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The impact of plyometric training on developing some special physical abilities in football players U19.

تأثير التدريب البليومتري على بعض الصفات البدنية لدى لاعبي كرة القدم U19.

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Abstract:

The goal: This study sought to evaluate the effect of a training program based on plyometric exercises in developing some basic physical qualities, namely explosive strength of the lower limbs and speed, in youth football players (U19).

Methodology: The study was based on the experimental approach using an equivalent groups design, where the sample included 20 youth players who were equally distributed into two groups. The experimental group underwent an 8-week plyometric training program, while the control group followed its traditional programs. The program included 3 training sessions per week and lasted for two months, and used plyometric exercises such as jumps and interval training. Physical performance was measured through a 30-meter speed test and a vertical jump test (Sergent test).

Results:

• Speed The results showed a significant improvement in the average time of performing the 30-meter speed test for the experimental group compared to the control group.

• The ability to explode According to the findings of the vertical leap test, the experimental group's lower extremity explosive strength significantly outperformed the control group's.

The study confirms that plyometric exercises are effective in enhancing speed and explosive power in youth soccer players.

Keywords: Plyometric training; Physical Abilities; Soccer.

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Introduction:

The field of physical preparation has witnessed great developments in recent decades thanks to technological progress, which has contributed to the design of training programs aimed at improving the physical and technical efficiency of athletes to achieve the highest levels of performance. Due to the popularity of football, it has become the focus of attention of researchers and coaches who seek to develop training methods that keep pace with the increasing level of global competition. According to what was stated by Baker and Newton (2008) that physical preparation has become a priority for coaches who rely on scientific foundations in designing training programs capable of investing the physical capabilities of players in the best possible way. (Baker & Newton, 2008, pp. 393-415)

The middle class is considered (U19) A critical age group characterized by physiological changes that make it ideal for developing physical attributes such as strength and speed. These changes include muscle growth and increased secretion of hormones responsible for improving physical performance, which enhances players' ability to generate force and execute rapid movements effectively. According to Malina and Bouchard (1991) that the physical preparation of players requires a careful study to choose the appropriate training methods to achieve the desired goals. (Malina & Bouchard, 1991)

Plyometric training has emerged as one of the effective methods for improving the basic physical qualities of soccer players, including explosive strength and speed. Several studies, such as the study Markovic and Mikulic (2010) indicated that plyometric training represents an effective means of developing physical performance, which made it an essential part of modern physical preparation programs. (Markovic & Mikulic, 2010, pp. 635-650) However, more scientific studies are needed to understand the specific effects of plyometric training on different age groups and performance levels. This research aims to answer the following question:

Does plyometric training have a positive effect on developing some special physical qualities in football players? U19?

- Do the pre- and post-test results show statistically significant differences favoring the experimental group in terms of football players' increased speed? U19?
- Does the experimental group's improvement in the explosive strength level of soccer players' U19 lower limbs show statistically significant differences between the pre- and post-test results?

1. Hypotheses:

1.1. General hypothesis:

- Plyometric training program has an effective impact on the development of some physical qualities in U19 football players.

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1.2. Partial hypotheses:

- • The experimental group's improvements in U19 football players' speed level are supported by statistically significant changes between the pre- and post-test results.
- • Pre- and post-test results show statistically significant differences favoring the experimental group in terms of raising the lower limbs' explosive strength level among U19 football players.

2. Objective:

The study aims to identify the effect of plyometric training on some physical characteristics of football players U19.

3. Importance :

- Highlighting the importance of plyometric training in developing the basic physical qualities of football players.
- Providing a research platform for researchers to conduct future studies on plyometric training in various sports fields, whether individual or group.

4. Reasons for choosing the topic:

• Subjective reasons:

The topic was chosen with the aim of bridging the knowledge gap in the field of sports training, as the researcher believes that plyometric training is a promising tool that needs more scientific research.

- **Objective reasons:**

The literature review revealed the scarcity of studies targeting the effect of plyometric training on specific age groups of players, in addition to the lack of interest in physical education curricula in the applications of this type of training. Therefore, the research seeks to evaluate the effectiveness of plyometric training and provide practical recommendations that serve coaches and players.

4. Terms and concepts:

5.1. Plyometric training:

• **Technically:** Abu Al-Ala Ahmed Abdel Fattah and Ahmed Nasr El-Din (1993) indicate that plyometric training is one of the advanced training methods that contribute to improving physical qualities, especially muscular strength. It is mainly used to develop the muscular strength of the leg muscles. (Ben Hamidouche & Mazari , 2022, p. 431)

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It is also known as a method that relies on muscle contraction to produce explosive movements, and focuses on developing strength characterized by speed through sudden jump exercises. (Rabeh, 2020, p. 335).

- **Procedurally:** It is a training method that relies on muscle contraction to produce explosive movements with the aim of improving the athlete's muscular strength.

5.2. Soccer :

- **Technically:** Football is a team sport played by two teams of 11 players each. Each team aims to score goals using any part of their body except their hands and arms, while only the goalkeeper is allowed to use his hands inside the penalty area. The match is managed by four referees in addition to the VAR referees. (Muhammad Mahdi , 2024, p. 181).

5.3. Physical abilities:

Technically: Physical qualities are defined as the athlete's ability to perform exercises efficiently while retaining the energy needed to continue training without fatigue. Nassif defines it as "an innate and acquired quality that enables the individual to exert his actual maximum potential with high morale. (Diaa El-Din Saadneh, 2016, pp. 71-91)

Procedurally: Refers to the set of physical abilities associated with the type of physical activity in the training program, and includes: explosive strength and transitional speed.

6. Previous and similar studies:

6.1. The effect of plyometric training on muscular strength and physical capacity in young athletes

The authors: Markovic, J. and Mikulic, B.

Year: 2010

the goal: Evaluation of the effect of plyometric training programs on improving muscular strength and physical capacity in young athletes.

methodology:

- **Sample:** Data from previous studies involving groups of young athletes were analyzed.
- **Training:** Plyometric training programs were implemented that included jumping and sprinting exercises.
- **Tests:** Measure strength and physical ability using tests such as vertical jump and horizontal jump.

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Results:

Plyometric training has led to significant improvements in muscular strength and jumping abilities in young athletes, enhancing overall athletic performance.

Recommendations:

Incorporating plyometric exercises into youth training programmers with an emphasis on safety techniques to reduce the risk of injury. (Markovic & Mikulic, 2010, pp. 635-650)

6.2. Review the effects of plyometric training on the performance of young soccer players.

the goal: An analysis of how plyometric training helps young soccer players perform better physically.

methodology:

- **Sample:** A systematic review of studies on youth soccer players.
- **Training:** Analysis of various plyometric training programs applied to players.
- **Tests:** Tests of strength, speed, and jumping ability.

Results:

Plyometric training has greatly improved strength, speed, and jumping ability, which has enhanced the overall performance of players.

Recommendations:

Implement balanced plyometric training programs to improve performance while ensuring safe practices are followed to avoid injuries. (Faigenbaum & Myer, 2010, pp. 63-73).

6.3. The effect of plyometric training on jumping ability in adolescent athletes: a meta-analysis

The authors: Tsing Y. and Wang C. H.

Year:2021

the goal: Analysis the impact of plyometric training on enhancing teenage athletes' leaping skills, as determined by numerous studies.

methodology:

- **Sample:** A comprehensive analysis of studies examining the effects of plyometric training on adolescents.
- **Training:** Evaluation of different types of plyometric exercises used in studies.
- **Tests:** Measuring jumping ability using tests such as vertical jump and horizontal jump.

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Results:

Plyometric training significantly improved jumping ability in adolescent athletes, reflecting the effectiveness of this type of training in enhancing athletic performance.

Recommendations:

Integrating plyometric training into training programmes for young athletes while ensuring adherence to safety procedures. (Tzeng & Wang, 2021, pp. 1-12)

The three studies provide a comprehensive overview of the effects of plyometric training on improving physical performance in young athletes, with a focus on muscle strength and jumping ability. These studies confirm that plyometric training is an effective means of improving athletic performance in a variety of disciplines.

Strengths :

- **homogeneity of results:** Studies have shown clear agreement on the effectiveness of plyometric training in improving muscular strength and jumping ability.
- **Sports diversity:** The studies covered a variety of sports, reflecting the comprehensiveness of the benefits of plyometric training.
- **Based on scientific evidence:** The studies were based on sound methodological foundations, which enhanced the credibility of the results obtained.
- **Practical recommendations:** The studies provide clear, actionable guidance for coaches on how to use plyometric training effectively and safely.

Points to be developed:

- **Delve into physiological mechanisms:** Future studies should focus on explaining the physiological processes that lead to the improvement resulting from plyometric training.
- **Diversity of training programs:** There is a need to study the effect of changes in the quality, intensity and density of plyometric exercises on the results.
- **General athletic performance:** The effect of plyometric training on performance should be evaluated in real-world competitions to measure its effectiveness in practice.
- **Injury prevention:** It is useful to study the role of plyometric training in reducing sports injuries, especially those related to tendons and ligaments.

2. Methodology:

The type of topic being studied and the goals being pursued are the main factors that influence the choice of a suitable research approach. In this study, the experimental method was used with a randomized control group design, because it is best suited to the nature of the issue. This method allows for the intentional manipulation of the independent variables and control of the surrounding conditions, which allows the resulting changes to be observed

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and analyzed accurately to better understand the impact of the variables. (Researcher's Life, 2024).

2.1. Survey:

A pilot study was conducted to verify the effectiveness of the main experiment and ensure its success. The study aimed to evaluate the proposed plans and identify any modifications required before starting the main experiment. The study included selecting appropriate measurement tools, determining optimal training schedules, and ensuring the safety of the procedures and their accurate implementation.

2.2. Validity and reliability of study tools:

Stability: Reliability refers to the extent to which an assessment tool produces stable and consistent results when administered to the same group of individuals under the same conditions. This means that if a test is administered again under similar conditions, the results should be similar. Reliability is essential to ensuring that a measurement accurately reflects what it is supposed to measure.

In this study, two consecutive tests were conducted on a group of five individuals, the first on February 4, 2024 and the second on February 8, 2024. This process aimed to evaluate the reliability of the tools used. Data analysis using Pearson's correlation coefficient showed that the tests have a high degree of reliability, which increases the credibility of the results.

HonestyIn general, there is no absolute requirement to re-measure the validity and reliability of standardized tests in every new study, especially if these tests have been developed and carefully examined in previous studies and their results have appeared reliable.

Table No. (01) shows the validity and reliability of the 30-meter pre- and post-test speed test:

Test	the law	Results
Select speed before me	Pearson's correlation coefficient	,883
	Sig (billed)	,047
	N	5
Speed test after	Pearson's correlation coefficient	,883
	Sig (billed)	,047
	N	5

Validity and reliability results for the survey sample Validity and reliability of the speed test 30 meters.

Table (1): The table shows the validity and reliability of the 30-meter speed test in the pre- and post-applications. Pearson's correlation coefficient law was applied to a sample of 10 individuals as shown in the previous table, and we reached the same result indicating the presence of a strong relationship at a significance level of 0.05 between the two tests.

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Table (02) with the position of truth and reliability of the choice of vertical jump from stability (sergeant test)

Test	the law	Results
Vertical jump selection before me	Pearson's correlation coefficient	,924
	Sig (billed)	,025
	N	5
Post-test vertical jump	Pearson's correlation coefficient	,924
	Sig (billed)	,025
	N	5

The findings of the test used to measure the recursive jump's validity and reliability, using Pearson's correlation coefficient, showed a strong and positive correlation between the pre- and post-application of the test. ($r = 0.924$, $p < 0.05$). This result indicates that the test has a high degree of reliability, meaning that it measures the same trait consistently each time it is administered, and a high degree of validity, meaning that it actually measures the trait it purports to measure.

2.3. Study community:

The research community represents players. Football active in the first regional division, the regional football league, the junior category for males, for the state of Laghouat, for the sports season 2023/2024.

2.4. Study sample:

A random sample is a subset of individuals selected from a larger population, where each individual in the population has an equal chance of being selected. This method ensures that the sample accurately represents the population, allowing the results to be generalized. A random sample reduces selection bias and enhances the validity of research results. (Fowler, 2014)

As a result, after eliminating (05) players who took part in the exploratory investigation, the study sample consisted of 20 players who were split equally into two groups: (10) players in the experimental group and (10) players in the control group.

2.4.1. Characteristics of the research sample:

Table No.: (03) Table of morphological characteristics and age variable for the study sample

Standard deviation	Arithmetic mean	N	Weight (kg)	Length (cm)	Age (in years)	The group
0.876	-1.734	100	64.90	172	21	whole sample
0.852	-1.617	10	65.35	172	19.10	Experimental sample
6.289	-1.337	90	65.80	172	19.10	Control sample

Q: It means the arithmetic mean.
A: Standard deviation

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And: Coefficient of Torsion

2.5. Fields of study:

2.5.1. Spatial domain:

The field study was conducted at the municipal stadium of Laghouat Municipality..

2.5.2. Time domain:

Phase 1: It lasted for 10 days and included field visits to the team, interviews with trainers, and conducting pre- and post-tests for a survey sample..

Phase II: The main experiment began on March 3, 2024, with pre-tests on the research sample, followed by the application of the plyometric training program for two months until April 30, 2024, and concluded with post-tests on May 2, 2024..

2.6. Determine study variables:

- **independent variable:** Plyometric training.
- **Dependent variable:** Explosive strength of the lower limbs • Speed characteristic.

2.7. Search Tools:

The following tests were used in the field study:

1. **Cooper's test of persistence**
2. **Vertical jump test from standing**
3. **30m speed test**

Vertical jump test from standing (Sergent Test):

- **The purpose of the test:** Measuring the explosive strength of the leg muscles.
- **Tools used:** Chalk, tape measure, graduated board.
- **Performance Description:** A board is placed next to the tester, and the player jumps to reach the highest possible point after taking the signal.
- **Registration:** The distance between the first and second signals is measured, and the best number of two attempts is calculated.

30m speed test:

- **the goal:** Speed measurement.
- **Tools:** Stopwatch, cones.
- **Specifications:** Draw two parallel lines 30 meters apart.
- **Performance method:** When the player hears the start signal, they instantly begin sprinting from the starting line to the finish line.
- **Registration:**The time taken from the starting signal until the athlete reaches the finish line is recorded.

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2.8. Field procedures:

- **Program duration:** 08 weeks.
- **Frequency:**1-3 training units per week.

2.8.1. Basic Ingredients:

Training cycles: 3 main cycles (gradual 1 and 2, and basic 3).• Training sessions: consist of mini-cycles (intense, normal, recovery).• Exercises: focus on plyometrics (jumps) and interval training (alternating work and rest).• Loads: gradually increased throughout the program.• Equipment: balls, chairs, resistances, weights, etc.

2.8.2. Class details:

- **The share:**It consists of 2-3 exercises.
- **Repetitions:**Range between 10-15 repetitions of each exercise.
- **Loads:**Specifies a percentage of the maximum weight that can be lifted.
- **Comfort:**Rest between 30 seconds and 2 minutes between reps.
- **Duration:**It ranges from 45-60 minutes per session.

2.9. Statistical methods used in the study:

Statistical analysis aims to extract accurate and significant results from the data, and the program was used. (SPSS) to calculate a set of descriptive and inferential statistics such as:

- Arithmetic mean
- Standard deviation
- Correlation coefficient
- a testt

2.10. Study methods, devices and tools used:

Sources and references in Arabic - Physical and physiological tests - Whistle - Tape measure - Medical scale - Cones - Timer.

3. Presentation and discussion of hypotheses:

3.1. Presentation and discussion of the first partial hypothesis:

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Table No. (04): Shows the differences between the pre-test and post-test of the 30-meter running speed test for each group (experimental and control).

probability value(p-value)	degree of freedom(df)	t-table	t-arithmetic	Standard deviation	Average	Number of cases	The group
0.004	18	4.506	-0.398	0.103	4.802	20	The first group
0.003	18	4.714	-0.398	0.086	4.785	20	Group Two

For the pre-test of the experimental group: The results show that the arithmetic mean of the 30-meter speed test was (4.506) with a standard deviation of (0.161). We note that the calculated t value (-0.398) at the probability value (0.695), which is greater than the significance level value of 0.05 under a degree of freedom of 18. • As for the pre-test of the control group: The arithmetic mean of the 30-meter speed test was (4.714) with a standard deviation of (0.103), and we note that the calculated t value (0.398) at the probability value (0.696), which is greater than the significance level value of 0.05 under a degree of freedom of 18.

Hence, Regarding the 30-meter speed test pre-test, we observe that there are no statistically significant differences between the experimental and control groups.

Regarding the experimental group's post-test: The findings indicate that the 30-meter speed test was (4.802) with a standard deviation of (0.103). We note that the calculated t value was (3.423) at the probability value (0.004), which is less than the significance level value of 0.05 under a degree of freedom of 18. Regarding the control group's post-test, the 30-meter speed test's arithmetic mean was (4.785), with a standard deviation of (0.086), and we note that the calculated t value was (-0.398) at the probability value(0.003), which is less than the significance level of 0.05 under a degree of freedom of 18

As a result, we observe that there are statistically significant differences between the experimental and control groups after the 30-meter speed test.

Discussion:

The first hypothesis, which stated that there were statistically significant differences between the experimental and control groups in favor of the experimental group in the 30-meter speed test, is supported by the current study's findings. This noticeable improvement in performance is attributed to the distinctive nature of the plyometric exercises used in the training program for the experimental group.

Plyometric training, as he points out, (Bastawisi , 1999, p. 160) works to increase the explosive power of the lower limb muscles by developing their ability to generate maximum force in the shortest possible time. This development in explosive power is positively reflected in the players' performance in speed tests. In addition, these exercises contribute to increasing the circumferences of the lower limbs, which increases the muscle mass available to generate force and movement.

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The results of Al-Waili's study (2012) support these results, as it showed that plyometric training has a positive effect on the speed variable for a distance of 30 meters. Therefore, it can be concluded that plyometric training is an effective tool for improving the speed level of middle-aged football players.

Presentation and discussion of the second partial hypothesis:

Table No. (05) shows the differences between the pre-test and post-test of the strength test.For each group (experimental and control):

probability value(p-value)	degree of freedom(df)	t-table	Standard deviation	Average	Number of cases	The group
0.002	18	-3.897	2.73	26.10	20	The first group
0.001	18	-3.897	1.95	26.55	20	Group Two

Regarding the experimental group's pre-test: The findings indicate that the standard deviation was (2.73) and the arithmetic mean was (26.10). We note that the calculated t value was (0.424) at the probability value (0.677), which is greater than the significance level value of 0.05 under a degree of freedom of 18. • As for the pre-test of the control group: The arithmetic mean was (26.55) with a standard deviation of (1.95), and we note that the calculated t value was (0.424) at the probability value (0.677), which is greater than the significance level of 0.05 under a degree of freedom of 18.

Therefore, we see that the pre-test of the strength test does not show any statistically significant differences between the experimental and control groups.

Regarding the experimental group's post-test, the findings indicate that the arithmetic mean was (33.86) with a standard deviation of (3.96). We note that the calculated t value was (3.897) at the probability value (0.002), which is less than the significance level of 0.05 under a degree of freedom of 18. • As for the post-test of the control group: The arithmetic mean was (28.45) with a standard deviation of (1.88), and we note that the calculated t value was (3.897) at the probability value (0.001), which is less than the significance level of 0.05 under a degree of freedom of 18.

As a result, we observe that the experimental and control groups differed statistically significantly in the strength test post-test.

Discussion:

The standing jump falls under the category of plyometric exercises, specifically within the type of single-response jumps that aim to achieve the maximum possible distance. This classification is consistent with what the researchers confirmed. (Smith & Johnson, 2020, pp. 1234-1245).(Ali Hassan, 2018) confirms that plyometric training is a specialized training approach that focuses primarily on enhancing the explosive power of muscles, which is the ability to generate maximum force in the shortest possible time. This ability plays a crucial

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role in many sports activities, especially those that require fast and powerful movements such as jumping, jumping, and running.

The accreditation of the famous high jump coach (Brown, 2021) on a long-term training plan based primarily on plyometric exercises reflects the importance of this type of training in achieving global levels of athletic performance. The study (Khan & Ali, 2019, pp. 456-467) also confirms the effectiveness of plyometric training in developing the physical capabilities necessary to achieve outstanding performance in various sports activities.

Reasons for the effectiveness of plyometric training:

• Increase muscle strength: Plyometric exercises increase muscle strength, especially the muscles of the lower extremities, which contributes to increasing the force of propulsion during jumping and bouncing. • Improve the flexibility of tendons and ligaments: These exercises contribute to improving the flexibility of tendons and ligaments, which increases the ability of muscles to absorb shocks and generate greater force.

• Develop neuromuscular coordination: Plyometric exercises improve the coordination between the nervous system and muscles, which leads to increased speed of response and effectiveness of movement.

General conclusion:

Football requires a high level of explosive physical strength that enables the player to perform a series of short, high-intensity movements. This physical ability depends largely on the development of specific physical attributes, the most prominent of which are explosive strength and speed. Studies indicate that muscle contraction systems, particularly the plyometric system, are an effective tool for improving these attributes.

Based on the results obtained, the level of physical qualities (speed, explosive power, endurance) that the player needs during the competition increases according to the muscle contraction system applied in the program.

Our study's findings, which focused on middle-aged football players (18–20 years old), demonstrated that giving the participants an 8-week training regimen centered on plyometric exercises significantly increased their lower limb speed and explosive strength.

According to what we have achieved in proving the partial hypotheses, we accept the validity of the general hypothesis that states that plyometric training effectively affects some physical qualities in middle-aged football.

Conclusion:

The field of sports training, especially in football, has witnessed a remarkable development thanks to extensive research and studies aimed at improving sports performance in all its aspects. These studies have shown that developing physical qualities is a decisive factor in achieving sports excellence, as these qualities are the foundation upon which the player's technical and tactical performance is built.

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By examining the impact of a plyometric exercise-based training program on the development of certain fundamental physical attributes in middle-aged football players, this study seeks to advance this concept. The results of the study showed, as shown in the partial hypotheses, that plyometric training has a positive and tangible effect on improving these qualities.

Based on the results obtained, we can conclude that plyometric training represents an effective tool for developing the physical capabilities of football players, which confirms the importance of integrating this type of training into comprehensive training programs.

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