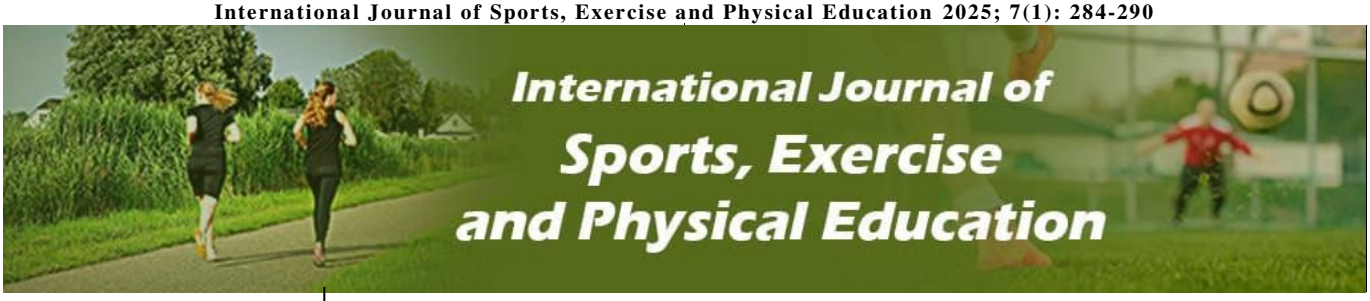


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Sajjad Kareem Flayyih
Faculty of Physical Education and Sports Sciences, University of Kerbala, Iraq

Dr. Hussein Makki Mahmood
Professor, Faculty of Physical Education and Sports Sciences, University of Kerbala, Iraq

Dr. Hussein Manati Sajet
Professor, Faculty of Physical Education and Sports Sciences, University of Kerbala, Iraq

Corresponding Author:
Sajjad Kareem Flayyih
Faculty of Physical Education and Sports Sciences, University of Kerbala, Iraq

The effect of HIIT exercises on some bio-kinetic abilities of basketball players under (18) years old

Sajjad Kareem Flayyih, Hussein Makki Mahmood and Hussein Manati Sajet

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Abstract
The current study represents a scientific attempt to utilize HIIT exercises, as they are characterized by organizing training units according to several stages that have a significant impact on the training process. Therefore, their correct use is an important necessity. The researcher aims to prepare training units based on HIIT exercises that aim to develop the biokinetic capabilities of players at the specialized basketball school in Karbala Governorate. The study also aims to identify the effect of HIIT exercises on some biokinetic capabilities of players under (18) years of age in the experimental group. According to the objectives, the researchers formulated the following hypotheses: HIIT exercises have a positive impact on developing some biokinetic capabilities in basketball for players under (18) years of age in the experimental group. The researchers employed an experimental approach by designing equivalent groups (control and experimental, with pre-and post-tests). The research community included (14) players from the specialized school of the National Center for Talent Care in Karbala. The research sample consisted of (14) players, who were randomly assigned to each group (control and experimental). The researchers then used the statistical package (SPSS) to extract the results of the pre- and post-tests. The researchers concluded that the use of HIIT exercises as a training method had a positive impact on the development of the variables under study. The use of HIIT exercises also contributed to saving the coach's effort and time in developing the bio-kinetic abilities of basketball players under (18) years of age.

Keywords: HIIT exercises, (18) years, bio-kinetic abilities, of basketball players, scientific attempt

Introduction
Sports, including team sports, have become a modern phenomenon that reflects the progress and advancement of a country. Global Olympic, international, continental, and local competitions are forums where the brilliance of physical performance is demonstrated, crafting kinetic skills and tactical formulas at their best. The numbers recorded and the levels achieved have become a living embodiment of a person's ability to perform what some once believed to be difficult. The game of basketball has reached advanced levels of development and popularity, and has received widespread attention from practitioners, spectators, and the media. This interest has sparked numerous researchers in the field of physical education and sports sciences to study and analyze it, also contributing to the development and success of the game. Some have focused on developing the physical and skill aspects of sports teams, while others have focused on physiological aspects, as these are important aspects of all sports, including basketball. Therefore, it has become necessary to pay attention to the various age groups, including the youth category, as they represent the main and important tributary to clubs and national teams, both present and future. According to this, the special preparation processes for these events must include coaches who aim to develop exercises to develop bio-kinetic abilities and to build training programs using modern exercises and diverse training methods that are beneficial to training. This aims to enhance the bio-kinetic abilities of players to reach the desired level. High-intensity interval training (HIIT) is a modern training method that is of great importance in improving the efficiency of both muscular and respiratory work. This is achieved by alternating periods of maximum effort with periods of rest. HIIT is one of the fastest and most effective methods for cardiorespiratory fitness, due to its direct impact on the heart muscle and blood vessels due to the short periods of intense, high-intensity effort that follow periods of rest.

With continued, gradual performance of high-intensity interval training, the body adapts to these exercises and improves performance. These exercises further develop the body's overall functional efficiency index, which is reflected in improving other physical abilities specific to basketball players. The importance of this research lies in developing HIIT exercises, as it is a modern method in sports training, particularly for basketball, and in examining its impact on some of the biokinetic abilities of basketball players under the age of 18.

Research Problem

Through the researchers' observations, and their interest in basketball, they found weaknesses in the performance of some offensive and defensive skills among basketball players at the National Center for Talent Care. Despite their technical proficiency, this was insufficient to complete the offensive process or perform the defensive duties assigned to each player. The researchers sought to find a solution to this weakness by implementing high-intensity interval training (HIIT) and examining its impact on biokinetic abilities, such as speed endurance, strength endurance, and agility, as these are important areas that must be focused on in order to build a comprehensive physical and skill level for the player.

Research Objectives

- To identify the effect of HIIT exercises on some biokinetic abilities of basketball players under (18) years of age.
- To identify the differences between the control and experimental groups on some biokinetic abilities of basketball players under (18) years of age.

Research Hypotheses:

- There is a positive effect of HIIT exercises on some biokinetic abilities of basketball players under (18) years of age.

There is an advantage for the experimental group over the control group on some biokinetic abilities of basketball players under (18) years of age.

Research fields

- **Human field:** Players of the National Center for Talent Care in Basketball in Karbala Governorate under (18) years of age for the 2024-2025 training season
- **Time field:** (17/4/2024) to (1/3/2025)
- **Spatial field:** The Olympic Hall located in the Al-Malhaq neighborhood.

Research Methodology and Field Procedures

Research Methodology

Given the nature of the problem, the researchers adopted the experimental approach by designing two equivalent experimental and control groups with pre-and post-tests, as this was appropriate for the objectives and problem of the research.

Research Community and Sample

The research community included (14) players from the National Center for Talent Care under (18) years of age for the 2024-2025 season in Karbala Governorate. The researcher selected his sample using a comprehensive enumeration method, which included all members of the community, totaling (14) players. They were divided into two groups (control and experimental), with (7) players per group.

Homogeneity of the Research Sample

The researchers sought to verify the homogeneity of the research sample in variables related to anthropometric measurements (height, mass, chronological age, and training age). To achieve this, they used the Levene test, as shown in the following table.

Table 1: Shows the homogeneity of the research sample in terms of physical variables (height, mass, chronological age, training age)

No.	Test Name	Unit of Measurement	Calculated	Sig	Level	Sig Level
1	Height	Cm	0.629	0.443	Non sig	Homogeneous
2	Mass	Kg	1.318	0.273	Non sig	Homogeneous
3	Training age	Month	3.913	0.071	Homogeneous	Homogeneous

Equivalence of the two research groups

To ensure that the two research groups started from a single starting point, the researchers performed a process of equivalence between the groups on the dependent variables, based on statistical testing of the differences between them.

Table 2: Shows the equivalence of the groups in the variables under study

Variables	Unit of Measurement	Experimental Group (Mean ± SD)	Control Group (Mean ± SD)	Calculated t-value	Level Sig	Type Sig
Speed endurance	Second	47.840±0.816	46.895±0.739	2.267	0.061	Non-sig
Strength endurance for legs	Count	35.713±2.927	35.142±2.911	0.366	0.721	Non-sig
Agility	Second	13.086±0.704	13.030±0.503	0.179	0.861	Non-sig

Methods, Tools, and Equipment Used

Research Methods

- Observation.
- Testing and Measurement.

Equipment and Tools Used

- Korean-made Dell computer.
- Chinese-made manual stopwatches.
- (20) Plastic stakes of different heights.
- (10) Chinese-made rubber ropes.
- (14) Chinese-made basketballs.
- Whistles.
- (2) Chinese-made ladders.
- (2) Chinese-made 3D stakes.

Field Research Procedures

Defining the Variables under Study

Through a reference survey of sources and the researchers' personal experience, the following variables were identified (speed endurance, strength endurance, agility).

Tests, Measurements Used, and Their Description

Speed Endurance Test (25 x 8 m) (Hussein Karim Al-Lami, Karar Salah Al-Tamimi, 2020) [5]

- **Purpose of the Test:** To measure speed endurance.
- **Required Equipment:** Tape measure, masking tape, stopwatch, 28m basketball court and whistle.
- **Performance:** Draw two parallel lines 25m apart. The test subject stands at the starting line. At the start signal, they run at full speed toward the second line, touching it with their foot. They then turn around to return to the starting line. This performance is repeated (8) times, bringing the total distance covered (25 x 8m) to 200m.
- **Recording:** The time taken to cover the distance (25 x 8m) is recorded for the test subject, in times per second and fractions thereof.

Strength endurance test for leg muscles (full squat from standing position 60 seconds) (Ali Salman Abdul Tarfi, 2013) [1]

- **Purpose of the test:** To measure the strength endurance of the leg muscles.
- **Equipment Required:**
- **Electronic stopwatch, whistle.**
- **Recorder:** To record the number of times performed (fully flexing and extending the legs and counting the number in 60 seconds).
- Timer to give the start and end signals, along with the timing, and to note the accuracy of the test and counting.
- **Performance:** From a standing position, fully flex and extend the legs and count the number in (60 seconds).
- **Test Instructions:** Fully flex and extend the knees. Each player is given only one attempt.
- **Recording:** To count the number of times correctly performed (fully flexing and extending the knees) for 60 seconds.

Agility T-Test

- **Purpose of the test:** To measure agility.
- **Equipment required:** A measuring tape, four cones, and a stopwatch.
- **Test specifications:** Set up four cones. The subject stands at cone A. When the whistle sounds, they quickly run to cone B and touch it with their right hand. They then run sideways to cone C and touch it with their left hand. They then run sideways to cone B and touch it with their right hand. They then run sideways to cone D and touch it with their right hand. They then run sideways to cone B and touch it with their left hand. They then run sideways to cone A and touch it with their right hand. They then run sideways to cone B and touch it with their left hand. They then return to cone A.
- **Note:** The distance between cones A and B is 9.14, between B and C is 4.57, and between B and D is 4.57.
- **Recording**
- The attempt will not be counted if the run is incorrect, one-foot crosses in front of the other, or if the subject fails to touch the cones.
- The subject is given three attempts.
- The best time of three successful attempts is calculated to the nearest 0.1 seconds.

Experimental Test

The researchers conducted their pilot test on Tuesday, December 31, 2024, at 4:00 PM, in the Olympic Hall located in the Al-Malhaq neighborhood, Karbala Governorate, with the support team on (4) players from the research community. The purpose of the pilot test was to:

- Identify the obstacles and drawbacks that may accompany the experiment.
- Determine the difficulty and ease of measurement.
- Determine the validity of the tools used.
- Determine the adequacy of the support team.
- Determine the time required to perform the tests.
- Ensure the validity and operation of the devices and tools used in the research.

Scientific Foundations of the Test

Validity

Validity is one of the most important criteria researchers relied on to verify the accuracy of the instrument used to measure the phenomenon to be measured. The tests achieved apparent validity.

Stability

The researchers used the test-retest method to determine stability. The test was administered to a sample of (4) players, representing the research community, on Tuesday, December 31, 2024, at 4:00 PM, in the Olympic Hall located in the Al-Malhaq neighborhood, Karbala Governorate. The test was then readministered seven days later, taking into account the same conditions under which the first test was conducted. The researcher then used the simple correlation coefficient (Pearson) to determine the stability of the tests. The results showed high correlation coefficients, with significance values less than the significance level (0.05). This confirms the test's high degree of stability, as shown in Table 5.

Objectivity

The researchers calculated the objectivity of the test results using the simple correlation coefficient (Pearson) between the first and second judgment scores. The results were obtained as shown in Table 5. The degree of objectivity is considered high because it approached (±1).

Table 3: Shows the stability and objectivity coefficients for the research tests

No.	Tests	Stability Coefficient	Sig	Objectivity Factor	Sig
1	Kinetic Response Speed	0.898	0.000	0.899	0.000
2	Legging Endurance	0.899	0.000	0.811	0.000
3	Agility	0.901	0.000	0.902	0.000

Pre-measurements
Pre-measurements were conducted on the research sample on Tuesday, January 7, 2025, to determine the level of the variables under study among the players at the National Center for Talent Care in basketball in Karbala Governorate. All bio-kinetic abilities measurements were conducted at 4:00 PM in the Olympic Hall located in the Al-Muhallaq neighborhood, Karbala Governorate.

Main Experiment
The researchers prepared and organized HIIT exercises, which were implemented from January 11, 2025, to March 7, 2025. They took into account intensity, repetitions, and appropriate rest periods, as well as the physical and functional abilities of the research sample, the tools used, and the training method.

The details of the HIIT exercises in the training curriculum are as follows:

- The duration of the experiment was (8) weeks, with (24) training units, at a rate of three units per week.
- The exercises were implemented during the special preparation phase for the research sample and at the beginning of the main part of the training unit.
- The duration of the exercises in the training unit was (20-25 minutes).
- The training days during the week were (Thursday, Friday, Saturday, and Sunday).
- The exercise intensity was (85-95%) during the training unit.
- The training method was high-intensity, repetitive interval training.
- Short, passive rest periods were used between repetitions and exercises only.
- The researcher considered the principle of diversity in providing exercises to prevent the players from feeling bored during training.
- The exercises were implemented by the coach of the National Center for Talent Care in Basketball in Karbala Governorate, under the direct supervision of the researcher.

Post-Measurements
After completing the exercises prepared by the researchers, the researcher conducted the post-tests on Saturday, March 8, 2025, as follows:

Statistical Methods
The researchers used the Statistical Package for the Social Sciences (SPSS) to process the data and obtain the results (Shafiq Ahmed Al-Atoum, 2008) [16].

Presentation, Analysis and Discussion of Results
Presentation, analysis and discussion of the results for the two research groups

Table 4: Shows the arithmetic means, standard deviations, and the calculated (T) value for the correlated samples and their level of statistical significance for the pre-and post-tests of the experimental group for the studied variables

Variables	Unit of Measurement	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	Calculated t-value	Level Sig	Type Sig
Speed endurance	Second	47.840±0.816	41.351±0.914	12.948	0.000	Sig
Strength endurance for legs	Count	35.713±2.927	53.285±2.288	-10.077	0.000	Sig
Agility	Second	13.086±0.704	10.182±0.613	13.383	0.000	Sig

Table 5: Shows the arithmetic means, standard deviations, and calculated (T) values for the correlated samples and their level of statistical significance for the pre-and post-tests of the control group for the variables under study

Variables	Unit of Measurement	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	Calculated t-value	Level Sig	Type Sig
Speed endurance	Second	46.895±0.739	43.637±0.960	8.137	0.000	Sig
Strength endurance for legs	Count	35.142±2.911	48.428±0.975	-10.485	0.000	Sig
Agility	Second	13.030±0.503	11.101±0.183	8.659	0.000	Sig

Speed tolerance
Through the presentation and analysis of the results of the pre-and post-tests and measurements for the control and experimental groups, as shown in Tables (4) and (5), significant differences appeared between the two tests (pre- and post-tests) for the experimental group, indicating that there was a development in the speed tolerance variable in favor of the post-test. The researcher attributes the improvement achieved by the experimental group in the post-test to the nature of the HIIT exercises designed by the researcher, as they were effective in developing the physical aspect. HIIT exercises are also considered an effective and time-efficient training method for developing bio-kinetic abilities in general. This is consistent with what Gibala, M.J., stated: "HIIT exercises are characterized by short, alternating periods of high intensity, which requires the body to consume a greater amount of oxygen than usual. These are followed by very short rest periods, and are applied in many training programs". (Gibala MJ, 2012) [4].

During the exercises, training methods were also used that were unknown to the players, such as changing the player's speed during the exercise itself. This is consistent with the requirements of basketball.
Training can be organized in accordance with the desired goal and the principle of gradual progression from easy to difficult. This was confirmed by Wilkinson (2009) [17]. The use of speed-endurance exercises on the basketball court, which include multiple changes in direction, confirms that speed-endurance training must be performed in accordance with the movement patterns specific to the sport (Wilkinson M, Leedale-Brown D, Winter EM, 2009) [17].
As for the improvement of the control group in the post-test, this is due to the players' continuation in training and their commitment to the training units prepared by the coach, where the exercises were mostly skill-based and focused on lactic acid training, and this is what was indicated by (Muqaddad Al-Sayyid Jaafar Hassan, 2000) [13]. "Training must be diverse and continuous and work must be done to

find special exercises that aim to develop aerobic and anaerobic capabilities according to the specificity of the game" (Muqdad Sayed Jaafar Hassan, 2000) [13].

Strength Endurance

Through the presentation and analysis of the pre-and post-test results for the control and experimental groups, as shown in Tables 4 and 5, significant differences emerged between the two tests (pre-and post-test) and for both groups (control and experimental), indicating a development in the strength endurance variable in favor of the post-test for both groups. The researcher attributes the improvement achieved by the experimental group in the post-test to the nature of the HIIT exercises he prepared, as strength endurance contributed to increasing the muscles' ability to produce repeated muscle contractions. Developing strength endurance facilitates transitions during physical and skill tests and increases the muscles' ability to produce repeated muscle contractions, supported by appropriate force throughout the performance period, preventing a decline in skill performance. Increasing the player's ability to perform repeated defensive movements from above or below the blocking player means providing a greater opportunity for successful defense and ensuring continuous monitoring of the player in possession of the ball. The researcher also believes that HIIT exercises aim to improve players' physical ability and develop strength endurance because they are built and designed on the principle of developing the athlete's physical fitness level. These exercises feature diverse movement paths characterized by diversity, excitement, and a challenge to personal abilities, which impacts performance and improves and develops game skills (Omar Muhammad Majeed, 2009) [15].

The researcher also attributes the reason for the improvement in strength endurance for the control group in the post-test to the nature of the exercises prepared by the coach, as well as the continued and regular training of the players in the control group. Among the factors taken into account were the presence of speed in kinetic performance and the number of repetitions used by the players with or without the ball.

In addition, there is a correlation between the physical and skill aspects, as an athlete cannot master technical performance if they lack the physical qualities for the type of activity being practiced. The researcher agrees with Ibrahim Khalil Al-Hasani (1996) [6] who states that "the level of skill and physical abilities develops with the development of the other" (Ibrahim Khalil Al-Hasani, 1996) [6].

Agility

Through the presentation and analysis of the results obtained by the researcher in the pre-and post-tests and measurements for the experimental and control groups, as shown in Tables 4 and 5, it became clear that there were significant differences between the pre-and post-tests and for both research groups, indicating that there was development in the agility variable in favor of the post-test for both groups. The researcher attributes the significance of the differences in this ability to the (HIIT) exercises, as the exercises used had a positive impact on the development of agility, and also because they focused on developing dual and triple complex abilities and capabilities in a single exercise, such as developing kinetic, physical, and skill capabilities. Through the use of ground stairs and their combination with jumping movements, changing speed and direction, and fast running, in addition to the exercises of indicators, launches, and rapid movement training using the feet, trunk, and hands, while linking the exercises together in a single exercise according to the conditions of correct performance, this was one of the important factors in achieving development in agility. Both (Nawal Mahdi and Fatima Abdul) indicate that Agility "is clearly evident during complex and varied kinetic performance characterized by speed and difficulty of execution" (Nawal Mahdi, Fatima Abdul Maliki, 2011) [14]. Therefore, the development that occurred in the experimental group in the post-test of agility test is attributed to (HIIT) exercises through the process of linking physical, kinetic, and skill performance, as it includes speed tasks of all types and forms, physical and skill performance, which contain bio-kinetic abilities including speed and strength. All of these physical, kinetic, and skill qualities are combined by agility in a single crucible, which leads to their development. This was confirmed by Amr Allah Al-Basati (1998) [2]. "There is a close connection between skills and physical requirements in every activity" (Amr Allah Ahmed Al-Basati, 1998) [2]. In addition, the performance of the training was linked to situations and conditions similar and close to what happens in match conditions, because training on complex defensive skills according to match conditions motivates the defender and adapts to perform them during matches. This development appeared as a result of the players' ability to combine types of physical and skill movements in a single form characterized by fluidity and good performance that results in good achievement. The HIIT exercises used by the researcher in the training modules had a clear impact on the significant differences that emerged in the post-test for the experimental group. These exercises directly impacted their agility abilities, primarily due to their association with defensive footwork through maneuvering, changing direction, and kinetic control. This was reflected in the fluidity and accuracy of performance.

Presentation, Analysis and discussion of the results of the post-tests and measurements for the two research groups (Experimental and Control)

Table 6: Shows the arithmetic means, standard deviations, and calculated (T) values for independent samples, the level of test significance, and the significance of the differences between the results of the post-tests for the experimental and control groups for the variables studied

Variables	Unit of Measurement	Experimental Group (Mean ± SD)	Control Group (Mean ± SD)	Calculated t-value	Level Sig	Type Sig
Speed endurance	Second	41.351±0.914	43.637±0.960	-4.558	0.001	Sig
Strength endurance for legs	Count	53.285±2.288	48.428±0.975	5.165	0.000	Sig
Agility	Second	10.182±0.613	11.101±0.183	-3.794	0.003	Sig

Speed Endurance

Table 6 shows that there are significant differences between the control and experimental groups, in favor of the experimental group, in the speed endurance variable. The researcher believes that the reason for the experimental group's superiority over the control group in this variable is due to the nature of the exercises applied to the research sample. HIIT exercises led to the development of physical abilities, especially those of importance to basketball players, such as speed endurance. This is confirmed by (Carl Foster *et al*., 2015) [3], who states that HIIT exercises are "repetitions at very high intensity with relatively short rest periods. It is considered a very difficult physical challenge and is used to develop anaerobic abilities." (Foster, *et al*., 2015) [3].

The researcher also attributes the superiority of the experimental group over the control group to the quality and nature of the HIIT exercises prepared by the researcher, which were performed over relatively medium distances and with short rest periods. This is consistent with (Jamal Sabry, 2019) [8] stating, "Speed endurance can be developed through training or running short distances (10-35 m) and allowing short rest periods (10-30 seconds) between repetitions." (Jamal Sabry Faraj, 2019) [8]. This is what the researcher sought to achieve in his exercises. Numerous studies have also confirmed that HIIT exercises have a significant impact on improving repeated running efficiency, which enhances speed endurance in athletes (Mima Stankovic *et al.*, 2023) [12]. The researcher used HIIT exercises to develop speed endurance, as the exercises prepared by the researcher were performed at the beginning of the main section to exploit the integrity of the central nervous system, and they were implemented at the highest possible speed during the training unit "because the training intensity in team games is very complex, and because keeping the match going is fast and the intensity changes and alternates constantly between high and low, and in order to meet the need for these requirements, the coach must include in his training program how to use a varied formation on an ongoing basis".

Strength Endurance

From Table 6, we find that there are differences in the results of the post-tests and measurements for the two groups (control and experimental), in favor of the experimental group in the strength endurance variable. The researcher attributes the superiority of the experimental group over the control group to the quality and nature of the exercises prepared by the researcher (HIIT exercises), as well as the regularity and continuity of the training units by the research sample, using a scientific approach, according to many references and scholarly sources, in terms of the training volumes specific to HIIT exercises.

Thus, training based on gradual progression of training load from one training unit to the next, with appropriate increases, will lead to appropriate muscular adaptation to this increase, leading to improved muscular strength (strength endurance).

Kamal Jamil (2004) [9] states, "The introduction of strength exercises using body weight, as well as a gradual increase in the frequency of skill performance according to the anaerobic energy system, led to improved strength endurance among the players in the experimental group". (Kamal Jamil Al-Rabdi, 2004) [9]. This is what the players did during the training program, as well as the continuity of training and the duration of the program, which provided sufficient opportunity for development. All of the above factors contributed effectively to the positive results achieved between the pre-and post-tests, favoring the post-test for the experimental group. Therefore, the distinguishing feature of strength endurance lies in the fact that endurance is not related to maximizing the duration of the load, but rather to maintaining a high level of performance throughout the training session. Thus, the task in sports is focused on performing at a specific level, and the stages of strength endurance training involve performing exercises appropriate to the specialty and physical load. (Yixuan Liu *et al.*, 2024) [18].

Agility

Through the presentation and analysis of the results of the tests and post-measurements for the two groups (experimental-control), as shown in Table 6, significant differences appeared between the two groups in favor of the experimental group. The researcher attributes this development to the (HIIT) training method prepared by the researcher and applied to the players according to the scientific foundations of sports training, from easy to difficult, to develop and improve agility among the players, as it is an important characteristic that a basketball player must be distinguished by, through which the player can change direction and body positions on the ground and in the air, and move from acceleration to deceleration in a smooth manner, and place it in the prepared exercises that are compatible with the players, and with appropriate repetitions that helped improve the agility of the players, as "regular sports training that is based on solid scientific foundations, and in which the player gradually increases training loads, gives positive results and ensures his continued progress in the various aspects of basketball" (Zouhal H, *et al.*, 2020) [19], and the focus on agility exercises and their inclusion in the exercises prepared by the researcher and of various types Different, throughout the training units period, it gave fruitful results in developing it among players, as "kinetic abilities are acquired qualities that the player or learner acquires from the environment or that are present and develop according to his physical, sensory and cognitive abilities through training and practice, which are the basis for them" (Imad Al-Din Abbas Abu Zaid., 2005) [7]. In addition, the basketball player needs agility to try to succeed in integrating several basic skills within one framework, or changing from one skill to another, or changing his speed or direction in a correct rhythm on the ground or in the air in an easy and smooth manner according to the playing conditions. Agility is considered one of the important bio-kinetic abilities that help the player to accomplish kinetic performance in a sound manner through his ability to control the correct body coordination, which the researcher worked on during his preparation for training in order to reach the correct technique for the player's performance, as agility plays an important and effective role by raising the ability to quickly learn kinetic skills. Sports, and applying skills well, as "agility is the ability to perform a kinetic duty characterized by diversity and difference and is characterized by the accuracy and smoothness of movement and timing". "Al-Saleem" (Makhlouf I, *et al.*, 2018) [11].

Conclusions and Recommendations

Conclusions

According to the results reached by the researcher through the field experiment, he concluded the following:

- HIIT exercises helped develop the physical and skill aspects of the players according to the variables studied.
- HIIT exercises have a significant impact on the development of bio-kinetic abilities (strength endurance, speed endurance, agility).

Recommendations

According to the conclusions reached by the researcher, the following recommendations are recommended:

- The necessity of using modern training methods such as HIIT exercises by coaches, particularly in basketball, in order to save effort and time and achieve training goals.
- Adopting HIIT exercises to develop bio-kinetic abilities (strength endurance, speed endurance, agility).
- Conducting further studies and research using HIIT among different age groups and different skills and for both genders in basketball.

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