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<p>Effectiveness of an Integrated Multidimensional Training and Educational Program Combining Physical Conditioning, Technical Skill Development, and Neuromuscular Enhancement on the Performance of Young Amateur Football Players: An Experimental Study in Souk Ahras Province, Algeria</p>	
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Abstract	
<p>The continuous development of modern football requires training approaches that integrate physical, technical, and neuromuscular components within a unified scientific framework. The present study aimed to evaluate the effectiveness of a proposed integrated training and educational program designed to improve physical fitness, technical performance, and neuromuscular capabilities among young amateur football players.</p> <p>An experimental pre-post design was adopted. The study sample consisted of 24 youth football players from amateur clubs in the Wilaya of Souk Ahras, Algeria. The training intervention was structured to combine physical conditioning (strength, speed, endurance, and agility), technical skill development (ball control, passing accuracy, dribbling, and shooting), and neuromuscular training targeting translational speed and movement reaction efficiency. Standardized field tests were administered before and after the training period. Statistical analysis was conducted to determine differences between pre- and post-measurements and to estimate effect sizes. The results demonstrated statistically significant improvements ($p \leq 0.05$) across all measured physical fitness variables, with large effect sizes indicating substantial enhancement in strength, speed, and overall physical readiness. Significant progress was also observed in technical performance indicators, with medium to high effect sizes reflecting improved execution of fundamental football skills. Furthermore, neuromuscular performance showed significant gains, particularly in linear sprint speed and movement speed, indicating improved motor coordination and neuromuscular efficiency. The findings confirm that integrated multidimensional training programs represent an effective strategy for improving overall performance in young amateur football players. The study highlights the importance of scientifically planned training models for youth development and provides practical guidance for coaches, sports academies, and football development programs seeking to enhance competitive performance at the grassroots level.</p>	
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Introduction:

Football is the most popular sport both locally and globally, played by men and women, children and adults, across various levels of expertise. All scientific efforts and practical experiences have converged to advance the technical level of this game. Skill execution in football is characterized by a combination of strength and speed, performed collectively with a high degree of understanding and precision. This demands that players possess high physical capacities enabling them to withstand fatigue and sustain performance throughout the match. Consequently, players must be developed from an early age, both qualitatively and quantitatively, to achieve physical, technical, and tactical competence that allows them to fulfill individual and collective roles efficiently, make sound decisions, and react swiftly to changing situations during play. Such achievement can only be realized through the proper scientific preparation and formation of young players.

As the performance level of football players around the world has improved remarkably, those responsible for the sport are compelled to find methods that enable local players to keep pace with this progress. Scientific and practical evidence has confirmed the importance of physical fitness in addition to technical proficiency. A football player can no longer rely solely on technical skill without possessing a high level of physical conditioning. Thus, physical and technical fitness have become inseparable at all stages of preparation and even during competition periods (Amr Allah & Ahmed Bastawisi, 1994, p.1).

The nature of high-level athletic performance requires the athlete to utilize his physical, technical, tactical, and psychological capacities in an integrated manner to achieve the best possible results (Osama Rateb & Mustafa Mohamed, 1991, p.331). Through the development of the essential physical abilities required by the sport, the player's technical and tactical performance can be elevated. This improvement can only be achieved through the application of scientifically based training methods, whose positive effects become evident over time, reflected in the player's performance level during matches.

Sports training aims to help the athlete reach the highest possible level in a specific type of athletic activity. To achieve this, training seeks to develop physical, technical, tactical, and psychological aspects in a balanced way (Mohamed Abdelkader & Yasser Mohamed, 1995, p.60). In addition to enhancing various physical capacities such as strength, speed, agility, and endurance—which improve the functional efficiency of the internal systems—athletes acquire new motor skills through continuous learning and practice (Kamal Abdelhamid & Mohamed Sobhi, 1980, p.38).

A player who lacks mastery of compound performance tends to focus more on the ball and its handling than on tactical aspects. Consequently, this narrow focus prevents the player from accurately observing the movements of teammates or opponents, which undoubtedly affects the precision of tactical execution (Mohamed Ibrahim Sultan, 2004, p.88).

Research Problem:

In recent years, new training methods have been introduced in team sports, fundamentally transforming their structure. These modern methods have become key factors in raising players' performance levels to the impressive standards observed today. The effective selection and correct application of a training method depend on the coach's knowledge and experience, as well as the players' performance level. Furthermore, the choice of method depends on the training objectives and the available conditions for implementation.

Training methods refer to systematic approaches governed by specific principles and requirements used to develop the training status of both the player and the team, aiming to reach the highest possible "sport form." The type of training state achieved depends on the level of development across physical, technical, tactical, and psychological domains. These training methods must be viewed as interconnected components of a single process—sports training—and should be given equal importance to achieve optimal athletic performance.

The training program is one of the key elements of the coach's overall training plan; without it, planning is incomplete. The program represents the practical steps and detailed activities that must be executed to achieve the set objectives (Farouk Abdelwahab, 1999, p.15). Performance improvement results from the development of formative programs and training loads, which influence various biological factors—including physiological and morphological ones. Among these, physiological factors play a primary role in determining the player's physical, technical, and tactical performance level, which is closely linked to the nature and structure of training loads.

Kamal Darwish and colleagues emphasized that to enhance a player's ability to resist fatigue, training loads must be properly regulated so that they induce effective fatigue rather than overtraining. Repeated exposure to these loads, within specific timeframes and supported by successful physiological adaptation during recovery, leads to improved and developed performance levels (Kamal Darwish et al., 1998, p.69).

It has been observed during the preparation phase of football players—particularly among amateurs—that most coaches lack well-structured, planned, and scientifically based training programs. Moreover, the physical and technical performance levels of young players in the Wilaya of Souk Ahras are notably lower compared to those in other regions.

A general observation across youth and amateur teams indicates that most players do not reach the expected level of performance required for progression to professional clubs. Their participation remains limited to basic practice, primarily due to insufficient attention to proper formative training by coaches, clubs, and sports associations.

All these considerations led us to propose an **integrated formative training program** that combines **physical, technical, and neuromuscular components** (translational speed and movement speed) for youth football players, and to pose the following research question:

Research Questions:

- Does the proposed formative training program have an effect on the physical aspect of young football players?
- Does the proposed formative training program have an effect on certain basic skills among young football players?

- Does the proposed formative training program have an effect on neuromuscular strength (linear speed and movement speed) among young football players?

Research Hypotheses:

- The proposed integrated formative training program has a positive effect on the physical aspect of young football players.
- The proposed integrated formative training program has a positive effect on certain basic skills among young football players.
- The proposed integrated formative training program has a positive effect on neuromuscular strength (linear speed and movement speed) among young football players.

Research Objectives:

This study aims to:

- Design a proposed formative training program to improve the physical fitness of young football players.
- Design a proposed formative training program targeting certain basic skills among young football players.
- Design a proposed formative training program to develop neuromuscular strength (linear speed and movement speed) among young football players.

Significance of the Study:

- The proposed formative training program is among the few programs conducted in amateur football that integrates physical, technical, neuromuscular, and muscular aspects within a single training framework.
- The proposed formative training program can be beneficial for both youth and amateur football players, providing a structured model for comprehensive athletic development.

Operational Definitions:

Physical Aspect:

It represents a fundamental and essential factor in improving skill performance. Physical abilities aim to identify specific components that play a vital role in mastering fundamental skills. Football, as a team sport, is highly technical and requires numerous motor skills that depend heavily on the player's physical capabilities to ensure accurate and efficient execution (Hassan El-Sayed Abu Abda, 2004, p.37).

Mufti Ibrahim defined it as "the sound physical condition of the athlete in terms of bodily efficiency, which enables him to perform physical and motor tasks skillfully and effectively with minimal effort" (Mufti Ibrahim, 2001, p.18).

Skill Performance:

It refers to a set of coordinated and integrated movements executed by the player according to the situational demands of the competition, relying on his physical and technical capacities, as well as his psychological and mental state. The integration of these factors directs performance toward a high level of effectiveness and achievement (Yasser Hassan, 1996, p.19).

The nature of football performance involves numerous and diverse skills that players must master—both with and without the ball—to gain an advantage over opponents. Therefore, training on these skills occupies a significant portion of the training schedule for both youth and senior football players (Mohamed Shawky Keshk, 1996, p.3).

Muscular Strength:

Muscular strength is the amount of force a muscle can produce during maximal effort. It depends on muscle fiber size and the nervous system's ability to activate those fibers. Muscle strength is measured during contraction and is closely related to two other terms: muscular endurance and muscular power.

- Muscular endurance refers to the duration during which muscles can continue contracting against resistance or weight.
- Muscular power refers to the strength and speed of muscular movement.

Neuromuscular Strength (Neural Adaptation):

This term refers to the brain's ability to control muscle contractions and generate specific movements. Resistance or balance training helps the brain learn to activate muscles efficiently to perform desired actions. Over time, these movement patterns become more ingrained and automatic, leading to smoother and more coordinated motion—this is the essence of neuromuscular strength. The greater the neuromuscular adaptation, the higher the level of neural efficiency and the greater the number of motor units recruited for muscle contraction and relaxation (Ahmed Maher, 2019, Internet).

Operational Definition:

- Linear speed refers to the player's ability to move from one point to another in the shortest possible time, such as sprinting.

- Movement speed (or execution speed) refers to the speed of muscle contractions required to perform a specific movement, such as kicking a ball or jumping—the ability to cover a distance or perform an action at maximum speed in minimal time.

Previous and Related Studies:

Jamal Abdullah Hassan (1994) - “The Effect of a Proposed Training Program on Physical and Skill Performance and Cardiac Function in Football Players.”

The aim of this study was to investigate the impact of a proposed training program on the physical and skill performance as well as on cardiac function in football players. The sample included 38 players under the age of 20, and the experimental method was applied.

Key findings: Significant differences and improvements were observed between the experimental and control groups in terms of heart size and function as a result of the proposed training program. The study also revealed significant differences in physiological variables such as heart rate and systolic and diastolic blood pressure during the training season.

Abdel-Basit Hamad Abdel-Halim (1998) - “The Effect of a Training Program on Some Complex Skill Performances of Youth Football Players.”

The study aimed to identify the effect of a training program on the development of complex skill performances among football players under the age of 16. The sample consisted of 30 players aged under 16, and the experimental method was used.

Key findings: The researcher designed a set of ten tests to assess complex skill performances and determined their scientific parameters. The results showed statistically significant differences in the level of complex skill performance between the experimental and control groups, in favor of the experimental group.

Study Procedures:

Study Methodology:

The researcher employed the **experimental method** due to its suitability for the nature of this study, using a **single-group design** with **pre- and post-measurements**.

Study Domains:

A. Human Domain:

The study was conducted on players from *Afaq El-Marahna Club* (Souk Ahras), totaling **24 players** for the sports season.

B. Spatial Domain:

The **pre-tests, training program application, and post-tests** were all carried out at *Baji Mokhtar Stadium* in Souk Ahras.

C. Temporal Domain:

The pre-tests, implementation of the training program, and post-tests for the main study sample were conducted during

the period from **January 5, 2025, to May 2, 2025**.

Study Sample:

The study sample consisted of **24 players** who were **intentionally selected** from the amateur players of Afaq El-Marahna Club (Souk Ahras).

The researcher chose this club for the following reasons:

- The team’s consistent training without interruption.
- Ease of communication and experimental control of the study sample.
- The coach’s approval to conduct the experiment on the players.
- Homogeneity among the participants in all the main study variables.

Table (01): Statistical Description of the Research Sample According to Variables (Age - Height - Weight - Training Age)

Variables	Measurement Unit	Mean	Standard Deviation	Median	Skewness Coefficient
Age	Year	10.67	0.69	17.00	1.35
Height	Centimeter	1.45	0.18	1.46	1.43
Weight	Kilogram	45.58	1.21	54.09	0.37
Training Age	Year	1.02	0.65	2.10	1.19

Interpretation:

From Table (01), it is evident that the research sample demonstrates **normal distribution** in the **psychometric variables** (age, height, weight, and training age), as the skewness coefficients ranged between ± 3 . This indicates that the sample is **homogeneous** and that the data are **normally distributed** across all studied variables.

Pilot Study:

A. First Pilot Study:

The first pilot study involved conducting **physical fitness tests**, **skill performance tests**, and **neuromuscular ability tests** (translational speed and movement speed) on a sample of **15 young players** representing the original population but not included in the main study.

The purpose was to assess the **appropriateness of the tests**, identify potential **difficulties** that the researcher might encounter, determine the **suitability of the testing venue, tools, and equipment** required for the main study, and ensure that assistants clearly understood the **measurement procedures**.

B. Second Pilot Study:

The second pilot study aimed to calculate the **scientific coefficients** of the tests, namely **validity** and **reliability**.

Test Validity

1. Discriminant Validity:

To determine validity, the researcher used the **discriminant validity method**, administering the tests to **two groups**:

- A **distinguished group** of first-division football players (n = 15).
- A group of under-12 young players (n = 15), similar to the main study sample.

The tests for **physical fitness**, **skill performance**, **translational speed**, and **movement speed** were conducted on **January**

5, 2025, and the **T-value** was calculated to determine the significance of the differences between the two groups. The results showed **statistically significant differences**, indicating that the tests were **valid** and capable of distinguishing between groups of differing performance levels.

A. Discriminant Validity of Physical Fitness Tests:

The obtained results revealed significant differences between the two groups in the following physical fitness variables:

- Leg muscle strength,
- Vertical jump from a standing position (leg power),
- Standing broad jump,
- Agility (running in place for 10 seconds),
- Barrow agility test,
- Flexibility (trunk bend forward from standing),
- Muscular endurance (inclined push-up test).

The calculated T-values were **(3.97), (2.22), (2.34), (32.32), (2.23), (3.27)** respectively, all of which were greater than the **tabulated T-value (1.761) at the 0.05 level**, confirming statistically significant differences in favor of the distinguished group.

This demonstrates the **validity** of the physical fitness tests and their ability to discriminate effectively between players of different performance levels.

Validity and Reliability of Measurement Tools

Discriminant Validity of Skill Performance Tests

To verify the discriminant validity of the selected offensive skill performance tests, comparisons were conducted between distinguished and non-distinguished players. The skill tests included:

- Passing and receiving with a partner from a distance of 3 meters within 30 seconds
- Zigzag dribbling over a distance of 15 meters
- Long passing from the wings (five attempts)
- Shooting after overcoming a defensive obstacle
- Feinting with the ball followed by fast and accurate shooting
- Ball control (receiving and delivering)
- Shooting at intersecting target squares

The calculated T-values for these tests were 2.52, 8.52, 20.28, 19.60, 17.77, 8.64, and 3.20, respectively. All calculated values exceeded the tabulated T-value of 1.761 at the 0.05 significance level, indicating statistically significant differences in favor of the distinguished group.

These results confirm that the selected skill performance tests possess strong discriminant validity and are capable of effectively differentiating between players of different technical performance levels.

Discriminant Validity of Neuromuscular Ability Tests

Discriminant validity was also examined for neuromuscular ability variables, specifically translational speed and movement speed. The tests included:

- 30-meter sprint from a standing start
- Barrow zigzag run test
- 400-meter run

- Numbered circle transition test

The calculated T-values were 7.12, 3.18, 23.91, 4.18, and 7.47, all of which exceeded the tabulated T-value (1.761) at the 0.05 level. The results indicate statistically significant differences in favor of the higher-performing group.

Accordingly, the neuromuscular tests demonstrated adequate discriminant validity and were considered appropriate for distinguishing between varying performance levels among young football players.

Test Reliability

To determine the stability and consistency of the measurement tools, the test-retest method was applied to a sample of 15 players, who were also involved in the validity procedures. The interval between the two test administrations was 14 days (January 5 to January 19, 2025).

Reliability coefficients were calculated using Pearson's correlation between the first and second measurements.

Reliability of Physical Fitness Tests

The correlation coefficients for physical fitness tests ranged between 0.82 and 0.95, all exceeding the tabulated r-value (0.537) at the 0.05 significance level. These values indicate a high degree of reliability.

The intrinsic validity coefficients (calculated as the square root of reliability) ranged between 0.91 and 0.97, reflecting strong internal consistency and measurement stability.

Reliability of Skill Performance Tests

For offensive skill performance tests, correlation coefficients between the two test administrations ranged from 0.80 to 0.91, exceeding the tabulated value (0.426) at the 0.05 level.

The intrinsic validity values ranged between 0.89 and 0.95, confirming that the selected skill tests provide stable and consistent measurements over time.

Reliability of Neuromuscular Ability Tests

The reliability coefficients for neuromuscular performance variables ranged between 0.84 and 0.99, all statistically significant and higher than the tabulated value (0.426) at the 0.05 level.

The intrinsic validity values ranged from 0.91 to 0.99, indicating very high reliability and confirming the suitability of these tests for evaluating translational and movement speed.

Research Tools and Test Selection Procedures

First Test: Physical Fitness Assessment

The selection of physical fitness components and their corresponding tests was carried out through two main procedures.

Content Analysis of Scientific Literature

Relevant scientific references and previous studies were analyzed to:

- Identify the most important physical fitness components required for football players in the studied age category
- Determine standardized and scientifically accepted tests for assessing these components

Expert Consultation

Two questionnaires were distributed to specialists in sports training and physical education:

1. Identification of the most important physical fitness components for youth football players
2. Selection of the most appropriate tests for measuring these components

Based on expert agreement of 90% or higher, the following components and tests were adopted:

Muscular Strength

- Vertical jump from standing position (leg strength)
- Standing broad jump (explosive power)

Agility

- Barrow agility test

Flexibility

- Trunk forward bend from standing position

Muscular Endurance

- Inclined push-up test

Second Test: Skill Performance Assessment

The offensive skill performance tests were selected through content analysis of specialized references and previous research, followed by expert evaluation.

The selection criteria aimed to:

- Identify the most important offensive skills for the target age group
- Determine reliable and practical field tests for evaluating these skills

Based on expert approval rates exceeding 90%, the following tests were adopted:

- Passing and receiving with a partner from 3 meters within 30 seconds
- Zigzag dribbling around cones over a distance of 15 meters
- Shooting at a goal divided into four target squares (10 attempts)
- Feinting with the ball followed by fast and accurate shooting

Third Test: Neuromuscular Performance Assessment

Neuromuscular performance was evaluated through tests measuring movement speed, translational speed, accuracy, and speed endurance:

- Running in place for 10 seconds (movement speed)
- 30-meter sprint from a standing start (translational speed)
- Zigzag dribbling followed by shooting at intersecting targets (speed-accuracy coordination)
- 400-meter run (speed endurance)

Instruments and Equipment

The following equipment was used to conduct the measurements:

- Measuring tape graduated in centimeters
- Four digital stopwatches
- Standard football field
- Ten footballs
- Twenty training cones
- 400-meter running track
- Stadiometer for height measurement

- Medical scale for body weight assessment
- Dynamometer for measuring leg muscle strength

The Training Program

The researchers designed an integrated developmental training program for young football players that included physical preparation, skill performance, and neuromuscular strength development. The program was structured according to the scientific principles of sports training, drawing on specialized sources, references, and research studies. To ensure the program's validity, it was reviewed by a group of experts and specialists in sports training, including university professors from Souk Ahras University (Department of Sports Training). Their feedback and recommendations were carefully considered and incorporated into the final version of the program.

Based on the experts' opinions and the specialized literature, the total duration of the program was four (4) months. It included components of general and specific physical preparation, technical skill development, and neuromuscular strength training, while taking into account the age characteristics of the young players.

The training plan extended over sixteen (16) weeks, with three (3) training sessions per week, totaling forty-eight (48) sessions. Each session lasted ninety (90) minutes, resulting in an overall training duration of 4,320 minutes.

The intensity of the training sessions was determined by the maximum achievable values of time, distance, weight, and repetitions—or alternatively, by the maximum heart rate each player could sustain during the exercises included in the program.

Procedures for Implementing the Main Study

1. Pre-Tests for the Experimental Group:

Pre-test measurements were conducted for all participants from January 11 to January 16, 2025. Physical fitness variables were assessed on the first day, technical performance on the third day, and neuromuscular strength on the sixth day. All measurements were carried out at the "Baji Mokhtar" Stadium in Souk Ahras.

2. Implementation of the Training Program:

The program was implemented over sixteen (16) weeks, at a rate of four training sessions per week, totaling forty-eight (48) sessions. The intervention took place from January 21 to May 2, 2025, and was conducted at the *Afaq El-Marahna* Football Club under the supervision of the researchers.

3. Post-Tests for the Experimental Group:

After completing the training program, post-test measurements were carried out on all participants between May 4 and May 6, 2025, following the same conditions and sequence as the pre-tests.

Statistical Treatments Used

Data were collected and statistically analyzed using the SPSS software package to obtain the following statistical indicators:

- Percentage (%)
- Estimated score
- Arithmetic mean
- Standard deviation
- Median
- Skewness coefficient
- Correlation coefficient
- t-value (Student's t-test)

Effect size

Where:

- T represents the calculated t-value,
- r represents the correlation coefficient between pre- and post-tests,
- N represents the sample size.

According to Al-Khawli (2009, p. 25), an effect size value of 0.2 indicates a small effect, 0.5 indicates a moderate effect, and 0.8 or higher indicates a large effect of the independent variable on the dependent variable.

2. Presentation, Analysis, and Discussion of the Study Results

The researchers believe that there are significant effects worth interpreting. In this section, we present, analyze, and discuss the study’s hypotheses with reference to previous and related studies that addressed similar aspects of this topic, either supporting or contradicting the present findings.

Table 1. Discriminant Validity of Offensive Skill Performance Tests

No.	Skill Test	Calculated T-value	Tabulated T-value (0.05)	Significance	Interpretation
1	Passing and receiving with a partner (3 m / 30 sec)	2.52	1.761	Significant	Valid - discriminates between performance levels
2	Zigzag dribbling (15 m)	8.52	1.761	Significant	High discriminant validity
3	Long passing from the wings (5 attempts)	20.28	1.761	Significant	Very high discriminant validity
4	Shooting after a defensive obstacle	19.60	1.761	Significant	Very high discriminant validity
5	Feinting followed by fast and accurate shooting	17.77	1.761	Significant	High discriminant validity
6	Ball control (receiving and delivering)	8.64	1.761	Significant	High discriminant validity
7	Shooting at intersecting target squares	3.20	1.761	Significant	Valid test

Note: All calculated values exceeded the tabulated T-value at $p \leq 0.05$, indicating that the selected tests effectively distinguish between higher- and lower-skilled players.

Table 2. Discriminant Validity of Neuromuscular Ability Tests

No.	Test	Physical Ability Measured	Calculated T-value	Tabulated T-value (0.05)	Significance	Interpretation
1	30 m sprint from standing start	Translational speed	7.12	1.761	Significant	High validity
2	Barrow zigzag run	Movement speed / agility	3.18	1.761	Significant	Valid

3	400 m run	Speed endurance	23.91	1.761	Significant	Very high validity
4	Numbered circle transition test	Movement coordination speed	4.18	1.761	Significant	Valid
5	Running in place (10 sec)	Movement frequency speed	7.47	1.761	Significant	High validity

Table 3. Test-Retest Reliability Coefficients for Physical Fitness Tests

No.	Test	Physical Component	Reliability Coefficient (r)	Tabulated r (0.05)	Intrinsic Validity (\sqrt{r})	Interpretation
1	Vertical jump	Leg strength	0.82-0.95	0.537	0.91-0.97	High reliability
2	Standing broad jump	Explosive power	0.82-0.95	0.537	0.91-0.97	High reliability
3	Barrow agility test	Agility	0.82-0.95	0.537	0.91-0.97	High reliability
4	Trunk bend forward	Flexibility	0.82-0.95	0.537	0.91-0.97	High reliability
5	Inclined push-ups	Muscular endurance	0.82-0.95	0.537	0.91-0.97	High reliability

Table 4. Reliability of Offensive Skill Performance Tests

No.	Skill Test	Reliability Coefficient (r)	Tabulated r (0.05)	Intrinsic Validity	Interpretation
1	Passing and receiving	0.80-0.91	0.426	0.89-0.95	High reliability
2	Zigzag dribbling	0.80-0.91	0.426	0.89-0.95	High reliability
3	Shooting at target squares	0.80-0.91	0.426	0.89-0.95	High reliability
4	Feinting and shooting	0.80-0.91	0.426	0.89-0.95	High reliability

Table 5. Reliability of Neuromuscular Ability Tests

No.	Test	Ability Measured	Reliability (r)	Tabulated r (0.05)	Intrinsic Validity	Interpretation
1	30 m sprint	Translational speed	0.84-0.99	0.426	0.91-0.99	Very high reliability

2	Running in place	Movement speed	0.84-0.99	0.426	0.91-0.99	Very high reliability
3	Barrow zigzag run	Movement agility	0.84-0.99	0.426	0.91-0.99	Very high reliability
4	400 m run	Speed endurance	0.84-0.99	0.426	0.91-0.99	Very high reliability

Table 6. Selected Research Tools and Equipment

Category	Equipment
Measurement tools	Measuring tape (cm), stadiometer, medical scale
Timing devices	Four digital stopwatches
Training materials	Ten footballs, twenty cones
Facilities	Standard football field, 400 m running track
Strength assessment	Leg dynamometer

2.1. Presentation and Analysis of the First Hypothesis

The proposed integrated developmental training program has a positive effect on the physical performance of young football players.

Table (2) below shows the mean, standard deviation, mean differences, calculated *t*-values, and the effect size of the program between pre- and post-tests for the physical variables of the sample.

Variable	Test Description	Pre-Test		Post-Test		Mean Difference	SD of Mean Difference	Calculated (t)	Effect Size
		Mean	SD	Mean	SD				
Leg Muscular Strength	Vertical Jump from Standing (Sargent Test)	68.25	1.32	74.67	1.45	6.42	0.13	5.149	1.19
Leg Muscular	Standing Broad Jump	66.27	0.96	73.39	1.02	7.12	0.06	4.210	1.02
Agility	Barrow Zigzag Run Test	53.64	1.25	60.77	1.54	7.37	0.29	3.701	1.06
Flexibility	Trunk Flexion Forward from Standing Position	49.33	1.10	54.21	2.70	4.88	1.06	5.370	0.98

n	Coordination	Movement through Numbered Circles	55.21	1.86	61.41	1.99	6.02	0.13	4.820	0.81
		Muscular Endurance	Bent-Arm Push-Ups from an Inclined Position	45.42	2.59	48.22	2.82	2.08	0.23	3.890

The tabulated t-value at 23 degrees of freedom and a significance level of (0.05) = 3.768 Effect size interpretation: 0.20–0.50 = small; 0.51–0.80 = moderate; ≥0.81 = high effect.

Interpretation of the Results

From Table (2), which displays the means, standard deviations, and calculated t-values, it is clear that there are statistically significant differences between the pre- and post-tests in all physical fitness variables—leg strength (vertical jump, standing broad jump), agility (Barrow zigzag run), flexibility (trunk bending forward from standing), coordination (moving through numbered circles), and muscular endurance (push-up test)—in favor of the post-test results.

The calculated t-values for these variables were respectively: 5.149, 4.210, 3.701, 5.370, 4.820, and 3.890. These differences indicate varying levels of effect size, ranging from the highest value in leg strength (1.19) to the lowest in muscular endurance (0.55), reflecting high to moderate impact levels.

Discussion

The study results revealed noticeable improvement in the physical strength of young football players. This enhancement can be attributed to the well-structured integrated training program developed by the researchers, which included exercises aimed at developing specific components of physical fitness. Maintaining training continuity without interruption contributes to preserving physical gains and steadily improving performance.

These findings align with the view of Mounir Gergis (1990, p. 43), who stated that physical preparation is one of the fundamental pillars of sports training upon which player development—whether beginner or advanced—depends. It constitutes a crucial foundation that complements motor skills in shaping an athlete’s physical capacity.

Furthermore, as Kamal Abdel Hamid et al. (2002, p. 59) noted, the specific physical attributes of a football player are among the essential elements of daily, weekly, monthly, and annual training plans. A player’s high physical fitness level directly supports efficient technical performance, which in turn enables effective tactical execution.

that there is a strong correlation between physical fitness and the fundamental skills of football. Performing offensive skills requires specific physical abilities for their execution, as no skill is devoid of one or more physical components. It is therefore impossible to separate physical performance from skill performance, and competition itself serves as the true test linking physical fitness components to skill execution. This connection becomes evident during matches, where the foundation of technical skill is the athlete’s high level of physical fitness.

2.2. Presentation, Analysis, and Interpretation of the Second Hypothesis

The second hypothesis states that “the proposed integrated formative training program has a positive effect on some of the basic skills among young football players.”

Table (3) presents the mean, standard deviation, calculated t-value, and the effect size of the program between the pre-test and post-test for offensive skill performance variables among the sample.

Variables	Test Description	Pre-Test		Post-Test		Mean Differences	SD of Differences	Calculated t Value	Effect Size
		Mean	SD	Mean	SD				

Passing and Receiving	Passing and receiving with a teammate from a 3 m distance for 30 s	57.79	1.10	68.78	1.32	10.99	0.22	4.243	1.02
Dribbling	Zigzag dribbling with the ball through cones over a 15 m distance	33.51	2.42	41.22	2.67	7.71	0.25	5.513	1.44
Shooting	Shooting the ball at a goal divided into four squares (10 attempts)	37.08	2.75	41.18	2.96	4.10	0.21	3.960	0.52
Feinting	Performing feints combined with accurate and fast shooting toward the goal	28.33	1.48	30.02	1.59	1.69	0.11	4.165	0.54

- The t -table value at 23 degrees of freedom and a significance level of (0.05) = 3.768

- Effect size interpretation: 0.20–0.50 = weak effect, 0.51–0.80 = moderate effect, 0.81 or higher = strong effect

It is evident from Table (3) – which shows the mean, standard deviation, calculated t -values, and effect sizes – that there are statistically significant differences between the pre- and post-tests in all offensive skill variables. These include passing and receiving (passing with a teammate from a distance of 3 m for 30 s), dribbling (zigzag dribbling through cones over 15 m), shooting (10 shots on a goal divided into four squares), feinting (accuracy and speed of shooting toward the goal), and accuracy (shooting at overlapping rectangles). The calculated t -values were respectively (4.243), (5.513), (3.960), (4.165), and (4.234), all significant at the 0.05 level.

The effect sizes of the program on skill performance variables ranged between a maximum of **1.44** for *dribbling* and a minimum of **0.52** for *shooting*, indicating moderate to strong effects.

Based on these results, there was a notable improvement in the level of technical performance, which serves as an important indicator of the players' physical and skill condition. Technical preparation is closely linked to physical preparation, relying heavily on the player's physical attributes, which enable him to perform a variety of offensive and defensive skills in football. This relationship, developed from early training stages, is essential for executing tactical plans during competition.

Moreover, the athlete's success in performing technical skills is directly influenced by his physical capacities and the fitness components specific to the nature of the sport. These components also vary depending on the specific skill performed within the same sport.

The researchers attribute the improvement in skill performance to the content of the designed program, which focused on developing essential football skills that young players must master. The program included practical drills for different playing positions, combined exercises for passing and shooting, fast-attack training, and defensive formations.

This finding aligns with the study by **Ibrahim Mahmoud Gharib (1990)**, who stated that developing specific physical fitness components positively influences players' technical performance. Similarly, **Mufti Ibrahim (1998)** emphasized that improving physical qualities contributes significantly to enhancing technical performance levels. In the same context, **Darwish et al. (2002)** reported that improvements in technical performance stem from enhanced physical conditioning. Furthermore, **Munir Gerges (1990)** noted that ball-based training leads to better technical performance since motor skills are the central axis linking physical preparation and tactical play. Therefore, coaches must select exercises that serve both physical and technical development.

In conclusion, both the study results and previous research confirm a strong correlation between the development of players' physical capacities and the enhancement of their motor and technical skills.

3.2. Presentation and Analysis of the Third Hypothesis:

The third hypothesis states that the proposed integrated training program positively affects the neuromuscular system (translational speed and movement speed) among young football players.

Table (4) illustrates the mean, standard deviation, mean differences, standard deviation of mean differences, calculated *t*-values, and the effect size between the pre-test and post-test measurements of the neuromuscular strength variables.

Variables	Test Description	Pre-Test		Post-Test		Mean Differences	SD of Differences	Calculated t Value	Effect Size
		Mean	SD	Mean	SD				
Transitional Speed	Endurance of transitional speed: 30 m sprint from a standing start	3.42	2.15	4.11	2.69	0.69	0.54	4.401	0.91
	Endurance of transitional speed: 400 m run	17.44	1.12	21.33	1.57	3.89	0.45	3.822	0.78
Movement Speed	Endurance of movement speed: running in place for 10 seconds	17.10	1.23	20.18	1.28	3.08	0.75	4.219	1.11
	Endurance of agility and accuracy: zigzag running between cones and shooting stationary balls at overlapping rectangles	53.11	1.43	56.23	1.51	3.12	0.08	4.234	1.01

The tabulated *t*-value at (23) degrees of freedom and (0.05) significance level = 3.768
 Effect size: 0.20–0.50 = small, 0.51–0.80 = medium, ≥ 0.81 = large.

Based on **Table (4)**, which displays the mean, standard deviation, calculated *t*-values, and effect sizes between pre- and post-test measurements of neuromuscular strength variables, there are statistically significant differences between the two measurements in favor of the post-test. These differences were found in all neuromuscular strength variables (translational speed, translational speed endurance, and accuracy in the 400 m run). The calculated *t*-values were respectively (4.401), (3.822), (4.219), and (4.234), all statistically significant at the 0.05 level.

The results also revealed that the effect size of the program on all neuromuscular variables ranged from a **high effect size** for *movement speed while running in place for 10 seconds* (1.11) to a **moderate effect** for *400 m translational speed endurance* (0.78).

These results confirm that one of the essential aspects the sports coach should focus on during training is the neuromuscular component—particularly movement speed and translational speed—closely linked to mental preparation and motor imagery (Maher Moussa, 1983, p. 33).

The efficiency of the nervous system directly influences performance level, as it is responsible for interpreting sensory information and neural signals from both internal and external environments. Through sensory pathways, the nervous system organizes and translates these signals into motor commands that reach the muscles via motor neurons, resulting in observable movement coordination. This coordination reflects the ability of the nervous system to process and transform motor messages into accurate physical actions. The central nervous system, therefore, acts as a “coordination center”, regulating the force output across the body’s limbs and storing these movement patterns as motor memory.

Moreover, complex motor performances consist of multiple independent yet dissimilar movements, differing in structure and purpose, which are integrated and linked in a way that allows them to be executed smoothly, efficiently, and with a high degree of coordination (Jamal Alaa El-Din & Nahed Al-Sabbagh, 1995, p. 106).

Consequently, executing several movements simultaneously in different directions requires complete neural control over various neural pathways. This control manifests through precise timing of excitation (activation) and inhibition (stopping) processes within the nervous system, ensuring accurate movement synchronization.

Conclusions

Based on the presentation and discussion of the results, the following conclusions were drawn:

- The proposed training program had a positive effect on all physical strength variables, as statistically significant differences were found between the pre-test and post-test measurements at the 0.05 level in favor of the post-test, with a high effect size across all components of physical fitness.
- The proposed training program also had a positive impact on all skill performance variables, as statistically significant differences were observed between the pre- and post-tests at the 0.05 level in favor of the post-test, with moderate to high effect sizes for the basic football skills among young players.
- The proposed training program positively influenced neuromuscular strength (translational speed and movement speed), with statistically significant differences between the pre- and post-tests at the 0.05 level in favor of the post-test, and medium to high effect sizes for neuromuscular power.

Recommendations

Based on the findings of this study, the researchers propose the following recommendations:

- Implement **comprehensive developmental training programs** that integrate physical, technical, psychological, and tactical aspects during the preparation and development of young players. This is crucial, as youth athletes represent the foundational base for future athletic achievement, particularly in football, which is a collective sport with a broad popular following.
- Conduct in-depth studies of the developmental characteristics of youth age categories before designing training programs, to help coaches understand the specific demands and requirements of this stage of growth.
- Sports federations and clubs should give greater attention to scientifically grounded planning when designing and implementing training programs for young players, ensuring they are based on principles of sports science and long-term athlete development.
- Utilize physical, technical, and psychological testing and assessments as essential tools for planning, monitoring, and developing the variables related to training programs. Such evaluations are of great importance in understanding the health and performance status of youth football players and guiding individualized training interventions.

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Ethical Considerations

The study was conducted in accordance with ethical standards for research involving human participants. Participation was voluntary, and informed consent was obtained from all players and their legal guardians prior to data collection. Confidentiality and anonymity of participants were strictly maintained. The training procedures were designed to ensure player safety and to comply with institutional and international ethical guidelines for sports science research.

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Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this study.

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