ISSN: 2392-5442 ESSN : 2602-540X		Sport system journal
V/12. N/01. Year/2025		International scientific journal published by: Ziane Achour –Djelfa- Algeria
P 301 - 318		Received: 2024-10-13 A ccepted: 2024-12-01

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

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Abstract

This study aims to determine the effect of plyometric exercises using elastic bands and weights on lower limb explosive strength in U19 football players. The researcher employed an experimental approach on a sample of six randomly selected players. The players were tested on their vertical jump (Sargent test) and 15-meter sprint performance. An improvement in both tests was observed after applying the training program for four weeks, with two sessions per week. The results concluded that the proposed plyometric training program using elastic bands and weights positively affects the explosive strength of football players

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Keywords: Plyometric Training, Explosive Power

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INTRODUCTION

Modern football has gained a more complex dynamic at the moment that requires a high level of physical readiness to rely on the reliability of the preparation system, technology and performance analysis to effectively exploit players' potential to work to improve the qualities of individual and collective performance and constantly search for the best methods and methods of training and evaluation to improve athletic performance in all aspects required to reach the forme of competition day.

Statistics and data obtained from (GPS) and analysis are indicating an increase in passes, runs and fast shifts at a higher pace and that many players have a strong speed and explosion during the match, not merely an advantage but a necessity that imposes itself in line with the current tactic used by coaches in their teams to create excellence and scoring opportunities.

On the other hand, the match-sequencing factor has become increasingly important as the footballer has to be at a high level of performance during violent and repeated efforts such as rapid breakthroughs, rapid changes in trends, bilateral conflicts and fast dynamic movements are all important and crucial moments during the match. For this, players' muscles and strings need to be stronger, stiffer, balanced and coordinated to counter sudden changes of movement and recruit a large number of muscle fibers to produce greater strength in order to exploit important situations in the match well.

Strength is one of the requisite physical characteristics that allows us to improve other qualities such as speed and endurance. That makes sense that being stronger will allow us to be faster. s leadership ", Abdelaziz Nimr and Nariman Al-Khatib point out that the results of some research and studies have agreed that muscle strength is a key factor in the ability to develop motor performance because of its correlation with other physical performance abilities such as speed, endurance, agility and flexibility.

(Abdelaziz n.- Neriman k, 1996, p. 74), perhaps among the most important forms of power in football that are part of our subject "Explosive force" relates to the ability of the muscular nervous system to impose as much force as possible in as little time as possible, or is the ability of the muscular nervous system to try to overcome resistance that requires a high degree of speed of muscle contractions **(Moufak Majid Al Mawla, 2008, p. 24).**

Some research has agreed that explosive force can be improved by Plyometrics exercises and this method can be defined as "extending and contracting the working muscle which causes its flexibility and works to benefit the muscle from the reflected mechanical energy resulting from the effect of prolongation resulting in greater strength and speed of performance" **(Zaki m d, 1998, p. 78).**

The plyometrics training improved muscle strength, balance, linear running time 10 meters and time to change direction 40 meters. **(Chaabane, H., Negra, Y et all, 2020)**

In order to enhance explosive strength, it is recommended to integrate various types of plyometrics exercises with rubber ropes and weights, the use of resistance style with explosive exercise components in the exercises will improve the athlete's ability to produce high energy. **(Dede Baştürk, Alper Tunga Peker 2019).** It also has a positive effect on improving vertical jumping and agility Mor, **(Ahmed fatih- karakas et all 2022).**

During the application of multi-level resistance, the system allows the athlete to maintain his natural center of gravity while amplifying the neuromuscular stimulation during the sport's movement, it can move in any direction and at any speed. **(Dario Novac, Iva loncar et all.2023)**

Therefore, reliance on rubber ropes and weights in plyometrics exercises has become high because they have achieved accurate results that enable this less expensive and easy-to-execute format to obtain better performance. Accordingly, on these pages, we have studied the effects of

the plyometrics training supported by resistance ropes and weights on the explosive strength of the central U19 footballers in the National League Division II amateur, from the following question:

2. Questions:

2. 1 Main question:

Does the proposed plyometrics training programme using rubber ropes and weights affect the explosive strength of footballers less than 19 years old?

3. Hypotheses:

1.3 General premise:

The proposed biometric training programme using rubber ropes and weights affects the explosive strength of footballers under the age of 19.

4. The importance of research:

_ Provide a training programme with key milestones to develop explosive force, speed and injury prevention for footballers under 19 years of age

_ In scientific terms, we want to improve players' performance by making more intense efforts throughout the match while spending less energy and covering more space.

_ Through the results obtained, we try to offer a plyometrics style supported by rubber ropes and weights that can help develop coaches and young players.

5. Research Objectives:

Detection of the effectiveness of the duration of application of the program in improving the explosive strength and speed of footballers under 19 years

_ Make sure that improvements can be made in the bottom side's explosive power classes through the plyometrics exercises with rubber ropes and proposed weights in the program

6. Definition of concepts and terminology:

1.6 plyometrics training:

This method can be defined as "extending and contracting the working muscle which causes its flexibility and works to benefit the muscle from the reflected mechanical energy resulting from the effect of prolongation resulting in greater strength and speed of performance" **(Zaki M -Darouish, 1998, p. 78).** While the researcher defines it as the performance of the stretching and shortening cycle movements after rapid and robust muscular action that forces the nervous system to produce maximum strength in the shortest possible time, resulting in more rapid employment of motor units and muscle activation and used as a bridge between strength and speed.

2.6 Explosive Force:

Is the ability of the muscular nervous system to try to overcome resistance that requires a high degree of speed of muscle contractions **(moufak m, 2008, p. 24).**

While we know it as the ability to generate maximum power in the shortest possible time and it is necessary to perform many skills in football such as jumping, shooting, changing direction and acceleration.

7. Previous studies:

7-1 Studies **(Rabah Erioua and Muhammad Ali Al-Antry 2023)**

Article entitled The Impact of a Proposed plyometrics Training Programme on the Explosive Power of Lower Limbs and Linear Speed of Footballers Under 19 Years

The study sample consisted of 18 players from the team of the Gigil State Sports Federation. The researchers used the experimental curriculum by designing the control and experimental groups in a deliberate manner. The pilot group underwent two training units per week within 6 weeks. The study found that the plyometrics training had a positive impact on the explosive strength and linear speed of footballers under 19 years.

Researchers recommended that more research should be done on the plyometrics method and methods of programming and application.

7-2 Study **(Ghaith Alaoui, Suhail al-Hermasi et al. 2020*)*** under the heading:

The effects of plyometrics exercises based on flexible ligaments on explosive muscle performance and trend change capabilities in male handball players in teams.

Effects of Elastic Band Based Plyometric Exercices on Explosive Muscular Performance and Change of Direction Abilities of Male Team Handball Players.

The study examined the integration of 8 weeks of plyometrics training loaded on the basis of the rubber tape of the lower limbs, twice a week in the seasonal system of junior handball players, the sample consisted of 15 players. The study found that the plyometrics training loaded with flexible tape every twice a week improves the ability to run fast and the muscle strength of the lower limbs compared to regular training.

Researchers recommended that the plyometrics method of rubber ropes should be used to improve important physical elements of performance.

7-3 **Yassine Negra. Helmi chaabane.2019** under the heading:

The increased effectiveness of plyometrics jump drills loaded against unloaded jump drills in improving muscle strength, speed, trend change and long-distance kicking performance in male footballers before puberty.

The Increased Effectiveness of Loaded Versus Unloaded Plyometric Jump

Training in Improving Muscle Power, Speed, Change of Direction, and Kicking-Distance Performance in Prepubertal Male Soccer Players.

The study examined the impact of two plyometrics programmes, one resistance and the other without resistance at the distance of kicking a ball, muscular strength, speed and changing direction for male footballers before puberty. The study sample consisted of 29 randomly selected players who conducted tests to assess muscle strength, speed, kicking the ball and changing direction. The study found that the bearing plyometrics is more effective than the unloaded plyometrics in improving muscle strength measures, speed, changing direction and performing the ball kicking distance of male footballers before puberty.

8. Methodological procedures for the study:

8-1 Curriculum:

The curriculum used varies according to the phenomenon studied and suited to it, and this diversity in the curriculum of studies is of great importance. These curricula consist of a set of systematic processes and steps that enable the researcher to effectively achieve his research objectives.

8-2 Society and Sample Research:

8. 2. 1 Research Community:

A group that includes all study members, the results of the sample selected for dissemination to the indigenous community. The concept of society here means "the overall set of elements upon which the researcher seeks to disseminate the relevant results studied" **(Morsley, 2005, p. 44)**

In our study the research community is all the players of the National Amateur Division II - Central East - are active in 16 a team for a group of less than 19 years, for the 2023-2024 football season.

8. 2. 2 Sample Search:

It is "a group of units extracted from the statistical community, where the community is genuinely represented, in other words, the sample must be characterized by the same characteristics as the study community **(bouhafes, 2022, p. 136).**

The sample was deliberately selected from the Ain M'lila Association team under the age of 19 in Oum El bouaghi state, which is active in the second National Amateur Division, numbering 24 players. Five were selected for reconnaissance study and a pilot group of 10 individuals who had never been trained in a plyometrics style as a program. Four players were excluded for disciplinary and medical reasons. (knee pain and thigh and ankle muscles) and the next test group consisted of 6 players.

8. 3 . Study variables:

a. Independent variable: The element that the researcher changes or manipulates in the experiment to study its impact on another variable is the plyometrics exercise training programme.

b-Dependent variable: It is the variable measured or observed in a scientific experiment to determine the effect of the independent variable on it that researchers are interested in studying and analysing its results. It is explosive force.

8. 4. Areas of study:

8. 4. 1 Human field: Soccer players active at the level of the Second National Division are amateurs - Central East - for the category under 19 years of the Algerian Championship represented in the study community.

8. 4. 2 Spatial Area: The field study took place at IRONS GYM Bodybuilding Hall in Ain M'lila City and the Brethren Damman Debbih Stadium in the same city which is ready and has all the means, capabilities and conditions to assist in the application of the training program.

8. 4. 3 Time Field: The field study was launched on 28 April 2024 where we were able to start fieldwork, by learning more about the players and the field of work and taking permission from the hall and club administrator.

The survey began with tests on 5 players on 22 April 2024, and then the tests were reinstated on 25 April 2024, followed by 26 April 2024. Tribal tests were applied to the experimental sample and then the 4-week training program was applied on 28 April 2024 in the bodybuilding hall.

8. 5 Data Collection Tools:

8. 5. 1. **Training programme**: The training programme was arbitrated by physical lecturers and university professors in the specialization. The researcher was able to identify 4 weeks at a rate of two portions per week as sufficient to bring about an evolution in explosive force due to the plyometrics exercises supported by rubber ropes and weights. Exactly 4 weeks and two portions per week were determined due to the period of competition that month.

The content of the training program is plyometric exercises supported by rubber ropes and various weights that do not rise to excess weight suitable for players. Exercises comply with the specificity of football, players perform jumping skills under resistance of different modes. In our study, we used rubber ropes, boxes, barriers and weights Dumbbell/Disque/Barre in different sizes depending on the exercise and upon completion of each repeat we added the ball as a tool to provide an enthusiastic atmosphere where the player rises to hit the ball with the head several times, adding the ball during the quota is lovable.

8. 5. 2 Physical Tests:

A _ Sargent Test:

The objective of the test: to assess the explosive force of the bottom. Thus, this test assesses the driving force of the leg's belligerent muscles and the

explosive force of the bum muscle, thigh muscle, quadriceps and leg.

Equipment: flat vertical surface. A piece of chalk. Scale centimeter or adhesive tape.

Test description: A person should immediately jump using the movement of arms along the wall and try to put fingers at the highest possible level. Stands with bent legs -knee joint at 90 degrees. He must make the maximum leap of bending position without running up, from bending position, up. The height reached is measured by taking the distance between the start mark (arm raised) and the highest point reached by the hand. The test is not valid until the person returns to the same position.

Results: in centimetres, the best experience of the two experiments.

B _ 15m jogging test:

Objective of the test: To assess explosive force during launch.

Equipment: Funnel or adhesive tape determines the starting point and access point, distance measuring device, whistle, Cronometer, assistant referee, net assessment.

Test description: The athlete stands on the line of departure (from stand-up mode) at the moment of hearing the whistle go off at full speed to the line of arrival, each athlete has 3 attempts counting the best amenities.

8. 7 Sample homogenization:

In order to control all variables affecting the accuracy of the search results, the researcher sought to verify the homogeneity of the search sample in the age variables (calculated for the nearest half month), length (calculated for the nearest centimeter), and weight (calculated for the nearest half kg), by:

Table No. (01): Shows the homogeneity of the sample in age, length and weight variables.

Variables	Age (month)	Length (cm)	Weight (kg)
n		*06*	
Arithmetic Average	228	1.72	67.26
Standard deviation	2.68	0.03	1.95
Computational Broker	229	1.71	66.85
Difference Factor	1.17	1.74	2.90
The lowest value	223	1.68	1.74
Highest Value	230	1.77	65.40
Connectedness	***It has no meaning.***	***It has no meaning.***	***It has no meaning.***

Table 01 shows that the difference factor for both age, height and weight came in a small value of 1.17, 1.74 and 2.90 respectively, which is less than 30 per cent.

8. 8 Scientific Foundations of Tests:

The scientific transactions of the tests in question in terms of honesty and consistency were calculated as follows:

- Calculation of honesty:

To verify the validity of the tests used, the researcher verified the validity of the tests in the following ways:

- Believe the content:

The researcher presented a series of tests to measure the explosive power of a group of sports professionals (coaches, physical lecturers, sports coaches) to express their opinion on their suitability for research. The arbitrators agreed on the validity of the content of the above tests.

- Self-honesty: Self-honesty is measured by the quadratic root calculation of the

test stabilizer, i.e.:

$$\text{Self-Honesty Coefficient} = \sqrt{\text{Constant Factor}}$$

(Mohamed N R, Entrance to Measurement in Physical and Sports Education, Book Publishing Center, Egypt, 2006, p. 226).

- Calculation of stability:

See self-authenticity results in Table No. (02)

Table No. (02): Showing the stabilization and self-authenticity factors of the exploratory experiment tests:

Number	tests	Stability (Sperman)	Self-honesty (root stability)
01	*Vertical jump test (Sargent).*	0.71	0.84
02	*15m jogging test*	0.74	0.86

The researcher calculated the consistency of the tests used by searching in the way of re-applying the test by conducting them on 05 players from the non-sample of the research and from the same research community. The tests were selected in a random manner, and the tests were re-applied after three days to calculate the values of the stabilization transactions using the Spearman coefficient (Because the sample is less than 30, and because it is not a teacher alternative to the Pearson coefficient), the following table shows the correlation (persistence) coefficients of the tests in question:

Through Table No. (02) we note that all correlation transactions are positive (between medium and high) where they are confined between 0.71 -0.74 and their square roots are limited between 0.84-0.86, this indicates the stability and sincerity of the tests used.

9. Statistical processing:

After the collection of data on the variables used in this research, appropriate statistical processing was carried out to achieve the goals and validate assumptions using statistical laws, as well as computer through the V26 Predictive Analysis Programme (formerly the Social Science Statistical Package - SPSS) (statistical package of The Spatis Social ices)

Table No. (03): shows the most important means used in statistical processing.

Mean	**Minimum**
Standard Deviation	Maximum
Median	Wilcoxon W
Impact volumes	Cohen (d)
	Glass's delta
	Hedges (g)

Bearing in mind that 0.05 minimum indicator level.

10- Presentation, analysis and discussion of results in the light of hypothesis:

Hypothesis text: The proposed Plyometrics training programme using rubber ropes and weights affects the development of explosive power in footballers under the age of 19.

Table No. (04): shows the arithmetic average, standard deviation, Wilcoxon values (associated comparison) and their indication between tribal and post measurements of research tests.

tests	Tribal measurement			telemetric			Wilcoxon Value (Z)	Value sig	significance
	Mean	Median	Standard Deviation	Mean	Median	Standard Deviation			
Sargent Test	30.67	30.5	1.21	43.8	44.5	2.79	2.21-	0.03	connotation
Speed test 15m	3.53	3.61	0.23	3.07	3.08	0.10	2.21-	0.03	connotation

10. 1 Display the results of tribal, post measurements and Wilcoxon value in research tests:

Table 04 shows that all Wilcoxon values calculated for the two tests were a function at an indicative level (0.05) (because the sig value is below the indicative level of 0.05), indicating a statistically significant discrepancy between tribal and

post measurements, in favour of dimensional measurement. Consequently, the proposed training programme for plyometric exercises supported by rubber ropes has significantly affected the strength and balance.

Table (05): Showing the impact of experimental group research tests (problem solving) between tribal and Baadi measurements

tests	Tribal measurement			telemetric			Cohen' s d	Glass's delta	Hedges' g
	Mean	Median	Standard Deviation	Mean	Median	Standard Deviation			
Sargent Test	30.67	30.50	1.21	43.83	44.50	2.79	Huge 6.12	Huge 10.88	Huge 6.12
Speed test 15m	3.53	3.61	0.23	3.07	3.08	0.10	Huge 2.59	Huge 2	Huge 2.59

Table No. (05) Shows impact sizes with three impact factors:

- Cohen's d
- Glass's delta
- Hedges' g

The results indicated that in both tests the impact magnitude indication was huge, showing that differences were significant in favour of both tests' dimensional measurement.

10. 2 Interpretation and discussion of the study's findings:

10. 2. 1 Interpretation and discussion of results under hypothesis:

The proposed plyometrics training programme using rubber ropes and weights affects the development of explosive power in footballers under the age of 19.

Through the statistical processing of the results of the physical tests for explosive force (Sargent test, 15 metres jogging test) we are shown to have statistically significant differences in the measurements of the two tests between tribal and postmetric measurements in favor of postmetric

It is clear to us through the results obtained in the table (04) Statistically significant differences between 15 metre test results averages and vertical jump test (SARGENT) for tribal and remote tests of the search sample in favor of the dimensional at the indicative level of 0, 05 in the two tests This indicates the effectiveness of plyometrics exercises supported by rubber ropes and weights in developing explosive force in the research sample While improvements in the 15

metres test have not been significant in just 4 weeks by two portions per week, if we increase the number of weeks, we expect greater improvements in explosive force in the 15 metres test on the one hand. On the other hand, we'll get good improvements in the Sargent vertical jump test.

As can be seen from table (05) showing the scale of the impact of the research tests with the criterion: "Cohen" "Picker" "Hedges" for the pilot group, where the results show that in both tests the magnitude of the effect was significant, which shows that the differences are significant in favour of the dimensional measurement of both tests.

These improvements are due to the occurrence of neuromuscular adaptations that increase the muscle's ability to produce energy and express greater strength during performance, as pointed out ***(Goran Markovic, Pavle Mikulic, 2010)*** that 2-3 plyometric sessions per week lead to a change in muscle activation strategy (improved neuromuscular coordination) and changes in the mechanics and structure of muscle and tendon fibers.

(Ahmet mor, F.karaks,2022) emphasized that resistance bar exercises have a positive impact on performance in vertical jumping tests, agility test, 30 meter jogging test. The trainers recommended incorporating resistance bar exercises into the content of their programmes.

The results of our study are arguably identical to the results of previous research as a study ***(Ghaith A, Suhail H, 2020)***. Plyometrics training loaded with flexible tape twice weekly within 8 weeks improves the speed-running ability and muscle strength of the lower limbs compared to regular training.

We also agree with a study ***(Yassine n, Helmi c, 2019)*** entitled The Effectiveness of plyometric Exercises Loaded Versus Unloaded plyometrics Jump Drills in Improving Muscle Strength, Speed, Trend Change, and Kicking Distance Performance of Footballers before Puberty. The study showed that bearing plyometrics training is more effective than unloaded plyometrics training in improving metrics of muscle strength, speed, changing direction and performing ball-kicking distance in male footballers before puberty. We also agree with the study ***(Ghaith A, Sohail H, 2021)*** which showed positive results in running a distance of 10 meters and vertical jumping.

The results of these studies are consistent with what we found in our current study and are unanimous that this method has the potential to achieve improvements in explosive force and performance in general and in particular.

The plyometric training programme supported by rubber ropes and weights can be said to contribute effectively to the development of the explosive power of footballers. The study recommends adopting this type of training in sports training programs to improve sports performance and achievements.

From the foregoing, statistical analysis has demonstrated the general premise that the proposed plyometric training programme using rubber ropes and weights affects the development of players' explosive power under the age of 19.

11. Conclusion:

At the conclusion of this study, we conclude that the plyometric program supported by rubber ropes and weights is an effective and new way to develop the explosive power of footballers. Through this method, players can improve their physical abilities well, reflecting positively on their performance during competitions.

Results have shown that the use of rubber ropes and weights as part of the plyometrics programme contributes to the enhancement of explosive force In addition, our study corresponds to many research on this topic But research in this area has to be intensified to get more details, This style of training is complex in nature and requires careful planning and careful implementation to ensure that the desired benefits are in line with modern physical and tactical requirements in football. People must be equipped and able to explode quickly and robustly in an appropriate and correct manner during many actions such as jumping, shooting, acceleration, changing trends, bilateral conflicts and movements that need quality and effectiveness of muscle contractions for the longest period of time without decreasing performance during competition.

The researcher made the following recommendations:

_ Trainers and physicists should obtain a large and sufficient amount of theoretical and applied information about biometric training before applying exercises.

_ Good selection of plyometric exercises that suit performance requirements for your sport type.

_ Rubber ropes and weights should fit the abilities of athletes and age to avoid possible injuries and get comfortable performance and good results.

_ Diversification in the performance of inhibitions between vertical, horizontal and lateral jumping for greater neuromuscular adaptations

Research further on this topic for details and information regarding the complex nature of plyometrics exercises.

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<u>The impact volumes are based on the following locations in their calculation:</u>

https://goodcalculators.com/effect-size-calculator_
https://www.socscistatistics.com/effectsize/default3.aspx _
_Computation of different effect sizes like d, f, r and transformation of different effect sizes: Psychometrica
Effect size calculator - The Campbell Collaboration_