



Effects of a physical training program on under-15 male soccer sports performance

Efectos de un programa de entrenamiento físico en el rendimiento deportivo sub-15 de fútbol masculino

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Abstract

Introduction: The effects of a physical training program on sports performance in under-15 male soccer players were studied. **Objective:** To determine the influence of a physical training program on sports performance in under-15 male soccer players. **Methodology:** The research was conducted in Guayaquil (Mapasingue Oeste sector) with players from a training school. A quantitative approach with a pre-test post-test experimental design was used. To collect and analyze the data, experimental, descriptive, comparative, and statistical

methods were employed. Variables of aerobic endurance (YoYo test), abdominal strength (one-minute sit-up test), and speed (30-meter sprint test) were evaluated using standardized physical tests, applied before and after the program.

Results: The results showed significant improvements in physical performance, with increases observed in aerobic endurance (decrease from 68.8% to 56.3% at a low level), abdominal strength (decrease from 75.0% to 43.8% at a low level and the appearance of 12.5% at a good level), and speed (decrease from 37.5% to 18.8% at a low level and an increase from



62.5% to 81.3% at a regular level). Discussion: It is deduced that a progressive, structured, and age-adapted training has a positive influence on sports performance and competitive performance in the under-15 category. Conclusion: Consequently, implementing well-designed physical conditioning programs during early adolescence is crucial, as they not only enhance specific fitness components but also lay the essential groundwork for long-term athletic development and sustained competitive success.

Keywords: Physical training; Sports performance; Under-15 soccer; Physical condition.

Resumen

Introducción: Se estudiaron los efectos de un programa de entrenamiento físico sobre el rendimiento deportivo en futbolistas masculinos sub-15. Objetivo: Determinar la influencia que tiene un programa de entrenamiento físico sobre el rendimiento deportivo en futbolistas masculinos de categoría sub-15. Metodología: La investigación se realizó en Guayaquil (sector Mapasingue Oeste) con jugadores de una escuela formativa. Se utilizó el enfoque cuantitativo con diseño experimental pre-test post-test. Para recopilar y analizar los datos se emplearon los métodos experimental, descriptivo, comparativo y estadístico. Se evaluaron variables de resistencia aeróbica (test YoYo), fuerza abdominal (test de abdominales en un minuto) y velocidad (test de sprints de 30 metros) mediante pruebas físicas estandarizadas, aplicadas antes y después del programa. Resultados: Los resultados mostraron mejoras significativas en el rendimiento físico, observándose incrementos en la resistencia aeróbica (disminución del 68,8 % al 56,3 % en nivel bajo), fuerza abdominal (disminución del 75,0 % al 43,8 % en nivel bajo y aparición de un 12,5 % en nivel bueno) y velocidad (disminución del 37,5 % al 18,8 % en nivel bajo y aumento del 62,5 % al 81,3 % en nivel regular).

Discusión: Se deduce que un entrenamiento progresivo, estructurado y adaptado a la edad de los deportistas tiene una influencia positiva en el rendimiento deportivo y en el desempeño competitivo en la categoría sub-15. Conclusión: En consecuencia, es crucial implementar programas de acondicionamiento físico bien diseñados durante la adolescencia temprana, ya que no solo mejoran los componentes específicos de la condición física, sino que también sientan las bases esenciales para el desarrollo atlético a largo plazo y el éxito competitivo sostenido.

Palabras clave: Entrenamiento físico; Rendimiento deportivo; Fútbol sub-15; Condición física

Introduction

Physical training in soccer is a systematic process aimed at improving an athlete's conditional abilities, such as strength, endurance, speed, and flexibility. In youth categories, such as the under-15 level, this process must be adapted to the adolescent's biological and maturational development (Alvear Vasquez, 2023). Several studies indicate that training planning for young soccer players should include physical, technical, and tactical components, since athletic performance is based on the interaction of these factors (Burgos, 2024).

Sports performance in soccer is a multifaceted construct encompassing physical, technical, and tactical components. There is no single universal indicator, as performance depends on many actions during the game, such as



movement, passing, shooting, and decision-making (Zhou et al., 2024).

Furthermore, it has been shown that performance is closely linked to competitive success, demonstrating that better physical and technical indicators are associated with better athletic results. A training program focused on developing explosive strength has demonstrated significant improvements in speed and physical performance in under-15 players (Bautista-Sánchez et al., 2025).

In the under-15 category, athletic performance is also influenced by the stage of biological maturation, which can produce significant differences between players of the same chronological age (Alvear-Vásquez et al., 2023). This means that training programs must be individualized, taking into account the physical and physiological development of each athlete. Proper training planning is essential for achieving significant improvements in athletic performance. It should include load dosage, exercise progression, and continuous performance evaluation (Carrasco et al., 2014). Poor planning can limit the effects of training or even lead to overload in young athletes.

There are gaps in knowledge regarding the specific effects of short-term (4-week) programs on young soccer players under 15

years of age, even within the South American development context, despite the available evidence on the benefits of structured physical training. Furthermore, few studies simultaneously assess aerobic endurance, abdominal strength, and speed using standardized tests in the same sample. Therefore, this study aims to determine the influence of a physical training program on athletic performance in male soccer players under 15 years of age, as well as to identify the components that generate significant changes in competitive performance (Blechschiemied et al., 2024).

Materials and Method

Research Design and Type

A quantitative research study was conducted using a pretest-posttest experimental design without a control group. The study was descriptive and comparative in scope. To optimize internal validity, variables such as training duration (45-60 minutes per session) and exercise intensity were controlled. Exercise intensity was monitored through the subjective perception of effort (Kahraman & Kızılcı, 2025).

Population and Sample

The population consisted of 32 male soccer players under 15 years of age belonging to the Atlético de Madrid soccer school,



located in Guayaquil, Mapasingue Oeste sector. The sample consisted of 16 players selected by simple random sampling (Soussi et al., 2025). Inclusion criteria were: a) being between 13 and 15 years old at the start of the study, b) being enrolled and actively training at the school for at least six months, and c) attending at least 85% of the program sessions. Exclusion criteria were: a) having a musculoskeletal injury in the three months prior to the start of the study; b) having a chronic condition that contraindicates the practice of physical exercise and c) not completing all pre or post intervention evaluations. Atlético de Madrid football school, located in Guayaquil, Mapasingue Oeste sector (Singh et al., 2025).

Variables and Measurement Indicators

Three dependent variables were evaluated using standardized physical tests:

Speed: The 30-meter linear sprint speed test was used. Two attempts were made with a 3-minute recovery period between them, and the best time was recorded with a digital stopwatch (0.01 s precision). The start was from a standing position, 0.5 m from the first photoelectric cell.

Aerobic Endurance: The YoYo Intermittent Recovery Test Level 1 was used. Participants performed 20-meter shuttle runs, progressively increasing their speed,

with 10 seconds of active rest between each run. The result was recorded as the level and total distance achieved, and participants were classified according to established norms for the under-15 category.

Abdominal strength: The one-minute sit-up test was used. Participants were instructed to raise their torso until their elbows touched their knees and then lower it back down, keeping their shoulder blades on the ground, while lying supine with knees bent at 90° and feet flat on the floor. The number of correct repetitions performed within 60 seconds was counted.

All assessments were performed twice: one week before the program began (pretest) and one week after the program ended (posttest), under the same environmental conditions (temperature 24-26 °C, artificial turf) and at the same time (4:00-6:00 PM).

Physical Exercise Plan

The program lasted 4 weeks, with 3 weekly sessions of 45 to 60 minutes each. It consisted of three specific blocks, described below (Ramírez Lucas et al., 2026).

Block 1: Speed Training

This took place on Mondays, Wednesdays, and Fridays of each week.

Week 1: Light jogging and joint mobility exercises (5 minutes); running technique



drills (skipping, heel kicks, lunges); speed progressions: 3 repetitions of 30 meters at 60-80% intensity (Kiss et al., 2015).

Week 2: Starts from different positions (seated, lying down): 5 x 10 m; short sprints: 6 x 20 m at 90% intensity; coordination drills with an agility ladder; 1-2 minutes of recovery between repetitions.

Weeks 3 and 4: Sprints with changes of direction: 5 x 20 m; sprints with visual or auditory stimuli: 6 repetitions; Resistance running with light resistance or elastic band: 4 x 15 m; lower body stretches at the end.

Block 2: Cardiovascular endurance training

This takes place on Tuesdays and Thursdays of each week. Duration: 20-30 minutes during the session.

Week 1: Continuous running for 15-25 minutes at moderate intensity (comfortable pace, allowing you to talk while running).

Week 2: 20 minutes of fartlek alternating 2 minutes of light jogging with 1 minute at a fast pace, repeating the cycle 6 times.

Weeks 3 and 4: Continuous circuit without rest, with stations of light jumping, jogging, skipping, and ball dribbling, 2-3 rounds of 5-6 minutes. Also, a circuit with a ball: running + passing + sprinting, with 4-6 repetitions of 10-20 meters back and forth (chase race).

Block 3: Core strength training (abdominals)

This is done at the end of each session (3 times per week), lasting 15-20 minutes.

Week 1: Traditional abdominal exercises: 3 sets of 12-15 controlled repetitions (without pulling on the neck), abdominal crunches: 3 sets of 15 repetitions, focusing on abdominal contraction. Week 2: Front plank: 3 x 20-30 seconds, taking care to maintain proper body alignment; leg raises: 3 x 10-12 repetitions, controlling the descent.

Weeks 3 and 4: Combination of the previous exercises with a slight increase in volume (plank up to 40 seconds, abdominal crunches up to 20 repetitions).

Results

The physical training program was completed with an average attendance rate of 92% of the scheduled sessions and no injuries reported during the intervention period. The results obtained in the pre-test and post-test assessments for each of the three dependent variables—speed (30-m sprint test), aerobic endurance (YoYo test level 1), and abdominal strength (one-minute sit-ups test)—are presented. The frequency tables show the distribution of the 16 participants into performance levels



(low, average, good) at the two measurement points. The changes observed

after the program's implementation are then described.

Table 1 Yoyo test

Category	Distance
Excellent	≥ 2200 m
Good	1600 – 1999 m
Average/fair	1200 – 1599 m
Low / Below average	< 1200 m

Note: Own elaboration

Table 2 Yoyo test results

Yoyo test	Under 15 Male Soccer Category			
	Pre test		Post test	
	Fre	%	Fre	%
Low	11	68.8	9	56.3
Regular	5	31.2	7	43.8
Total	16	100	16	100

Note: Own elaboration

In the assessment of aerobic endurance using the YoYo test level 1, an improvement in the performance of the soccer players was observed after the implementation of the physical training program. In the pre-test, 11 players (68.8%) were at the Low level, while 5 players (31.2%) reached the Regular level. In the post-test, the proportion of athletes at the Low level decreased to 9 (56.3%), while at the Regular level it increased to 7 (43.8%). No participant achieved the Good level in

either assessment. These results suggest that the program produced a favorable trend in the group's aerobic capacity, but the changes were moderate and insufficient for any player to reach an outstanding level. The fact that no child was categorized as Good suggests that four weeks of intervention may be a limited time to achieve significant improvements in this capacity, especially in young people starting from a low level.

Table 3 Speed Test

Category	Distance
Excellent	$< 4,5$ s
Good / Very good	4,6 – 4,8 s
Fair / Average	4,9 – 5,2 s
Low	$> 5,3$ s



Note: Own elaboration

Table 4 Speed Test Results

Speed Test	Under 15 Male Soccer Category			
	Pre test		Post test	
	Fre	%	Fre	%
Low	6	37.5	3	18.8
Regular	10	62.5	13	81.3
Total	16	100	16	100

Note: Own elaboration

In the assessment of linear speed using the 30-meter sprint test, an improvement in the performance of the soccer players was observed after the intervention. In the pre-test, 6 players (37.5%) were classified as Low, while 10 (62.5%) were classified as Average. In the post-test, the proportion of athletes at the Low level decreased to 3 (18.8%), while the Average level increased to 13 (81.3%). No participant reached a higher level (Good or Excellent) in either assessment. These results indicate that the four-week speed training program, which progressively incorporated sprints, starts from different positions, and resisted runs,

produced a positive transfer of performance from the Low level to the Average level. However, the absence of players in higher categories suggests that the intervention time may have been insufficient to achieve greater improvements, or that the participants' baseline levels required more prolonged and specific training to reach optimal performance in this capacity.

Table 5 Abdominal Test

Category	Distance
Excellent	> 30
Good	26 – 30
Average/fair	20 – 25
Low / Below average	< 20

Note: Own elaboration

Table 6 Abdominal Test Results

<i>Abdominal Test</i>	Under 15 Male Soccer Category			
	Pre test		Post test	
	Fre	%	Fre	%
Low	12	75,0	7	43,8
Regular	4	25,0	7	43,8
Total	0	0	2	12,5
Total	16	100	16	100

Note: Own elaboration

In the one-minute sit-up test, designed to assess abdominal strength, a significant improvement in the performance of the soccer players was observed after the training program was implemented. In the pre-test, 12 players (75.0%) were classified as having Low strength, 4 (25.0%) as having Regular strength, and none (0%) as having Good strength. In the post-test, the proportion of athletes at the Low level decreased to 7 (43.8%), the proportion at the Regular level increased to 7 (43.8%), and for the first time, 2 players (12.5%) reached the Good level. These findings indicate that the specific core training (traditional sit-ups, crunches, planks, and leg raises) resulted in a significant improvement in the soccer players' ability to perform the correct number of repetitions in one minute. The decrease in the Low level by more than 30 percentage points and the emergence of a Good level, which was not present in the initial assessment, suggest that the 4-week program was particularly effective for this physical capacity. The

progression from low to regular levels and, in two cases, to a good level, demonstrates a positive response to the training stimulus, possibly because the planned exercises were appropriately suited to the participants' baseline level.

Discussion

The results obtained in this study show that a structured 4-week physical training program generates differential improvements in the conditional abilities of under-15 soccer players. Abdominal strength showed the most significant change (decrease from the low level of strength from 75.0% to 43.8% and the emergence of 12.5% at the good level), followed by speed (decrease from the low level of strength from 37.5% to 18.8%) and, finally, aerobic endurance (reduction from the low level of strength from 68.8% to 56.3%). These results indicate that the response to the training stimulus depends on both baseline capacity and the specificity and duration of the work performed.

The substantial improvement in abdominal strength coincides with the reports of Magallanez-Braudasky et al. (2024), who found that short-duration core training programs (4-6 weeks) generate significant adaptations in young soccer players due to the high neuromuscular plasticity of the trunk stabilizing muscles. Similarly, Carrasco et al. (2014) noted that proper planning with exercises such as planks and leg raises produces measurable improvements in abdominal endurance tests. On the other hand, aerobic endurance showed the least progress, possibly due to the short intervention period (4 weeks) and the predominantly anaerobic nature of soccer in the under-15 category, where intermittent high-intensity efforts are more frequent than prolonged continuous runs (Barbero et al., 2010). Bautista-Sánchez et al. (2025) found significant improvements in speed with explosive strength programs, but their interventions were carried out over periods of 6–8 weeks, indicating that 4 weeks may be insufficient to fully optimize this capacity.

Partial results in speed and aerobic endurance could also be influenced by the participants' biological maturation. Alvear-Vásquez et al. (2023) and indicate that the under-15 group includes players at different maturational stages (prepubertal, pubertal,

and postpubertal), which affects their response to aerobic and speed training differently. The study did not control for maturation level, so some participants may have responded better than others simply due to their biological age, introducing an uncontrolled source of variability (Manolopoulos et al., 2013).

highlighted that multidimensional soccer performance is determined by the interaction of physical, technical, and tactical factors that influence competitive performance (Trajković et al., 2020). This study only considered physical components, which is a limitation, since improvements in abdominal strength or speed do not necessarily translate into better performance in actual gameplay if they are not accompanied by technique and decision-making skills (Burgos, 2024). However, the results demonstrate that a systematic and progressive program promotes the development of basic physical abilities, which form the basis for subsequent integrated training.

Limitations of the study include: a) The lack of a control group, preventing the program from being solely responsible for the results; b) The small sample size ($n=16$), which limits the generalizability of the findings; c) The short intervention duration (4 weeks), insufficient to induce structural physiological adaptations in

aerobic endurance; d) The failure to control for biological maturation; and e) The exclusive use of descriptive statistics without inferential significance testing. Future research should include larger samples, control groups, longer intervention periods (≥ 8 weeks), and statistical analyses that consider maturation as a covariate.

In conclusion, the results confirm that a structured, progressive, and age-appropriate physical training program has a positive impact on the athletic performance of soccer players under 15 years of age, with abdominal strength being the capacity most sensitive to short-term improvements. It is suggested that physical training be combined with technical and tactical components, and that training loads be individualized according to each player's level of biological maturation.

Conclusion

The objective of the present study was to determine the influence of a physical training program on sports performance in under-15 male soccer players, and to identify the components that produce significant changes in competitive performance. The results obtained confirm the implicit hypothesis that a structured, progressive and age-adapted intervention

produces improvements in fundamental conditional abilities.

It is deduced that the physical training program had a positive influence on sports performance, with differential improvements being observed according to the capacity worked. The ability that showed the greatest response to the stimulus was abdominal strength (reduction in low level from 75.0% to 43.8% and appearance of 12.5% in good level), followed by speed (decrease in low level from 37.5% to 18.8%) and, to a lesser extent, aerobic endurance (reduction in low level from 68.8% to 56.3%). These differences indicate that four weeks of training are sufficient to produce adaptations in core strength-endurance and linear speed, but are limited to produce significant changes in the aerobic capacity of young soccer players with low base levels.

The practical relevance of these findings is that coaches and physical trainers can prioritize abdominal strength and speed work in short-term interventions (4 weeks), while aerobic endurance would require longer periods (≥ 8 weeks) and a specific dosage that combines continuous running, fartlek and intermittent circuits. The importance of incorporating periodic evaluations through standardized tests is

also confirmed, in order to monitor progress and adjust training loads.

However, the absence of a control group, the small sample size, the short duration of the intervention and the fact of not controlling biological maturation limit the generalization of the results. Hence, new lines of research are opened: (a) studies with larger samples and control groups that allow causal relationships to be established; (b) comparison of programs of different duration (4, 6, 8 weeks) to determine the minimum time necessary to improve each capacity; (c) analysis of the effect of biological maturation as a covariate on the response to training; (d) research that integrates physical work with technical and tactical components to evaluate the transfer to performance in competition.

In conclusion, physical training planned in a progressive manner and adapted to age, contributes positively to the development of conditional abilities in under-15 soccer players, laying the foundations for better competitive performance in higher stages of training.

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