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Original article

Plyometric program to develop explosive strength in women's soccer

[*Programa pliométrico para desarrollar la fuerza explosiva en el fútbol femenino*]

[*Programa Pliométrico para Desenvolver a Força Explosiva no Futebol Feminino*]

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ABSTRACT

Introduction: This study analyzes the influence of plyometric exercises on the explosive power of female soccer players, a crucial capacity for sprints, jumps, and rapid movements. A systematic plyometric training program was implemented, and changes were evaluated using a longitudinal experimental design. The results showed improvements in explosive power and performance consistency among the athletes, confirming the effectiveness of plyometrics in optimizing physical performance and enhancing motor skills in women's soccer. This research supports the importance of implementing specialized programs that promote the holistic development of female soccer players.

Objective: To determine the impact of a plyometric exercise program on the development of explosive strength in women's soccer.

Methods: The long jump and 30m sprint tests were used to compare a numerical variable in the same group at two time points, pre- and post-test . The quantitative data were analyzed using statistical methods such as the Shapiro-Wilk normality test and Student's t-test, allowing for reliable results.

Results: In the post-test explosive strength test (Long test), 4 athletes (22.2%) achieved the "excellent" category, 9 (50%) "good," and 5 (27.8%) "fair." The group average increased from 184.61 cm in the pre-test to 201.33 cm in the post-test , demonstrating a significant improvement. In the 30-m sprint test, without equipment, the "excellent" category predominated, while with equipment, the "good" category stood out. The average sprint time without equipment decreased from 4.92 to 4.43 seconds, and with equipment, from 8.83 to 8.09 seconds.

Conclusions: The results show a significant increase in explosive strength after the intervention, confirming the effectiveness of the plyometric program.

Palabras clave: ejercicios pliométricos, fuerza explosiva, velocidad, fútbol femenino.

RESUMEN

Introducción: el presente estudio analiza la influencia de ejercicios pliométricos en la fuerza explosiva de futbolistas femeninas, capacidad determinante para esprints, saltos y desplazamientos rápidos. Se aplicó un programa sistemático de entrenamiento basado en pliometría, evaluando los cambios mediante un diseño experimental longitudinal. Los resultados evidenciaron mejoras en la fuerza explosiva y en la consistencia del desempeño de las deportistas, confirmando la eficacia de la pliometría para optimizar el rendimiento físico y potenciar habilidades motoras en el fútbol femenino. La investigación respalda la importancia de implementar programas especializados que favorezcan el desarrollo integral de las futbolistas.

Objetivo: determinar la incidencia de un programa de ejercicios pliométricos en el desarrollo de la fuerza explosiva en el fútbol femenino.

Métodos: se emplearon las pruebas de salto horizontal (Long test) y velocidad 30 m para comparar una variable numérica en el mismo grupo en dos momentos, pre y postest. Los datos cuantitativos fueron analizados mediante métodos estadísticos como la prueba de normalidad de Shapiro-Wilk y la t de Student, permitiendo obtener resultados confiables.

Resultados: en el postest de fuerza explosiva (Long test), 4 deportistas (22,2%) alcanzaron la categoría "excelente", 9 (50%) "bueno" y 5 (27,8%) "regular". La media grupal aumentó de 184,61 cm en el pretest a 201,33 cm en el postest, evidenciando una mejora significativa. En la prueba de velocidad 30 m, sin implemento, predominó la categoría "excelente", mientras que con implemento destacó la categoría "bueno". La media de velocidad sin implemento disminuyó de 4,92 a 4,43 segundos y con implemento de 8,83 a 8,09 segundos.
Conclusiones: los resultados evidencian un aumento significativo en la fuerza explosiva después de la intervención, confirmando la eficacia del programa pliométrico.

Palabras clave: ejercicios pliométricos, fuerza explosiva, velocidad, fútbol femenino.

RESUMO

Introdução: O presente estudo analisa a influência de exercícios pliométricos na força explosiva de jogadoras de futebol feminino, capacidade essencial para sprints, saltos e deslocamentos rápidos. Foi aplicado um programa sistemático de treinamento baseado na pliometria, avaliando as mudanças por meio de um desenho experimental longitudinal. Os resultados evidenciaram melhorias na força explosiva e na consistência do desempenho das atletas, confirmando a eficácia da pliometria para otimizar o rendimento físico e potencializar as habilidades motoras no futebol feminino. A pesquisa reforça a importância de implementar programas especializados que favoreçam o desenvolvimento integral das jogadoras.
Objetivo: Determinar a incidência de um programa de exercícios pliométricos no desenvolvimento da força explosiva no futebol feminino.
Métodos: Foram utilizados os testes de salto horizontal (Long test) e velocidade de 30 m para comparar uma variável numérica no mesmo grupo em dois momentos: pré-teste e pós-teste. Os dados quantitativos foram analisados por métodos estatísticos, como o teste de normalidade de Shapiro–Wilk e o teste t de Student, permitindo a obtenção de resultados confiáveis.
Resultados: No pós-teste de Força Explosiva (Long test), 4 atletas (22,2%) alcançaram a categoria "Excelente", 9 (50%) "Bom" e 5 (27,8%) "Regular". A média do grupo aumentou de 184,61 cm no pré-teste para 201,33 cm no pós-teste. No teste de Velocidade

de 30 m, sem implemento, predominou a categoria "Excelente", enquanto com implemento destacou-se a categoria "Bom". A média de velocidade sem implemento diminuiu de 4,92 para 4,43 segundos e com implemento de 8,83 para 8,09 segundos.
Conclusões: Os resultados evidenciam aumento significativo da força explosiva após a intervenção, confirmando a eficácia do programa pliométrico.

Palavras-chave: Exercícios pliométricos, força explosiva, velocidade, futebol femenino.

INTRODUCTION

More and more young women around the world are passionately playing football. This sport has become a global discipline, practiced by women and children alike, regardless of race, religion, ethnicity, or socioeconomic status. It can be played in professional stadiums or community pitches, with modern or improvised equipment, demonstrating advanced skills or simply with the enthusiasm of those just starting out in the sport (FIFA, 2020).

In Ecuador, women's soccer is undergoing an evolutionary process that requires significant advancements in physical development. Improving motor skills, grounded in physiological principles, is becoming increasingly necessary. In this regard, strength and power exercises have emerged as key tools for enhancing players' physical fitness and improving their competitive performance. These training methods allow female soccer players to gain advantages in individual duels, improve the execution of specific game actions, and strengthen their physical presence on the field (Antunez *et al.,* 2022; Flórez Jairo *et al.,* 2024).

Strength is defined as the muscle's ability to generate tension in different situations, allowing the body to move, resist external forces, or maintain positions. Explosive strength, on the other hand, is especially important due to the demands of the game, which involve the constant execution of actions such as jumping, shooting, changing direction, accelerating, passing, and ball control (Rosado & Pin, 2024).

Football, as a team sport, demands high levels of physical performance, with explosive strength being a determining factor in actions such as sprints, jumps, and turns. Therefore, developing this quality in the lower body is essential for improving performance in specific game situations. Recent studies, including systematic reviews and meta-analyses, have shown that plyometric programs based on jumping exercises produce significant improvements in abilities such as speed, agility, power, and jumping ability (Guerrero, 2022; Soto *et al.*, 2022). Thus, implementing plyometric training adapted to the needs of women's football is emerging as an effective strategy for optimizing physical performance (Ospina *et al.*, 2023).

In recent years, plyometric training has gained prominence as an effective tool for developing explosive strength, especially in team sports like soccer (Intriago & Paula, 2024). Strength has become an essential component of performance in modern women's soccer, and is the subject of numerous studies seeking to optimize its development according to the athlete's age and training stage (Gorka *et al.*, 2021). As players progress through competitive categories, it becomes essential to complement technical and tactical work with specific strength routines, both in the gym and through functional exercises on the field. In this context, explosive strength becomes a key factor for individual performance (Peña Tovar *et al.*, 2022).

This capacity is crucial in actions such as short bursts of acceleration, rapid changes of direction, powerful shots, and effective defensive maneuvers (Amaguaya Andrade, 2025). Furthermore, it has been shown that proper explosive strength training significantly contributes to the development of offensive and defensive performance, increasing reaction speed and the ability to overcome opponents. It can also play a significant role in injury prevention (Rosero Parra and Taro, 2024).

There are various methods for developing explosive strength in sports. A relevant example is the Colombian study "Development of Explosive Strength and the Force-Time Curve in Youth Soccer Players," which analyzed the effectiveness of the Nordic and plyometric methods to determine their impact on injury prevention. This research highlights that explosive strength consists of the ability to apply force during the

execution of specific technical movements, evaluated through concentric or isometric contractions recorded on the force-time curve.

Studies such as that by Castro and León (2024) have focused on training methods aimed at developing lower body explosive power. The results revealed significant improvements in shooting distance and ball-handling speed, key variables in soccer. These improvements positively impacted the execution of technical skills and demonstrated the effectiveness of plyometric training not only in physical strengthening but also in improving technical movements. In female soccer players, the benefits were even more evident, highlighting the importance of integrating these methods into physical conditioning plans (Arnanz Galián, 2023; Sánchez *et al.*, 2024).

Based on this premise, the present study aims to analyze the impact of a plyometric exercise program on the development of explosive strength in professional female soccer players. The research is grounded in scientific evidence that supports the inclusion of this type of exercise in training. The purpose is not only to verify the direct effects of plyometrics on explosive strength, but also to quantify the multiple benefits associated with its practice, in the pursuit of optimal athletic performance. Through the application of on-field physical tests and a detailed analysis of the results, the study intends to examine the relationship between the systematic practice of plyometric exercises and the development of explosive capacity in competitive contexts.

This research, with its experimental design and quantitative approach, seeks to generate scientific evidence to optimize training methods applied to women's soccer. The results will enrich current knowledge, lay the foundation for more effective physical conditioning programs, and provide coaches and professionals with evidence-based tools to enhance the athletic performance of female soccer players.

MATERIALS AND METHODS

The study was conducted using a quantitative approach, employing a longitudinal experimental design and an explanatory scope to evaluate the effects of plyometric exercises on explosive strength. Tests were used to compare a numerical variable within the same group at two different time points, collecting and analyzing quantitative data using statistical methods. These assessment instruments allowed for obtaining accurate results in a real-world setting, as the study was conducted on the playing field.

The research was conducted in two distinct evaluation periods: a pre-test and a post-test , both focused on measuring explosive strength in the same group of players before and after implementing the plyometric exercise program. First, the *Long test was administered* , followed by a 30-meter sprint speed test with and without equipment. The results were categorized into three performance levels: 'fair', 'good', and 'excellent', based on the recorded times.

For eight weeks, a specific plyometric exercise program was implemented, with training sessions held three times a week, each lasting 60 minutes. The program included a variety of activities and exercises focused on improving the explosive power of the female soccer players.

At the end of the program, the Long Test and the 30-meter test (with and without equipment) were administered again to reassess the players' explosive power under the same initial conditions. Subsequently, the pre-test and post-test results were compared to identify improvements in the dependent variable. The data obtained allowed for a rigorous statistical analysis, which demonstrated the effectiveness of the plyometric exercise program in developing explosive power.

The study population and sample consisted of 18 female soccer players, aged between 15 and 24 years, who comprised the experimental group. These players are members of the professional sports club Vinotinto Ecuador. Measurements and tabulation of test

results were carried out using specific norms adapted to this age group within the aforementioned age range.

RESULTS AND DISCUSSION

Based on the analysis of the results of the initial test, the "Long test," it is evident that the majority of the 18 athletes evaluated present a level of explosive strength classified as "fair." In this group, ten fall into this category, while seven reached the "good" classification, and only one athlete achieved the "excellent" level. The group average obtained was 184.61 cm (Table 1).

Table 1. *- Quality of studies*

Athletes	Distance in cm	Scale
D 1	188	Regular
D 2	198	Well
D 3	176	Regular
D 4	180	Regular
D 5	152	Regular
D 6	206	Well
D 7	195	Well
D 8	200	Well
D 9	222	Excellent
D 10	164	Regular
D 11	198	Well
D 12	167	Regular
D 13	161	Regular
D 14	173	Regular
D 15 D 16	196	Well
D 17	175	Regular
D 18	197	Well
Average	184.61	

Source *: Own elaboration*

Based on the analysis of the results of the initial 30-meter sprint test administered to the 18 athletes, five were classified as "fair," 13 as "good," and none as "excellent." The group's average time was 4.92 seconds. In the assessment with implements, 12 athletes were classified as "fair," four as "good," and only two achieved "excellent." In this case, the group average was 8.83 seconds (Table 2).

The results obtained reveal significant deficiencies in speed capacity, both with and without equipment. Given the predominance of performances in the "regular" category and the relevance of this physical capacity for athletic performance, the implementation of a specific plyometric exercise program aimed at its development is proposed. This program will last eight weeks, with 60-minute sessions three times a week, and its main objective will be to optimize explosive strength levels in the athletes evaluated (Table 2).

Table 2. *- Initial speed test*

Without Implement			With Implement	
Dep	Pretest Scale		Pretest	Scale
D 1	4.92	Bueno	7,92	Bueno
D 2	5,55	Regular	7,44	Excelente
D 3	5,27	Regular	8,7	Regular
D 4	4,84	Bueno	9,06	Regular
D 5	5,19	Regular	7,68	Excelente
D 6	4,84	Bueno	9,78	Regular
D 7	4,84	Bueno	8,82	Regular
D 8	5,09	Regular	9,30	Regular
D 9	4,34	Bueno	8,88	Regular
D 10	4,41	Bueno	9,12	Regular
D 11	4,81	Bueno	9,72	Regular
D 12	4,65	Bueno	8,22	Bueno

D 13	5,11	Regular	9,42	Regular
D 14	5.02	Well	9.66	Regular
D 15	5.00	Well	8.58	Well
D 16	4.85	Well	8.10	Well
D 17	4.95	Well	9.00	Regular
D 18	4.90	Well	9.60	Regular
Average	4.92	-	8.83	-

Source *: Own elaboration*

Post-test data, which evaluated 100% (18) of the athletes, showed that four athletes (22%) received an "excellent" rating, nine athletes (50%) were categorized as "good," and five athletes (28%) as "fair." The group mean was 201.33 centimeters (Table 3).

Table 3. *- Final explosive strength test Long test*

Dep	Distance in cm	Scale
D1.	190	Well
D2.	208	Well
D3	194	Well
D4	193	Well
D5	173	Regular
D6	221	Excelente
D7	221	Excelente
D8	209	Bueno
D9	233	Excelente
D10	186	Regular
D11	225	Excelente
D12	185	Regular
D13	187	Regular

D14	190	Bueno
D15	218	Well
D16	178	Regular
D17	213	Well
D18	200	Well
Average	201.33	-

***Source** : Own elaboration*

Post-test data, which evaluated 100% (18) of the athletes, showed that, without equipment, nine athletes (50%) received an "excellent" rating, seven athletes (39%) were categorized as "good," and two athletes (11%) as "fair." With equipment, five athletes (28%) reached the "excellent" category, eight athletes (44%) the "good" category, and five athletes (28%) the "fair" category. In this case, the "good" category was the most prevalent (Table 4).

***Table 4.** - Final test 30m speed*

Without Implement			**With Implement**	
Dep	**Posttest**	**Scale**	**Posttest**	**Scale**
D 1	4,12	Excelente	7,30	Excelente
D 2	4,15	Excelente	6.95	Excelente
D 3	5,01	Regular	8,0	Bueno
D 4	4,15	Excelente	8,4	Bueno
D 5	4,18	Excelente	7,1	Excelente
D 6	4,22	Excelente	8,95	Regular
D 7	4,28	Excellent	8.1	Well
D 8	5.02	Regular	7.45	Excellent
D 9	4.20	Excellent	8.2	Well

D 10	4.18	Excellent	8.45	Well
D 11	4.25	Excellent	8.9	Regular
D 12	4.50	Well	7.7	Well
D 13	4.52	Well	8.7	Regular
D 14	4.55	Well	8.95	Regular
D 15	4.58	Well	7.95	Well
D 16	4.60	Well	7.5	Excellent
D 17	4.63	Well	8.3	Well
D 18	4.65	Well	8.85	Regular
Average	4.43		8.09	

***Source** : Own elaboration*

After applying the *Shapiro-Wilk normality test* and comparing the significance values with an alpha level of 0.05, it was observed that in all cases the explosive strength and speed variables, both before and after the implementation of the plyometric exercise program, presented a p-value greater than 0.05. This indicates that the data come from a normal distribution; therefore, the Student's t-test for related samples was applied, where the following results were obtained, demonstrating the comparison of means before and after the application of the program, as well as the correlation and significance (Table 5).

***Table 5.** - Shapiro-Wilk normality test – Long explosive strength test*

P-Value		**Alpha level**
P- Value (Explosive strength before) = 0.967	>	α = 0.05
P- Value (Explosive strength after) = 0.953	>	α = 0.05

***Source** : Own elaboration*

Analysis of the data reveals that, in the " Long Test " explosive strength test, the pretest mean was 184.61, with a variance of 330.84 and a standard deviation of 18.18, while in the posttest the mean increased significantly to 201.33, with a variance of 311.17 and a standard deviation of 17.64, demonstrating a notable improvement in this physical capacity. In the 30-meter sprint without implements, the pretest mean was 4.92 s, with a variance of 0.08 and a standard deviation of 0.28; the posttest mean decreased to 4.41 s, with similar dispersion values in terms of variance and standard deviation, indicating a uniform improvement in the participants' speed.

In the speed test with implement, the pretest mean was 8.83 s, with a variance of 0.51 and a standard deviation of 0.71. In the posttest , the mean decreased to 8.09 s, with a variance of 0.42 and a decrease in the standard deviation to 0.65, demonstrating an improvement in performance, although with slight heterogeneity among participants. Overall, the results show that both explosive strength and speed improved after the intervention; without implement, the changes reflected greater individual variability in the training response, while with implement, the improvements were more consistent (Tables 6 and 7).

Table 6. *- Shapiro-Wilk Normality Test - 30m speed*

P-Value		**Alpha level**
P- Value (Speed 30m without implement before) = 0.957	>	α = 0.05
P- Value (Speed 30m without Implement after) = 0.868	>	α = 0.05
P- Value (Speed 30m with Implement before) = 0.945	>	α = 0.05
P- Value (Speed 30m with Implement after) = 0.942	>	α = 0.05

Source*: Own elaboration*

Table 7. *Related Sample Statistics*

Explosive Strength Long Test Speed 30 m							
	Dep.	**Average**	**Variance**	**D. Stand**	**Average**	**Variance**	**D. Stand**
Pretest without implementation	18	184.61	330.84	18,18	4.92	0.08	0.28
Posttest without implement	18	201.33	311.17	17.64	4.41	0.08	0.28
Pretest with implement			-		8.83	0.51	0.71
Posttest with implement			-		8.09	0.42	0.65

Source *: Own elaboration*

In the pre- post analysis of the *Long* Explosive Strength Test, the correlation of 0.910 reflects that the female soccer players maintained a very similar pattern between their initial and final results, indicating stability in their response to the test. However, the significance of 0.000 ($p < 0.05$) demonstrates that, despite this stability, there was a real and significant difference between the pre-test and post-test . This means that the plyometric program effectively increased explosive strength, an essential capacity for jumps, sprints, and other rapid actions characteristic of women's soccer.

In the unequipped speed test, the correlation was low (0.292), indicating that the pre- and post-test measurements were not very related; that is, the participants' performance varied inconsistently. Furthermore, the significance of 0.240 ($p > 0.05$) indicates that there were no statistically significant differences between the pre- and post-tests. This suggests that the plyometric program did not have a direct or sufficient impact on unequipped speed, probably because this type of speed requires more technical and specific training.

On the other hand, in the speed test with implement, the correlation of 0.914 shows a very strong relationship between the measurements, indicating stable performance in the players. The significance of 0.000 demonstrates that the differences between the pre- and post-tests were indeed statistically significant, indicating that the plyometric

program improved the ability to accelerate and move quickly under load or resistance conditions, which is consistent with the plyometric stimuli applied (Table 8).

Table 8. *- Paired Samples T-Test*

	Peers	**N**	**Correlation**	**Significance**
Pair	1 Pre- and Post- test Explosive Strength "Long test"	18	0.910	0.000
Pair	2 Pre - Post test without Implement speed	18	0.292	0.240
Pair	1 Pre - Post test with Speed Implement	18	0.914	0.000

Source *: Own elaboration*

This study explored a key aspect of sports training in women's soccer: the improvement of explosive strength through a plyometric exercise program. Previous research (Barquero Jiménez & Salazar Rojas, 2020; Ramírez & Paula, 2025) supports the effectiveness of this type of program, highlighting it as a relevant alternative for optimizing motor skills and the execution of high-speed movements, which promotes better performance in soccer development.

The results obtained provided representative evidence of the program's effectiveness, revealing significant improvements in explosive strength both with and without equipment. Initially, the analysis of the long jump test revealed a notable deficiency in explosive strength. Most of the 18 soccer players were classified in the "fair" category, highlighting the need for intervention and improvement, especially under more challenging conditions involving the use of equipment. In the sprint test without equipment, no athlete reached the "excellent" category, 13 fell into the "good" category, and 5 into the fair category.

Regarding the speed test with implement, 12 athletes are in the regular category, 4 athletes reach the "good" category and; only 2 athletes manage to position themselves in the "excellent" category.

Following the application of the plyometric exercise program for six weeks, a significant improvement in the athletes' explosive power was evident. In the post-test long jump, administered to the entire sample (18 athletes), it was observed that 4 of them (22.2%) achieved the "excellent" category, 9 (50%) were classified as "good," and 5 (28%) fell into the "fair" category.

The results of the 30-meter sprint post-test , administered to all 18 athletes, showed that without equipment, 9 athletes (50%) achieved the "excellent" category, 7 (39%) were rated "good," and 2 (11%) were classified as "fair." With equipment, 5 athletes (28%) achieved the "excellent" category, 8 (44%) were rated "good," and 5 (28%) were rated "fair." The "excellent" category predominated in the test without equipment, while the "good" category was more common with equipment. Although the distribution varied between the two assessments, the results demonstrate a notable improvement in explosive power after the intervention, confirming the effectiveness of the plyometric exercise program.

The positive and significant impact of plyometric exercises is evident not only in the improvement of jump height or reduction of times, but also in the consistency of the athletes' performance. Thus: The mean explosive strength of the pretest was 184.61, with a variance of 330.84 and a standard deviation of 18.18. In the posttest , the mean increased significantly to 201.33, with a variance of 311.17, and a standard deviation of 17.64, which indicates a considerable improvement in this capacity.

On the other hand, in the speed test without implement, the pretest mean was 4.92 seconds, with a variance of 0.81 and a standard deviation of 0.28. In the posttest , the mean decreased to 4.43 seconds, while both the variance and the standard deviation remained unchanged, indicating a homogeneous improvement in the group.

Similarly, in the speed test with implement, the pretest mean was 8.83 seconds, with a variance of 0.51 and a standard deviation of 0.71. After the application of the plyometric exercise program, the mean decreased to 8.09 seconds, accompanied by a smaller variation reflected in the standard deviation (0.65) and variance (0.42). These results

demonstrate that plyometric exercises were effective in improving speed even under more challenging conditions.

The findings confirm that the plyometric program had a positive and significant effect on the development of explosive strength in the athletes. These findings from the study contribute significantly to the development of this capacity in female soccer players, providing evidence of the effectiveness of plyometric exercises.

Improving explosive strength through plyometric training had significant implications for the athletic performance of female soccer players, as adequate explosive strength is essential for executing precise, powerful, and efficient movements. Furthermore, this increase not only optimizes performance but also significantly contributes to injury prevention. Several studies (Álvarez et *al.,* 2022; Dudagoitia, 2024; Utreras *et al.,* 2024) corroborate this assertion, indicating that strengthening explosive strength considerably reduces the risk of sports injuries.

This research provides compelling evidence of the effectiveness of a plyometric exercise program for enhancing explosive power in women's soccer. The improvements observed in jump distance and sprint times, along with greater stability in the players' performance, highlight the usefulness of these exercises. Ultimately, plyometric training is established as a key resource for developing explosive power, thus promoting the overall development of female soccer players.

CONCLUSIONS

The theories related to the variables analyzed in this study strengthen the theoretical framework by demonstrating, through practical experience, the relevance and impact of plyometric training on improving explosive strength and speed in female soccer players. The results obtained support the effectiveness of the implemented program and demonstrate its contribution to the athletes' physical performance.

The pretest analysis showed limitations in both explosive strength, assessed using the Long test , and speed, measured with the 30-meter sprint. However, the posttest results reflected significant improvements in both abilities. These improvements were confirmed by strong correlations and high statistical significance, demonstrating the effectiveness of the plyometric program and its relevance within sports training.

The application of the plyometric program for six weeks had a positive impact on the explosive power of the female soccer players, with a considerable increase observed in the number of athletes who reached the highest performance categories in the Long test. Similarly, an improvement in 30-meter speed was evident, both in tests without and with equipment, confirming that the training enhanced acceleration and rapid movement capabilities.

The results of the "Long test" showed a more marked improvement compared to the speed tests, demonstrating that plyometric exercises directly and significantly influenced rapid force production, an essential quality for explosive actions such as jumps, changes of pace, and individual duels in women's soccer. This indicates that the development of explosive strength allowed the athletes to execute more powerful and efficient movements.

Despite the added challenge of using equipment in the speed test, the post-test results showed improvements in this area as well. This suggests that the plyometric program not only strengthened explosive power in unloaded situations but also improved the players' ability to maintain speed and coordination under more demanding conditions, reflecting a greater transfer of training to the real game context.

Finally, the observed improvement in explosive power and speed highlights the importance of plyometric training for optimizing physical performance in women's soccer. This type of exercise not only enhances explosive power and acceleration efficiency but also promotes better force transfer in key game actions, establishing itself as an essential methodology in the holistic development of female soccer players.

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***Authors' contributions*:**

The author participated in the writing of the work and the analysis of the documents.