- 1- Identify the obstacles that accompany the research to overcome them.
- 2- Identify the time of the test procedures.
- 3- Know the extent of the consistency of the tests with the research sample.
- 4- Training the assistant work team\*\*

#### 2-6 Scientific foundations for tests

First: Validity: The researcher used content validity to suit the nature of the research.

Second: Stability coefficient: In order to identify the stability coefficient, the researcher decided to utilize the test and retest method on the research sample with a time difference (5 days) from 4/4/2023 to 4/9/2023 by utilizing the simple correlation coefficient (Pearson) on the research sample and Table (3) shows this. The Table (3) ions led to the identification of the following type of tests.:

Correlation coefficient	Tests	
0.91	Vertical jump test from standing0	1
0.90	Long jump test from standing0	2
0.85	Forward throwing of a 4 kg iron ball0	3



0.87	Backward throwing of a 4 kg iron ball	4
0.92	Five-step javelin throw	5
0.86	Javelin throw (full tower).	6

The results of Table (3) indicate that there is a significant correlation between the first and second tests for the strength tests that are characterized by speed, this indicates their stability, the correlation coefficient is (0.85-0.92).

Third: Objectivity: The researcher employed objective, understandable tests that are far from self-assessment, the recording and evaluation of these tests is done using units of distance, time, and the number of repetitions, in addition, the research assistant is dedicated to physical education, as a result, the tests are highly objective.

#### 2-7 Main experiment:

Pre-tests: Pre-tests were conducted for the research sample members on 10-11/4/2023 at the Youth and Sports Stadium in Baghdad.

**2-8 Proposed training method:** The researcher relied in constructing the proposed training method for developing a distinct strength while maintaining speed in analyzing similar references, studies and research (which the researcher incorporated in this research) regarding plyometric training during the development of the method, the number of daily training units and their duration, and methods of standardizing the load, as the proposed method was employed to the players of the study sample on 4/15/2023 for a period of (8) weeks. The load was initially low and increased by approximately 60%, the principle of which was followed by the researcher. The proposed training method was employed for a period of (8) weeks during which the training units were distributed at a rate of three units each week, and the unit duration was (60) minutes. Regarding the number of repetitions, the exercise was repeated (10) times for (3) groups that were interspersed with periods of rest.

The two groups were subject to: The first experimental group for a proposed training method that involved plyometric exercises for a duration of (8) weeks. These exercises utilize the player's body's resistance and weight as well as their speed, this results in the player's muscles being elastic and then shortened in order to surmount the resistance. This training method employs deep jump exercises that use obstacles and boxes in order to accomplish this, the purpose of these exercises is to develop the distinct speed of the players' leg muscles. "The goal of this training is to produce an amount of strength in a shorter period of time." [7].

The proposed training method contained (6) exercises performed using the plyometric method, which are:

1. Deep jump from above the box and then crossing an obstacle.
2. Jumping between obstacles (10 obstacles).
3. Rebound jump on both sides of the rope 0
4. Jumping with the feet over the obstacle continuously (10 obstacles).
5. Jumping over the box facing 0
6. Lateral jump over obstacles prepared for this purpose 0

As for the control group, it underwent a training curriculum proposed by the trainer.

#### 2-8 Post-tests:



After implementing the components of the proposed curriculum for training, the post-tests were conducted for the research sample (2 groups) on 6/9/2023 at the Youth and Sports Stadium in the capital, Baghdad, in a manner similar to the pre-tests' method, with the same equipment, and under conditions similar to the pre-tests' conditions.

## 2-9 Statistical methods used in the research:

The researcher processed the data using the following statistical methods:

Arithmetic mean, standard deviation, simple correlation law (Pearson), skewness law, (t) law

## 3- Presentation, analysis and discussion of the research results:

Where the data were processed for the tests (pre- and post-test) of the variables for the two research groups, and after using statistical treatments, the following results appeared:

3-1 Displaying the results of the tests under study for the experimental sample pre- and post-test, analyzing and discussing them:

Table (4)

shows the arithmetic mean, standard deviation and t-value to show the difference between the pre- and post-test for the experimental group

Significance level	Calculated t-value	Post-test		Pre-test		Variables
		a	m	a	m	
0.04	3.43	4.92	47.20	3.13	41.43	1. Vertical jump (cm)
0.03	3.67	12.97	2.60	8.05	2.20	2. Standing long jump (cm)
0.02	4.79	1.79	12.64	0.6	11.94	3. Forward throw of 4 kg iron ball (meter)
0.056	2.06	0.81	16.11	0.49	15.20	4. Backward throw of 4 kg iron ball (meter)
0.01	5.01	4.7	40.22	4.3	36.80	5. Five-step javelin throw (meter)
0.03	4.11	19.53	49.20	18.13	46.14	6. Full performance javelin throw (meter)

\* The value of the tabular t at a degree of freedom (22) and a significance level of 0.05 = 2.89 Table (4) shows the average and standard deviation of the vertical jump test for the pre-test (41.43) (3.13) and the standard deviation of this variable for the post-test were (47.20) and (4.92). For the calculated (t) value alone, its value was (3.43), which is smaller than the table value (2.89) at a significance level of (0.5). This implies that the two groups have no significant difference. Regarding the long jump variable that came from stability, the experimental group's pre-test values were (2.20) (8.05). For the post-test group, it was (2.60) (12.97). The estimated (t) value for this test was (3.67), which is also smaller than the table, which indicates that there are no significant differences. Morality between these two classes of people

The variable that tosses a steel ball forward, the average values and standard deviation in the pre-test were respectively (11.94) (0.6), while in the post-test they were (12.64) (1.79), while the calculated (t) value was (4.79), which is greater than the table (t) value, which means that there were no significant differences between the two tests in this variable. As for the test throwing a steel ball backwards, the results were (15.20) (0.49)



for the experimental group in the pre-test and (16.11) (0.81) in the post-test for the same group, and the calculated (t) value was (2.06), which is smaller than the table, which means that there was no significant significance.

Regarding the variable that releases a javelin from five different steps, the average values and standard deviation values for the experimental group were respectively (36.80) (4.3) and (40.22) (19.53). The values were (40.22) (19.53) and the calculated (t) value for this variable was (0.06), which is smaller than the tabular (t) value, which indicates that there are no significant differences. Regarding the javelin's throwing motion, full performance, the values of the average arithmetic and standard deviation were: (46.14) (18.13) for the experimental group in the pre-test, and (49.20) (19.53) in the post-test. Regarding the calculated (t) value, it was (4.11), which is smaller than the tabular value, which indicates that there are no significant differences.

Presentation and analysis of the results of the two control groups in the post-tests. The following is Table (6) showing the (t) values for the post-test results for the two groups.

3-2 Presentation of the results of the tests under study for the experimental sample, pre- and post-test, and their analysis and discussion:

Table (5)

shows the arithmetic average, standard deviation, and t value to show the difference between the pre-test And the post-test for the control group

Significance level	Calculated t-value	Post-test		Pre-test		Variables
		a	m	a	m	
0.02	2.60	4.80	44.10	4.57	41.93	1. Vertical jump (cm)
0.01	0.85	11.98	2.35	16.90	2.22	2. Standing long jump (cm)
0.01	0.60	1.56	12.22	1.50	12.1	3. Forward throw of 4 kg iron ball (meter)
0.04	0.62	3.85	15.50	3.10	15.10	4. Backward throw of 4 kg iron ball (meter)
0.01	0.80	0.91	38.80	0.82	36.90	5. Five-step javelin throw (meter)
0.01	0.85	2.90	46.80	2.85	46.80	6. Full performance javelin throw (meter)

The tabular (t) value at a degree of freedom (22) and a significance level of (0.05) = 2.89

If we examine Table (5), we notice that the different tests of the control's distinct speed of travel are:



The average height and standard deviation of the vertical jump test for the pre-test were (41.93) (4.57), while in the post-test, the values of the average height and standard deviation were (44.10) (4.80) 0. Regarding the calculated (t) value, it was (2.60), which is smaller than the table (t) value at a level of significance of (0.5). Regarding the long jump variable that came from stability, the average values and standard deviation were 2.22 and 16.90, respectively, for the control group in the pre-test, and 2.35 and 11.98, respectively, for the post-test. The estimated (t) value was 0.85. For the variable that involves tossing the javelin, the table above demonstrated that the values of the average and standard deviation were respectively (36.90) (0.82) in the pre-test and (38.80) (0.91) in the post-test for the control group. The estimated (t) value was 0.85. When discussing the results of Tables (5) and (6), it is evident that there are significant differences in all of the research variables prior to and following the posttest, in favor of the following posttest:

It is clear from Tables (6.5) the following:

- There are significant differences in the pre-and post-tests' strength in regards to speed at a level of (0.5) in the tests (vertical jump, long jump, forward and backward shots put, five-step javelin throw, and javelin throw, the complete performance of the skill, which is greater than the pre-test).
- There are significant differences in the pre and post tests of the two groups in the sportsmanship skills at a level of significance (0.5) in the tests (vertical jump, long jump, forward and backward javelin throw, and javelin throw, the complete performance of the skill and in favor of the post-test).

3-3 The results of the post-tests for the experimental and control groups are presented and discussed:

Table (6)

shows the arithmetic mean, standard deviation, and t-value to show the difference between the post-tests for the experimental and control groups

Significance level	Calculated t-value	Control group		Experimental test		Variables
		a	m	a	m	
0.00	5.60	4.80	44.10	4.92	47.20	1. Vertical jump (cm)
0.01	3.85	11.98	2.35	12.97	2.60	2. Standing long jump (cm)
0.01	3.60	1.56	12.22	1.79	12.64	3. Forward throw of 4 kg iron ball (meter)
0.03	0.62	3.85	15.50	0.81	16.11	4. Backward throw of 4 kg iron ball (meter)
0.01	1.80	0.91	38.80	4.7	40.22	5. Five-step javelin throw (meter)
0.01	3.88	2.90	46.80	3.60	49.20	6. Full performance javelin throw (meter)



Table (6) illustrates the average and standard deviation of the vertical jump test for the post-it. The composition of the experimental group was (47.20) (4.92), while the control group's composition was (44.10) (4.80). The estimated (t) value was only 5.60. Regarding the long jump variable that came from standing, the experimental group's mean and standard deviation were (2.60) (12.97), while the control group's mean and standard deviation were (2.35) (11.98), and the calculated (t) value for this test was (3.85). The variable tossing a iron ball forward, the average and standard deviation of the post-test for the control group was (12.64) (1.79), while the experimental group's was (12.22) (1.56). For the estimated (t) value, it was (3.60). Regarding the iron ball's throw, the experimental results were (16.11) (0.81) in the post-test and (15.50) (3.85) in the post-test for the group. Regarding the variable that releases a javelin from five different steps, the experimental group's mean and standard deviation were (40.22) (4.7), while the control group's mean was (38.80) (0.91), and the calculated value of (t) for this variable was (1.80). For the variable that tosses a javelin, full performance, the average values and standard deviation were as follows (49.20) (3.60) for the experimental group in the post-test, and (46.80) (2.90) for the control group in the post-test. The calculated value of (t) was (3.88).

4-3 Discuss and analyze the resultss: The results demonstrated a significant difference between the pre and post-tests in favor of the post-test of the control group in regards to physical abilities. The cause is the team's coach's emphasis on physical development via exercise, as well as the utilization of common exercises that resulted in this simple increase in the sample. Regarding the experimental's development, the researcher believes that this is caused by the utilization of exercises within the training regimen. They must be placed in a scientific and linear manner that is in line with the requirements of the specific activity, considering the priority of training and the percentage of each exercise in the development of the activity, this will have a significant effect on the training unit and will lead to a highly effective and influential achievement. The researcher attributed this discrepancy in importance to the fact that the weights and plyometric exercises employed had a positive impact on the development and enhancement of the variables involved in the research, as a result, the research hypothesis was achieved. Regarding the vertical leap, there was a significant increase in the experimental sample's development, the instructor utilized a unique method for them that involved the plyometric method of training that focuses on developing speed while maintaining a specific strength (5). For the long jump from a standstill, its results were positive for the experimental sample because of the utilization of modern exercises derived from the plyometric method, which is considered to be one of the most modern training methods today (6). Regarding the practice of tossing the iron ball forward and backward, we can deduce that the plyometric exercise regimen had a significant role in developing this propensity in the experimental population, according to the researchers' special method of preparation. For the development of the javelin throwing skill from the five steps as a separate practice from performing the entire javelin throwing event, the researcher found that the utilization of plyometric exercises had greatly benefitted the experimental sample in the method prepared by the researcher, this showed a significant difference between the experimental sample and the control sample, the latter had a greater degree of success in the javelin throw than the former. The researcher attributed this to the fact that the experimental sample had a greater propensity to utilize plyometric exercises during their training regimen than the control sample. This was considered an important component of the performance of most athletes. Regarding the progress made by the control sample, which the team's coach developed on his own a curriculum for, we can see that there is growth, but it was small or medium in scale and failed to account for the use of plyometric exercises in training. As a result, the researcher suggests using plyometric training to promote the development of field and track activities like javelin toss, weight toss, discus toss and hammer toss, these activities have a significant role in the development of power and speed.





### 3-4 Discussion and analysis of the results:

#### Conclusions:

The procedure employed by the researcher resulted in the development of the explosive capabilities of the arms and legs of Al-Hashd Club's youth players.

2- The method the researcher created enhanced the rapid power of the arms and legs of Al-Hashd Club's youth players.

The method of training proposed by the researcher has a positive impact on the development of strength characterized by speed and success.

4- The experimental group had a superior performance in the variables of interest in the two following tests, and as a result, favored the experimental group.

5- The experimental group had a superior performance and achievement in the two following tests compared to the control group, and as a result, the experimental group was favored.

#### Recommendations:

The plyometric method is beneficial because it promotes strength with a speed that's associated with endurance.

Conduct a similar study using the plyometric method of training on other endeavors.

4- Studies on training methods that facilitate the development of abilities in the path of sports movement.

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