EFFECT OF LIMB WEIGHT TRAINING ON SOME KINEMATIC VARIABLES LONG-RANGE SHOOTING IN YOUTH BASKETBALL (UNDER 16 YEARS OLD)

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ABSTRACT

Background. Importance of this research lies in demonstrating the impact of these exercises on developing the mechanical aspects of long-range shooting skills among young basketball players. It also highlights the training method of limb weight training and its effect on certain kinematic variables related to long-range basketball shooting. This contributes to raising the level of skill performance, improving shooting accuracy, and achieving better results in sports competitions, research problem was the weakness and inconsistency in long-range shooting accuracy, in addition to some mechanical variables affecting the movement during the skill's execution. **Objectives.** Research objective was to identify the effect of limb weight training on certain kinematic variables in long-range basketball shooting among young players (under 16 years old). **Method.** The experimental method was used, and the research sample was the Basra Governorate Education Directorate team for the 2025-2026 season. After implementing the exercises. **Results.** By observing Tables (3) and (4) of the pre- and post-tests for the control and experimental groups, it became clear that both groups improved their kinematic variables and long-range shooting accuracy (calculated as three points). This is attributed to the regularity of training in both groups and their use of targeted exercises that affect the physical aspect, which in turn affects skill performance, including endurance. **Conclusion.** The weight training exercises enhanced the physical aspects, kinematic variables, and accuracy of three-point shooting in basketball for youth players (under 16 years old).

Keywords; weight training, kinematic variables, long-range shooting, basketball.

A. INTRODUCTION

Sports activities are among the important fields that contribute to developing human physical and motor abilities (Harianto et al., 2023). Scientific advancements in sports training and movement science have significantly improved athletes' skill performance. Adopting modern training methods has become essential for achieving optimal results. Training no longer relies solely on the traditional repetition of skills but is now based on scientific principles built upon a precise understanding of the biomechanical and physical variables that influence motor performance (Gunawan et al., 2023; Hardinata et al., 2023; Suniga et al., 2025). Among these variables, kinematics stands out, focusing on the study of movement in terms of trajectory, speed, angles, and timing. These variables aid in analyzing the technical performance of athletic skills and achieving optimal movement mechanics, thus contributing to improved athletic achievement and enhanced performance accuracy (Apriandi et al., 2023; Balore et al., 2026; Islam et al., 2024).

Basketball is a team sport that demands a high level of physical, motor, and technical abilities, particularly shooting, which is the primary means of scoring points and achieving victory. Long-range shooting is a crucial skill in modern basketball, playing a significant role in creating space on the court and disrupting the opposing team's defense. Proper execution of this skill requires a range of physical and mechanical factors that contribute to achieving the necessary accuracy and power during the shot. One training method that can help develop this skill is the use of limb weight training, which involves adding resistance or light weights to the limbs during movement exercises to increase muscle strength, improve coordination, and enhance movement control.

Diyar Muhammad Siddiq, (2009) believes that "shooting is an important part of most team games, including basketball, due to the difficulty of shooting. The reason for this is the small size of the goal, represented by the basketball ring, in addition to it being high above the court floor. Therefore, it requires accuracy and focus in shooting the ball to put it in the opponent's basket to score points" (Diyar, 2009: 37). The use of weight training exercises can also have a positive impact on some of the kinematic variables associated with shooting motion, as developing the specific strength of the upper and lower limbs may contribute to improving the mechanics of movement during skill performance.

This is why (Essam Abdel Khaleq, 2005) believes, Qualitative exercises are sports movements that are similar in their composition in terms of the composition of the motor performance, in terms of the strength and speed of the time course of the force, as well as the direction of the muscular work from it, to those movements performed. Therefore, they are considered a direct means of the main preparation for the sports level to develop the individual's training state (Essam, 2005: 21). This highlights the importance of this research in demonstrating the impact of these exercises on developing the mechanical aspects of long-range shooting skills among young basketball players. It also sheds light on the training method of limb weight training and its effect on certain kinematic variables related to long-range shooting in basketball. This contributes to raising the level of skill performance, improving shooting accuracy, and achieving better results in athletic competitions.

Long-range shooting is a fundamental basketball skill, essential for scoring points. It requires a good level of physical fitness, particularly muscle strength, as well as precise mechanics. Kinematic variables also play a crucial role in the success and accuracy of shooting; therefore, analyzing these variables has become essential for developing players' skill performance.

The researcher's observation of the performance level of young basketball players, particularly those from the Basra Governorate Education Directorate team revealed weaknesses and inconsistencies in long-range shooting accuracy, in addition to some mechanical variations in the kinematic aspects of the skill execution. This may be due to the training methods used, which lack the use of training aids such as limb weight training exercises that could contribute to developing specific strength and improving the kinematic variables associated with shooting. Identifying the effect of limb weight training exercises on some kinematic variables in long-range shooting in basketball for youth (under 16 years old). There is a positive effect of limb weight training exercises on some kinematic variables in long-range shooting in youth basketball (under 16 years old).

B. METHOD

The researcher used the experimental method with an equivalent group design (control and experimental) and with pre- and post-tests in order to address the research problem.

Research areas

1. Human field: The Basra Governorate Education Directorate Youth Team (under 16 years old) for the 2025-2026 season
2. Location : The closed hall in the Basra Governorate Education Directorate.
3. Time frame : From 10/12/2025 to 10/2/2026.

Research community and sample

Research community was determined intentionally, and they are the Basra Governorate Education Team for the 2025-2026 season, numbering (20) players (under 16 years old). The sample, numbering (10) players relied upon for long-range shooting (three points in basketball), was chosen, and thus the sample percentage constitutes (%) of the original population. The sample was then randomly divided into two control and experimental groups, each group containing (5) players. Homogeneity was achieved using the coefficient of variation in body measurements, as in Table (1). As for equivalence, test (t) was used in the variables and test used, as in Table (2).

Table 1. Shows the means, deviations, and coefficient of variation for the purpose of homogeneity in age measurement.

Tests	Control Group			Experimental Group		
	M	S	Coefficient Of Variation	M	S	Coefficient Of Variation
Age/Year	14.52	0.745	5.13	14.62	0.867	5.93
Length/Cm	156.2	1.24	0.793	156.5	1.74	1.111
Weight / Kg	53.21	0.678	1.274	53.42	0.845	1.581

Table 2. It shows the means, deviations, and t -values for the purpose of equivalence in skill tests

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Tests	Unit Of Measurement	Control Group		Experimental Group		Values T Account ant	Sig	Level Of Significance
		M	S	M	S			
Height Of The Hip Center Of Gravity	Meter	0.521	0.087	0.542	0.054	0.411	0.467	Immoral
Maximum Flexion For Angles Detailed Knee	Degree	133.541	0.864	133.621	0.964	0.123	0.241	Immoral
Ball Launch Angle	Degree	51.562	0.746	51.35	0.854	0.374	0.471	Immoral
Ball Launch Speed	M/Th	13.214	0.547	13,524	0.624	0.748	0.881	Immoral
Hip Joint Angle At The Moment Of Throwing	Degree	179.564	1.14	179.42	1.21	0.173	0.242	Immoral
Ball Entry Angle	Degree	45.452	0.623	45.62	0.634	0.378	0.421	Immoral
Accuracy Of Aiming	Points	4.124	0.412	4.232	0.521	0.325	0.356	Immoral

Information gathering methods and research tools

1. Data Collection Method
   a. References.
   b. Scientific observation.
   c. Tests and measurements used.

2. Tools and Equipment Used
   a. Stopwatch.
   b. Camera (video)
   c. laptop.
   d. Drawing scale length.
   e. Basketballs.
   f. Basketball court.

Research procedures

1. Defining the research variables:

research variables were identified and included the kinematic variables necessary for the success of a three-point long-range shot, which are:

   a. High hip center of gravity.
   b. Maximum flexion For angles detailed knee.
   c. Ball launch angle.
   d. Ball launch speed.
   e. Hip joint angle at the moment of throwing.
   f. The angle of entry of the ball.
   g. Accuracy of aiming.

2. Long-Range Shooting Test (Recorded at three points (Faeiz, Muayad,1999:220).
   Purpose Long-range shooting measurement (calculated as three points).
   Tools: basketball, a goal for a basketball.

Performance: The player performs the pat from the middle of the field towards the goal, and when he reaches the three-point arc area, he jumps and shoots. The player is given (10) attempts.

Registration

The player is awarded one point for each successful shooting, and the highest points obtained are (10) points

Exploratory Experiment

The researcher conducted the study on 10/12/2025 An exploratory experiment on the experimental research sample through the application of some competitive educational exercises and according to mechanical specifications to identify the required tools and materials, as well as the educational exercises and how to perform them and the obstacles that the researchers face in the main experiment in order to address them.

Field Experience

1. Pre - tests : Conducted on 14/12/2025

Weight training exercises used:

The researcher prepared a set of weight training exercises for the arms and legs using sandbags with a binding belt, according to standardized weights, and the performance is done with the execution of long-range shooting.

Therefore, the intensity of the performance (80-90%) was used and the repetitions were determined according to the intensity. Regarding rest, it was standardized according to the pulse as an indicator of rest between repetitions (120-130) bpm and between sets (120-130) bpm. The number of months was two months. The number of weeks is (8) weeks, and it includes the number of units (24) Training units, unit days: Sunday, Tuesday, Thursday. It was programmed into the main section of the trainer's training modules and was implemented during the special preparation period. The training program began on 15/12/2025 and ended on 9/2/2026.

2. Post- tests: Conducted on 10/2/2026

Statistical Methods:

SPSS system was used for data processing.

C. RESULTS AND DISCUSSIONS

Table 3. It illustrates the differences between the cardiac and post-test scores of the control group in Measurements and testing

Variables	Unit Of Measurement	Arithmetic Mean		Standard Error	Calculated T Value	Sig	Level Of Significance
		Tribal	Post				
Height Of The Hip Center Of Gravity	Meter	0.521	0.674	0.054	2.833	0.00	Moral
Maximum Flexion For Angles Detailed Knee	Degree	133.541	135.42	0.574	3.273	0.00	Moral
Ball Launch Angle	Degree	51.562	52.12	0.211	2.644	0.00	Moral
Ball Launch Speed	M/Th	13.214	15,241	0.741	2.735	0.00	Moral

Hip Joint Angle At The Moment Of Throwing	Degree	179.564	180.99	0.541	2.6358	0.00	Moral
Ball Entry Angle	Degree	45.452	47.524	0.794	2.609	0.00	Moral
Accuracy Of Aiming	Points	4.124	6.14	0.885	2.277	0.00	Moral

Table 4. It illustrates the differences between the cardiac and post-test scores of the experimental group in Measurements and testing

Variables	Unit Of Measurement	Arithmetic Mean		Standard Error	Calculated T Value	Sig	Level Of Significance
		Tribal	Post				
Height Of The Hip Center Of Gravity	Meter	0.542	0.812	0.078	3.461	0.00	Moral
Maximum Flexion For Angles Of Knee	Degree	133.621	137.52	0.895	4.356	0.00	Moral
Ball Launch Angle	Degree	51.35	54.42	0.996	4.086	0.00	Moral
Ball Launch Speed	M/Th	13,524	17.52	0.979	4.081	0.00	Moral
Hip Joint Angle At The Moment Of Throwing	Degree	179.42	182.14	0.84	3.238	0.00	Moral
Ball Entry Angle	Degree	45.62	49.47	0.979	3.932	0.00	Moral
Accuracy Of Aiming	Points	4.232	7.99	0.975	3.854	0.00	Moral

Table 5. It shows the (t) values for the post-hoc differences between the control and experimental groups in Measurements and testing

Variables	Unit Of Measurement	Control Group		Experimental Group		Calculated T Value	Sig	Level Of Significance
		M	S	M	S			
Height Of The Hip Center Of Gravity	Meter	0.674	0.094	0.812	0.082	2.225	0.00	Moral
Maximum Flexion For Angles Of Knee	Degree	135.42	0.674	137.52	0.746	4.183	0.00	Moral
Ball Launch Angle	Degree	52.12	0.712	54.42	0.567	5.054	0.00	Moral
Ball Launch Speed	M/Th	15,241	0.741	17.52	0.768	4.275	0.00	Moral
Hip Joint Angle At The Moment Of Throwing	Degree	180.99	0.768	182.14	0.745	2.153	0.00	Moral
Ball Entry Angle	Degree	47.524	0.845	49.47	0.764	3.42	0.00	Moral
Accuracy Of Aiming	Points	6.14	0.523	7.99	0.431	5.473	0.00	Moral

By observing Tables (3) and (4) of the pre- and post-tests for the control and experimental groups, it became clear that both groups improved their kinematic variables and long-range shooting accuracy (calculated as three points). This is attributed to the regularity of training in both groups and their use of targeted exercises that affect the physical aspect, which in turn affects skill performance, including endurance. This is confirmed by (Saad Fadel Al-Hamdani, 2001) "that mastering individual or complex skills is a basis" for advancement and excellence, whether in training units, skill tests, or real competition" (Saad, 2001: 20).

As (Adel Naji Hassan Al-Saadoun, 2010) points out, quoting (Muhannad Abdel Sattar, 2001), "The standardized training programs organized according to scientific foundations work to develop the physical and skill level of the players" (Adel, 2010: 104).

In Table (5), it became clear to us that the experimental group outperformed the control group in the kinematic variables and the accuracy of long-range aiming (calculated at three

points), which is due to the exercises in which weight was used, which enhanced the physical aspect required to implement the movements, give the correct paths, and raise the level of accuracy, which was similar to the actual performance. for this reason you see (Ishraq Ali Mahmoud, 2002) Movements that the player must perform in all situations and that are similar to the playing situation and that the game requires in order to reach the best results while saving effort (Ashraq, 2002: 15).

Saad Moneim (2001) also explains, "It is one of the effective training methods through which the player is prepared and provided with experience through different competitive situations and the development of special skills as well as his adaptation to the requirements of the match." He also adds, it is an important training method that works to develop and enhance the player's physical, skill and psychological experience and competence. Performance in this method is represented according to movements performed within the framework of the rules and laws of the game, while preserving the movements and functions of the motor paths that lead to the race to a large extent (Saad, 2001: 56).

The exercises used, despite the presence of the external influence, which is weight, gave a competitive character in implementing the motor duty, which gave speed and accuracy in performance and enhanced the development of the long-range shooting calculated at three points, as (Talha Hossam El-Din, 1994) believes that "the interaction of both the elements of accuracy and speed is necessary to ensure the achievement of the training goal." It is necessary to use the movements of the body and its various parts according to positions and rates, if rhythm and synchronization, in order to achieve the best results" (Talha, 1994: 19).

Regarding the evolving variables, the most important of which In terms of advanced variables, the most important variable is the angle of entry of the ball, which depends greatly on the starting angle. Since the learners achieved the starting angle well, the entry angle also improved. The connection between these two angles is that the more appropriate the starting angle, the better the entry angle. (Wadih Yassin Al-Tikriti, Muhammad Hassan Al-Ubaidi, 1999) confirm "that the height does not increase beyond what is normal, as a large height means the need to increase accuracy in a way that, while the need for accuracy decreases in the case of an appropriate height that is appropriate to the type of scoring and works to achieve the goal" (Wadih, Muhammad, 1999: 292).

In terms of the height of the center of gravity. (Muhammad Qasim, 2010) believes that, "motor performance in basketball, especially when shooting, requires the player that the height of his body's center of gravity be at a level appropriate for the performance, and the height of the player's center of gravity for performing the skill will affect the point of height at which the ball starts." (Muhammad Qasim, 2010: 107).

The importance of force in aiming, as the result of the force of the body's movement for each aiming operation is flexion and extension of the knee joint. (Hoda Hamid, 2004) believes that "the result of bending and stretching gives the result of a force, since this force will be directed in the vertical direction upwards, and obtaining the result of a force for the vertical direction that we aim to reach to achieve the main goal, we must make the angle of rise (°90)" (Hoda, 2004: 15).

D. CONCLUSION AND RECOMMENDATIONS

The exercises using weights enhanced the physical aspect, kinematic variables, and accuracy of long-range shooting that counts as three points in basketball for youth players (under 16 years old). The success of shooting accuracy depends on advanced kinematic variables, which in turn depend on training and assistive means to raise the physical aspect that enhances those variables. Doping exercises using weights as they enhance the physical aspect, kinematic variables, and accuracy of long-range shooting that counts as three points in basketball for youth players (under 16 years old). In order to achieve success in shooting accuracy, it is necessary to develop the kinematic variables by using training and aids to improve the physical aspect, which in turn enhances those variables.

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F. AUTHOR CONTRIBUTION STATEMENT

All authors contributed to this research

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