The journal « sports creativity »

Volume: (17) / N°: (01)-(2026), p 150-176

The effect of plyometric training units on developing explosive strength to enhance blocking skills in volleyball players

تأثير وحدات تدريبية بالتدريب البليومتري لتطوير القوة الانفجارية لتنمية مهارة الصد لدى لاعبي الكرة الطائرة

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Received: 11/12/2025 **Accepted: 05/02/2026** **Published:30/03/2026**

Abstract:

This study aimed to identify the effect of proposed training units using plyometric training on the development of explosive strength and the improvement of blocking skill performance in under-17 volleyball players. An experimental method was employed on a sample consisting of 20 players from the Riad Chabab M'sila team. The plyometric training program was applied to the players, and the Statistical Package for the Social Sciences (SPSS) was used to analyze the data and verify the validity of the research hypotheses.

The results revealed statistically significant differences in the post-test between the control and experimental groups, in favor of the experimental group, indicating the effectiveness of plyometric training in developing explosive strength and improving blocking skill performance. Accordingly, the study recommended incorporating this type of training into volleyball training programs and called for further studies to investigate the effect of plyometric training on other technical skills.

Keywords: Plyometric training, blocking skill, volleybal

الملخص:

هدفت هذه الدراسة إلى التعرف على تأثير وحدات تدريبية مقترحة باستخدام التدريب البليومتري في تنمية القوة الانفجارية وتحسين أداء مهارة الصد لدى لاعبي الكرة الطائرة أقل من 17 سنة. استخدمنا المنهج التجريبي على عينة مكوّنة من 20 لاعباً من فريق رائد شباب المسيلة، حيث تم تطبيق البرنامج التدريبي البليومتري عليهم، مع الاستعانة بالحزمة الإحصائية (SPSS) لتحليل البيانات والتحقق من صحة الفرضيات أظهرت نتائج الدراسة وجود فروق ذات

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دلالة إحصائية في الاختبار البعدي بين المجموعتين الضابطة والتجريبية، وكانت هذه الفروق لصالح المجموعة التجريبية، مما يدل على فعالية التدريب البليومتري في تنمية القوة الانفجارية وتحسين مهارة الصد. وقد أوصت الدراسة بضرورة اعتماد هذا النوع من التدريب ضمن البرامج التدريبية للاعبي الكرة الطائرة، مع الدعوة إلى إجراء دراسات إضافية لتقصي تأثير التدريب البليومتري على مهارات فنية أخرى.

الكلمات المفتاحية: التدريب البيومتري، مهارة الصد،الكرة الطائرة

Introduction and problematic of the study:

Volleyball is one of the sports that not only relies on individual skills and technical abilities but also requires the player to possess a high level of development in a set of basic physical attributes that are considered among the most important elements of physical fitness specific to the game. These elements can be influenced and improved thru appropriate training programs. Volleyball has witnessed significant development in both organizational and technical aspects, prompting us to question the extent to which the game keeps pace with these advancements and its ability to adapt to modern innovations in the field of sports training, whether in physical, skill-based, tactical, or mental aspects. Reaching global levels is a goal that can only be achieved thru proper training of youth categories and sports training schools, relying on specialized technical frameworks, and using effective training methods that select appropriate exercises for each age group according to modern scientific training methods (Saqli, 1996, p. 10). The rapid development in achieving high sports levels in various sports fields, whether in team or individual games, goes hand in hand with the technology of sports training sciences. The advancement to this level did not come from nowhere; rather, science has always been and remains the foundation. Consequently, efforts have been ongoing toward a deeper understanding of the foundations, rules, and concept of sports training science to elevate the training condition and reach high levels. This requires shedding light on what is new and innovative in the field of training and its applications. A

strong and successful coach derives their success and strength from science, and if they wish to maintain that, they must always stay updated with the latest developments and use science as a guiding light in their training work. (Amr Allah, 1998, p. 01) Explosive strength is considered one of the important factors for performing most skills in this sport in general. Therefore, a volleyball player must possess a high degree of strength, speed, and coordination to integrate speed and muscular strength, as these qualities are crucial for achieving maximum explosive power when performing skills. Given the importance of this element or characteristic in performing motor skills and developing skillful performance, coaches have increasingly focused on developing it and have adopted various training methods and techniques, including the plyometric training method. Donalld sees plyometric training as a targeted approach aimed at developing the explosive power of the legs. This has been confirmed by several studies and research, such as the study by Veroshansky (1968), who tested the use of various forms of the plyometric method to measure the increase and growth in explosive power of the upper and lower limbs (Jamal, 2011, p. 17). Plyometric exercises have become one of the effective training methods that can be employed in a wide range of sports activities. This type of training helps bridge the gap between maximum strength and speedspecific strength, leading to the enhancement of explosive motor abilities in athletes. The basic idea of plyometric training is based on the mechanism of muscle stretching and shortening during performance, where the muscle is lengthened in the first phase of the movement and then immediately shortened. This process is known as the stretch reflex, which is the central principle of plyometric training. This type of training aims to utilize the elastic energy stored in the muscles during the stretching phase and invest it in the subsequent contraction phase to generate greater explosive strength, which is known as the stretchshortening cycle

(Bashtosi, 1996, p ...). Based on the above, we decided to pose the following general question: Does the method of plyometric training influence developing explosive strength and improving the Blocking skill among volleyball players under 17 years old?

Partial questions:

- Are there statistically significant differences in the pre-test between the control group and the experimental group for explosive strength and Blocking skill among volleyball players under 17 years old?

- Are there statistically significant differences in the post-test between the control group and the experimental group for explosive strength and Blocking skill among volleyball players under 17 years old?

Hypotheses of the study:

General hypothesis:

- The plyometric training method has an effect on developing explosive strength and improving the Blocking skill among volleyball players under the age of 17.

Partial hypotheses:

- There are no statistically significant differences in the pre-test between the control group and the experimental group for explosive strength and Blocking skill in volleyball.

- There are statistically significant differences in the post-test between the control group and the experimental group for explosive strength and Blocking skill in volleyball.

Importance of the study:- The importance of the study lies in elevating the athlete from a lower level to a higher level, which helps provide sports teams with some elements capable of achieving victory and positive results.

- Proposing training units to develop explosive strength and improve the performance of the high spike technique among volleyball players.

- This study helps in applying a set of exercises intended for use by coaches to develop the physical and technical attributes of volleyball players. This study contributes to the development of the game and aims to advance scientific research in Algerian volleyball.

Study objectives:

-Identifying whether there are statistically significant differences in the pre-test between the control group and the experimental group for explosive strength and Blocking skill in volleyball.

-Identifying whether there are statistically significant differences in the post-test between the control group and the experimental group for explosive strength and Blocking skill in volleyball.

Defining the concepts and terms of the study:

Training:

A-Terminologically: It means a set of planned procedures based on scientific foundations, implemented according to specific conditions, and aimed at achieving a goal or purpose in a particular field (Amr Allah, 1998, p. 2).

B-Operationally: It is a set of programs and curriculum that adhere to scientific principles with the aim of developing the player's abilities and reaching the best level.

Plyometric training:

A-Terminologically: A method and system of a set of definitions that primarily rely on the elasticity of the muscle to impart high kinetic energy by exceeding the maximum possible strength and speed with the aim of developing explosive power. Marwan, 2015, p. 118)

B- Procedurally: These are activities that involve a cycle of stretching and contracting of the working muscle, which causes its flexibility and allows the

muscle to utilize the reflected mechanical energy resulting from the stretching effect, leading to greater strength and speed in performance.

Explosive strength:

A-Terminologically: It is the instantaneous ability of a muscle or a group of muscles to produce the maximum muscle contraction once and in the shortest possible time. (Esmaeil, Youssef, 2005, p. 115)

B-Operationally: It is the maximum force that the athlete can produce during a muscle contraction now of jumping from the ground and smashing the ball with the arms.

Volleyball:

A-Terminologically: It is one of the most popular sports in which two teams are separated by a high net, and the objective is to hit the ball over the net into the opponent's area. Each team has three touches to hit the ball over the net. A point is scored for the team when the ball hits the opponent's ground, or if a fault is committed, or if the team fails to block the ball and return it correctly. Raad, 2010, p. 77.

B-Operationally: Volleyball is a team sport played on a court that is 18 meters long and 9 meters wide, separated in the middle by a net that is 2.43 meters high for the junior category. Each team consists of 6 players, and the teams take turns passing the ball over the net, with each team trying to send it to theopponent's ground in a way that prevents them from returning it, using basic skills such as spiking.

Blocking Terminological Definition: Blocking in volleyball is defined as one of the fundamental defensive skills. It refers to the attempt by one or more front-row players to stop or impede the opponent's attack by performing a vertical jump near the net and extending the arms above the net level to intercept the ball or return it to the opponent's court (Allawi, 1999.(

: **Operational DefinitionOperationally**, blocking refers to the action performed by one or more players who jump alongside the net at the appropriate timing and extend their arms upward to intercept the ball resulting from the opponent's spike, with the aim of preventing the ball from crossing the net or reducing its speed and directing it toward the opponent's court or to a teammate (Mufti, 2004; International Volleyball Federation [FIVB], 2016

Adolescence:

A-terminologically: It is derived from the change from the word adlexem, which means "to grow" in Latin.(Saadiah Mohamed Ali, Scientific Research House, p.25

B-Operationally: These are the changes that an individual undergoes during a certain stage where personality traits begin to emerge and crystallize, forming the initial nucleus for the development of the man of the future.

Previous studies:

First study: Bounchada Yassine, thesis submitted in partial fulfillment of the requirements for the Master's degree, University of Algiers 3, 2010/2011

Study Title: The Impact of Using Plyometric Training Methods During a Training Program on Developing Explosive Strength and Some Basic Skills in Junior Volleyball Players.The objective of the study**:** Designing a training program for integrated physical preparation in developing specific endurance in football for the senior category and understanding its impact on developing specific endurance during the special physical preparation phase for football players.

Study sample: The sample included the Amel Djelfa volleyball team, youth category. The methodology used**:** the experimental method.

Study hypotheses:

-Plyometric training during atraining program effectively impacts the explosive strength attribute and some basic skills among volleyball setters.

-Plyometric training during a training program positively affects the jump height of intermediate volleyball players.

-Plyometric training during a training program positively affects explosive strength among intermediate volleyball players.

-Plyometric training during a training program positively affects execution speed among intermediate volleyball players.

Study conclusions: -Plyometric training positively affects the improvement among intermediate volleyball players. Plyometric training positively affects explosive strength among intermediate volleyball players. -plyometric training positively affects execution speed among intermediate volleyball players. Plyometric training during a training program effectively impacts the quality of explosive strength and some basic skills among intermediate volleyball players. Does the effect of plyometric training vary with the duration or intensity of the training program applied to the players?

Second Study Smara Mohamed & Haimoud Ahmed"A Study of the Effect of Plyometric Training on Improving Explosive Strength among Volleyball Players Under 19 Years Old."Published in the Journal of Human Sciences, Vol. 31, No. 02, University of Constantine.The study aimed to identify the effect of a plyometric training program on improving explosive strength among volleyball players. The researchers used the experimental method as it suits the nature of the study. Physical tests related to explosive strength were used as the primary data collection tool. The sample consisted of 16 volleyball players under 19 years old from the "El Jeel Essaed" team of Ouled Addouane, competing in the premier division. The sample was divided into two groups of 8 players each. The plyometric program was applied to the experimental group for a duration of 8 weeks, while the control group followed the coach's traditional training program.

The study concluded with the following results: Implementing plyometric exercises has a positive effect on improving explosive strength. There are statistically significant differences between the pre- and post-tests for the experimental group across all tests, in favor of the post-test.

No statistically significant differences were found between the experimental and control groups in the post-tests.

Third Study Ghallab Hakim & Boukeratm Belkacem (2019)"The Effect of Proposed Plyometric Training Units on Lower-Limb Explosive Strength among Volleyball Players Under 19 Years Old."Published in Sports Creativity Journal, Vol. 10, No. 04.This study aimed to investigate the effect of plyometric training units on the lower-limb explosive strength of volleyball players under 19 years old. The study population included all volleyball teams in the Wilaya of M'sila in the youth category. The sample was intentionally selected due to the nature and requirements of the research. The sample consisted of two teams:

The "MSila Sports Star" team (10 players), which formed the control group.

The "Raed Chabab M'sila" team (10 players), which formed the experimental group. The researchers used the experimental method and conducted physical tests, specifically the standing long jump and the vertical jump tests.

The study concluded that plyometric exercises have a positive effect on developing explosive strength among volleyball players under 19 years old.

The practical aspect:The exploratory experiment: The exploratory experiment was conducted on a sample that included 5 players from the Riad ChababM'sila volleyball team, under 17 years old. The test was administered to them and then repeated after 5 days, after which they were excluded from the original experiment. The sample taken met the research sample criteria. Spatial domain: I conducted this study at the Maïouf Salem Multipurpose Hall in the Rotal Beshir Sports Complex in the Wilaya of M'Sila, and the pre- and post-tests

were held in the same hall. Time frame: It extended over the period: from 02/01/2025 to 30/05/2025.

- The methodology followed in the study: The methodology means a set of principles and rules that the researcher follows in order to reach the truth. Ammar Bouhouch says: "It is the method that the researcher follows in studying the problem to discover the truth." Amar, 2001, p. 137).

- It is a set of rules and regulations established to reach accepted facts about phenomena of interest to researchers in various fields of human knowledge (Anderson, 1974, p. 327).

- The methodology in scientific research varies depending on the topics, so there are many types of scientific methodologies, as the nature of the study and the type of problem determine the methodology followed in the study.

The objective of the current studyis to determine the impact of plyometric training on developingexplosive strength to improve the Blocking skill among volleyball players under the age of 17. The nature of this study investigates the causality between more than two variables, which is a relationship of influence and effect. Accordingly, the experimental method was used.

The experimental method: The experimental method refers in its general scientific content to measuring a specific situation, factor, or phenomenon. Mohammed, 1983, p. 117). Based on the study problem that investigates the extent of the impact of plyometric training on developing explosive strength and improving the Blocking skill among volleyball players under 17 years old, the experimental method is the most suitable for this study. Mohamed Hassan Al-Alaoui and Osama Kamel Rateb state, "The experimental method is the only research method that can truly test the hypotheses of cause-and-effect relationships" (Al-Alaoui, Osama, 1999, p. 123).

As defined by Salah Mustafa Al-Ghul: "It is a deliberate and controlled change in the specific conditions of an event, observing the changes occurring in that event and interpreting them." Fadail, 1999, p. 123).

I used two groups (the experimental and the control) with pre-test and post-test measurements, and I used this method because it suits the nature of the study and helps achieve the research objectives.

To verify the hypotheses in this study, the experimental method was followed, which is considered one of the most precise methods in the sciences because it is the closest to objectivity and allows the researcher to control the various factors that affect the studied phenomena.

Study Population and Sample:

In order for the research to be acceptable and feasible according to the experimental method, it is necessary to define the research population we want to examine and clarify the measures used for it.

-Study population: The original community for my research is the Raed Chabab M'sila Team, Under-17 Category)

- Study Sample: It is the study group from which field data is collected, and it is considered part of the whole. In respect of the methodological foundations in conducting scientific research and to be more accurate and objective, the research sample was selected from the original community and included 20 players from the team distributed as follows:

The experimental sample: which included 10 players.

Control group: which included 10 players.

Type of sample: Purposive, as it aligns with the study's objectives.

- Homogeneity of the sample: One of the fundamentals of applying and implementing the experimental method is controlling all variables and factors that may affect the main research experiment. To ensure that the difference

between the research results is attributed to the independent variables, we conducted homogeneity among the study sample members concerning certain variables (height, weight, age). This was achieved by applying the (T) test for paired samples.

Statistical methods	Control group		Experimental group		T value	T significance	Decision
Variables	Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation			
Height	177.00	5.66	176.9	5.76	0.039	0.97	Not applicable
Weight	60.30	7.61	61.0	6.66	0.12	0.90	Not applicable
Age	16.50	0.78	16.40	0.87	0.27	0.79	Not applicable

Table No. (01): Represents the homogeneity of the two samples in (height, weight, age)

- Through Table 01, we can conclude the following:

Regarding height, the value of (T) reached 0.039 with a significance level of 0.97, and we have 0.97 < 0.05, meaning there are no statistically significant differences between the control and experimental groups. This indicates that the two groups are homogeneous in terms of the height variable.

As for weight, the value of (T) was 0.12 with a significance level of 0.90, and we have 0.90 < 0.05, which means there are no statistically significant differences

between the control and experimental groups. This indicates that the two groups are homogeneous in terms of the weight variable.

Regarding weight, the value of (T) was 2712 with a significance level of 0.79, and we have 0.79 < 0.05, which means there are no statistically significant differences between the control and experimental groups. This indicates that the two groups are homogeneous in terms of the age variable.

Data collection tools: Study tools are the main axis on which the researcher relies and employs to uncover the truth about the study problem.

- The theoretical aspect of the research: The researcher relied in the theoretical part of the study on specialized books and previous similar studies, all in Arabic and foreign languages. **5-5-2- The practical aspect of the research:** The researcher relied on plyometric exercises and pretest and post-test in the practical aspect.

- The test used:

Physical tests for explosive strength:

Explosive strength of the lower limbs:

Vertical jump test from a standing position (Sargent): (38p, 2012, aurelinenbroussai).

The purpose of the test: Measuring the vertical jump of the athlete (measuring the vertical muscular power of the legs).

Tools: piece, chalk, wall, metric tape measure.

Method of performance: The tester warms up well before starting the test.

The athlete places a piece of chalk between his fingers. The distance between the shoulder and the wall is about 15 cm, and the heels are touching the ground, then he draws on the wall at the highest possible point.

Then the tester swings their arms back, jumps, and marks a second line on the wall.

The tester must make three attempts.

Recording: The first distance is recorded before the jump. Recording the second distance after the jump (choosing the best attempt out of 3 attempts). The difference between them is the test result.



Figure No. (01): Shows the Sargent vertical jump test

Effectiveness Test of the Blocking Skill Performance in Volleyball

Purpose of the Test

The purpose of this test is to assess the player's level of performance in the blocking skill in terms of:

Appropriate timing of the jump-

Height reached above the net-

Positioning of the arms and hands-

Ability to impede or stop the opponent's spike-

Equipment Used

A regulation volleyball court-

A volleyball net set at the official height according to the age category-

Regulation volleyballs-

Adhesive tape or floor markers-

A score recording sheet-

A stopwatch-

Test Description (Performance Procedure)

.1The tested player stands in one of the front-row blocking positions (positions 2, 3, or 4.)

.2Another player or the coach performs spikes from the opposite side of the court toward a predetermined direction.

.3The tested player attempts to block the ball using proper blocking technique above the net.

.4The player is given ten (10) consecutive attempts.

.5The result of each attempt is recorded according to the approved scoring system.

Performance Explanation and Interpretation

The success of blocking depends on coordination between

Proper motor timing of the jump-

Explosive leg power-

The extent to which the arms are extended above the net-

Correct positioning and direction of the hands to prevent the ball from crossing the net-

Scoring Method

-Successful block that directly returns the ball to the opponent's court: 3 points

-Contact with the ball that clearly changes its direction: 2 points-

-Contact with the ball without effective impact: 1 point-

-Failure to touch the ball: 0 points-

Final score = the total points of the ten attempt

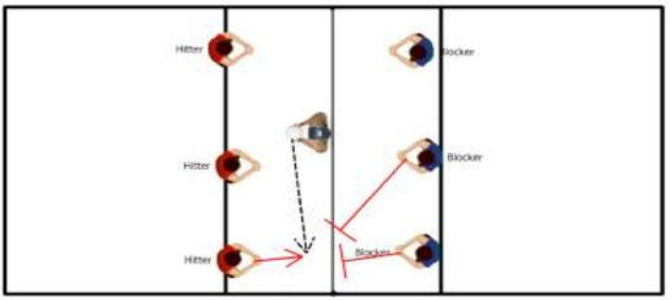


Figure No. (03): It shows the accuracy test of the Blocking skill.

-The psychometric properties of explosive strength and high crushing skill tests:

Reliability: To calculate the reliability coefficient, the researcher used the test-retest method on a sample of consisting of 05 players (pilot study sample) who were excluded from the main study sample. The reliability coefficient was calculated using Pearson's correlation coefficient.

Validity: To determine the internal consistency of the explosive strength and high crushing skill tests used, we calculated the square root of the reliability coefficient, and Table No. (02) It shows the results of the psychometric properties of the tests applied to the pilot sample:

Table (02): Shows the psychometric properties of explosive strength and high crushing skill tests

Tests	Test		Retest		Reliability	Self-confidence
Variables	Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation		
Sargent	48	04	48.50	5.36	0.95	0.95
Blocking	9.33	2.50	10.17	1.72	0.95	0.95

Through Table (02): We observe that the reliability and validity coefficients of the tests used in the research are high, with the first ranging between 0.85 and 0.91 and the second between 0.92 and 0.95. This indicates the validity and reliability of the tests applied to the research sample studied.

Statistical tools:

- The arithmetic mean.
- Standard deviation.
- Paired t-test (for one sample).
- Independent samples t-test (for two samples).
- Pearson's simple correlation coefficient.

- Study design for statistical processing:

- Study Design:

- Study Tests: The study was designed by the researchers following systematic steps in accordance with scientific research standards. This included conducting a pre-test for both samples (control and experimental) after the warm-up process. After completing the series of plyometric training, a posttest was conducted for both samples (control and experimental), and the results were recorded and compared according to the hypotheses of this research. - Statistical analysis: In light of the study's objectives and hypotheses, the students used some statistical methods to process the data and test the validity of the hypotheses, which included the following:

1- SPSS program

2- Arithmetic mean

3- The standard deviation

4- T-Test for independent samples and paired samples

- Steps for conducting the field study:

- The field experiment:

- Upon reviewing the data extracted from the exploratory experiment, the student conducted the field experiment as follows:

- Pre-test: The pre-test was conducted on both groups (control and experimental) on 19-03-2025. Before starting the test, warm-ups and explanations of the tests were conducted for the players to ensure a good understanding and correct application of the tests, followed by conducting the tests on the team's designated field.

- Exercise duration: The student determined the exercises according to a series of plyometric exercises divided into training units. The duration of each exercise varies according to its position and goal in the session and the overall goal of the session within the weekly and monthly cycle.

- Post-test: The post-test was conducted on both groups (control and experimental) on 30-05-2025.

Presentation and analysis of results:

-Presentation of the differences between the control and experimental groups in the pre-tests of explosive strength and high crushing skill:

To determine the nature of the differences between the control and experimental groups in the tests of explosive strength and high crushing skill, independent samples t-tests were used, and the following table illustrates this:

Table No. (03): Shows the nature of the differences between the control and experimental groups in the pre-tests of explosive strength and high crushing skill.

Test	Pilot sample		Control sample		Calculated T-value	Schedule t-value	Error rate	Degree of freedom	Statistical significance
	Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation					
Sargent	48.40	2.59	48.10	2.33	0.27	2.10	0.05	18	Not applicable
Blocking	10.60	1.51	9.90	2.18	0.84				Not applicable

According to Table (3), we observe that the mean value of the experimental sample in the pre-test coefficient was 48.40 with a standard deviation of 2.59, while the mean value of the control sample was 48.10 with a standard deviation of 2.33.. The mean value of the experimental sample in the **Blocking** test was 10.60 with a standard deviation of 1.51, while the mean value of the control sample was 9.90 with a standard deviation of 2.18.

We also observe that the calculated t-values between the control and experimental groups in the following pre-tests: Sergeant,. This indicates that there are no statistically significant differences between the control and experimental groups in the pre-tests of explosive strength and high crushing skill.

- Presentation of the results of the differences between the explosive strength tests and the **Blocking** skill pre- and post-tests for the experimental sample:

To determine the nature of the differences between the explosive strength tests and the high crushing skill pre- and post-tests for the experimental sample, a paired t-test was used, and the following table illustrates this:

Table No. (4): Shows the nature of the differences between the explosive strength tests and the **Blocking** skill pre- and post-tests for the experimental sample.

Test	preliminary		dimensional		Calculated T-value	Schedule t-value	Error rate	Degree of freedom	Statistical significance
	Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation					
Sargent	48.40	2.59	52	2.21	3.43				applicable
Blocking	10.60	1.51	12	1.05	4.58				applicable

Through Table No. 4, we notice that the mean value of the experimental sample in the pre-Sargent test was 48.40 with a standard deviation of 2.59, while the mean value of the post-test was 52 with a standard deviation of 2.21.. The mean value of the experimental sample in the pre- **Blocking** test was 10.60 with a standard deviation of 1.51, while the mean value of the posttest was 12 with a standard deviation of 1.05.

We also notice that the calculated t-values between the pre-test and post-test for the following tests: Sargent, This indicates significant differences between the pre-test and post-test for the following tests: Sargent, and Blocking in the experimental sample, favoring the post-test because its mean values (52, 7.81, 12) are greater than the mean values of the pre-test (48.40, 07, 10.60). This means that the experimental sample improved in explosive strength and

Blocking tests, and this improvement is attributed to the applied training program.

6 - 1- 3- Presentation of the results of the differences between the pre-test and post-test of explosive strength and **Blocking** skill in the control group: To determine the nature of the differences between the explosive strength tests and the **Blocking** skill pre- and post-tests for the control group, a paired t-test was used, and the following table illustrates this:

Table No. (5): Shows the nature of the differences between the explosive strength tests and the **Blocking** skill pre- and post-tests for the control sample.

Test	preliminary		dimensional		Calculated T-value	Schedule t-value	Error rate	Degree of freedom	Statistical significance
	Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation					
Sargent	48.10	2.33	47.70	1.66	0.30	2.26	0.05	09	Not applicable
Blocking	9.90	2.18	9.90	2.18	0.84				Not applicable

Through Table No.5, we observe the mean value of the experimental sample in the pre-Sargenttest was 48.10 with a standard deviation of 2.33, while the mean value of the post-test was 47.90 with a standard deviation of 1.66 the pre-high crush test was 9.90 with a standard deviation of 2.18, while the mean value of the post-test was 10.20 with a standard deviation of 1.69.

We also observe that the calculated t-values between the following pre-test and post-test: Sargent, and **Blocking** in the control group.

6 - 1- 4-Presentation of the results of the differences between the control and experimental groups in the post-tests of explosive strength and **Blocking** skill:

To determine the nature of the differences between the control and experimental groups in the tests of explosive strength and **Blocking** skill, an independent samples t-test was used, and the following table illustrates this:

Table No. (5): Shows the nature of the differences between the control and experimental groups in the post-tests of explosive strength and **Blocking** skill.

Experimental sample	Control sample								
Test	Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation	Calculated t-value	Tabulated t-value	Error rate	Degree of freedom	Statistical significance
Sargent	52	2.21	47.90	1.66	4.69	2.10	0.05	18	applicable
Blocking	12	1.05	10.20	1.69	2.86				applicable

Through Table No.5, we notice that the mean value of the experimental sample in the post-Sargent test reached 52 with a standard deviation of 2.21, while the mean value of the control sample was 47.90 with a standard deviation of 1.66.. The mean value of the experimental sample in the high jump test was 12 with a

standard deviation of 1.05, while the mean value of the control sample was 10.20 with a standard deviation of 1.69.

As we observe, the calculated t-values between the control and experimental groups in the following post-tests: Sergeant, and 18 degrees of freedom. This indicates significant differences between the control and experimental groups in the post-tests of explosive strength and **Blocking** skill, favoring the experimental group because their mean values in the tests: Sergeant, 3 kg medicine ball throw, and high crushing are greater than the mean values of the control group. This difference is attributed to the applied training program.

Discussion and comparison of the results with the hypotheses:

Discussion and comparison of results with the first hypothesis: Based on the results obtained, it was found that there are no differences regarding (explosive strength, **Blocking** skill), which means that both groups have the same level. This is confirmed by the results of the pre-tests, which supports the first hypothesis that states there are no statistically significant differences in the pre-test between the control group and the experimental group for explosive strength and Blocking skill among volleyball players under 17 years old. Therefore, we conclude that there is agreement with the, which confirms that there are no statistically significant differences in the pre-test between the control group and the experimental group regarding the effect of plyometric training on the development of jumping for the blocking skill.

- Discussion and comparison of results with the second hypothesis: Based on the results obtained, it was found that there are differences regarding (explosive strength, Blocking skill) between the control and experimental groups in the post-tests. This means that there is an improvement in favor of the experimental group, which underwent the training program that included plyometric exercises. This confirms that the second hypothesis was achieved, which states

that there are statistically significant differences in the post-test between the control group and the experimental group for explosive strength and Blocking skill among volleyball players under 17 years old.

This is what the study by Ben Yahia Abdallah (2021) indicated, confirming the existence of statistically significant differences in the pre-test and post-test for the control group and the experimental group regarding the impact of plyometric training on the development of the jump skill for blocking. Additionally, there is also the study by Hamraein Adel and Boukhatem Mohamed (2014), which included that there are statistically significant differences between the pre-test and post-test in favor of the post-tests for the experimental research sample in the blocking skills

Discussion and Comparison of Results with the General Hypothesis: In light of the study's results and discussion and based on the results obtained in the partial hypotheses, it can be said that they align with the general hypothesis. Therefore, it can be concluded that the general hypothesis, which states that plyometric training has an effect on developing explosive strength and improving the Blocking skill in volleyball for the under-17 category, is supported. This was evident thru the training program applied to the experimental group, where the plyometric training method was used, and it had a clear impact on the players' physical and skill performance levels. This is what a study for a master's degree (Bounchada Yassine, 2011) indicated, which focused on the impact of using the plyometric training method during a training program on developing explosive strength and some basic skills in volleyball players under the age of 17. The training program using the plyometric training method, with a set of plyometric exercises, achieved a noticeable improvement in developing explosive strength and some basic skills in volleyball. This is also what was indicated by the study (Adel, Mohamed, 2014).

This included the use of plyometric exercises to develop and improve explosive strength for the skills of blocking in volleyball players. The researchers concluded that the plyometric training method positively affects the improvement of explosive strength and the skills of blocking. This was determined through a comparison with previous studies that included the same topic. Additionally, there is also the study by Lahaj Issa (2015), which, through comparing its results with its hypotheses, concluded that plyometric training has a clear positive effect on improving the basic skills of volleyball players. After applying for the program that includes this type of exercise, which is a form of plyometric training, there was a noticeable improvement in the players' performance. There is also a study (Abdullah, 2021) which included that plyometric training has an effect on developing the jump for the blocking skill in volleyball.

- General Conclusion:Considering the results and their discussion, we can conclude the following:

1. Plyometric training had a positive effect on the explosive strength attribute of volleyball players under the age of 17.
2. There are no statistically significant differences between the control and experimental groups regarding the pre-tests. There are no statistically significant differences between the control and experimental groups regarding the pre-tests.
3. There are statistically significant differences between the control group and the experimental group regarding the post-tests.
4. The use of plyometric training influences developing explosive strength and improving the Blocking skill in volleyball, both in the pre-training phase and in the training phase.

Suggestions:

- Using plyometric training to develop explosive strength. Using plyometric training to improve the Blocking skill in volleyball.
- Emphasizing scientific principles when designing the training program in terms of selecting physical and skill exercises, repetitions, time, and rest intervals, as well as the tools used, due to their impact on the physical development of volleyball players.
- Paying attention to the technical aspects of volleyball players because it is the key to success and excellence, especially. Providing the necessary pedagogical tools and resources to facilitate the training process and ensure its smooth progression.
- Involving trainers in workshops and training courses so they can benefit from them and enhance their cognitive, scientific, and training capabilities. The necessity for coaches to focus on linking physical, skill-related, and tactical aspects within the proposed training curriculum using the plyometric training method.
- Conducting physical measurements before, during, and after the sports season to understand the impact of training programs and facilitate the process of regulating training loads.

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