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The Basic Stability of The Core Muscles and Its Relationship to Some Defensive Skills in Basketball Players Under 16 Years Old

Yaseen Abbas Yaseen [1], Ahmad Aboodee Al-Ruhaim [2],

1,2 University of Kufa, College of Physical Education and Sports Sciences

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Abstract

The importance of the research lies in involving the process of developing core stability of the trunk muscles, as it treats the athlete's body as a single unit, specifically targeting the trunk muscles in basketball players. Therefore, the researchers wanted to explore this experiment. The research problem focused on the observation made by the researchers and their monitoring of most matches in the Iraqi Premier League, as well as their work as supervisors at the Al-Najaf Youth Forum and their observation of some local tournaments and league matches. They noticed that most coaches, whether national team coaches or club coaches, rely on a comprehensive training regimen for body muscles without paying attention to the deep trunk muscles (core stability) during their training application on the players, which leads to incomplete muscle strength in players, especially in the trunk area, and since it has a significant impact on mastering defensive skills. The research aimed to prepare exercises to develop core stability to strengthen the trunk muscles and some defensive skills for players under 16 years old in basketball, and to identify the effect of these exercises in developing core stability to strengthen the trunk muscles and some defensive skills for players under 16 years old in basketball. The researchers chose the experimental method using the two groups of experimental and control as it suited the research problem. As for the research samples, they were represented by basketball players at the National Center for Talent Care in Najaf Al-Ashraf, numbering (26) players, all of whom were selected for the experiment. The most important conclusion drawn by the researchers is that the development of flexibility, trunk strength, balance, and coordination positively reflected on the development of

[1] University of Kufa, College of Physical Education and Sports Sciences.
yassina.alkhazali@student.uokufa.edu.iq
[2] University of Kufa, College of Physical Education and Sports Sciences.
ahmeda.hussein@uokufa.edu.iq

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defensive movement and defensive follow-up performance. The main recommendations were the importance of using specific and targeted training to achieve defined objectives in developing basic stability according to standardized scientific principles to raise the training level of basketball players across various categories.

Keywords: Functional training method, accuracy of spiking.

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Introduction

Sports have become in the third millennium an important part of individuals' lives and hold significant importance in modern human life. Progress and development in all areas of life have led to changes in lifestyle to suit the demands of this era, characterized by its speed and advancement. Sports have a share in this progress, as they have become an integral part of daily life, as well as a fertile field for researchers.

Basketball is one of the team sports and is considered one of the most popular games. In some countries, it has even ranked first among other games due to its wonderful combination of technical performance and fast rhythm, which excites the audience.

It is noticeable that the current rapid development in the training world is simply a result of using specialized training methods such as Pilates exercises, which help players perform well and prevent injuries in most different sports. The effect of core strength training on athletic performance is particularly significant in sports like basketball, which require fast and coordinated movements.

The kinetic chain refers to interconnected groups of body parts, muscles, and joints that work together to perform movements. In this chain, the trunk coordinates the movements of the upper and lower parts of the body and acts as a central axis. Therefore, enhanced trunk strength may improve physical performance in athletes, especially in terms of dynamic balance and agility. The fundamental stability of the deep trunk muscles is one of the important factors in performing most body movements that contribute to balance, maintaining body posture, as well as serving as the foundation for initiating every movement. Strengthening the trunk muscles is very important as it contributes to the development of physical and motor abilities and achieving better performance, which is clearly reflected in the generation of different forces in young athletes. Various defensive methods and forms have been diversified, and emphasizing effective defense in basketball has become a clear characteristic of the game. Many coaches believe that the optimal way to win a match is through vigilant defense, as a team with cohesive defense largely controls the match outcomes. The trunk muscles, which include the abdominal muscles ,The oblique muscles.

The importance of this research lies in the necessity of incorporating Pilates exercises into training, which helps coaches and players in the training process by engaging in the development of core stability and trunk muscle strength. This approach treats the athlete's body as a single unit, specifically targeting trunk muscles, ultimately achieving optimal strength stability. This enables the regulation of exercises and the continuation of training in a scientifically studied manner.

Also, not neglecting the importance of defense, whether individually or in teams, as it is considered a fundamental factor in the difference between high-level teams and modest-level teams. Especially the youth category, which is considered an important age group and the foundation in the training process of this game, as they are the pillar on which achieving sports ambitions depends. This requires preparing exercises to develop physical and motor abilities according to the applied scientific principles, as they are the basis for effective defense .

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Therefore, through the researchers' field experience, through their observation and follow-up of most matches of the Iraqi Premier League, and through their work as supervisors at the Najaf Youth Forum and their monitoring of some local championships and league matches, they noticed that most coaches, whether national team coaches or club coaches, rely on a comprehensive training approach for the body muscles without paying attention to the deep trunk muscles (core stability) while applying the training approach to the players. This leads to incomplete muscular strength in the players, especially in the trunk area, which has an effective impact on mastering defensive skills.

Accordingly, the two researchers have defined the research objectives: to prepare exercises for developing core stability to strengthen trunk muscles and some defensive skills for players under 16 years old in basketball, and to identify the effect of exercises in developing core stability to strengthen trunk muscles and some defensive skills for players under 16 years old in basketball . As for the research domains, the human domain consisted of basketball players at the National Center for Sports Talent Care in Najaf Al-Ashraf, while the temporal domain was from 30/10/2024 to 10/3/2025, and the spatial domain was the indoor hall at the National Center for Sports Talent Care in Najaf Al-Ashraf.

Methodology

Research Method

The experimental method was selected as it aligns with the nature of the research problem. The study was designed using two equivalent groups (experimental and control) with both pre-test and post-test applications.

Research Population and Sample

The research population was identified as the players, represented by the basketball players at the National Center for the Care of Sports Talent in Najaf Al-Ashraf (2024–2025), numbering (26) players.

Devices, tools, and means used in research

Data collection methods

- Arabic and foreign sources and references
- Observation and experimentation
- Tests and measurements.

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Tools and equipment used

1 -Laptop computer (Acer type) made in China .
2 -Video camera, quantity (1), Canon type, made in Japan for the purpose of documenting tests .
3 -Electronic medical scale, made in China, Silver Crest type, for conducting uniformity .
4 -Electronic stopwatch, quantity (2), made in China, digital type .
5 -Basketballs, quantity 20 .
6 -Ball carrying basket, quantity (2), locally made .
7 -Medicine balls of various weights (2 kg, 3 kg), quantity (6) .
8 -Stability ball, quantity (3) .
9 -Platform with a height of (50 cm), quantity (2) .
10 -Dumbbells of various weights (2 kg, 3 kg, 4 kg), quantity (18) .
11 -Colored paints and adhesive tapes for marking tests .
12 -Measuring tape with a length of (10 meters), made in China .
13 -Whistle, quantity (1), Fox type, made in China .
14 -Video camera, Canon type, quantity (2) .
15 -Office supplies (ballpoint pens and papers).

Field Research Procedures

Description of the tests used in the research

After reviewing numerous sources, scientific references, and similar studies, the measurements and tests for measuring the research variables were identified, which can measure and represent the research variables in their measurement.

Trunk Flexion Test from Standing) (Alawi and Radwan, 1982, pp. 341–344)

Purpose: To assess trunk and thigh flexibility during forward bending from a standing position.

Equipment: A 20 cm measuring stick or wooden ruler, and a stable bench, chair, or flat table capable of supporting the examinee's weight.

Procedure: Attach the ruler to the edge of the bench/table so that half extends above and half below the edge. The zero mark should align with the bench edge; upward deviations are recorded as negative, downward as positive.

Performance: The examinee stands at the edge with feet on either side of the ruler, bends forward, and reaches fingers toward the ruler. They then continue bending slowly and steadily, keeping fingers aligned and moving parallel to the ruler.

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Test instructions

The test is performed without stiffness in the arm, trunk, and neck muscles. The test is carried out from a kneeling position. The trunk is bent downward slowly and forcefully, with an attempt to achieve the maximum possible bending range. It is preferable to give the test subject two or three attempts as a means of warming up and practicing the test before measurement, noting that this should be done before climbing onto the table. The subject should direct their gaze downward towards the scale. It has been shown that bending the trunk forcefully downward achieves better results; however, this method of performance reduces the consistency and objectivity of scores due to the difficulty of calculating the score. Therefore, when calculating the score, it is required that the subject maintains their final position for a duration of 2–3 seconds.

Test Management

- A supervisor monitors performance and calculates scores .
- A recorder calls on the examinees and records the results.
- Scoring: Lab score: The highest point the lab can reach from bending the trunk forward to the bottom.

Defensive Follow-up Test: (Hussein, 2012, p. 99)

- Purpose of the test: To measure the speed of defensive rebound performance .
- Equipment used: Tape, measuring tape (20m), marker number (1), electronic stopwatch, whistle, one basketball, papers and pens for recording .
- From the point under the basket and at a distance of (2m) forward, a mark is placed on the ground .
- Performance description: The defending player stands with the mark between his feet and his back to the backboard, holding the ball over his head with his arms. Upon hearing the start signal via the whistle, the player performs a front half-turn with the right foot, then shoots the ball at the backboard to rebound defensively and returns with the ball to the first mark to perform defensive rebound from the other side by executing a front half-turn with the left foot and returning to the first mark, as shown in Figure (9) in the six steps .
- Test conditions: Execute the test steps quickly .
- The defending player's stance before starting the performance should have bent knees.
- Before catching the ball from above, the player takes a step toward the board, with the right foot forward on the right side and the left foot forward on the left side.
-Touch the board from both sides, completing eight repetitions, and then return to the starting mark.
-Only one attempt.
-Test administration: start and finish are signaled with a whistle along with timing.
-Recorder: calls out the names and observes the performance while recording the test time.

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-Scoring: the player's time to complete the test for the eight attempts is recorded, using the start and finish whistle as reference.

Pilot Experiment

The pilot experiment was conducted prior to the main study to detect potential challenges and limitations. Its aims include:

The aim of the pilot experiment for the tests is as follows:

1. Ensure the suitability of the field and tools, confirming their appropriateness for the tests.
2. Prepare the assisting team and identify potential difficulties they may encounter.
3. Determine the required duration for the tests.
4. Identify practical challenges the researcher may face during test implementation.
5. To ensure the suitability of the components of the training loads for the research sample individuals.

Main Experiment

Pre-tests

After completing and validating the exploratory experiment, the researchers proceeded with the main study by administering the tests to the research sample. The pre-tests were conducted on November 3, 2024.

Equivalence of the two research groups

To attribute differences in the post-test results to the variables under study, the researchers first verified the equivalence of the two groups. This was accomplished by applying the independent samples t-test to the selected research variables.

Table 1. *Shows the equivalence of the research groups*

Research Variables	Unit of measurement	Regulation		Experimental		t value	sig	Significance
		will	A	will	A			
Trunk muscle strength	kg	57.00	11.674	54.625	6.545	0.502	0.624	Not sig
Defensive Follow-up	second	22.400	3.590	23.157	4.305	0.382	0.708	Not sig

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Post-tests

With the assistance of the support staff, the researchers conducted the post-tests for the research sample following the completion of the training program on May 1, 2025. The tests were administered under the same conditions as the pre-tests, maintaining consistency in the sequence and procedures.

Statistical Methods Used

The researchers employed the Statistical Package for the Social Sciences (SPSS) to analyze the collected data and interpret the research results.

Results

Table 2. *Means, Standard Deviations, t-Values, and Significance Levels for the Control Group (Pre- vs. Post-Tests).*

Research Variables	Unit	Pre-test		Post-test		t value	Sig value	Sig
		will	A	will	A			
Trunk muscle strength	kg	57.000	11.674	62.375	11.400	6.715	0.000	sig
Defensive Follow-up	second	22.400	3.590	20.750	3.651	5.459	0.000	sig

Table 3. *Arithmetic Means, Standard Deviations, t-Values, and Significance Levels for the Experimental Group (Pre- vs. Post-Tests of the Researched Variables)*

Research Variables	Unit	Pre-test		Post-test		t value	Sig value	Sig
		will	A	will	A			
Trunk muscle strength	kg	54.625	6.545	75.625	7.744	25.493	0.000	sig
Defensive Follow-up	second	23.157	4.305	18.796	2.093	11.152	0.000	sig

Table 4. *shows the calculated value (T) for the independent samples, the significance level of the test, and the significance of the .differences between the post-test results of the control and experimental groups for the studied variables*

Research Variables	Unit	Regulation		Experimental		t value	Sig value	Sig
		will	A	will	A			
Trunk muscle strength	kg	62.375	11.400	75.625	7.744	2.719	0.017	sig
Defensive Follow-up	second	20.750	3.651	18.796	2.093	2.920	0.015	sig

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Discussion

After analyzing the outcomes of the experimental and control groups, the findings revealed statistically significant differences across all tests, with the advantage consistently favoring the experimental group. The researchers attribute this to the use of exercises, which means that the performance of the trunk muscles in the experimental group improved noticeably after the training period, while similar improvements were not recorded in the control group. This difference is due to the focus on building the strength and stability of the "Powerhouse," the concept introduced by Joseph Pilates himself. He explained that the center of the body (from the pelvis to the lower ribs) represents the main point from which all movements originate and should be strengthened and maintained active throughout the exercise. In this context, Isaacowitz and Kleubinger define (Core Stability) as "the neuromuscular control that allows the pelvis and spine to be maintained in the desired position while moving the limbs or the body as a whole without unintended distortions or compensations".

. Accordingly, exercises targeting the deep muscles in the trunk area work to enhance this neuromuscular control, leading to better support of the pelvis and spine during movement .

The duration of the training, during which exercises were applied, was also sufficient to achieve this improvement, because any change requires a period of time to have a clear impact on the body's abilities, which in turn affects performance levels. This was confirmed by (Abu Al-Ala Ahmed) quoting both (Wilmore and Costill) that most changes resulting from training occur during the initial period of the program within 6-8 weeks (Ahmed, 1996, p. 32).

From the table, it is clear that significant differences emerged between the post-test results of the experimental and control groups in motor abilities specifically trunk muscle performance and selected defensive skills. These differences favored the experimental group, which distinguished itself by avoiding routine and employing exercises characterized by variety, specialization, and focused application.

The improvement in the flexibility variable and the strength of the trunk muscles is attributed by the researchers to exercises that include movements taking the limbs' range of motion to the natural limit of movement or to their widest range. These exercises also target the deepest layer of the abdominal muscles. Previous studies have confirmed that deep trunk muscles, such as the Transversus Abdominis, the spinal extensor muscles, and the pelvic floor muscles, play a vital role in stabilizing the spine and protecting the lower back. For example, Sacowitz and Clippinger explain that the Transversus Abdominis contracts automatically to support the spine and pelvis before movements with small forces, making it like a natural corset for the body.

For this reason, the correct method in many of its exercises requires conscious exhalation to stimulate this muscle to contract. It is also important to coordinate the work of all trunk muscles (external and internal) together, as the internal abdominal muscle (Internal Oblique) is functionally connected with the transverse muscle, which is why training focuses on improving strength, endurance, and neuromuscular coordination of all abdominal muscles. Strengthening them is the key to good performance, relieving back pain, and reducing waist circumference (Austin, 2012, pp. 6–7), as sources confirm that reducing fat in the muscle area increases its elasticity .

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Karon Carter (Karter, 2001, p. 21) indicates that the highest rate of muscle stretching development can occur through yoga exercises, while the highest rate of muscle strength development can occur through weight training. She also noted that both muscle stretching and strength can be developed simultaneously through the exercises used.

As for the development of the balance trait, the researchers also attribute it to these exercises that include movements aiming to change the body's center of gravity, in addition to compound movements in various directions, as they cover a comprehensive range of muscular motion. In addition to the abdominal muscles, they activate the group of back extensor muscles, including the Erector Spinae and the Multifidus muscle, which is considered one of the most important stabilizers of the lumbar vertebrae. It has been found that strengthening these promising muscles prevents the tendency to bend the back forward (anterior displacement) and contributes to preventing common back injuries and post-injury spinal problems. According to Isacowitz and Klebingger, the exercises used specifically focus on engaging the Multifidus muscle, as it is a large muscle with a vital role in stabilizing the lower spine and aiding patients' recovery from lower back injuries. Strengthening these deep muscles leads to a coordinated contraction of all stabilizing muscles during movement.

,which is essential for achieving effective spinal stability. Panahan and colleagues (2020) emphasized that this co-contraction of the core muscles is the main mechanism for achieving spinal stability, and that classic exercises targeting this group improve trunk stability and strength without unnecessary strain on the deep structures of the spine .

King (2006, p. 31) indicates that training works on the principle of focus by perceiving each movement and controlling it with the mind, as the mind must always be in a state of full concentration on the performance goal .

Cardiorespiratory fitness and exercises follow the principle of (FITTE), which is an abbreviation for Frequency, Intensity, Type, Time, and Enjoyment. These exercises work on coordination and connection through muscular training and mental focus simultaneously, leading to an increased sense and awareness of the movement performed by the individual during exercise, especially the compound movements included in these exercises that require coordination between muscles and nerves. These exercises operate on the principle of concentration, which has helped in the development of the neuromuscular system. Ghanem (2018, p. 103) cited Michael (King,2001) stating that activating concentration gives the individual skill. At the beginning of practicing exercises, the practitioner tends to rush through the difficult part of the movement to finish it as quickly as possible, but by activating concentration during performance, the practitioner can properly control the execution of the skill. Moreover, the repetitions used in repeating all exercises are factors that helped develop motor coordination. This is also emphasized by Mufti Ibrahim, Wajih Mahjoub, and(Badri,2000).

The rapid development of coordination is attributed to the development of mental and intellectual levels, as well as the development of physical and motor abilities, and to the motor experiences stored in memory. This helps accelerate good movement coordination. (Both Michael King and Denise Austin 2002), and quoting Joseph Pilates agree that the exercises used help to move with more precision and reveal the natural dimensions of the body. Usually, the practitioner

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does not have awareness of how to move in the surrounding space, and because the exercises require not only correct movement but also correct breathing, the practitioner will thus gain more awareness of how to find their personal space through focus and precision (Pilates, n.d., p. 21).

As for the development observed in the defensive variables (defensive tracking) of the experimental group, the researchers attribute it to the exercises that gave the player superiority in motor abilities, which served as the foundation that enhanced the player's movement and facilitated easy movement (as a result of the acquired abilities) on the court to perform defensive duties, whether with or without the ball. The researchers attribute the significance of the differences in these defensive skills to the exercises, as the exercises used in this approach positively affected the development of defensive tracking, because they focused on developing the abilities specific to tracking, which are (coordination and balance), which directly impact the performance of these defensive skills, namely (pivoting and turning towards the basket to block the attacker and proper timing for jumping at the moment of shooting, as well as defensive movement to intercept passes that require high coordination). The results of the skill performance test for these skills in the experimental group were higher than in the control group, confirming the suitability of the type of exercises in improving the abilities specific to defensive skills through motor integration by combining flexibility and strength as a trait.

Physical fitness, coordination, and balance, which contribute to improving the performance of defensive tasks, and this was affirmed by Qasim Hassan Hussein who said: 'Focus should be on training coordination and motor linkage and including it in the training program, as using motor coordination over a long period and with continuous repetition will lead to habituation to the ideal motor and temporal framework' (Hussein, 1991, p. 47). The researchers also attribute the significance of differences to the development of physical and motor abilities, because most motor skills in all sports in general, and in basketball in particular, depend on the athlete's physical and motor abilities for good performance. 'Motor skill cannot be achieved without the presence of specific physical abilities, and likewise, mastering and improving the skill aspect of a sporting activity is not possible in the absence of specific physical abilities.' Many experts and specialists in the field of training science advise the necessity of developing skill performance through the development of specific physical abilities for each activity. All these mentioned factors have effectively contributed to showing significant results between the experimental and control groups in the post-test, in favor of the experimental group in performance tests .

Defensive skills, and thus the two researchers achieved one of the research objectives.

The experimental group, through the exercises, gained the ability to move laterally or move from back to front, as well as the ability to perform repeated jumps upwards. Brian Wanes confirms that 'the player who jumps for the follow-up is the winner, as his chances of getting the ball increase more effectively' (Coleman & Ray, 1980, p. 107). This led to the development of the defensive skills under study as a result of using the mixed training composed of specialized exercises. The desired results came as a result of the correct combination of these exercises, which stems from the proper specification of the exercises and their non-conflict, in addition to the coordination of the exercises with the supporting tools, such as using a stability ball in the exercise and in the training unit itself. The development of the physical capacities of the experimental group players

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in the working muscles, due to the inclusion of physical exercises, affected movement development as it reduced the players' random movements, which contributed to their performance during skill tests. As for defensive follow-up, the results came from using exercises of different intensities with dumbbells.

This helped in focusing performance on different muscles with appropriate motor execution, as the movements of a basketball player mainly rely on these muscles since most of the exercises used were highly effective due to isolating the muscles not involved in the movement, which directly impacted the skill, making it more difficult than during the test (the development of both the motor and physical aspects is an essential and important factor in performing defensive skills, influenced by motor speed and reaching the required technical level), (Al-Khashab et al., 1988, p. 49). In addition, the gradual increase in intensity level led to muscle development, as well as an increased ability for repeated movement in different directions due to the development of coordination, which positively affected its function. Studies proved (the existence of a significant correlation between physical and skill levels) (Jawad, 1995, p. 107).

This indicates the appropriateness of the exercises under study with the players' abilities. Similarly, the improvement was a result of the increased training intensity while regulating rest periods in the exercises and their impact, which had a positive effect on this improvement in the research sample. Mona Abdel Sattar affirmed (that the development of skills should be accompanied by the development of physical fitness elements as well as the development of motor skills as a single integrated process) (Abdel Sattar, 1989). The exercises had a significant impact on developing the defensive player's movement skills through flexibility, coordination, balance, and trunk muscle strength, which in turn led to the improvement of the player's defensive movement.

Here, the difference between the results of the experimental group and the control group becomes clear, as those results favored the experimental group, since its exercises were focused on improving the players' physical abilities, in addition to the coach using the remaining time of the training units to develop skill-related abilities. Thus, the exercises became more precise, directed, and beneficial for the players. Muhannad Abdul Sattar emphasized, 'The development of skills should be accompanied by a process of developing physical fitness elements as well as the development of motor skills, as they are two parts of a single process.' (Al-Ta'i et al., 1995, p. 15). The fatigue generated by the effort exerted, whether in training or competition, causes the player to lose focus and time during skill performance. Abdul Hakim Al-Ta'i et al. mentioned that 'one cannot expect good team play without good physical preparation, because basketball is a strenuous and aggressive sport, which requires players to have high skill and physical fitness. Many teams have good skills but are unable to win due to their players losing physical fitness during the match, while other teams lack precision in skill and tactical preparation because they '

Physically incomplete in general, which negatively affects basketball skills; therefore, the development of physical abilities under study helped the experimental group players to perform skills better and carry out skill tasks at a high proficiency. These differences are also based on the nature of training. The control group received traditional, non-specialized training, often focusing on skill exercises or general strengthening without precisely targeting the deep trunk muscles. On

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the other hand, the experimental approach was carefully designed to continuously stimulate the core of strength, prompting clearer and more precise motor performance. This explains that the results of this study align with what is reported in the scientific literature, as trunk muscle training programs often show superiority in improving core muscle strength and stability compared to other forms of exercise.

Conclusions

1. Training according to motor performance has great importance in developing defensive skills in basketball.
2. Regulated-intensity training, which employs the physical and skill aspects of the core stability muscles using training tools, has great importance in developing trunk strength and defensive skills.
3. The development of flexibility, trunk strength, balance, and coordination has positively reflected on the development of defensive movement and the performance of defensive follow-up.

Recommendations

1. The importance of specialized and targeted training to achieve specific goals in developing core stability based on regulated scientific foundations to raise the training level of basketball players for different categories.
2. The necessity of regulating the training load of exercises, due to its high positive impact on the player during performance.
3. The necessity of knowing and incorporating modern training into the training program of other sports, which require varied motor programs through the integration of the physical aspect with the skill aspect.

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