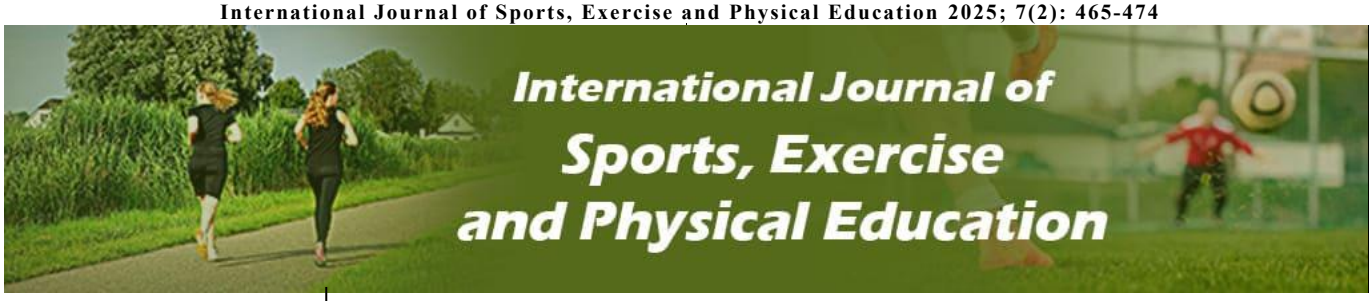

ISSN Print: 2664-7281
ISSN Online: 2664-729X
Impact Factor: RJIF 8.15
IJSEPE 2025; 7(2): 465-474
https://www.sportsjournals.net
Received: 23-07-2025
Accepted: 27-08-2025

Thaer Saleh Shneair
Engineering Technical College of Najaf, Al-Furat Al-Awsat Technical University, Iraq

Ali Kadhim Hadi
Jabir Ibn Hayyan Medical University, Iraq

Corresponding Author:
Thaer Saleh Shneair
Engineering Technical College of Najaf, Al-Furat Al-Awsat Technical University, Iraq

The effect of anaerobic training on performance endurance and some biochemical indicators (CPK - LDH) and blood lactic acid in people with mild mental disabilities in futsal

Thaer Saleh Shneair and Ali Kadhim Hadi

DOI: https://www.doi.org/10.33545/26647281.2025.v7.i2g.260

Abstract
This research aims to identify the effect of anaerobic training on physical performance endurance and the concentration levels of some biochemical indicators in the blood, namely creatine kinase (CPK), lactate dehydrogenase (LDH), and lactic acid concentration, among players on the Iraqi national futsal team with mild intellectual disabilities. The research problem was the observation of a state of poor skill and physical performance, lack of concentration, and the appearance of signs of fatigue in the second half of official matches, indicating a weakness in the ability to endure performance. The researcher adopted a solution to this problem by developing an anaerobic training program during the special preparation period to determine the effect of anaerobic training on performance endurance and the aforementioned biochemical indicators. The expected results recommend the adoption of targeted anaerobic training, which contributes to improving and raising physical and skill efficiency by developing and improving the concentration of the enzymes under study, along with the concentration of lactic acid in players, and improving blood indicators related to performance endurance. This is closely related to these indicators, which have an impact on Select and know the players' levels through it.

Keywords: Anaerobic, training, performance, endurance

Introduction
Futtas football for people with mild intellectual disabilities has witnessed rapid development, requiring specialized physical and physiological preparation to achieve high levels of achievement and international competition, as well as local competition. Blood biochemical indicators are a true tool and means for assessing and evaluating players, and an objective indicator of training status. This is measured by the results of the indicators under study, and by the close correlation between performance endurance and these indicators. The value and level of players are derived from this data regarding the components of the external training load (intensity, volume, and rest) and its impact on the internal load, developing and improving the efficiency of the body's functional systems. Measuring the biochemical indicators under study is considered one of the most prominent scientific methods for revealing the extent to which the intensity of physical effort affects the extent of muscle recovery and reaching a state of recovery more quickly, avoiding stress or injuries by increasing the value of these indicators. With futsal relying on anaerobic physical performance (phosphagen and lactic) to a large extent, short repetitions, and few rest periods, here performance endurance becomes an effective ability to delay the manifestations of fatigue and maintain the level of skill and physical performance for a longer period, perhaps until the end of the match.[1] Here lies the importance of this research in designing and implementing an anaerobic training program dedicated to futsal players with mild mental disabilities, aiming to raise the level of physical performance endurance in high-intensity playing conditions throughout the competition period. This research is distinguished by studying these changes in biochemical indicators (CPK, LDH, and lactic acid) before and after physical effort. The results of this research guide coaches and specialists with a scientific database that helps plan and organize training programs and standardize training

loads in a manner that is compatible with the capabilities and abilities of this group, and in a way that supports the development of futsal. Football for people with mild mental disabilities locally and internationally.

Research problem

Despite the clear development in futsal for people with mild intellectual disabilities, the skill and physical performance of the Iraqi national team players continues to suffer from a clear weakness, especially in the second half of friendly and official competitive matches. Signs of fatigue and a decline in skill performance are evident, as is a decline in the players' level of concentration at this time. This indicates a deficiency in the players' ability to endure performance, which is a crucial element in all sports in general, and in futsal in particular, which relies on short, repeated, and high-intensity efforts. Furthermore, scientific research and studies that have addressed this group of people with mild intellectual disabilities in futsal have not been as ambitious as in other activities for healthy athletes, regarding the impact of training programs and their ability to develop performance endurance, as well as on the biochemical indicators under investigation for this group, and have been very limited. Despite the importance of these indicators, such as the enzyme creatine kinase (CPK), the enzyme lactate dehydrogenase (LDH), and lactic acid concentration, and the indications they provide of the players' ability and capacity. In assessing the efficiency of the body's systems in general, and the capacity of the muscular system in particular, and assessing the impact of external training loads on internal loads, the need for systematic scientific research is highlighted. This research aims to understand the impact of anaerobic training on performance endurance and its levels, and to focus on these biochemical indicators. This will develop the level of physical and skill readiness, increase the adaptation of players' body systems, and provide coaches with data that will help in assessing, planning, and regulating appropriate training loads within the capabilities and capacities of futsal players with mild intellectual disabilities.

Research objectives

1. To develop anaerobic training for performance endurance for the Iraqi national team's futsal players with mild intellectual disabilities.
2. To identify the effect of anaerobic training on improving performance endurance and biochemical indicators (CPK, LDH, and lactic acid) among the research sample.

Research hypotheses

- There are statistically significant differences between the pre- and post-tests in performance endurance and some specific biochemical indicators, in favor of the post-tests.

Research areas

- **Human area:** Players of the Iraqi National Futsal Team with Mild Intellectual Disabilities (10) players for the 2024-2025 sports season.
- **Temporal area:** From 12/8/2024 to 5/20/2025.
- **Spatial area:** The athletics stadium of the Sports Talent Center affiliated with the Ministry of Youth and Sports in Baghdad.

Research methodology

The researcher used an experimental approach using a single-group experimental design with pre-tests and post-tests (matched sample) to suit the research procedures.

Research population and sample

The research population and sample were determined using the exclusive method, consisting of (10) players from the Iraqi national team for the 2024-2025 sports season, representing (100%) of the original research population.

Table 1: Shows the experimental design of the research

The group	The first step	Step two	Step three	Step four
	Pre-tests	Independent variable	Post-test	
Experimental group	1. Enzyme (CPK-LDH) 2. Lactic acid measurement 3. Performance endurance	Anaerobic training	1. Enzyme (CPK-LDH) 2. Lactic acid measurement 3. Performance endurance	The difference between pre- and post-tests

Sources of information gathering, devices, and tools used

1. Sources of information gathering

- Scientific sources (Arabic and foreign).
- Observation.
- Measurement and testing.
- The Internet.

2. Devices and tools used

- Lactate Pro2 lactate measuring device and accessories (made in Japan).
- Monarch ergometric bicycle.
- KTAT strips for measuring lactic acid.
- EDTA-free blood storage tubes (Plan Tube).
- Medical syringe for drawing blood.
- Cool Box.
- Compression belt attached to the upper arm area.
- Electronic height and weight measuring device (CMS-5000), made in England.
- Kits for measuring blood LDH concentrations, imported from the British company Randox, and blood LDH enzymes, imported from the Spanish company Linear.
- Cotton swabs with an alcohol-free sterilizing solution and a medical glove.
- Sony video camera.
- (4) Casio stopwatches, with a metal measuring tape, adhesive tape, and chalk.
- (3) HP laptops, Korean-made.
- (20) Torshen five-a-side footballs, Chinese-made.
- (50) small and large cones, Chinese-made, with (5) Fox whistles.
- Standard futsal field.
- Information registration form.

Defining research variables and testing them

The researcher identified the biochemical variables of futsal players with mild intellectual disabilities, namely the enzymes (CPK-LDH) and lactic acid, given the nature of the study in terms of its objective and importance. The researcher used the Lactate Pro2 device to measure lactic acid and an ergometer bike to measure the physical effort exerted by the research sample. He then measured lactic acid after the effort on the bike, based on the weight of each player and their overall abilities and capabilities.

"Average performance endurance test for futsal players with mild intellectual disabilities based on scoring and rolling between futsal markers [2]

- **The objective of the test:** To measure the average performance endurance of futsal players with intellectual disabilities.
- **Tools used:** (13) futsal balls, (11) markers, and a stopwatch.
- **Performance method:** The tested player stands at the starting point next to the goal. Upon hearing the start signal, he runs towards a marker located (10m) from the goal. He then returns to score six balls into the goal, which is divided into six zones numbered from (1) to (6), three upper zones and three other zones below them. Each zone is a square measuring (1m). Scoring is done in sequence for six balls located (8m) away, so that he returns to the marker located (2m) from the balls after each time to score. After completing the station, he runs to the middle of the field from the side to roll the ball between (9) markers of different dimensions to the other side of the field to stop the ball. He then runs without the ball to a marker located (22m) from the end of the center line towards the other goal, turns around the marker placed there, and returns to the other side of the field for the running station on the ground ladder consisting of (8) ladders. He then runs to the second scoring station to score (6) more balls on the goal in sequence, after which he completes the performance.
- **Conditions:** If the sequence is correct, the player receives one point, while if they make a mistake, they receive zero. The first ball is scored in zone (1), the second in zone (2), the third in zone (3), and so on up to the sixth ball in zone (6). Performance at all stations and throughout the test must be as fast as possible.
- **Note:** The highest accuracy score is (12) points, and the lowest is zero.
- **Recording**
  - The time for the entire situation (test) is calculated, and the accuracy score is calculated for both scoring stations.
  - The player's score is divided by the total score to obtain a (success rate) and subtracted from the correct one to obtain the failure rate for performance accuracy.
  - Multiply the accuracy failure rate by the total time to produce a fraction of the performance time.
  - Add the result of the previous point as a fraction of the performance failure rate to the total time to produce the final unit of measurement for performance endurance. For example, if a player scored (8) points in scoring accuracy out of (12) and completed the test in (80) seconds, his score for the test would be:

A. Calculate the accuracy success rate as 8/12 = 0.75

- Subtract this percentage from one to produce the accuracy failure rate: 1-0.75 = 25.0
- Multiply the accuracy failure rate by the time to produce the accuracy failure time: 80 x 25.0 = 20
- Add the failure time to the total time to produce the final score: 80 + 20 = 100"

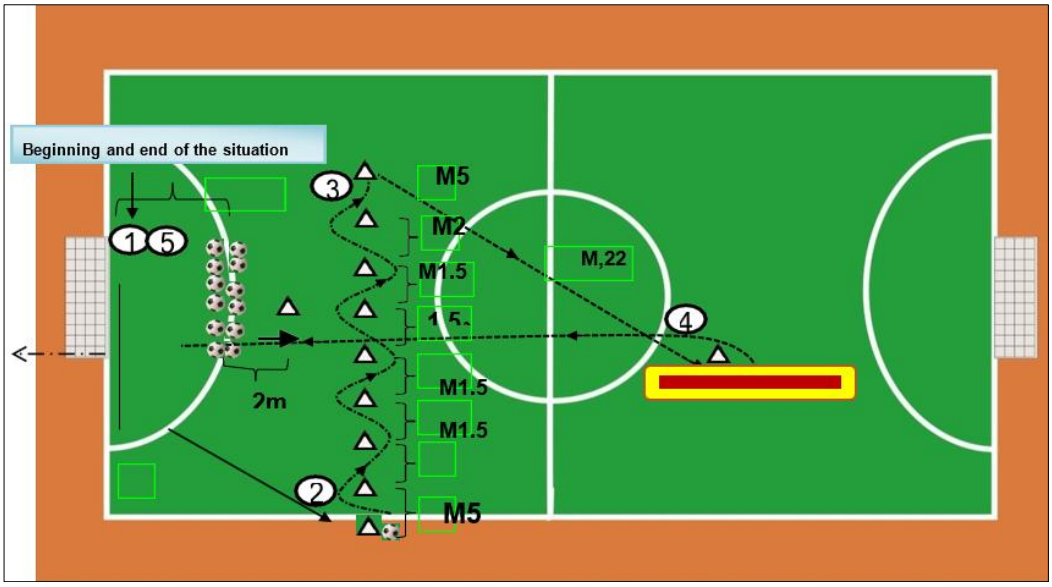

Fig 1: Shows the average performance of the load bearing capacity

Player movement direction		Agility without the ball	.....	Roll indicator	
Pass		Ball agility		Ground ladder	
		Scoring		Station sequence number	

2. Wingate bike test [3]

- **Purpose of the test:** "To measure anaerobic effort, power, and capacity.
- Necessary equipment (stopwatch, calculator, Monarch exercise bike)
- **Test procedures:** Procedures: The test is conducted using a Monarch stationary bike according to the following steps:

1) The subject is weighed to the nearest kilogram.
2) The subject performs a warm-up on the bike for (3) minutes, applying a resistance of (1-2) kg, depending on the subject's weight. Before the end of the warm-up, the subject rotates the bike at maximum speed for (3-5) seconds, repeating this process two to three times.
3) The subject's data is entered into the computer, and the resistance is set according to the subject's weight, which is equivalent to 7.5% of their body weight.
4) The subject climbs onto the bicycle, and the seat is adjusted according to their height, leaving a very slight bend at the knee joint of approximately (10) degrees. The foot strap is then adjusted, and the procedures are explained to the subject, reminding them to move upon receiving the signal.
5) The weight is lifted from the basket, and the subject begins rotating the bicycle wheel at the maximum possible speed, at no less than (80) revolutions, for a period not exceeding three seconds. The weight is then gently lowered. At the same time, the program's start button is pressed to begin the measurement process. The subject continues rotating the wheel for (30) seconds at maximum speed, being encouraged and urged to maintain the rotational speed as much as possible. The results are recorded directly by connecting the bicycle to a program installed in an electronic calculator for the purpose of calculating variables. The subject is then given a (1) minute rest, followed by the test for another 30 seconds."

3. Blood CPK and LDH enzyme concentration test [4]

- **Purpose of the test:** To measure the concentration of CPK and LDH enzymes in the blood at rest and after physical exertion.
- **Equipment used**

1) Medical cotton, sterile materials, a medical syringe, and a compression belt to be tied around the upper arm.
2) EDTA-free blood storage tubes, a manual pipette to withdraw serum from the blood, and a cooling case.
3) Centrifuge, spectrophotometer, and electronic reader.
4) Kits to determine CPK and LDH enzyme concentrations in the blood.

- **Laboratory procedures:** A special test was conducted to measure the concentration of the enzymes CPK and LDH in the blood. Blood was drawn from the physiology laboratory of the Ministry of Youth and Sports. Measuring the concentration of the enzyme CPK in the blood is considered the best indicator of the level of creatine phosphate in the blood, while the enzyme LDH is considered the best indicator of the breakdown of carbohydrates (glucose) in the blood. Blood is drawn from the athlete before any effort (while at rest). The doctor wraps a pressure bandage around the upper arm to restrict the blood to the upper arm vein. He then sterilizes the area and begins drawing (5) cc of blood, which is considered a sufficient amount according to the instructions included with the kit. The doctor then empties the blood from the syringe into designated tubes labeled with the runner's name. Before the effort, the blood tubes are collected for all members of the research sample and placed in a refrigerator. He then repeats these procedures after the effort on an ergometer bike for a period of (10) minutes.

4. Blood lactic acid concentration test [5]

Before performing the effort (performance endurance test) and during rest, the lactic acid concentration is measured using the (Lactate Pro2) device. The doctor begins by sterilizing the player's thumb, then pricking it with a needle, then wiping the first drop with cotton. He then takes the second drop and places it on the pad used to measure the lactic acid concentration. After less than (5) seconds, the result appears. The doctor then repeats the same previous procedures after performing the performance endurance test for (10) minutes to measure the acid concentration after the effort.

Pilot study

The pilot study was conducted on (2) players from the research sample on Friday, December 19, 2024. Tests were conducted to measure the concentration of the enzyme (CPK-LDH) before the effort at the Ministry of Youth and Sports (Physiology Laboratory) on a Wingate ergometer bike. Blood samples were then taken from the players after the effort for a period of (10) minutes. To restore the state of full recovery, lactic acid was measured on Saturday, December 20, 2025, before the effort. A performance endurance test was then conducted to measure the level of lactic acid concentration after the effort for a period of (10) minutes.

Anaerobic training implementation mechanism

1) Determine the specific period for conducting the research during the special preparation phase, which is eight weeks, with three training units per week.
2) Determine the duration of the unit by the trainer, which is (120) minutes, and the main section (90) minutes.
3) Determine the duration of the independent variable (anaerobic training), ranging from (20-30) minutes, at a rate of (25) minutes.
4) Determine the number of anaerobic training exercises in each unit, ranging from (4 to 3) exercises.
5) The weekly training load oscillations are (1-2).
6) Calculate the total time for the independent variable (anaerobic training) over the entire program implementation period (25 x 24) = 600 minutes.
7) Determine the method of high-intensity interval training (80-90%) and repetition (90-100%) in implementing anaerobic training.
8) Determine the mechanism for using (intensity/volume/rest) components of the training load to regulate the heart rate.
9) Determine the rules for calculating the intensity and difficulty of the training unit according to specific equations.

Partial intensity percentage= Heart rate per exercise/ Maximum pulse*100

Heart rate per exercise= Partial intensity percentage* Maximum pulse/100

Percentage of difficulty of the training unit= Total (partial intensity x exercise volume)/ Exercise volume" [5]

Field research procedures

"After reviewing all the conditions and variables specific to the research, in order to conduct the tests (field experiment), the researcher set the dates for conducting the pre-tests for the research sample. The pre-tests were to measure the concentration of the enzymes (CPK) and (LDH) in the blood in the physiology laboratory of the Ministry of Youth. The pre-tests were also to be performed to measure the concentration of lactic acid in the blood before and after the effort in the closed hall of the Ministry of Youth and Sports, during the anaerobic training period, and the dates for conducting the post-tests in the same manner, as follows" [6].

1. Pre-tests for the research sample

"Before conducting the tests, the researcher explained and clarified how the tests were conducted for the research sample. The pre-test was conducted on the experimental research sample, which consisted of (10) players in futsal with mild mental disabilities representing the Iraqi national team, at nine o'clock in the morning on Friday, December 26, 2024. Pre-tests were conducted to measure average performance endurance and measure lactic acid before and after the effort (10) minutes in the closed hall for futsal. At the Ministry of Youth, on Saturday, December 27, 2024, a pre-test was conducted on a Wingate ergometer bike at ten o'clock in the morning, and the concentration of the enzymes (CPK) and (LDH) in the blood was measured before and after the effort (10) minutes in the physiology laboratory of the Ministry of Youth and Sports."

2. The main experiment

The twenty-four training units were held on Tuesdays, Thursdays, and Saturdays, with the first being on Tuesday, December 31, 2024, and the last training unit on Saturday, February 28, 2025.

"The researcher relied on the training curriculum established for the sample by the training staff. Anaerobic training exercises prepared by the researcher to improve performance endurance and some biochemical indicators in the blood, enzymes (CPK), (LDH), and lactic acid, were included in the main section of the training units for the sample. The application is for (20-30) minutes throughout the application period of the curriculum components established for a period of (8) weeks, with (3) training units per week (Tuesday/Thursday/Saturday). Thus, the total training units are (24) units, with an average of (25) minutes in each training unit. The total becomes (600) minutes, which is the full time period for applying the exercises (anaerobic training) under study. The exercises are given and implemented scientifically and gradually from easy to difficult, and the training load is standardized to suit the capabilities and potential of the sample of five-a-side football players." In addition, the scientific principles for training this sample are taken into account, using and focusing on volume more than intensity within the training load components.

3. Post-tests for the research sample

"The post-tests for the research sample were conducted using the same method as the pre-tests in terms of time, location, and amount of rest. After anaerobic training exercises were applied in all training units and in the main section of each training unit, according to the training curriculum components for the research sample, and over the course of (24) training units, post-tests were conducted to measure average performance endurance and lactic acid concentration before and after (10) minutes of effort on Tuesday, March 2, 2025, at nine in the morning in the indoor five-a-side football hall at the Ministry of Youth and Sports. The post-test was conducted on a Wingate ergometer bike at ten in the morning," and the concentration levels of the enzymes (CPK) and (LDH) in the blood were measured before and after (10) minutes of effort in the physiology laboratory of the Ministry of Youth and Sports at ten in the morning on Wednesday, March 3, 2025.

4. Statistical methods

The researchers used the statistical package (SPSS) to process the research data.

Results and Discussions

- Presentation and discussion of (CPK and LDH enzyme concentration test)

Table 2: displays the pre- and post-test averages, standard deviations, computed t-value, and significance of the differences between the biochemical variables of the test (CPK and LDH enzyme concentration) before and after ten minutes of physical exercise

Variables	Units	Pre-test		Post-test		Mean diff.	SD diff.	T calculated*	Table value	Significance of differences
		Mean	SD	Mean	SD					
CPK enzyme before exercise	U\L	114.00	25.03	267.75	43.61	153.75	42.48	7.23	2.262	Sig.
CPK enzyme after exercise	U\L	165.25	48.91	320.50	48.45	155.25	85.17	3.64	2.262	Sig.
LDH enzyme before exercise	U\L	223.25	22.66	310.00	49.65	86.75	28.15	6.16	2.262	Sig.
LDH enzyme after exercise	U\L	271.50	30.22	382.25	46.71	110.75	36.72	6.03	2.262	Sig.

*At a significance level of (0.05) and a tabular value of 2.262 degrees of freedom (10-1=9)

Discussion (CPK and LDH enzyme concentration test) after physical effort (10) minutes:

In the biochemical variables as shown in Tables (2) before and after physical effort (10) minutes, the researcher attributes the significant differences between the pre- and post-tests, in favor of the post-test, to the fact that the enzyme change is a progressive change that is always associated with the type of effort specific to the activity and the type of intensity used in performance during training or competition. Here, the change is logical, as all enzymes begin to develop and improve according to the changes that occur in the working muscles. Using high intensity in training sessions and near-maximum performance has an effective impact on improving the enzymes, as well as being reflected in improving the speed of energy-producing reactions. This is what Abu Al-Ala Ahmed indicated when he said, "Using exercises with a maximum or near-maximum training intensity with few repetitions and high

performance speed will increase the activity and effectiveness of the enzymes responsible for energy production and rebuilding during anaerobic work, as these enzymes work to destroy and break down the chemical bonds of creatine phosphate and carbohydrates or Muscle glycogen" [6], as there are responses of the body's organic systems through the impact and reflection of physical effort on these systems through the intensity and speed of training or competition, as "the body's biological systems respond to external stimuli when these stimuli are of a sufficient duration and intensity. One of these biological responses to physical performance is the response of skeletal muscles to this performance, which appears in the form of an increase in the activity level of the enzymes creatine phosphokinase (CPK) and Lactic Dehydrogenase (LDH) in the muscle and blood" [7]. The truth is that every normal person, if he or she performs any new physical activity or effort, will experience high and significant activity in the enzymes specific to the muscles that have exerted the effort, such as the enzymes (CPK - LDH), as well as all enzymes related to this effort. This is due to the confusion and unfamiliarity to which the body is accustomed, which occurs in the balance of muscle function in its normal state. This is a natural reaction of the body's systems in general, and of the working muscles in particular, to re-adapt these systems and muscles according to the type of effort. Or the new activity, which is called advanced adaptation, and continuing this activity will lead to permanent (chronic) adaptation, and the rise of these enzymes (CPK - LDH) is due to the rise in stimuli (physical effort) affecting the body's various systems, as "the activity of the enzyme (CPK) increases when the player performs activities that he is not accustomed to, and this appears, for example, when a short-distance runner runs a distance of (10 km) on foot, as this will lead to an increase in the activity of this enzyme and all the enzymes working in the same activity" [8]. The effect of anaerobic training that the researcher used in high-intensity training units (maximum or sub-maximum) so that the training work is in the anaerobic system with its two parts, phosphagen and acid, and on a continuous basis there is an adaptation in these enzymes, which in turn is reflected in the increase and improvement in the level of energy production in the muscles working at this intensity with which the experimental group was trained, as "the use of exercises with maximum or sub-maximal training intensity with few repetitions and high performance speed will increase the activity and effectiveness of the enzymes responsible for energy production and rebuilding during anaerobic work, as these enzymes work to destroy and break down the chemical bonds of creatine phosphate and carbohydrates or muscle glycogen" [9].

Presentation and discussion of the lactic acid test

Table 3: Demonstrates the difference between the pre- and post-test findings in the biochemical variables (lactic acid) before and after physical exertion (10) minutes, along with the means, standard deviation, and computed t-value

Variables	Units	Pre-test		Post-test		Mean diff.	SD diff.	T Calculated*	Table value	Significance of differences
		Mean	SD	Mean	SD					
Lactic acid before exercise	Mmol\l	2.70	0.53	1.70	0.29	1.00	0.62	3.12	2.262	Sig.
Lactic acid after exercise		10.87	0.68	12.35	0.33	1.47	0.89	3.27	2.262	Sig.

*At a significance level of (0.05) and a tabular value of 2.262 degrees of freedom (10-1=9)

Discussion of the lactic acid concentration test before and after exercise:

The researcher attributes the development and improvement in the results of the lactic acid concentration test to the anaerobic training followed in the application of the exercises used in the training units, which were applied scientifically and thoughtfully to the research sample, according to the high intensity (maximal and submaximal), which had a clear effect in raising the ability to tolerate a higher concentration of lactic acid in the blood. This indicates the success of applying this type of anaerobic exercise, with its two aspects: phosphagen through the application of maximal intensity, and lactic through the application of submaximal intensity. This was reflected in the development of production and increased concentration of the enzymes studied in the research (CPK - LDH). In other words, the higher the concentration of these enzymes, the more indicative it is of an increased reaction to carbohydrates and their decomposition, and the higher the level of energy production, which indicates the decomposition of these compounds and the greater production of lactic acid through the anaerobic work used in the application of the training units. The increased anaerobic effort used was based on the maximal and submaximal intensity in the training units in the main section, which resulted in an improvement in endurance. These chemical changes in the blood, such that the working muscles have the ability to tolerate the increased concentration of lactic acid and have a high capacity to produce energy, which secretes this amount of acid through the production of the energy necessary to perform the high-intensity physical effort followed in the training curriculum for the sample, and with the insufficient oxygen compensation due to the anaerobic effort, which led to the occurrence of adaptation in the working muscles to withstand these chemical changes in energy production using anaerobic effort using the phosphagen system and the lactic acid system for the performance time in the exercises used from 15 seconds to 1 minute, "and the player in indoor soccer depends on anaerobic work to obtain the energy necessary to perform skills and motor effort quickly and strongly, and this is what is required in the playing conditions during competition to overcome the opponent through these capabilities and abilities of the players, meaning that the muscular effort expended is at the maximum speed, ability and endurance to confront the fatigue resulting from the increased accumulation of lactic acid concentration in the working muscle and by providing the necessary energy during performance using the anaerobic system without the availability of oxygen, which in turn leads to an increase in the acid concentration at a higher level, and this in turn leads to the emergence of a state of adaptation in this variable and an increase It is produced by continuously increasing the acid concentration and increasing the muscle working time

according to these data" [9]. Muscle performance continues with an increase in the acidity level in the blood, which is what the player needs to adapt during continuous high-intensity training in general and during competition in a match against an opponent in particular. This leads to an increase and extension of the performance time, either less than maximum or maximum, without decreasing the player's performance level and efficiency. Here, the player begins to experience a delayed onset of fatigue, i.e., the ability to tolerate the increased acid concentration. The reason for this delay is the biological adaptations of the player's internal body systems to increase their endurance to the acidity level in the blood, i.e., a decrease in the pH level, through continued performance according to anaerobic effort and increasing this capacity with increasing difficulty of the effort exerted by the working muscles, as "anaerobic work leads to an increase in the accumulation of lactic acid as a result of anaerobic glycation, which leads to rapid fatigue, slower performance, and decreased ability. With the continued development of anaerobic endurance, the ability of the muscles to eliminate lactic acid improves and their endurance increases" [10]. As a result of this anaerobic training in the external load, the player can bear a higher percentage of the level of lactic acid concentration in the blood, i.e. an improvement in the ability of the internal load on the body's systems. This is what Risan Khuraibat and Ali Turki indicated: "The occurrence of an increase in the concentration of lactic acid in the blood after physical effort indicates an improvement in the physiological state of athletes and their ability to continue performing despite the concentration of lactic acid in the blood. The increase in the concentration of lactic acid in the blood indicates an improvement in the athlete's ability to tolerate lactic, and it also indicates an improvement in the ability to produce energy through the anaerobic effect of glycogen" [11].

"The researcher believes that the accumulation of a high percentage of lactic acid concentration after regular, high-intensity anaerobic exercise performed by players in training sessions increases the efficiency of internal systems in extracting energy through glycogen storage, increasing the concentration of the enzymes studied to produce energy from ATP within the working muscle cells through the anaerobic breakdown of glucose. This leads to an increased accumulation of large amounts of lactic acid, which is the product of the anaerobic energy system. The increase in lactic acid in the muscle and blood in many cases of fatigue is caused by glycogenolysis. High-intensity exercise causes development (physiological changes) in the muscles operating with the anaerobic energy system, improving the functional performance of these muscles through the development of fast-twitch muscle fibers within the muscles, which breaks down glycogen anaerobically, i.e., adaptation occurs within them. "The physiological changes associated with adaptation to anaerobic exercise with the lactic acid system appear in increased fiber capacity. Muscles rapidly break down glycogen to produce energy in the absence of oxygen (anaerobic glycation). The maximum anaerobic energy from lactic acid reaches 25-30 mmol/L in well-trained athletes" [12]. To develop the muscle's ability to withstand high-intensity anaerobic activity resulting from the anaerobic energy system, the researcher designed his exercises in training sessions. The exercise duration was generally up to 90 seconds, as the maximum accumulation of lactic acid occurs at maximum or submaximal physical loads for a period of one minute or more. "In order to develop the muscle's ability to withstand muscular performance resulting from the anaerobic energy system, i.e., the exercise design in this case must note that the maximum intensity of lactic acid formation occurs 45 seconds after the start of high-intensity muscle work, with the exercise targeting improved lactic endurance" [13]. Since developing performance endurance requires the exercise duration used to be from (15-45) to (60) seconds, repetition leads to an increase in the concentration of lactic acid, as "using an exercise for a period of one minute with a rest period of four minutes, and the acid concentration can reach its maximum concentration after the fifth repetition" [14], if the duration of the performance endurance exercise is in the manner of time, repetition, and rest above, then the researcher took this physiological fact into account when developing anaerobic training and forming the training load according to this scientific data to develop anaerobic capabilities, where "the total amount of work produced during maximum physical effort lasts approximately (30-90 seconds), as the athlete exerts maximum effort for a relatively long period of time in the absence of oxygen" [15], "and using short-term anaerobic training develops these capabilities to (60) seconds, as the number of repetitions of the exercise in the group was increased so that the total performance time was within the range of (3-4) to (5-6) minutes, and the total rest between repetitions of the exercises was from (10-15) seconds for continuous exercise of 60 seconds. "Here it becomes clear that performing anaerobic training exercises improves the muscle's ability to resist the increased concentration of lactic acid resulting from the anaerobic energy system to supply energy to the working muscles through the intensity and time of performing the exercises and at speed, so that it is a means of resisting the appearance of fatigue due to the effect of physiological adaptation by reducing the damage caused by high lactic acid in the muscles and blood, i.e. strengthening the defensive line of the body's functional systems, as the increase in blood acidity affects the decrease in (PH), which in turn changes the enzymes involved, including (CPK - LDH) in glycation reactions, which causes difficulty in transmitting the nerve signal (instructions) from the end of the nerves to the muscle due to the effect of increasing this acidity, as the continuation of anaerobic training causes an increase in vital regulators by 50% if the training period is (8) weeks, and the more anaerobic endurance develops," [14] the higher the efficiency becomes to withstand the level of lactic concentration in the blood, "as vital regulators such as bicarbonate and phosphate in the muscle interact with hydrogen to reduce the acidity of the muscle fiber, and thus fatigue is delayed when performing training Aerobic, and it has been proven that anaerobic training for 8 weeks leads to an increase in the capacity of vital organizations by 12-50% [16], so athletes who train in anaerobic training have an increase in adaptation in the muscles and blood and achieving development in the body is possible" [15].

The researcher believes that high-intensity performance that achieves development, ability, and efficiency for the player in tolerating lactic acid can only be achieved by using anaerobic training and different training methods with high intensity and training volume so that the functional systems can adapt to the lack of oxygen. This is accompanied by physiological chemical changes in the blood and muscles, the most important of which is lactic acid, at a higher

concentration than before in the muscles and blood, and for a relatively longer period without a decrease in the level of performance in training and competition. This is reflected in the speed of appropriate recovery, especially for members of the research sample with mild mental disability, so that its effect is to raise functional adaptation and develop the level and efficiency of the work of the players' systems, and to create a state of adaptation that improves muscle work, especially in anaerobic training at high intensity. This development in increasing the concentration of lactic in the blood was due to the effect of anaerobic training applied to members of the research sample, and these indicators help the training staff in choosing the type of players and the training method and its diversity, because the level of lactic acid concentration is considered one of the most important indicators that standardize the training process in all its methods and forms. It is the basis for knowing the improvement The level of players' performance and the nature of training, as well as the impact of all vital systems on physical effort, which adapt to the physical loads placed on them, as "the level of lactic acid during training is considered an indicator of the intensity of training, in addition to the adaptation of the muscles to this effort, as it accumulates more than its normal level during high effort, and this change in the acid concentration ratio is a measure of the intensity of the effort" [17]. The researcher believes that anaerobic training is a true standard for the player's ability and efficiency and knowledge of his actual level, and this is what worked to continue during the performance of the test with the required intensity while ensuring that the ability and physical efficiency do not decrease, and this is what the test results for the dependent variable showed by improving the ability to tolerate the concentration of lactic acid by means of the independent variable under study (anaerobic training) and the development of this factor in five-a-side football players by fulfilling the duties assigned to them and the development of the required biochemical indicators.

Presentation and discussion of the average performance endurance test

Table 4: Demonstrates the variations in the sample members' average performance endurance values between the pre- and post-tests

Variables	Units	Pre-test		Post-test		Mean diff.	SD diff.	T calculated*	Table value
		Mean	Sd	Mean	Sd				
Performance endurance	degree/n	98.28	7.695	84.349	5.821	13.931	4.864	9.057	0.000

*Significance level: 0.05, degree of freedom: 10-1=9

Discussion of the average performance endurance test

By progressively increasing the training load through its components (intensity, volume, and rest) in training units over the time period allotted to the independent variable, the researcher ascribes this improvement to the standardization of training loads for anaerobic exercise, which he prepared so that they were appropriate for the sample level (time and repetitions) in terms of volume. This resulted in a state of stability in performance (anaerobic effort). He also used appropriate rest between exercises and sets within the training unit, so that the training load was organized and based on scientific principles, through intensity, volume, and rest appropriate to the sample's ability level. This means that the load used was standardized according to the athlete's ability level, and by returning the pulse index to the pulse level before starting from one repetition to the next and from one set to the next, which is (120) beats per minute. "One of the most important basic factors for developing performance endurance is that the training load be compatible with the athlete's level, degree of training, and age" [18]. Diversifying the exercises designed with anaerobic effort gave the players a desire and excitement to perform them, thus instilling a spirit of competition among the players, given that the sample consisted of mentally disabled players.

The researcher believes that the reasons for this development in the average performance endurance result from a number of factors, the first of which is the type of training (anaerobic effort) that the sample members were exposed to during (24) training sessions, in which the work was at a high intensity (sub-maximal and maximal), which gave the players the ability to delay and resist fatigue resulting from the accumulation of lactic acid due to the applied training, in addition to insufficient rest to remove the accumulated lactic acid. This means that the players repeat the work in the presence of large amounts of lactic acid concentration, as "the level of blood lactate has a direct relationship with performance endurance and the ability to withstand this increase, and this correlation reached" (0.82) [19]. Improving the ability to produce energy through the anaerobic system requires that the training load be such that the accumulation of lactic acid concentration in the muscles and blood is greater than the rate of acid elimination, i.e., exceeding the lactic threshold. This is to "create functional adaptations in the body's various systems and make them able to tolerate a lack of oxygen and the accompanying high concentration of lactic acid. This leads to improving the athlete's ability to endure performance and such physiological and chemical conditions during training, which enables the athlete to compete with high efficiency because the training conditions have become more difficult than the competition conditions" [20]. Here, the researcher believes that the precise and organized handling of the training load components in a scientific and studied manner led to an improvement in performance endurance in the experimental sample using repetitive training and high-intensity interval training, which is "a process of regulated change in the duration of load and rest to try to bring the athlete to the required level" [21], which was used in applying the independent variable (anaerobic effort) in the training unit and throughout the time period of the curriculum, and it had a clear effect in developing performance endurance. The researcher also attributes the significance of the statistical differences between the tests in performance endurance and in the improvement that occurred for the members of the research sample to the researcher's use of anaerobic effort exercises that are compatible with the capabilities and potential of the players and are compatible with the type of activity, and their return was positive, as the nature of the exercises in the training unit tended to develop this aspect, and it is considered an important means in developing the studied variables and it depends on continuing to load the targeted intensity in the training unit completely, which

increases the difficulty in performing exercises on the working muscle of the player, and thus the accumulation of lactic acid concentration is greater and it becomes beneficial in that it is directed training for the nature of performance endurance and has the ability to produce lactic acid By using the lactic energy system, in terms of the duration and intensity of anaerobic training, it has a greater impact than any other type of training. Therefore, it should be considered an effective method with an influential nature linked to the biochemical aspect of the blood, and it plays an effective role in developing the body's functional systems.

The significance of the differences is indicative of the ability to perform the endurance test for a shorter period than before, despite the accumulation of lactic acid concentration. Anaerobic exercises helped achieve a lower score (faster through a shorter time and increased accuracy in scoring performance, as the speed factor directly affects the test value, in addition to the accuracy of skill performance through the method of calculating the final score) in the test and delaying the onset of signs of fatigue due to increased endurance to lactic acid. The method of exercising within the anaerobic energy system, through repeated exercises to increase the accumulation of lactate in the blood and muscles, with insufficient rest periods to eliminate lactic acid, and at submaximal intensity, all of these matters helped improve the adaptation of the body's systems in general, and the working muscles in particular, to receive these high loads. The use of anaerobic exercises, which are characterized by "With high intensity, there is a deficiency in the oxygen needed to produce energy, and thus energy is produced with insufficient oxygen, and then lactic acid accumulates to a degree greater than the rate of its disposal, and as a result, the blood becomes acidic. This condition occurs when the lactic threshold is exceeded, and thus the blood pH decreases, and this is a good indicator of the improvement of the training condition of the players, as the well-trained athlete can work in the presence of large quantities of lactic acid, which expresses the efficiency of the body's internal systems in resisting this accumulation" [22].

Conclusions

1. There is a positive effect of anaerobic exercise on the research sample's biochemical variables (CPK and LDH enzyme concentrations) before and after physical exertion (10) minutes.
2. There is a positive effect of anaerobic exercise, designed by the researcher, on the research sample during rest and after physical exertion, for the intermediate performance endurance test.
3. The training methods used in the research (repetitive training and high-intensity interval training) clearly contributed to the development of the above-mentioned biochemical variables under investigation, which was reflected in the results of the intermediate performance endurance test.
4. The principle of gradualism used in the training load components and its standardization (intensity, volume, rest) according to scientific principles and taking into account the type of mental disability of the research sample members, a futsal team with mild mental disabilities, created functional adaptations for the body's systems in general and the working muscles in particular. This was evident in the results of the post-test biochemical tests, and through an increase in the level of proficiency of the players in applying exercises (anaerobic effort training), which leads to an increase in the players' ability and capacity through muscular performance and an increase in skill accuracy, as shown by the results of the post-test for average performance endurance.

Recommendations

1. Adopt the use of anaerobic effort training designed to develop the biochemical variables studied and standardize them scientifically, based on the abilities and capabilities of the disabled futsal players. Additionally, use gradualism by increasing training loads.
2. Using repetitive training and high-intensity interval training, especially during the special preparation period, to achieve a clear improvement in physical fitness, which is directly reflected in the accuracy of skill performance during training and competition.
3. The Ministry of Youth and Sports and the Iraqi Special Olympics Committee should focus on the special needs segment to enable them to participate in all sporting events, while providing them with the necessary sports equipment and tools.
4. Conducting further experimental studies on physical and physiological capabilities, in line with the skill performance requirements of this and other sports.

References

1. Abu Al-Ala AA. Contemporary sports training: Physiological foundations, training plans, youth training, long-term training, and training load errors. 1st ed. Cairo: Dar Al-Fikr Al-Arabi; 2012.
2. Abu Al-Ala A. Physiology and morphology of athletes: Methods of measurement and evaluation. Cairo: Dar Al-Fikr; 1997.
3. Abu Al-Ala A. Physiology of training and sports. Cairo: Dar Al-Fikr Al-Arabi; 2003.
4. Bahaa El-Din IS. Physiology of sport and physical performance (Blood lactate). Cairo: Dar Al-Fikr; 2000.
5. Shinyar TS. The effect of lactate performance training on certain physiological indicators and offensive skills in futsal players with mild intellectual disabilities. Al-Qadisiyah: Al-Qadisiyah University; 2020.
6. Al-Kaabi JR. Physiological and chemical foundations of sports training. Baghdad: Dar Al-Kutub; 2007.
7. Khraibat RM. Bioenergy analysis for athletes. Amman: Dar Al-Shorouk; 1999.
8. Khraibat RM, Turki A. Physiology of sport. Baghdad: University of Baghdad; 2002.
9. Emad El-Din AZ. Planning and scientific foundations of building and preparing teams in team sports. Zagazig: Zagazig University; 2005.
10. Allawi MH. Sports training science. 1st ed. Cairo: Dar Al-Ma'arif; 1992.
11. Allawi MH, Abu Al-Ala A. Physiology of sports training. 2nd ed. Cairo: Dar Al-Fikr Al-Arabi, Helwan University; 2000.
12. Abdel Zaher MM. The effect of certain recovery methods on the enzymatic activity of lactate dehydrogenase and creatine kinase in athletes [doctoral dissertation]. Cairo: Faculty of Physical Education for Boys, Helwan University; 2002.

13. Nasr El-Din RM. Methods of measuring physical exertion in sports. 1st ed. Cairo: Al-Kitab Center; 1998.
14. Al-Haza'a HM. Physiology of physical exertion: Theoretical foundations and laboratory procedures for physiological measurements. Vol. 1. Riyadh: King Saud University; 2009.
15. Wilmore JH, Costill DL. Metabolic adaptation to training: Physiology of exercise and sport. Champaign (IL): Human Kinetics; 1994.
16. Athab NA. An analytical study of cervical spine pain according to the mechanical indicators of the administrative work staff. Indian J Public Health. 2019;10(5):1349.
17. Athab NA, Hussein WR, Ali AAM. A comparative study for movement of sword fencing stabbed according to the technical programming in the game of fencing wheelchairs class B. Indian J Public Health. 2019;10(5):1345.
18. Athab NA, Alsayigh HA. Rehabilitation of the wrist joint injury accordance of kinesiology variables; 2021.
19. Athab NA. Effect of a rehabilitation program to improve the structural stability of the elbow joint for injured players. J Stud Res Sport Educ. 1818;41.
20. Abdulhussein AR, Athab NA, Hassan RF. The relationship of some physical variables to heart health. J Coll Phys Educ. 2024;17(3):1142-1149.
21. Alsayigh HA, Athab NA. The study of rectus femoris activity after knee joint rehabilitation. Int J Pharm Tech Res. 2016;9(9):360-365.
22. Athab NAK, Hassan AA. Analysis study to the joint pain of knee with indication of loading mechanics for players; 2010.