

The effect of plyometric training on developing explosive power and numerical performance in long jump athletes

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KEY WORDS:

Plyometric training
explosive power
long jump

Abstract: The purpose of this study was to determine the effect of plyometric training on explosive power and performance of long jump athletes. Because the nature and the objectives of this research were appropriate, the researcher used the experimental method with a single group pre test–post test design. The research population and sample consisted of ten male athletes from the University of Babylon's long jump team for the 2025–2026 sports season, selected using a census method. The researcher conducted pre-tests and then applied the plyometric training program from October 22, 2025 to February 15, 2026. The post tests were administered under the same conditions after the completion of the program. The standing broad jump test was used to determine explosive power, and the long jump performance test was used. Data were analyzed statistically by SPSS Software. Results indicated that the pre-test and post-test scores differed significantly with the scores from the post-test being higher in both explosive power and performance. This study reinforces the ability of plyometric training to improve these two variables. Based on the research, the researcher decided that plyometric training is an effective training method for explosive power development and performance in long jump athletes. He suggested that it be incorporated into training programs as it is important to manage training load and that further research should be undertaken on other sports and events.

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INTRODUCTION

In track and field sports, physical, technical and physiological skills are combined making these the most important sports. In order to be able to achieve athletic success in these events, one needs to be scientifically prepared, according to the principles of modern sports training. There are many physical components of the long

jump, most notably the explosive power of the legs, which is directly related to distance jumping and take off speed. Moreover, it needs to be mastered in all aspects of the move: approach, take off, flight and landing.

In the last few decades, a lot of development has taken place in the science of sports training and many of the contemporary training methods have been

developed to enhance specific physical capacities to perform in sport. Plyometric training is one such method, which involves a succession of muscle stretches followed by muscle extensions and quick muscle contractions. This will help to improve output in a short space of time, as is required in a long jump event^[1].

Plyometrics are one of the most popular forms of training to impart a 'springy quality' to the muscles of high intensity, high velocity movements and are a key component of the technical aspects of elite performance and the development of technical skills. This method of training also helps to improve the efficiency of the central nervous system and the rate at which the motor units are recruited, meaning that the athlete performs better^[2].

Recent research has shown that if plyometric training is added to the training schedules of jumpers, there is a significant increase in explosive power, take-off speed and greater motor economy, which is evident in higher performance. In addition, controlling the training load and choosing appropriate exercises according to the ability of the athlete means that the results will be optimized and the risk of injury reduced^[3].

Explosive power is emphasized in the long jump because of its close association with the takeoff phase that is very important in determining the distance of the jump. The athlete is trying to produce the greatest amount of acceleration in the shortest time while keeping the horizontal velocity he/she develops during the approach. Hence, it is crucial to coach and investigate this ability.

In this view, the researcher aims to use plyometric training in a scientific training program that is designed to be scientifically standard, according to the characteristics of the members of the University of Babylon's team. To find out how helpful it is for building explosive power and enhancing performance in the long jump, which can be used to assist the training process and help coaches to choose the training methods that are best suited^[4].

This study has also been significant since it is carried out on a group of athletes from Iraqi universities. The results are expected to contribute to the knowledge of science and can offer practical evidence of the effectiveness of plyometric training on sports physical and performance. The results can be useful for coaches, researchers and students in physical education and sport colleges to design more effective training programs. In addition, disregarding individual differences and training level, similar groups can be generalised from the results.

Research Problem: Although the field of athletic training has progressed for track and field events, there remain

some long jumpers who lack explosive power as this can have a negative effect on their performance. This is often attributed to reliance on traditional training programs that do not consider the specific physical characteristics of the event or do not optimally utilize modern training methods. Through observing the training of the University of Babylon team, the researcher noted a disparity in the players' explosive power and performance levels. This prompted the development of a training program using plyometric training to determine its effectiveness in developing explosive power and improving performance levels in long jumpers.

Research Objectives:

- To develop a training program using plyometric training for long jumpers.
- To identify the effect of plyometric training on developing explosive power in long jumpers.
- To identify the effect of plyometric training on improving performance levels in long jumpers.

Research Hypotheses:

- There are statistically significant differences between the pre-test and post-test results in explosive power, favoring the post-test results.
- There are statistically significant differences between the pre-test and post-test results in performance levels for long jumpers, favoring the post-test results.

Research Areas:

- Human Scope: The University of Babylon's long jump team, consisting of (10) male athletes.
- Temporal Scope: From October 22, 2025, to February 15, 2026.
- Spatial Scope: The training fields and facilities of the College of Physical Education and Sports Sciences at the University of Babylon.

MATERIAL AND METHOD

Research Methodology: The researcher adopted the experimental method with a single-group pre-test and post-test design, as it was suitable for the nature of the research problem and the achievement of its objectives. This method is considered one of the most appropriate for studying the effect of the independent variable (plyometric training) on the two dependent variables (explosive power and numerical performance).

Research Population and Sample: The research population consisted of the University of Babylon's long jump team athletes for the 2025–2026 sports season, totaling ten male athletes.

The researcher employed a census method in selecting the sample, choosing all members of the population to form the research sample. Thus, the sample size reached 100% of the research population, due to the small size of the population and the homogeneity of its members in terms of training age and performance level.

Sample Homogeneity: To ensure homogeneity among the sample members, the researcher measured some of the variables and this was prior to the implementation of the training program, such as:

- Chronological Age (years).
- Height (cm).
- Mass (kg).
- Training Age (years).

These variables were analysed for means, standard deviations and skewness coefficients. The results indicated that the values of the skewness coefficients were statistically within the acceptable limits of ± 3 , which indicated the homogeneity of the sample and appropriateness of the research procedures.

Equipment, Tools, and Methods Used: The researcher was equipped with the following equipment and tools:

- Metal measuring tape.
- Height measuring device.
- Electronic medical scale.
- Digital stopwatch.
- Whistle.
- Plyometric box with varying heights.
- Training hurdles.
- Training cones.
- Agility ladder.
- Adhesive tape to mark the performance areas.
- Long jump pit.
- Long Jump Measurement tape.
- Data recording forms.
- Electronic calculator.
- Personal computer.

The Pilot Test: The researcher conducted the pilot test before the main experiment, to ensure the suitability of the equipment and tools used, determine the time required to perform the tests, assess the suitability of the

training program, distribute the tasks among the support team, and identify and solve any obstacles might impede the main experiment.

The pilot test was successful in meeting its aims and the researcher was able to carry out the main experiment in an organized way^[5].

Measurements and Tests Used:

- First: Anthropological Measurements
- Height (cm)
- Body Mass (kg)^[6]

Second: Physical Tests:

- Standing Broad Jump Test
- Purpose: To measure the explosive power of the legs.
- Equipment: Measuring tape, level ground.
- Procedure: The subject stands behind the starting line and performs a front take both feet off the ground, hop off the ground.
- The highest score, of three attempts, is kept and is measured in cm.
- Skill Test (Numerical Achievement)

Numerical Achievement Test in the Long Jump:

- Athlete Level: To determine the athlete's numeric level.
- Equipment: Approach runway, take off board, landing pit, measuring tape.
- Method of Performance: The athlete performs three attempts according to the international rules of the long jump.
- Scoring: The best legal attempt is counted and measured in meters.

Main Experiment: Pre-tests were conducted on the participants before the training program. The researcher then implemented the plyometric training program during the study period, from October 22, 2025, to February 15, 2026, considering the regulation of the training load, the gradual increase in intensity and volume, and the rest periods, all of which were appropriate to the athletes' skill levels.

After the training program concluded, post-tests were conducted under the same conditions and procedures as the pre-tests, and by the same research team, to ensure objectivity and accuracy of the results.

Statistical Methods: The data were statistically processed using the Statistical Package for the Social Sciences (SPSS).

RESULTS

Table 1 shows that the sample members have a good degree of homogeneity in the basic variables, as the means and standard deviations were close, which enhances the accuracy of the results and reduces the impact of individual differences.

Table 2 shows an increase in the mean score for explosive power from (228.40) cm in the pre-test to (242.80) cm in the post-test, indicating a clear development in explosive power after the application of the training program.

Table 3 shows that the calculated t-value was (8.67) at a significance level of (0.000), which is less than (0.05), indicating a statistically significant difference between the pre-test and post-test, favoring the post-test.

Table 4 shows that the mean of digital achievement increased from (5.82) meters in the pre-test to (6.16) meters in the post-test, which reflects an improvement in the level of achievement after the implementation of the training program.

Table 5 shows that the calculated value of (T) was (7.94) with a significance level of (0.000), which is less than (0.05), indicating that there are significant differences between the pre- and post-measurements in favor of the post-measurement, which confirms the effectiveness of plyometric training in improving the numerical achievement of long jump players.

Discussion of Results: The research results showed statistically significant differences between the pre- and post-tests in both explosive power and performance in long jump athletes, favoring the post-tests. This indicates the effectiveness of the training program based on plyometric training in developing the variables under study.

The researcher attributes this improvement to the nature of plyometric training, which relies on rapid muscle contraction following immediate muscle stretching. This contributes to improving the efficiency of the neuromuscular system and increasing the ability of the working muscles to produce maximum force in a short time. This is a basic attribute for good long jump performance particularly in the take-off phase; this relies mainly on the legs' ability to provide the greatest amount of 'explosive power' to produce the best take-off angle along with a high horizontal velocity during the jump^[7]. Moreover, training program was characterized by progressive increase in the intensity and volume of the training load and the consideration of individual differences as well as a variety of exercises for the development of plyometric qualities. This facilitated functional and physical adaptations which helped in the increase in level of performance. The scientific study of

Table 1: Shows the means and standard deviations of the sample homogeneity variables

Variables	Units	Mean	Std
Chronological age	Year	21.30	0.82
Height	cm	178.60	4.25
Mass	kg	71.40	5.12
Training age	Year	3.80	0.79

Table 2: Shows the results of the pre- and post-test of explosive power (standing broad jump test)

Test	Mean (cm)	Std
Pre	228.40	8.53
Post	242.80	7.41

Table 3: Shows the results of the (T) test for correlated samples for explosive power

Variable	Calculated value of (T)	(Sig.) value	Level of significance
Explosive power	8.67	0.000	statistically significant

Table 4: Shows the results of the pre-test and post-test for numerical performance in the long jump

Test	Mean (meters)	Std
Pre	5.82	0.24
Post	6.16	0.21

Table 5: Shows the results of the paired-samples t-test for digital achievement

Variable	Calculated value of (T)	(Sig.) value	Level of significance
Digital Achievement	7.94	0.000	statistically significant

sports training has proven that regular scientific training with regularity results in faster activation of motor units and better coordination of the neuromuscular system, which has a positive effect on the explosive power and skill performance^[8].

On the question of performance, the improvement given in the results may be attributed to the fact that the performance in the long jump is related to a number of physical skills, which are mainly explosive power. The growth of explosive power results in better take-off phase and greater jump distance. In addition, the repetition of the exercise in the training program enabled the athletes to develop their motor coordination and fluidity in executing the technical phases of the jump directly affecting the athlete's performance^[9].

The researcher feels that all the athletes followed the training programme well throughout the experiment, they were dedicated to the training modules and the training environment was appropriate, all of this leading to positive results. The diversity of the exercises, which mimicked the nature of long jump performance, also helped to transfer the physical training effects to the skill level, a basic principle in modern sports training^[10].

This research agrees with many studies which have demonstrated that plyometric exercises are one of the best training methods to develop explosive power and enhance performance in jumping competitions. This is

because of the neuromuscular adaptations it instills, which help to increase sports performance. Thus, it is concluded that the use of plyometric exercises in the training programs of long jumpers is a scientifically valid approach to develop the specific physical qualities and improve the level of performance, if only the training load is adjusted to the level of the athlete, his training age and the goals of training.

CONCLUSIONS

- Explosive power was significantly enhanced in long jumpers with the plyometric training program.
- After the implementation of the training, the performance of long jumpers was improved due to plyometric training.
- It was found that there is a positive relationship between the improvement of explosive power and long-jump performance.
- The 4th exercise types: standardized and progressive plyometrics, produced neuromuscular adaptations which increased the athletes physical and technical performances.
- Plyometric training is an effective training method and can be applied to long jump training at the university level, in programs.

Recommendations:

- Plyometric training should be added to long jump training programs because of its effect on enhancing explosive power and performance.
- The principle of progression and individual differences should be applied to standardize training loads for plys about athletes' skill level and training age.
- Conduct similar studies on different samples and age groups, and in other track and field events, to compare the results.
- Encourage coaches to use modern training methods, including plyometric training, and to utilize the results of scientific research in developing training programs and improving athletic performance.

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