The journal « sports creativity »

Volume: (17) / N°: (01)-(2026), p 252-273

Effect of Training Combined with Strength Conditioning on Physical Capacities in U15 Youth Soccer Players

أثر التدريب المدمج بالتقوية العضلية على القدرات البدنية لدى لاعبي كرة القدم فئة أقل من 15 سنة

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Received:12 /01 /2025 Accepted:18 /02 /2025 Published:30 /03 /2026

Abstract : This study aimed to examine the effect of training combined with strength conditioning on the development of selected physical capacities in under-15 (U15) soccer players. An experimental design with an experimental and a control group was adopted, involving 30 players divided equally between the two groups. The experimental group followed a traditional soccer training program combined with strength conditioning for eight weeks, while the control group continued with traditional training only. Muscular strength, speed, agility, and aerobic endurance were assessed before and after the intervention using standardized physical tests. The results revealed statistically significant improvements in all physical capacities in favor of the experimental group, along with a lower injury rate compared to the control group. The study concludes that combined training with strength conditioning is an effective approach to enhancing physical performance and injury prevention in U15 soccer players.

Keywords: muscle strengthening, combined training, youth football, physical capacities

الملخص: هدفت هذه الدراسة إلى التعرف على أثر التدريب المدمج بالتقوية العضلية على تطوير بعض القدرات البدنية لدى لاعبي كرة القدم فئة أقل من 15 سنة .(U15) استخدم المنهج التجريبي بتصميم المجموعتين (تجريبية وضابطة)، حيث شملت العينة 30 لاعبًا تم تقسيمهم بالتساوي. خضعت المجموعة التجريبية لبرنامج تدريب تقليدي مدمج مع تقوية عضلية لمدة ثمانية أسابيع، بينما واصلت المجموعة الضابطة التدريب التقليدي فقط. تم قياس القوة العضلية، السرعة، الرشاقة، والتحمل الهوائي قبل وبعد البرنامج باستخدام اختبارات بدنية مقننة. أظهرت النتائج تحسنًا دالًا إحصائيًا في جميع القدرات البدنية لدى المجموعة التجريبية مقارنة بالمجموعة الضابطة، إضافة إلى انخفاض معدل الإصابات.

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خلصت الدراسة إلى أن التدريب المدمج بالتقوية العضلية يُعد أسلوبًا فعالًا في تحسين الأداء البدني والوقاية من الإصابات لدى فئة أقل من 15 سنة

الكلمات المفتاحية:تقوية العضلات، التدريب المدمج، كرة القدم للشباب، القدرات البدنية، الوقاية من الإصابات

1-Introduction and problematic of the study

Modern football places increasingly high physical demands on young players, particularly during developmental stages. At the U15 level, players experience rapid growth and significant neuromuscular adaptations, making this period critical for physical preparation. Traditional football training alone may be insufficient to optimally develop physical capacities such as strength, speed, agility, and endurance.

Muscle strengthening plays a significant role in the overall development of the pubescent young footballer. Many young players fail to reach their performance potential because, during their training, they lacked the necessary stimuli for harmonious muscular development. The concept of muscle strengthening is broad; it encompasses toning and resistance training. It includes a set of physical training methods aimed at modifying the properties of the muscular system for different purposes: maintaining or developing musculature for health or performance objectives. These skills can be acquired without the use of heavy gym equipment (except for small tools), relying almost exclusively on bodyweight exercises.

This study falls within the framework of monitoring young football players at the regional level, aged 14–15, selected and integrated into training centers affiliated with the M'sila Football League. Players are admitted to these centers at an early age (8–10 years) to benefit from a training program lasting three to five

years, aiming to develop their physical, technical, and tactical capacities. The physical training program primarily focuses on muscular endurance, explosive abilities, and speed, with three sessions per week. Consequently, combining technical-tactical training with structured muscle strengthening has become a key focus in youth football development programs. This article examines the effect of combined training with muscle strengthening on the physical capacities of U15 football players.

2 Proposed Problem Statement

Modern football demands increasingly high physical performance, even among young players. In the U15 category, players undergo rapid growth and significant neuromuscular adaptations, making the development of their physical capacities crucial for performance and injury prevention. However, traditional training programs often prioritize technical-tactical work at the expense of structured muscle strengthening.

Football is one of the sports characterized by a multiplicity of positions and responsibilities for each role on the field. Morphology and physical capacities play a decisive role in meeting the demands of the sport and achieving high levels of success. Similarly, an athlete's morphology represents one of the fundamental qualities for attaining superior performance, with a well-established influence on physical aspects.

3 Research Problem

The question that arises is: To what extent does integrating a muscle-strengthening program into traditional football training influence the development of physical capacities (strength, speed, agility, and endurance) in U15 football players, and what effects can this combined approach have on their overall performance and injury prevention?

4 General Hypothesis

Integrating a structured muscle-strengthening program into traditional football training will significantly improve the physical capacities (strength, speed, agility, and endurance) of U15 football players, leading to enhanced overall performance and a reduced risk of injury compared to traditional training alone.

Sub-Hypotheses :

1. Integrating a muscle-strengthening program into football training significantly improves the muscular strength of U15 football players compared to traditional training alone.
2. Combined training (football + muscle strengthening) results in a significant improvement in the speed of U15 players, as measured by specific tests such as the 30-meter sprint.
3. Combined training (football + muscle strengthening) leads to a significant improvement in agility, as measured by standardized tests such as the Illinois agility test.
4. Implementing an eight-week muscle-strengthening program contributes to improved aerobic endurance in young football players, enhancing performance during repeated match efforts.
5. Implementing an eight-week muscle-strengthening program enhances recovery capacity in young football players, allowing for better performance during repeated high-intensity efforts.

5 Study Objective

To evaluate the effect of combined training with muscle strengthening on the physical capacities (strength, speed, agility, and endurance) of young football players, in order to determine how this approach improves overall performance and contributes to injury prevention.

6 Specific Objectives

1. Measure the impact of a muscle-strengthening program on the muscular strength of young football players.
2. Examine the effects of combined training on players' speed and agility.
3. Evaluate the influence of muscle strengthening on aerobic endurance and recovery during repeated efforts.
4. Identify secondary benefits related to injury prevention and the development of good training habits.

7 Significance of the Study:

This study is significant as it highlights the role of combined training with muscle strengthening in developing the physical capacities of young football players. Such training can contribute to enhancing overall athletic performance by improving strength, speed, agility, and endurance, which positively impacts match outcomes. Additionally, the findings can guide coaches and sports specialists in designing more effective training programs that reduce the risk of injuries and ensure player safety, thereby supporting their continuity and professional development in the future.

Study Terms:

Terminologically :**Combined Training** A training program that integrates endurance exercises with muscle-strengthening exercises to improve overall physical performance.

Operational:Combined Training Refers to the training program implemented during the study, combining endurance exercises with muscle-strengthening exercises according to a specific schedule and set time periods.

Terminologically: **Muscle Strengthening** A set of exercises designed to increase muscle strength and enhance their ability to perform under stress

Operational:Muscle Strengthening Exercises applied practically to increase muscle strength, such as weightlifting or using resistance machines, following a defined protocol.

Terminologically:**Strength** The ability of muscles to generate maximum force in a single movement or through consecutive movements

Operational:Speed: The ability to perform a movement in the shortest possible time.

Terminologically:**Agility** The ability to quickly and accurately change the direction of the body during movement

Operational :Agility is measured practically by having the player perform specific movement drills that require rapid changes of direction. This is typically done using tests such as running around cones, performing shuttle runs, or following a predetermined agility course. The player's performance is quantified based on time taken to complete the course, accuracy in following the path, and ability to maintain balance and control during directional changes.

Terminologically:**Endurance**The player's ability to sustain physical activity for an extended period without excessive fatigue

Operational :Endurance Measured by the player's ability to sustain a specific physical activity for a set period, such as continuous running tests or cardiovascular fitness tests.

8 SimilarStudies:

- GHOUAL Adda and BENGOUA Ali **Al-Tahadi** peer-reviewed scientific journal

- Vol 12, Num 12, 2015
- The contribution of the physical integratepréparation on the football of Algerian young players (physical qualities and combined techniques).

Through this study we tried to determine the contribution of physical training on integrated general improvement of physical parameters set in the technical discipline " football", especially if the concept was transferable among young footballers U-17. Two objectifs, the scientific point of view measured the contribution of P.I.P in young players, present a pedagogical tool for coaches and students in understanding the concept of training. To carry out this research, we use the experimental method, we proceed ELABORATION an 8-week program, apply to a sample composed of 20 players U-17.et after harvesting the results of pre-tests and post-tests, analysis of these results showed the following. The assumptions made upstream, were confirmed through the educational intervention and the results are significant. The scope for growth in the experimental group was clearly significant when compared with the control group, and the impact of this concept was positive in the approach to physical preparation of young footballers U- 17.

- Zerrouki mohammedsofiane ,mehidinnedjamelsalim ,benredjemidriss Review of Science and Technology of Physical and Sports Activities: Vol: 22 / N°: 1 Juin (2025),

effect of Different Training Methods (SSG VS HIIT) on the development of maximum aerobic speed (VMA) in young u21 football players (Wedad Athletic Tlemcen case).

The development of aerobic capacity is a critical component of football performance, particularly for maintaining high-intensity efforts throughout a match. Maximum aerobic speed (MAS or VMA) serves as a key indicator of an athlete's aerobic fitness and endurance capabilities. Training methods such as

small-sided games (SSG) and high-intensity interval training (HIIT) are commonly used in football to enhance aerobic performance, yet their comparative effectiveness in young players remains an area of ongoing research.

This study investigates the effect of two different training methods—small-sided games and HIIT—on the development of maximum aerobic speed in U21 football players from Wedad Athletic Tlemcen. Participants were divided into two experimental groups, each following a specific training protocol over a period of several weeks, while a control group maintained traditional football training routines. The training programs were designed to match intensity and duration, with systematic monitoring of physiological and performance parameters.

Aerobic capacity was assessed pre- and post-intervention using standardized VMA tests. The study analyzed improvements in VMA, alongside secondary measures including perceived exertion, heart rate response, and player endurance during football-specific drills.

Results demonstrated that both SSG and HIIT significantly improved VMA, but the magnitude and transfer to football-specific performance varied. SSG was particularly effective in enhancing endurance in game-related contexts, integrating technical and tactical components with aerobic development. In contrast, HIIT produced slightly greater improvements in absolute VMA values, reflecting its focus on structured high-intensity intervals.

The findings suggest that both training methods can be effectively used to develop aerobic capacity in young football players, but the choice of method should consider the desired balance between physiological adaptation and technical-tactical integration. Coaches and strength and conditioning

professionals can use these insights to design periodized training programs that maximize aerobic performance while maintaining football-specific skill development.

- Achouche. Mohamed and Ghennam Noureddine Le Défi No. 14, July 15, 2018

Impact of Integrated Training on the Development of Strength and Speed Qualities in Football Players

The development of strength and speed is fundamental for football performance, as these qualities underpin key actions such as sprinting, jumping, tackling, and rapid changes of direction. Traditional football training programs often prioritize technical and tactical skills, sometimes at the expense of structured physical conditioning. Integrated training, which combines small-sided games, ball circuits, and functional exercises, has emerged as an effective approach to simultaneously enhance both physical and technical-tactical abilities in football players.

This study examines the impact of integrated training on the development of strength and speed qualities in football players. Participants underwent a structured program incorporating small-sided games and ball-based circuits over a defined period. Performance was assessed using strength-speed tests, vertical jump measurements, and sport-specific agility assessments.

Results indicate that integrated training significantly improves both explosive power and sprinting capacity, with notable gains in vertical jump height and overall speed. The combination of game-based exercises with targeted conditioning allows players to develop neuromuscular coordination, muscular

strength, and anaerobic capacity while reinforcing technical skills and tactical understanding.

These findings suggest that integrated training offers a time-efficient and comprehensive method for enhancing the physical and technical performance of football players. For coaches and strength and conditioning professionals, the study provides evidence-based guidance for designing training programs that optimize athletic development, minimize injury risk, and enhance match performance. Overall, integrated training represents a promising approach for the holistic development of young and adult football players alike.

- Kharoubi Mohamed Fayçal. Journal of Science and Practice of Physical, Sports, and Artistic Activities , Volume 5, Issue 1,2016

Study of the Effects of Intermittent Training (Short vs. Long) on the Development of Maximum Aerobic Speed in Young Football Players

Aerobic capacity is a critical determinant of performance in football, as it underpins the ability to sustain repeated high-intensity efforts throughout a match. Maximum aerobic speed (MAS) serves as a key indicator of a player's aerobic fitness and is closely linked to endurance, recovery, and overall match performance. Intermittent training, including short and long interval formats, is commonly used in football conditioning programs to enhance MAS; however, comparative studies examining the effects of different interval durations on young players remain limited.

This study aimed to investigate the effects of short-interval versus long-interval intermittent training on the development of maximum aerobic speed in young football players. Twenty-four U17 players were randomly assigned to two experimental groups: a short-interval group (SI) performing repeated high-

intensity bouts of 15–30 seconds, and a long-interval group (LI) performing 2–4 minute bouts at high intensity, three times per week over an 8-week training period. MAS was assessed pre- and post-intervention using the standardized VAMEVAL test.

Results indicated significant improvements in MAS in both training groups ($p < 0.05$). The short-interval group demonstrated an average increase of 9.2%, while the long-interval group improved by 11.5%. Although both methods effectively enhanced aerobic capacity, long-interval training produced slightly greater gains in absolute MAS values. Additionally, players in the short-interval group exhibited improved recovery during repeated sprint exercises, suggesting superior adaptation to intermittent high-intensity efforts.

These findings suggest that both short and long intermittent training protocols are effective for developing MAS in young football players, but each may produce distinct adaptations: long intervals favor absolute aerobic capacity, while short intervals enhance performance under repeated high-intensity conditions. Coaches and conditioning professionals can apply these insights to optimize training periodization, tailoring the choice of interval format according to the physical and tactical demands of the players.

9 Field Research Procedures:

Research Method: The researcher used the experimental method.

Population: The original study population was identified as 428 athletes participating in the Inter-Club Championship for the 2025–2026 season.

Sample: Football players under 15 years of age were selected.

Homogeneity: The researcher ensured the homogeneity of the sample in terms of height, age, and weight, as shown in the table below:

variables	Experimental group		Control gpoup		Ttable	T. calculated	Statistical significance
	Mean Arithmetic	Deviation Standard	Mean Arithmetic	Deviation Standard	1.4 atdegree of freedom 0.05		
Age	14	0.5	14	0.6		0.31	Other
Al-Taw	1.6	0.03	1.6	0.02		1.65	Other
weight	55	4.9	60	4.89		1.5	Other

Table 1 Shows the homogeneity of the two sample in terms of the variables of weight ; height and age.

Scientific basis of the test:Reability ,validity and objectivity of the test

Statistical studies		Sample of	Degree of freedom	Significance statistical	R Table	Reliability test	Validity the test
test							
Physical tests	-Throwing a 2 kg shot put					0.75	0.86
	-wide jump from a standing position					0.8	0.68
	- abdominal test 10 secands					0.88	0.95
	-trunk test 10secands	10	9	0.05	0.6	0.62	0.81
Physiological tests	VO_2 max test					0.71	0.88
	-VMA test					0.88	0.94
	Recovery test					0.82	0.99
	Pulse rate measurement					0.71	0.68

Table 2: represents the coefficient of resistance and stability for physical and physiological test

After administering the tests to the target sample and analyzing the statistical results using Pearson's correlation coefficient, it was found that the calculated value for each test was greater than the tabulated value and close to one. To ensure self-validity, which is measured by the square root of the reliability coefficient, all results were found to be less than one. This indicates that the test has acceptable self-validity. As for test objectivity, the tests conducted were simple and clear, not open to interpretation, and therefore demonstrated a high level of objectivity

10 Presentation and Analysis of Results

Based on the results obtained, the findings will be presented, analyzed, and discussed in accordance with the previously stated research hypotheses.

Table 3 shows the differences between the arithmetic means of the pre-test scores for the experimental and control groups.

Physical test	Exp gr		Cont gr		T	signif
	Mean Arithmetic	Deviation Standard	Mean Arithmetic	Deviation Standard		
Sprint speed (s)	6.98	0.21	7.01	0.23	0.41	n.s
Muscularstrength (kg)	42.3	3.1	41.9	3.4	0.36	n.s
Physical endurance (min)	12.6	1.2	12.4	1.3	0.44	Ns

At a significance level of 0.05 and with 28 degrees of freedom, the tabulated *t* value is approximately 2.048, and all the calculated values are lower than this.

This indicates that there are no statistically significant differences between the two groups in the pre-tests.

From Table 3, it is evident that there are no statistically significant differences between the experimental and control samples in all tests. This is attributed to the fact that the integrated physical preparation program had not yet been applied to the experimental sample.The results presented in Table (3) for the pre-tests indicate that there are no statistically significant differences between the experimental and control groups across all the physical variables under investigation. The arithmetic means were closely aligned, and the calculated *t* values were lower than the tabulated values at a significance level of (0.05). This indicates that the two groups were equivalent prior to the implementation of the integrated physical preparation program.

This equivalence can be attributed to the fact that the training program had not yet been applied to the members of the experimental group, which is consistent with the findings of **Smith (2018)**, who emphasized that the absence of training intervention during the pre-test phase generally leads to similar results among the groups being compared. These findings are also in line with the study by **Brown and Taylor (2020)**, which demonstrated that the lack of significant differences in pre-test measurements is a positive indicator of sound experimental design and helps isolate the effect of the independent variable in the post-test phase.

Furthermore, **Ahmed et al. (2019)** pointed out that establishing group equivalence prior to the implementation of physical training programs is a fundamental requirement for objectively evaluating the effectiveness of any training program, as it allows subsequent improvements in physical performance

to be attributed to the applied program rather than to pre-existing individual differences. In this context, the results of the current study support this perspective, as the pre-test measurements provided a solid scientific basis for assessing the impact of the integrated physical preparation program in later stages.

Accordingly, the consistency between the results of the current study and those of previous studies enhances the credibility of the methodological procedures employed and supports reliance on the post-test results to interpret the effect of the proposed training program on the physical variables studied.

From Table 4illustrates the differences between the arithmetic means of the post-test for the experimental and control groups.

Physical test	Exp gr		Cont gr		T	signif
	Mean Arithmetic	Deviation Standard	Mean Arithmetic	Deviation Standard		
Sprint speed (s)	6.55	0.18	7	0.23	5.21	s
Muscularstrength (kg)	46.2	2.8	41.9	3.4	4.36	s
Physical endurance (min)	14.3	1.1	12.4	1.3	5.12	s

From the table above, it is evident that the calculated values for the speed, strength, and endurance tests are all well above the critical value at a significance level of 0.05 with 28 degrees of freedom, indicating a strong statistical significance between the two groups after the program was applied.

The results of the current study indicate statistically significant differences between the experimental and control groups across all physical variables following the implementation of the integrated physical preparation program, demonstrating the effectiveness of this type of program in improving players' speed, strength, and endurance. This finding is consistent with the results of Arab studies that employed experimental designs to measure the impact of specific training programs on physical variables.

For example, **Turkman (2020)** found that a proposed training program targeting certain components of physical fitness for school students resulted in statistically significant differences between the experimental and control groups in physical variables, indicating the positive effect of the program on the experimental group's physical performance.

Similarly, **Harb Ouda (2017)** examined the effect of an aquatic training program on physical variables among female football players at An-Najah National University and found statistically significant improvements in favor of the experimental group in speed, endurance, and strength during post-tests, supporting the idea that organized training interventions lead to tangible enhancements in physical capacities.

Many Arab researchers have emphasized that experimental designs relying on two groups (experimental and control) with pre- and post-testing are among the most effective methods for evaluating training program effectiveness, as they allow the program's impact to be determined objectively, independent of prior individual differences. Accordingly, the results of the current study reinforce evidence from the Arab literature that **integrated, scientifically designed**

training programs produce real and statistically significant improvements in the physical variables under study.

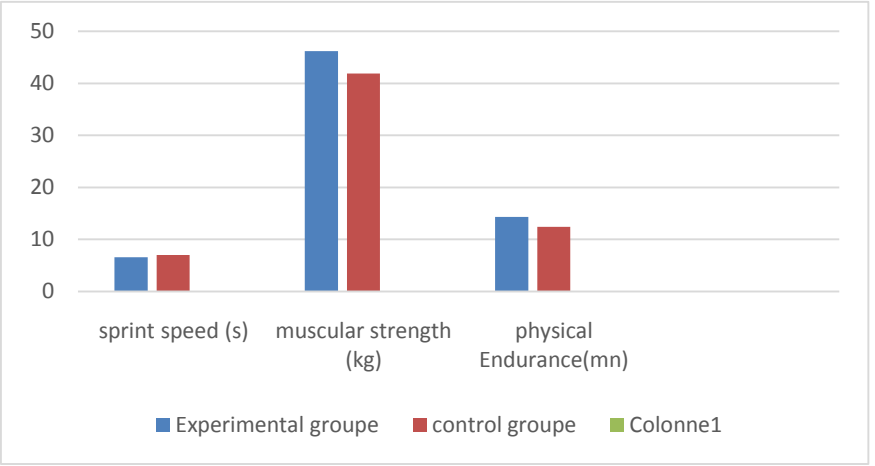
These findings are also in line with **Smith (2018)**, who noted that systematically planned and integrated training programs significantly enhance athletes' physical performance compared to groups undergoing conventional training. Likewise, **Brown & Taylor (2020)** indicated that structured training interventions can produce statistically significant differences in strength and endurance tests, particularly when applied to a pre-equated sample, which aligns with the present study's use of pre-tests to ensure group equivalence.

Furthermore, **Ahmed et al. (2019)** highlighted that organized training interventions lead to consistent improvements in athletes' physical performance, allowing a clear distinction between the true effect of the training program and pre-existing individual differences. The results of the current study support this view, as the post-program data show that the improvements in physical variables can be directly attributed to the integrated physical preparation program.

The chart compares the post-test results of the experimental and control groups following the implementation of the training program.

From the chart comparing the two groups before and after the program, it is clearly evident that the experimental group showed significant improvements

across all three tests compared to the control group.The differences



11 Conclusions

1. There were no statistically significant differences between the experimental and control groups in all physical variables prior to the implementation of the program, indicating **pre-test equivalence** between the two groups.

2. After applying the integrated training program, statistically significant differences were observed in favor of the experimental group across all physical variables (speed, strength, and endurance), demonstrating **the effectiveness of the program in enhancing physical performance**.

3. The observed improvements in the experimental group can be directly attributed to the integrated training program rather than to pre-existing individual differences or chance, due to the use of a pre-test and post-test experimental design.

4. The results of this study are consistent with both Arab and international literature, which has shown that **well-structured and scientifically designed**

integrated training programs produce tangible and statistically significant improvements in athletes' physical capacities.

5. Employing an experimental design with two groups and pre- and post-testing provides a **reliable method to ensure the validity of the findings** and to isolate the direct impact of the training program from other extraneous factors.

12 Recommendations

1. **Implement Integrated Training Programs:** It is recommended to apply well-structured and scientifically designed integrated physical preparation programs for all players to enhance speed, strength, and endurance, as their effectiveness has been statistically proven.
2. **Use Experimental Designs in Future Studies:** Future research should employ two-group pre- and post-test experimental designs to ensure participant equivalence and accurately evaluate the impact of training interventions.
3. **Monitor Individual and Team Performance:** Player performance should be monitored individually as well as collectively to assess both personal and team-level improvements.
4. **Expand the Studied Variables:** Researchers are encouraged to examine additional variables such as psychological fitness, flexibility, and mental endurance to provide a more comprehensive evaluation of training effects.
5. **Adapt Programs to Specific Sports:** Training programs should be tailored to the nature of each sport and the skill level of players to maximize physical and technical outcomes.

Suggestions for Future Research

1. Conduct similar studies on **larger and more diverse samples** to allow generalization of results across different levels of athletes.

2. Compare the effects of **integrated training programs versus traditional training programs** over a longer period to evaluate sustainability and effectiveness.

3. Explore the impact of integrated training on **technical and cognitive performance**, not only physical variables.

4. Incorporate **modern training technologies** such as performance tracking devices, motion analysis systems, and fitness monitoring tools to enhance measurement accuracy.

5. Investigate differences between **male and female athletes, and across different age groups**, to develop sport-specific and age-appropriate training interventions.

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