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## The effect of maximum strength exercises to developing muscular strength and achieving the long jump for age under 18 years

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### Abstract

The study aimed to prepare exercises within the training curriculum using maximum strength to develop muscular strength for achieving the long jump for under 18 years of age. The effect of maximum strength exercises in developing muscular strength and long jump achievement for those under 18 years of age. The researchers assume that there is an effect of exercises in the post-tests between the control and experimental groups and in favor of the experimental group in the research variable. The experimental technique (also known as the equal groups method) was used by the researchers because it is the best strategy for resolving the research issue and achieving the study's goals. The research sample consisted of (6) players divided into two groups—control and experimental—each with three players, and each group was homogenized separately using the coefficient of variation in the research variables as well as following the exploratory experiment and cardiac tests. The research sample also included players from Kerbala Governorate clubs competing in the long jump competition who were under the age of 18—a total of (8) players. For eight weeks during the special preparation phase, the researchers used their activities to train participants for two training units each week on Sunday and Wednesday. Each week, the length of the training units changed, and the researchers utilized a variety of training intensities, from (80-100%). techniques for repeating high-intensity interval training according to the level of intensity. The study's findings lead the researchers to the conclusion that the most crucial suggested workouts promoted the growth of muscular strength via maximal strength training. Due to their significance in increasing the degree of physical strength among long jumpers, researchers advised implementing the workouts specified by experts.

**Keywords:** Maximum strength exercises, muscular strength, long jump

### 1. Introduction

Athletics is one of the most important sports. Individual games are characterized by multiple competitions (jumping - running - throwing), which require abilities and physical elements in addition to high concentration. This makes physical exercises, which are concerned with raising the level of physical fitness, the foundation that enables the player to develop and improve. His physical and skill level.

The long jump competition is one of the interesting competitions in athletics that requires many important physical abilities and qualities, which play an essential role in the completion of this competition. One of the most important qualities that the jumper of this competition needs is maximum strength because of its important and effective role in the long jump competition and its completion. Especially in developing muscular strength for this competition, through which most jumpers are able to reach the achievement.

Hence the importance of research into preparing physical exercises that work to raise the level of this trait, knowing the extent of the impact of these exercises on developing the level of this trait, and working to provide all players and coaches with sufficient information to develop it and making this information in the interaction of their hands to reach the high achievement of this competition.

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**1.2 Research Problem**

The level of achievement in the long jump competition currently falls short of expectations when compared to the level of achievement of this competition at the Arab, Asian, and international levels. Numerous factors have contributed to the poor performance of the jumpers, and the coaches of this competition intend to develop strength in particular as a component of developing achievement through the use of exercises with different training methods.

**1.3 Research objective**

1. Preparing exercises within the training curriculum using maximum strength to develop muscular strength for achieving the long jump for under 18 years of age.
2. Identify the effect of maximum strength exercises on developing muscular strength and achieving the long jump for those under 18 years of age.

**1.4 Research hypotheses**

1. The effects of maximal strength workouts to improve muscular strength and accomplishment are evident in the considerable differences between the pre- and post-tests, favoring the post-tests.
2. Between the control and experimental groups, there are substantial differences in the post-tests, and the research

variable favors the experimental group.

**1.5 Research fields**

**1.5.1 Human field:** Kerbala Governorate club players under 18 years old.

**1.5.2 Time field:** From 7/2/2023 to 19/4/2023.

**1.5.3 Spatial field:** Al-Shabab Stadium in Kerbala.

**2. Research methodology and field procedures**

**2.1 Research Methodology:** The researchers chose the experimental method (Equal Groups Method) because it is the most appropriate method to solve the research problem and achieve its objectives.

**2.2 Research sample:** The research sample included players from Karbala Governorate clubs in the long jump competition under 18 years of age, who numbered (8) players. The number of individuals in the research sample was (6) players, divided into two control and experimental groups in a random manner, and the number of each of them was (3) players, and each group was homogenized separately. Using the coefficient of variation in the research variables, as shown in Table 1.

**Table 1:** Shows the homogeneity of the control and experimental groups in the research variables

Variables	Measuring unit	Experimental group			Control group			Calculated T values	Sig Level
		Mean	Std. Deviation	Coefficient of variation	Mean	Std. Deviation	Coefficient of variation		
Age	year	5.5	1.26	1.61	5.2	1.31	1.73	0.519	0.61
Mass	kg	67.1	3.28	10.76	65.3	3.19	10.23	1.24	0.23
Length	cm	167.3	4.47	20.01	165.5	3.53	12.5	0.99	0.331

**Table 2:** Experimental design adopted in the research

Group	Pre-test	Experimental dealing	Post-test
Experimental	Maximum strength of legs and arms	Exercises used in research	Maximum strength of legs and arms
Control		Trainer exercises	

**2.3 Devices and tools used**

1. Sources and references.
2. Testing and measurement.
3. Observation and experimentation.
4. 1 HP laptop.
5. Manual stopwatch 2.
6. Iron discs of different weights.
7. Medical scale number 1.
8. Measuring tape number 1.
9. Iron terrace.

**2.4 Field research procedures**

**2.4.1 Determine tests for special variables in the research**

The researchers surveyed many scientific sources related to the research topic and the following tests were determined.

1. Test the maximum strength of the legs and arms.
2. Long jump completion test.

**2.5 Tests used in the research**

**2.5.1 Testing the maximum strength of the legs**

- **The aim of the test:** To measure the maximum strength of the legs
- **Tools used:** Gym - iron bar weighing 20 kg - different weight discs.

**Description of performance:** The tester stands with a suitable opening for the legs and carries the barbell with a

maximum load of weight and performs it only once.

**2.5.2 Testing the maximum strength of the arms (pressing the weight by lying on the bench)**

- **Objective of the test:** To measure the maximum strength of the arms.
- **Tools used:** Gym - 20 kg barbell - different weight discs - training bench.

**Description of the performance:** The athlete lies on the bench and a suitable weight is placed for the overhead push-up using the arm press method. The weight is then increased after each attempt until the highest possible weight is reached. The weight of the weight must reach 80% of the athlete's maximum strength in this test.

**2.6 Long jump completion test**

**Objective of the test:** To measure long jump achievement.

**Tools used:** A legal mark for the long jump - a legal approach route - flags (white - red) - a measuring tape - a referee.

**Description of the performance:** The athlete places his approach mark on the approach path, and the athlete proceeds to perform the attempt, performing the complete jump (rising - flying - landing). The attempt is calculated from the last trace the athlete left in the long jump. Each player is given 3

attempts and chooses the best distance. He has three attempts.

**2.7 Exploratory experience**

For the purpose of identifying the work obstacles that may face the process of field experiment procedures, the researchers conducted a reconnaissance experiment on (2 players) from clubs in Karbala Governorate on Saturday, 7/2/2023, at exactly four o'clock in the afternoon, at the Al-Shabab Sports Stadium, and the goal of the reconnaissance experiment was It is to ensure the following matters:

1. Ensure the validity of tools and devices.
2. The extent of the sample's understanding and response to the tests.
3. The extent to which the work team implements the duties assigned to it.

**2.8 Scientific foundations of tests**

Tests and standards are an important tool for evaluation, and as such they are a tool that is used for all data for the purpose of evaluation. Tests or tools also have good qualities, including achieving scientific transactions, the conditions of which are (Validity, reliability, objectivity).

**2.8.1 Validity of the test**

There are many ways to find the validity coefficient, and the researcher used content validity to determine its validity by selecting it from scientific sources related to the research topic.

**2.8.2 Test reliability**

The reliability of the test means that it gives the same results when the test is repeated more than once for the same sample members on two different days, and the researchers used it to find the reliability coefficient of the test through the (test and retest) method, so the researchers applied the tests on 9/2/2023 and the same tests were repeated With the same conditions that they conducted in the exploratory experiment and on the same sample members on Tuesday, February 14/2/2023, that is, four days apart from the first test, the researchers extracted the reliability coefficient by applying the simple correlation coefficient (Pearson) between the first and second tests of the tests, and all values of the correlation coefficient were The simplex calculated for all tests is greater than the tabular value at degree of freedom (4) and its value is 0.811, which confirms that all tests have a high reliability coefficient, as shown in Table 3.

**2.8.3 Objectivity**

The objectivity of the test means that the test is not affected by changing the arbitrators or that the test gives the same results regardless of who is conducting the arbitration, that is, freedom from bias or fanaticism and not introducing the personal factors of the tester or arbitrator such as his opinions, personal whims and personal inclinations. Objectivity means that half of the individual's capabilities are as they exist. Really not what we want it to be.

**Table 3:** Shows the reliability and objectivity coefficients for the tests under study

Tests	Reliability coefficient	Sig type	Objectivity coefficient	Sig type
Test 1	0.859	Sig	0.896	Sig
Test 2	0.871	Sig	0.899	Sig

**2.9 Pre-Tests**

Measurements of height, weight, and training age were taken

beforehand because they have a relationship with the physical variable and achievement in order to determine the score of the tests and identify the level of the players. Members of the research sample, which consisted of six players, underwent the pre-test on Thursday, corresponding to 16/2/2023, at precisely four in the afternoon.

**2.10 Main experiment**

The researchers prepared exercises for jumpers to develop the research variable. They will include maximum strength exercises, relying on scientific sources in addition to the modest experience of the researchers that they gained through practicing the competition, in addition to the experience they gained in the study. The exercises were distinguished by the following:-

1. During the special preparation stage, the exercises were completed.
2. The exercises began on Sunday, February 19, 2023
3. The training program's workouts lasted for an additional eight weeks.
4. Number of training units (2 training units) per week.
5. Total number of training units (16 training units).
6. Days of training units: Sunday, Wednesday
7. The exercise time varied and ranged between (25 minutes - 28 minutes).
8. Based on the pre-tests that were conducted with the study sample, the exercise intensity employed varied from (80% - 100%) of the athlete's maximal capacity.
9. The researcher employed high-intensity interval training and repeated training (80% to 100%) as training techniques.
10. The rest period between repetitions was (2-3 minutes) and between exercises (5-6 minutes).
11. The training volume was equal for both experimental groups, but it was distributed in two different ways.
12. The researchers considered the need for training on the other days of the week to be as similar as feasible for all study sample participants in terms of training load components, physical features, and skills.
13. The training program's exercises were administered to both groups simultaneously.
14. The application for implementing the prepared exercises ended on Monday, 19/4/2023.

**2.11 Post-Test**

The researcher conducted post-test on the members of the research sample on Wednesday, April 19, 2023, at exactly 4 p.m. in the youth stadium located in Kerbala Governorate, taking into account providing the same spatial and temporal conditions and procedures in the pre-test as much as possible.

**2.12 Statistical methods**

- Mean.
- Std. Deviation.
- Median.
- Coefficient of Variation.
- T-Test for independent and symmetrical samples.

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

**3.1 Presenting, analyzing and discussing the results of the pre- and post-tests for the control and experimental groups on the variables under study**

**Table 4:** Shows the values of the means, std. deviation, and the calculated (t) value for the experimental group for the variables under study

Variables	Measuring unit	Pre-test		Post-test		Calculated T values	Sig Level
		Mean	Std. Deviation	Mean	Std. Deviation		
Leg Maximum strength	Kg	77.1	2.64	71.9	1.37	5.52	0.06
Arm Maximum strength	Kg	173	5.59	177.6	3.06	2.28	0.10
Long jump achievement	M	5.60	2.79	6.10	2.12	4.41	0.38

**Table 5:** Shows the values of the means, std. deviation, and the calculated (t) value for the control group for the variables under study

Variables	Measuring unit	Pre-test		Post-test		Calculated T values	Sig Level
		Mean	Std. Deviation	Mean	Std. Deviation		
Leg Maximum strength	Kg	76.3	3.19	75.4	2.45	0.705	0.39
Arm Maximum strength	Kg	171.6	7.02	174.1	4.3	0.959	0.38
Long jump achievement	M	5.69	3.26	5.70	2.67	2.39	0.34

It is clear from the results of Table 4, 5 that there are significant differences between the results of the pre- and post-tests and in favor of the post-tests and the control and experimental groups in the variable under study. If this indicates anything, it indicates that there is a positive effect of the exercises prepared by the researchers, and the researchers attribute this to Continuous training for maximum strength increases muscle strength, and the athlete needs maximum strength while building muscle strength, which together with the rest of the motor qualities bears the main load during races. It is characterized by the ability to fully contract the muscles, "the highest force produced by the neuromuscular system during voluntary contraction" (Hara, 1990, p. 164)<sup>[1]</sup>, and it is defined as "the force exerted during maximum voluntary work under the influence of isometric contraction, which shows the current muscle strength regardless of the

state of training or muscle atrophy" (Bastawisi Ahmed, Qasim Hassan, 1978, p. 42)<sup>[2]</sup>.

Maximum strength is the ability of the muscle or muscle groups to produce the maximum force during voluntary contraction. It is noted that it is very necessary in producing the energy needed for physical exercises and sports tournaments. Its importance also decreases the less the resistance to be overcome, the faster the muscle contraction speed, or the greater the endurance requirements, as in the case of Backgammon activities.

Maximum strength means overcoming various resistances with the greatest possible force, i.e. exerting maximum muscle contraction. Its importance is evident in jumping competitions, including the long jump, which is one of the events that rely on maximum strength to develop the jumper's muscular strength.

**Table 6:** Shows the values of the means, std. deviation, and the calculated t-value for the post-tests and for the control and experimental groups in the variables under study

Variables	Measuring unit	Pre-test		Post-test		Calculated T values	Sig Level
		Mean	Std. Deviation	Mean	Std. Deviation		
Leg Maximum strength	Kg	71.9	1.37	75.4	2.45	3.93	0.09
Arm Maximum strength	Kg	177.6	3.06	174.1	4.3	2.09	0.26
Long jump achievement	M	6.10	2.12	5.70	2.67	1.85	0.74

#### 4. Discussion

By observing Table 6, we found that there were significant differences between the results of the post-tests for the control and experimental groups and in favor of the experimental group in all variables. The reason for its development is due to the use of training units with exercises developed in a scientific and codified manner regarding the development of maximum muscular strength for those under 18 years of age. For jumpers, it is of great importance as it is a basic and important factor for the athlete, especially for high-level athletes, as the link between muscle strength and motor speed in the muscles is considered one of the requirements for good sports motor performance and appears when muscular work is in the states of systole and relaxation and the connection between them is in high agreement.

Muhammad Hassan Allawi and Ahmed Nasr El-Din point out, "The most important thing that distinguishes outstanding athletes is that they possess a great deal of strength and speed, and they possess the ability to link them together in an integrated manner to create strong, rapid movement in order to achieve optimal performance" (Muhammad Hassan Allawi and Ahmed Nasr Al-Din, 1982, p. 78)<sup>[3]</sup>.

Holman defines the force characterized by speed as "the muscular force or muscle group that athletes achieve as a result of the development of the voluntary movement path against resistance." (Hollman G., 1993, p. 300)<sup>[4]</sup>.

As for Qasim Hassan Al-Mandalawi and Mahmoud Abdullah Al-Shati, they mention that it is "the ability to provide power while increasing speed several times to the maximum" (Qasim Al-Mandalawi and Mahmoud Abdullah Al-Shati, 1987, p. 18)<sup>[5]</sup>.

#### 5. Conclusions and Recommendations

##### 5.1. Conclusions

1. The proposed exercises led to the development of muscular strength among long jumpers.
2. There was also an improvement in the level of muscle strength among members of the control group
3. The experimental group outperformed the control group in the values of all research variables for developing the muscular strength of jumpers.

##### 5.2. Recommendations

1. Adopting the exercises suggested by specialists due to their importance in developing the level of muscular strength among long jumpers.
2. The need to emphasize undulation through the training load and use appropriate exercises for the junior category.
3. Emphasis on developing the level of physical fitness, especially maximum strength, before starting to learn or develop skills.

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**Appendix**

Exercises used in research

**The first week (Sunday - Wednesday)**

N	Exercise	Intensity	Repetition	Groups	Rest between	
					Repetition	Groups
1	Complete dabney	80	7	3	-	2
2	Arm press	80	6	3	-	2
3	Double machine push	90	5	3	-	2
4	Arm pull	90	6	3	-	2

**The second week (Sunday - Wednesday)**

N	Exercise	Intensity	Repetition	Groups	Rest between	
					Repetition	Groups
1	Half deep fat	80	6	3	-	2
2	Arm press	85	6	3	-	2
3	One leg machine push	90	6	3	-	2
4	Bingpress italic	90	6	3	-	2

**The third week (Sunday - Wednesday)**

N	Exercise	Intensity	Repetition	Groups	Rest between	
					Repetition	Groups
1	Complete dabney	80	7	3	-	2
2	Arm press	80	6	3	-	2
3	Double machine push	80	5	3	-	2
4	Arm pull	80	6	3	-	2

**The fourth week (Sunday - Wednesday)**

N	Exercise	Intensity	Repetition	Groups	Rest between	
					Repetition	Groups
1	Half deep fat	90	5	3	-	2
2	Arm press	90	6	3	-	2
3	One leg machine push	90	6	3	-	2
4	Bingpress italic	90	6	3	-	2

**The fifth week (Sunday - Wednesday)**

N	Exercise	Intensity	Repetition	Groups	Rest between	
					Repetition	Groups
1	Half deep fat	85	5	3	-	2
2	Arm press	85	6	3	-	2
3	One leg machine push	85	6	3	-	2
4	Bingpress italic	85	6	3	-	2

**Sixth Week (Sunday - Wednesday)**

N	Exercise	Intensity	Repetition	Groups	Rest between	
					Repetition	Groups
1	Half deep fat	95	5	3	-	2.30
2	Arm press	95	6	3	-	2.30
3	One leg machine push	95	6	3	-	2.30
4	Bingpress italic	95	6	3	-	2.30

**The seventh week (Sunday - Wednesday)**

N	Exercise	Intensity	Repetition	Groups	Rest between	
					Repetition	Groups
1	Complete dabney	90	7	3	-	2
2	Arm press	90	6	3	-	2
3	Double machine push	100	4	3	-	3
4	Arm pull	100	4	3	-	3

**The Eighth Week (Sunday - Wednesday)**

N	Exercise	Intensity	Repetition	Groups	Rest between	
					Repetition	Groups
1	Complete dabney	100	5	3	-	3
2	Arm press	100	5	3	-	3
3	Double machine push	100	4	3	-	3
4	Arm pull	100	5	3	-	3