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|-------------------------------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| ISSN: 2392-5442<br>ESSN : 2602-540X |  | <i>Sport system journal</i>                                                             |
| V/13 N/01. Year/2026                |                                                                                  | <i>International scientific journal published by:<br/>Ziane Achour –Djelfa- Algeria</i> |
| P 448 - 466                         |                                                                                  | <i>Received: 2025-10-08 Accepted: 2026-02-23</i>                                        |

## The Effect of a Plyometric Training Program on Enhancing Explosive Strength (Jump Height and Speed) in Under-17 (U17) Football Players

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**Abstract:** This study aimed to identify the impact of a plyometric training program on improving explosive strength (measured by vertical jump and speed) in U17 football players. To achieve this, a single-group experimental design was utilized. The research sample was purposively selected, consisting of 18 players from the Karimia Sports Youth team, which competes in the Chlef Wilaya Football League during the 2024/2025 sports season. The participants underwent a series of pre- and post-tests before and after the implementation of the training program. These tests included the Sargent jump test to measure vertical jump ability and a 30-meter sprint test to assess speed. The statistical tools used to process the collected data included the arithmetic mean, standard deviation, validity and reliability coefficients, skewness, and the paired samples (T-Test).

One of the most significant findings was the presence of a positive and effective impact of the plyometric training program on enhancing explosive strength (vertical jump and speed) in U17 football players.

**Keywords:** Plyometric Training; Explosive Strength; Football; Players Under-17.

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### **1. INTRODUCTION**

Sports training has recently received significant attention and has become linked to various fields of science, such as medicine, anatomy, sociology, biomechanics, etc. This integration aims to bring the athlete to the highest possible level physically, tactically, technically, artistically, and psychologically. Sports training is considered to encompass all physical loads, or, in other words, all effort exerted by the body that results in an adaptation—whether functional or structural—which positively affects the individual's internal organs and consequently elevates their performance level (Naif Mofdi Al-Jbour, 2012, p. 13).

Football (soccer) is currently one of the most famous sports, compared to others, due to its major evolution across various domains, whether scientific or cognitive. It is a team sport with a wide fan base, which has led national authorities to focus on it by establishing specialized schools dedicated to finding modern, scientific methods, techniques, and standardized training curricula to develop their physical and technical characteristics throughout the training season. Coaches strive to select the best types of training methods and utilize the most suitable means according to their specific specialization.

Among training methods, plyometric training is one of the widely used techniques and means. Plyometrics utilizes movements characterized by a short time and explosiveness, and the activity of the neuromuscular units is higher than that which occurs in ordinary voluntary contraction (Jamal Sabri Faraj, 2010, p. 12).

For an athlete to achieve the desired results, especially in football, they must reach the highest levels of physical fitness. Football, as a team sport, is characterized by speed and excitement, in addition to fierce competition across all age groups. In this context, it combines many physical, technical, and mental characteristics and qualities through various game situations, ranging from defense to attack, requiring skills, tactics, and mental and psychological preparation. This can only be achieved through training, as its practice requires high physical fitness and significant physical strength (Subhi Ahmad Qablan, 2012, p. 09).

Plyometric training has recently emerged as one of the most important innovative training methods in various sports for refining and developing the athlete's efficiency and ability to reach the highest levels of achievement.

Plyometric training is considered a method for developing explosive power, and it is also a vital component of most athletes' performance. This is a result of players' and coaches' realization and understanding that plyometric training can improve performance and results (Khairiya Ibrahim Al-Sukari, 2025, p. 10).

To prepare the player for these situations, the physical capabilities such as speed and strength that a football player must possess need to be developed through regular training, particularly during the specific preparation phase. Many scientists and researchers assert that muscular strength is crucial for an athlete to reach the highest level in sports competitions, as it significantly influences the development of other physical qualities according to the nature of the activity and the sport (Qasim Hassan Husssein, 1998, p. 45)

Plyometric training is considered one of the best methods for elevating physical, technical, artistic, tactical, and psychological levels by using different stations that involve more than one quality in a single session.

Thus, the research problem is crystallized in the utilization of the plyometric training method to develop explosive strength in this age group, which is crucial for improving technical and tactical performance—both fundamentally built upon a base of physical performance. Considering that beyond this age stage, modern football players can compete in the most prestigious international and global competitions, as witnessed today in various continental and world leagues.

Based on this theoretical and cognitive background, and in service of football athletes in the Under-17 category in our country, the following question is posed:

## **2. Research Questions**

### **2.1 General Question**

What is the extent of the effect of a plyometric training program on enhancing explosive strength (jump height and speed) in Under-17 (U17) football players?

### **2.2 Specific Questions**

-Are there statistically significant differences between the mean scores of the players in the quality of jump height (vertical jump) between the pre-test and post-test measurements?

-Are there statistically significant differences between the mean scores of the players in the quality of speed between the pre-test and post-test measurements?

## **3. Research Hypotheses**

### **3.1 General Hypothesis**

The plyometric training program has a positive effect on enhancing explosive strength (jump height and speed) in Under-17 (U17) football players.



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### **3.2 Specific Hypotheses**

a-There are statistically significant differences between the mean scores of the players in the quality of jump height (vertical jump) between the pre-test and post-test measurements.

b-There are statistically significant differences between the mean scores of the players in the quality of speed between the pre-test and post-test measurements.

### **4. Research Objectives**

a-To determine the statistical differences between the mean scores of the players in the quality of jump height between the pre-test and post-test measurements.

b-To determine the statistical differences between the mean scores of the players in the quality of speed between the pre-test and post-test measurements.

### **5. Importance of the Study**

- **Scientific and Theoretical Significance:** the current research represents a new addition to the Algerian library in general, and particularly to the coaches of football teams. These specialized scientific references serve as a primary source for improving the coaches' cognitive competence and consequently facilitate the process of designing training programs.
- **Practical and Applied Significance:** the importance of this research lies in demonstrating the use of a plyometric training program in developing explosive strength. This is especially relevant as modern readings of the concept of contemporary training have introduced new concepts for the methods, techniques, and curricula used in training and physical preparation.

### **6. Study Terminology**

#### **a. Training Program**

A training program is defined as an organized and systematic set of physical activities and exercises designed and executed to achieve specific athletic goals. This program includes fundamental components such as training volume (quantity of work), intensity (degree of difficulty), and frequency (repetition). It is planned based on scientific principles such as progression, specificity, and overload. Its purpose is to induce physiological and technical adaptations in the athlete to enhance their performance (Salah Saleh Maamar, 2010, p. 13).

#### **b. Plyometric Training**

Plyometric training is one of the advanced training methods that focuses on developing explosive strength. This type of training relies on the Stretch-Shortening Cycle (SSC), where muscle is rapidly stretched (eccentric contraction), followed immediately by a forceful and rapid contraction (concentric contraction). This principle works to improve the ability of the neuromuscular system to generate maximum force in the shortest possible time (Adel Abdel Hamid Al-Fadhi, 2016, p. 10).

**c. Explosive Strength**

Explosive strength is the ability to generate maximum muscular force in the shortest possible time frame. This physical quality is a blend of maximum strength and speed, and it is crucial in athletic performance that requires fast and powerful movements, such as jumping, leaping, throwing, striking, and blocking (Talha Hussam et al., 2003, p. 45).

**d. Jump Height / Vertical Jump**

In the context of athletic performance, "Al-Irtiqaa" (Jump Height) refers to the act of pushing away from the ground or a specific surface with the feet, aiming for vertical or horizontal displacement upwards. This skill is considered an essential part of many athletic movements, such as leaping in track and field, jumping to block or spiking in volleyball, and jumping to score in basketball. It requires significant explosive strength in the lower limb muscles and good coordination with the rest of the body (Mohamed Hassan Allawi and Mohamed Nasr El-Din Radwan, 1988).

**e. Speed**

Speed in the sports field is defined as the ability to perform repetitive or non-repetitive movements in the shortest possible time frame, or the ability to move from one point to another at maximum possible velocity. It is one of the fundamental components of physical fitness and heavily relies on the efficiency of the nervous system and the strength of the participating muscles. Speed is typically classified into several subtypes such as reaction speed, movement speed, and locomotion speed (Abu Al-Alaa Ahmed Abdel Fattah and Ahmed Nasr El-Din Sayed, 2003, p. 88).

**f. Football**

**Conceptual Definition:** It is a game played between two teams, each consisting of eleven players, who use an inflated ball on a rectangular pitch, with a goal at



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each end. Each team attempts to put the ball into the opponent's goal to score a point (goal) and achieve victory (Mamoun Ben Hassan Al-Salman, 1998, p. 09).

Operational Definition: Football is a team game played between two teams equal in the number of players on a rectangular field fit for play, following specified rules. Each team attempts to score the largest number of goals against the opponent's goalkeeper. The match is managed by a central referee, two assistant referees on the sides, and a match commissioner. The match duration varies according to age and gender, divided into two halves with a 15-minute break in between, in addition to injury time. A leather ball is used on the field, and the teams' kits differ from each other.

### *g. Football players Under-17*

In the context of football, the "Under-17" age category refers to the group of players who have not yet reached their seventeenth year, according to the regulations and classifications of national and international sports federations. This category is considered a junior or youth category, and it represents a vital stage in the athletic development of the football player.

More specifically, this category is usually defined based on the year of birth, with the specific birth years included varying from one sports season to another, depending on the dates set by the concerned federation. For example, according to the regulations of some Algerian football leagues, this category might include players born in two specific years, such as 2008 and 2009 for the current season.

## **7. Previous and Related Studies**

1. Study by Kherraz Abdelhak et Al (2024): Titeld: "The Impact of a Proposed Training Program Using Plyometric Exercises Supported by Elastic Bands and Weights on the Explosive Strength of the Lower Limbs in U19 Football Players. "This research **investigated the utility** of a novel plyometric training protocol—one that **incorporates both elastic bands and weights**—to enhance the **explosive power of the lower extremities** in U19 football players. Six randomly selected athletes participated in the four-week experimental program (two sessions per week). Pre- and post-testing, using the **Sargent Vertical Jump Test** and the **15-meter sprint**, **demonstrated clear performance enhancement** across both variables. The study ultimately **concludes** that this specific, combined plyometric method **yields**

**positive results** and significantly contributes to improving explosive strength in this cohort of football players.

2. Study by Al-Eidi Abd Al-Rahim (2024): Titled: "Proposal of a Training Program Based on High-Intensity Interval Training (HIIT) Using Explosive Exercises and Its Effect on Raising the Level of Explosive Strength in Under-17 Football Players." The study aimed to identify the effect of the proposed training program, based on HIIT using explosive exercises, on improving the level of explosive strength in U17 football players. The researcher used the experimental method with a single-group design. The sample consisted of 10 U17 players selected via purposive sampling. The experimental group underwent the proposed training program, and explosive strength tests (Sargent + CMJ) and the training program (10 training sessions) were applied to the sample members. After statistical processing using the SPSS program, the results showed that the proposed training program influenced the improvement of the level of explosive strength, evidenced by differences between the pre-test and post-test measurements, with post-test results being higher than pre-test results.
3. Study by Hemmiche Zakaria and Kabouya Mohammed (2023): Titled: "The effect of plyometric training on the explosive power of the lower limbs of "U19"." This study was conducted to establish the impact of a specialized plyometric training intervention on the lower-extremity explosive power of U19 football athletes. Using an experimental design with two matched groups of 12 (from the Batna League), the research implemented a researcher-developed plyometric protocol over six weeks (three weekly sessions) for the experimental group. The control group maintained their standard training. Pre- and post-measurements were taken using the reliable and objective Sargent Vertical Jump Test. The statistically significant post-test results clearly indicate that the plyometric program led to substantially greater improvements in explosive power than the traditional approach. These findings provide concrete evidence for coaches and physical preparation specialists to adopt plyometric exercises to effectively develop lower-limb power during the competition phase. These findings confirm that the researcher's plyometric program effectively enhances lower-limb explosive power, offering valuable insights for coaches and specialists seeking to optimize physical preparation, particularly during the competition phase.



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### **8. Followed Methodologies**

#### **8.1 The Exploratory Study and Its Scope**

The First Exploratory Study: the exploratory study served as the initial step for fully grasping all aspects of the topic. Given that the study problem stemmed from the reality experienced by football players in various sports teams participating in national and regional championships, this phase involved a period of field observation. The researchers conducted several visits to various teams in Chlef Province to examine the training methods used by football coaches in their performance.

Interviews were also conducted with several coaches supervising training in these teams to ascertain their perspectives on the prevailing training methods and to identify the collective obstacles that hinder the use of various techniques to elevate their players' performance level. The viewpoints collected were highly consistent, which encouraged the undertaking of the current research to determine the actual effect of a plyometric training program on developing the quality of explosive strength. This included considering the variables of height, age, training age, and weight during the process of developing physical quality under investigation.

In alignment with the focus of the current study, which addresses the impact of a training program utilizing plyometric training during training units on developing explosive strength (jump height and speed) in the Under-17 age category, the exploratory study was conducted for the following purposes:

- Selection of appropriate physical tests, achieved through a reference survey of various tests and their presentation to specialists in the field.
- Prior designation and preparation of testing locations to prevent any emergencies that might impede the smooth and natural execution of the field study.
- Establishment of a work plan with assistant coaches to confirm the availability of the sample members.
- Identification of the research sample members and the collection of information regarding their characteristics and traits for proper engagement.
- Determination of the optimal procedure for conducting the research (specifying the time and location).
- Identification of potential problems that might confront the researcher during the application of tests to the research sample.

-Formulation of necessary solutions and modifications in case any obstacles were encountered by the researcher during test application in the exploratory study.

## 8.2 Adopted Method

Research methodology varies according to the topic. For this study, the Experimental Method was utilized due to its suitability for the nature of the subject.

## 9. Study Population and Sample

- Study Population

The study population consists of football players enrolled in the U17 age category football teams belonging to the Honor Division of Chlef Province, totaling approximately 380 players divided among 16 teams.

- Study Sample

The sample was selected using the Purposive Sampling method to mitigate the impact of certain confounding factors that could directly affect the expected research results. These factors include height, age, training age, and weight. The researcher selected individuals for the single-group sample from the club of Elkarimia football team, as it met the necessary prerequisites and resources for implementing the study effectively.

The number of individuals in the research sample reached 18 players from the JSCEK team who met the previously mentioned characteristics. They were selected via the purposive method, and those who did not meet the specified conditions were excluded.

**Table 01:** Distribution of the Sample Members According to the Variables of Weight, Height, Training Age, Age, and Physical Variables:

| Variable<br>s   | Sampl<br>e Size | Minimu<br>m Value | Maximu<br>m Value | Arithmeti<br>c Mean | Standar<br>d<br>Deviation | Coefficien<br>t of<br>Skewness |
|-----------------|-----------------|-------------------|-------------------|---------------------|---------------------------|--------------------------------|
| <b>Weight</b>   | 18              | 15.00             | 16.00             | 15.33               | 0.49                      | 0.77                           |
| <b>Height</b>   | 18              | 161.50            | 182.20            | 170.56              | 4.74                      | 0.43                           |
| <b>Age</b>      | 18              | 2.00              | 4.00              | 2.78                | 0.94                      | 0.50                           |
| <b>Training</b> | 18              | 57.50             | 72.70             | 63.15               | 3.75                      | 0.80                           |



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|              |    |       |       |       |      |       |
|--------------|----|-------|-------|-------|------|-------|
| Age          |    |       |       |       |      |       |
| Sargent Test | 18 | 42.60 | 48.10 | 45.43 | 1.72 | -0.17 |
| Speed Test   | 18 | 15.19 | 17.28 | 16.46 | 0.53 | -0.78 |

**Source:** Prepared by Belkacemi Brahim et al (2025) by (SPSS V25).

According to Table No. (01), the values of the Coefficient of Skewness for the variables (Weight, Height, Age, Training Age, and Physical Variables) among the members of the experimental group ranged between (-0.78 and 0.80). These values are confined within the range of the Normal Distribution [-3 to +3]. This indicates the normality of the distribution of the sample members with respect to the variables of age, training age, height, and weight.

### **10. Data and Information Collection Tools**

#### **10.1 Data Collection Forms**

The researcher prepared the following forms:

- Opinion Poll Form for Jurors regarding the determination of the appropriate tests and specific physical qualities.
- Registration Form for Growth Rates and the specific physical tests related to the homogeneity of the study sample.

The study tools were validated (judged/reviewed) by specialized experts and reviewers from Algerian universities and certain specialized coaches.

#### **10.2 Physical Tests**

##### **1. Sargent Vertical Jump Test**

-Purpose of the Test: To measure the muscular power of the legs in jumping upwards.

Required Equipment:

- A wooden board painted black, 0.5m wide and 1.5m long, marked with white lines at 2cm intervals.
- A smooth wall with a height of at least 3.6m from the ground.
- Chalk pieces or chalk powder, and a piece of cloth to wipe off the chalk marks after reading each attempt by the participant.

Procedure:

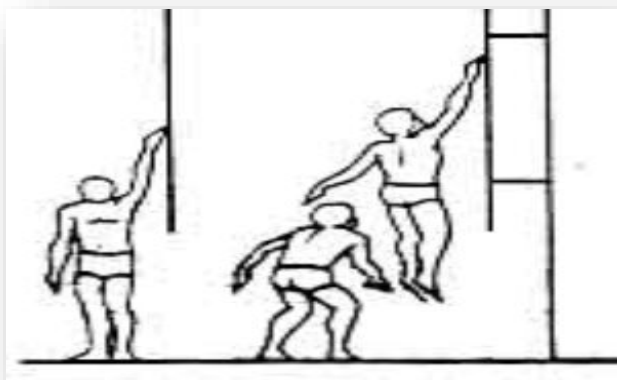
-The participant flexes both legs, then pushes off simultaneously with both legs to jump upwards while strongly swinging the arms backward and then forward high up to reach the maximum possible height. The participant marks the board or wall with chalk at the highest point reached.

-The participant swings the near arm forward and downward upon landing.

Scoring:

-The participant's score is: The number of centimeters between the mark reached from the standing position and the mark reached after jumping, rounded to the nearest 1 cm.

Fig.1. Illustrates the Sargent Vertical Jump Test.



## 2. (30-Meter) Sprint Test

-To evaluate speed (locomotor speed).

Required Equipment:

-Athletics track or field area with a length of 50m and a width of no less than 5m, including two corridors, each at least 1.22m wide.

-10 cones (or markers).

-Stopwatch.

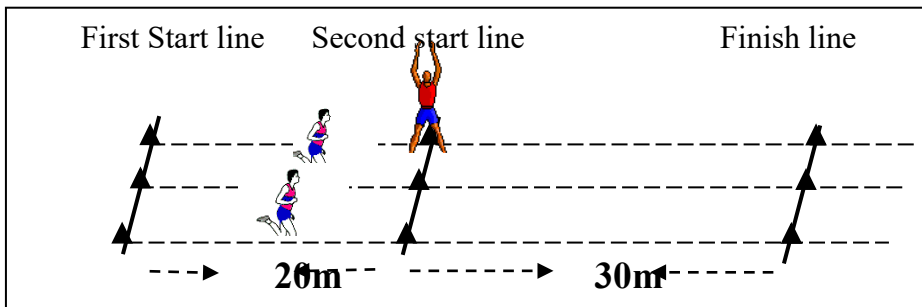
Procedures:

-The testing area is marked with three lines: a first starting line, a second starting line 20m from the first line, and a finish line 30m from the second line (and 50m from the first line).

### Test Execution:

-The time taken to cover the distance of 30m is measured (This is typically the time measured between the 20m mark and the 50m mark, or the 30m span of the test run, which evaluates maximal running speed).

**Fig.2.** Illustrates the 30m Sprint Test from a Flying Start (or Running Start).



### **3. Validity and Reliability of the Tests**

The researchers applied the physical tests and re-applied them one week later to a sample of six (06) players from the same research population but outside the main study sample.

**Table 2.** Shows the values of the Reliability, Validity, and Objectivity Coefficients of the Tests.

| Physical Tests              | Sample Size | Reliability Coefficient | Validity Coefficient |
|-----------------------------|-------------|-------------------------|----------------------|
| <b>Sargent Test</b>         | 06          | 0.998                   | 0.998                |
| <b>30-Meter Sprint Test</b> |             | 0.995                   | 0.997                |

**Source:** Prepared by Belkacemi Brahim et al (2025) by (SPSS V25).

Table No. (02) demonstrates that all physical tests possess a high degree of validity and reliability. Consequently, they are suitable for measuring what they are intended to measure throughout this study.

### **10.3 Field Application Procedures**

The execution of this research was conducted according to the following three fields:

➤ **Temporal Scope:** the temporal scope of this research extended from the beginning of December 2024 to May 2025.

-Research Plan December 2024 / May 2025

-Theoretical Aspect January 2025 / March 2025

-Exploratory Study February 2025 (15 days)

-Application of Tests and Training Program March 2025 / May 2025

➤ **Spatial Scope:** this research was conducted at the level of one of the teams participating in the Honorary Football Championship of Chlef Province, specifically the club of Elkarimia football team.

➤ **Human Scope:** the research was limited to male football players in the U17 category of Elkarimia football team.

### **11.The Proposed Training Program**

The researchers designed a group of football training sessions constituting the plyometric training program. This program was applied to the research sample over a period of two months, from March to May, followed by the post-test. It is noted that a pre-test was administered to the sample members prior to the program application.

The steps for applying the proposed training program were as follows:

- **Pre-test Measurement**

The pre-test measurement was conducted by the researchers during the first week of the proposed training program application (March 2025), specifically during the first training session. This involved applying the physical tests to the research sample members, under the supervision of the researchers and the assistant staff, serving as a diagnostic session within the content planning of the proposed training program.

Day One:

-Measurements were taken for the following variables: (Weight, Height, Training Age, and Age) for the main sample individuals.

-Measurements were taken for the following variables: Explosive Strength (Speed and Jump Height) for the main sample individuals.



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### **• Application of the Training Program**

The proposed training program, which primarily relies on the plyometric training method, was applied over a period of two months (March – May 2025), totaling eight (08) weeks. Each week contained two sessions, with the duration of each session ranging between 60 and 90 minutes. All scientific and training conditions and principles were considered during the program's application to ensure the smooth progress of the program and training sessions, and to guarantee the achievement of the best results through the application of the plyometric training method on the targeted research sample.

### **• Post-test Measurement**

The researchers conducted the post-test measurement in May 2025. This involved applying the physical tests to the research sample members, under the supervision of the researchers and the assistant staff, serving as an achievement session within the content planning of the proposed training program.

### **12. Statistical Methods Employed in the Study**

Statistical methods are among the most important tools for understanding the fundamental factors influencing the studied phenomenon, aiding in reaching, analyzing, applying, and critiquing results. Recognizing that every research has its specific statistical tools appropriate for the problem's type, characteristics, and research goal, the results obtained were calculated using the “SPSS” statistical software. The following statistical tools were adopted for this research:

- ✓ Arithmetic Mean
- ✓ Standard Deviation (SD)
- ✓ Coefficient of Validity and Reliability
- ✓ Coefficient of Skewness
- ✓ T-Test for Dependent Samples (T-Test)

### **13. Results Presentation, Interpretation, and Discussion**

#### **❖ Presentation and Interpretation Results:**

**Table .3.** Represents the results of the Pre-test and Post-test for the Sample in the Sargent Test and Speed test.

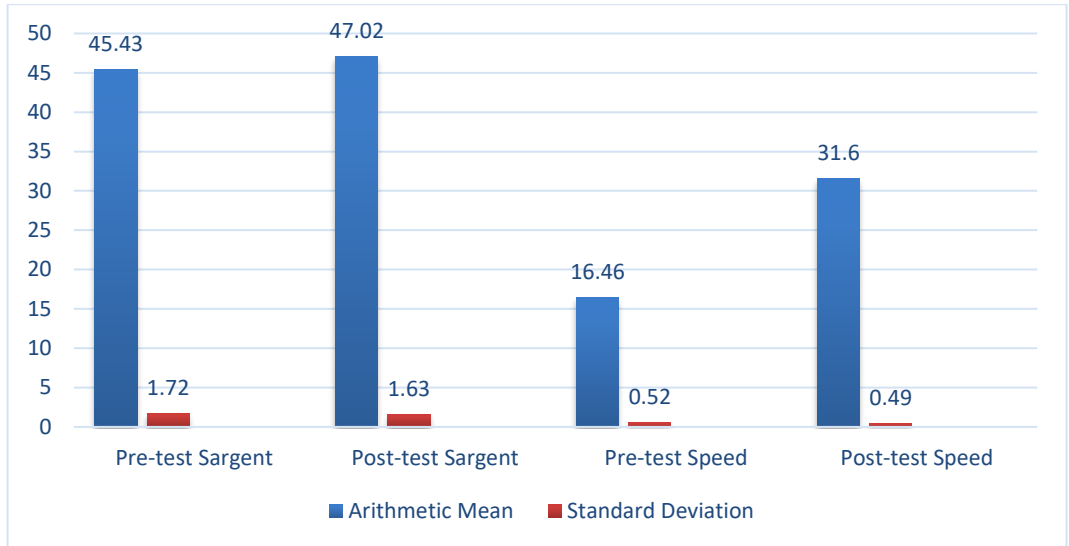
| Axes<br>Type of Scale | Arithmetic<br>Mean | Standard<br>Deviation | Calculated<br>t-value | Critical<br>t-value | Statistical<br>Significance |
|-----------------------|--------------------|-----------------------|-----------------------|---------------------|-----------------------------|
|-----------------------|--------------------|-----------------------|-----------------------|---------------------|-----------------------------|

|                |           |                       |      |                          |      |                           |
|----------------|-----------|-----------------------|------|--------------------------|------|---------------------------|
| Sargent test   | Pre-test  | 45.43                 | 1.72 | 27.49                    | 2.11 | Statistically Significant |
|                | Post-test | 47.02                 | 1.63 |                          |      |                           |
| Speed test     | Pre-test  | 16.46                 | 0.52 | 21.29                    |      | Statistically Significant |
|                | Post-test | 31.60                 | 0.49 |                          |      |                           |
| Sample Size=18 |           | Degrees of Freedom=17 |      | Significance Level= 0.05 |      |                           |

**Source:** Prepared by Belkacemi Brahim et al (2025) by (SPSS V25).

- a- **Presentation and Analysis of the First Hypothesis Results:** It is observed from Table No. (03) for Sargent test that the value of the Arithmetic Mean in the Pre-test measured 45.43 cm with a Standard Deviation (SD) of  $\pm 1.72$ . In contrast, the Arithmetic Mean in the Post-test reached 47.02 cm with a Standard Deviation of  $\pm 1.63$ . There were evident differences between the pre-test and post-test measurements for the Sargent Test, which measures the quality of Jump Height (vertical jump). The Calculated t-value reached 27.49, which is significantly greater than the Critical t-value of 2.11 (at the 0.05 significance level). This outcome confirms the existence of statistically significant differences between the pre-test and post-test measurements for the sample studied.
- b- **Presentation and Analysis of the Second Hypothesis Results:** It is observed from Table No. (03) for the Speed test that the value of the Arithmetic Mean in the Pre-test measured 16.46 with a Standard Deviation (SD) of  $\pm 0.52$ . In contrast, the Arithmetic Mean in the Post-test reached 1.603 with a Standard Deviation of  $\pm 0.49$ . There were evident differences between the pre-test and post-test measurements for the 30m Sprint Test, which measures the quality of speed. The Calculated t-value reached 21.29, which is greater than the Critical t-value of 2.11 (at the 0.05 significance level). This confirms the existence of statistically significant differences between the pre-test and post-test measurements for the sample studied.

**Fig 3.** Represents the results of the Pre-test and Post-test for the Sample in the Sargent Test and Speed test.



**Source:** Prepared by Belkacemi Brahim et al (2025) by (SPSS V25).

## ❖ Discussion of Hypotheses based on the Results:

### a- Hypothesis One

**Hypothesis:** There are statistically significant differences between the mean scores of the players in the quality of Jump Height between the pre-test and post-test measurements.

Based on the results obtained in Table No. (03) and illustrated in Figure No. (03), the Arithmetic Mean of the post-test was greater than the Arithmetic Mean of the pre-test, and the Calculated t-value was greater than the Critical t-value at the 0.05 significance level. This indicates that the differences between the two means are statistically significant at the 0.05 level, which supports the first sub-hypothesis.

This improvement in results is attributed to the positive effect of the plyometric training program on enhancing Jump Height in Under-17 football players. This improvement aligns with several previous studies, such as the study by Meddah Rachid and Sassi Abdel Aziz (2020), which confirmed that plyometric training works to develop explosive strength by increasing the strength and efficiency of the lower limb muscles. This allows for movement performance in the shortest possible time, overcoming external resistances with greater power and ease. Al-

Kherraz Abdelhak et al (2024) further added in there study that the function of the athlete's lower limbs is directly linked to training centered on physical exercises that enhance the efficiency of the neuromuscular system of the lower limbs, which in turn generates greater explosive power in the form of kinetic resistance, such as speed, jumping, or leaping. This is corroborated by Adel Abdel Hamid Al-Fadhi (2016, p. 10), who confirmed that plyometric training improves the ability of the neuromuscular system to generate maximum force in the shortest possible time. Based on the above, Hypothesis One is confirmed.

### **b- Hypothesis Two**

**Hypothesis:** There are statistically significant differences between the mean scores of the players in the quality of Speed between the pre-test and post-test measurements.

Based on the results obtained in Table No. (04) and illustrated in Figure No. (03), the Arithmetic Mean of the post-test was greater than the Arithmetic Mean of the pre-test, and the Calculated t-value was greater than the Critical t-value at the 0.05 significance level. This indicates that the differences between the two means are statistically significant at the 0.05 level, which supports the second sub-hypothesis.

This improvement in results is attributed to the positive effect of the plyometric training program on enhancing Speed in Under-17 football players. This improvement is consistent with several previous studies, such as the study by Jaafar Nawal and Salami Said Ali (2023), which concluded that plyometric training plays a direct and effective role in improving the muscle elasticity of the lower body, which allows for the development of maximum speed in Under-17 basketball players. The study by Hemmiche Zakaria et Kabouya Mohammed (2023) stated that training with the most modern methods, including plyometric exercises for developing lower limb power, leads to the development of the quality of explosive strength, which encompasses speed of all types, in addition to improving the ability to withstand external resistance and change direction with jumping and leaping during athletic performance.

Based on the above, Hypothesis Two is confirmed. In the same context, Bastawisi Ahmed (2014, p. 206) considers plyometric exercises to be crucial for developing explosive power. These exercises have been used by coaches for a long period, dating back to the 1960s, achieving great success due to their association with advancing the performance levels in many different sports and activities. Plyometric exercises were used to develop explosive strength even



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without explicitly using the term itself. These exercises work by elongating muscle fibers through eccentric muscular contraction, immediately followed by a concentric contraction, causing the muscle fibers to undergo elongation and shortening (Kamal Jamil Al-Rabdi, 2004, p. 232).

### **14. Conclusions**

The results of this study demonstrated that the proposed plyometric training program had a positive and statistically significant effect on improving both explosive strength (Jump Height) and Speed in Under-17 football players. The results can be summarized as follows:

- The plyometric training program contributes to a marked improvement in explosive strength among Under-17 football players.
- Plyometric training plays a significant role in developing the quality of speed among youth (juniors).
- The recorded statistical differences reflect the effectiveness of plyometric training in enhancing explosive strength and the physical efficiency of athletes, especially the youth category, and it is a suitable option for developing their general and specific physical performance.

### **15. Recommendations:**

Based on the results and conclusions reached, the following recommendations can be made:

- The use of plyometric training exercises leads to the improvement of explosive strength in the leg muscles of football players.
- The necessity of designing training programs in accordance with age-specific and physical characteristics, while respecting the principle of progression in intensity and load.
- Conducting more similar studies on other samples and under different conditions.

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