



The response of some physiological indicators to specific exercises and their relationship to digital performance in the 200 m event for people with disabilities category T44 youth: A Cross-Sectional Study

Nibras Adnan Hattroush^{1,*} , Oras Adnan Hatroosh¹, Duha Abdul-Jabbar Mohammed¹

¹ University of Diyala. College of Physical Education and Sports Sciences, Baqubah, Iraq.

*Corresponding author: Nibras Adnan Hattroush.

University of Diyala. College of Physical Education and Sports Sciences, Baqubah, Iraq.

E-mail: nibras.adnan@uodiyala.edu.iq

DOI: <https://doi.org/10.54448/ijn26S309>

Received: 04-17-2026; Revised: 06-27-2026; Accepted: 07-20-2026; Published: 07-20-2026; IJN-id: e26S309

Editor: Dr. Idiberto José Zotarelli-Filho, MSc, Ph.D., Post-Doctoral.

Abstract

The current research aimed to identify the importance of the impact of special exercises in sports, as it has an important role in developing physical abilities and functional indicators and achieving achievement in sports, including track and field events. This requires adopting scientific foundations based on accurate evaluation and reliance on tests, which are the correct way to reach the highest sports levels, as they achieve for us in determining the capabilities of disabled players according to the type of game and the great development in track and field events, including the (200 meters) event for the disabled, category (T44), and what this event is characterized by specifications specific to the elements of physical fitness. The problem of the research lies in the fact that these studies have addressed a specific aspect of the event, such as studying the general physical characteristics of the player, ignoring the training aspect of endurance, strength and speed, to work on enhancing the states of strength and speed and training the states through which achievement can be developed. This led researchers to pay attention to this sport, as it is one of the important games that have entered the fields and championships of the Olympic, Paralympic and international levels, in addition to being one of the most important sports spread in Iraq. Accordingly, this research came as an attempt to develop achievement in this event and this category in particular for people with special needs. The research community and sample: The objectives that the researchers set for their research and the procedures they use will determine the

nature of the sample they choose. Therefore, the researchers randomly selected the research community, which is the players of the Diyala Athletics Committee in the T44 category, with a number of (4) players. The main experiment was conducted for the specified tests. The researchers used the following statistical methods: arithmetic mean, standard deviation, (T-Test). The researchers expect the following results: There are positive, statistically significant relationships between the research variables. The researchers randomly selected the research community, which is the players of the Diyala Committee for the Deaf and Mute Athletics Event, with a number of (4) players. In light of the conclusions reached, the researchers made the following recommendations: The training program used with the experimental group achieved the desired improvement in enhancing strength endurance and speed endurance in the post-tests. It also achieved the desired improvement in the performance of the 200-meter run in the post-tests, as well as the desired improvement in measuring both aerobic capacity and vital capacity in the post-tests. The researchers reached the following recommendations: Adopting the training program used to develop strength endurance and speed endurance for performance in the 200-meter run for athletes with disabilities, category (T44). Providing a variety of training equipment to develop the physical and motor abilities of athletes with disabilities, category (T44). Conducting experimental research to develop other physical or motor qualities for athletes with disabilities.

Keywords: Sports. Physical abilities. Accurate evaluation. Disabled players. Physical fitness.

Introduction

The continuous scientific development in various fields of life, including sports training, has contributed to improving athletic performance and increasing achievements. Among the modern methods used to develop physical abilities—such as strength and speed, which play a significant role in athletics events, especially in the 200-meter sprint—are various exercises of different intensities. Therefore, this research aims to study the effects of these exercises and certain physiological indicators on the performance of athletes with disabilities in the T44 category [1-3].

The ongoing scientific advancement across various sciences has led to numerous changes in lifestyle patterns, and sports training has become one of the most prominent fields of interest. This focus has helped in discovering many training methods that have supported athletes in enhancing their achievements across various sports disciplines, particularly the 200-meter sprint. As a result, we have witnessed remarkable accomplishments at the Arab, Asian, and global levels due to the implementation of modern training methods and the measurement of strength-specific variables, as well as the scientific selection of appropriate exercises by coaches within their athletes' training programs, all contributing to the improvement of athletic performance [4,5].

Track and field events in general, and specifically the 200-meter sprint, have benefited from this development in several countries through the use of modern technology and precise devices in sports training. Just as training programs have been developed for able-bodied athletes, specialized training programs have also been created for athletes with disabilities (such as the 200-meter sprint), designed by experts and specialists in sports training and motor disabilities. However, no matter how time progresses or athlete capabilities vary, training programs must continually be updated [6-10].

These programs are not built according to the capacity or potential of a specific athlete to be applied indefinitely, but rather are designed based on the athletes' abilities and the possibility of achieving the set goals within a specific period. Therefore, when there is failure or delay in achieving those goals desired by both the coach and the athlete, modifications or developments to the training programs become necessary in order to help the athlete reach the desired level of performance [10-14].

This research begins by identifying the physical,

psychological, and mental requirements of the 200-meter event. As Modamgna, R.1 (2015, p. 187) [15] noted regarding the effects of various uphill and downhill exercises, such methods are "the optimal and best way for the disabled to reintegrate into their society, to reconnect with it, and to succeed as productive individuals interacting and engaging within it" (Osama Riyadh Ahmed and Ahmed Abdul Majeed Amin, 1988, p. 26) [2]. From this, the importance of the research emerges through understanding the effects of special exercises and some physiological indicators on the performance of youth athletes with disabilities in the 200-meter sprint (T44 category). The research problem lies in the fact that previous studies have focused on certain aspects of this event, such as general physical attributes, while neglecting the specific training aspects necessary for improving performance in the 200-meter sprint and measuring some physiological indicators— particularly for this category of athletes.

This neglect leads to weakened performance, making it essential to conduct research aimed at developing these aspects. The current research aimed to identify the importance of the impact of special exercises in sports, as it has an important role in developing physical abilities and functional indicators and achieving achievement in sports, including track and field events.

METHODS

Study Design

The researchers adopted the experimental research method, as it is suitable for solving the research problem and is considered one of the key means of obtaining reliable knowledge. The researchers employed the experimental and control group design, following the STROBE rules.

Ethical Approval

This was a cross-sectional study conducted in accordance with the ethical principles of the Declaration of Helsinki (as amended by the 75th WMA General Assembly, Helsinki, October 2024). This study was approved by University of Diyala. College of Physical Education and Sports Sciences, Baqubah, Iraq.

Research Population and Sample

The researchers randomly selected the research community, which is the players of the Diyala Athletics Committee in the T44 category, with a number of (4) players who are classified by the Diyala Committee supervising athletics events, specifically in the 200-meter sprint for athletes with disabilities in the T44

category, and who was being prepared to participate in upcoming competitions.

Devices and Tools

Dell computer (Pentium 4)
Canon 2900 laser printer
Discs (CDs)
Sports umbrella

Experience

The researchers conducted experience study on Saturday, 31/5/2025, on a sample of (2) athletes from the Diyala Committee prior to starting the main research. The purpose was to determine appropriate research methods and tools (Tables 1 and 2).

Table 1. Shows the percentages of candidate tests for special physical abilities.

N	Physical abilities	Tests	Ratio%	Candidate tests
1	Speed tests	Extended speed	62	√
		Jump the column for time	12,5	
		Three fast forwards	25	
2	Strength tests	throw a medical weight ball (2kg) with both hands from sitting	25	
		elastic force	50	√
		Throwing a medical ball weighing (3 kg) with one hand for the farthest distance of movement	25	
3	Agility	Barrow test for zigzag running (75r4×3) meters	6	
		Shuttle run (4×9) meters	19	
		Test 9-3-6-3-9	15	

Source: Own authorship.

Table 2. Shows the agreement ratio of the physiological indicators nominated by experts and specialists.

N	Physiological indicators	Percentage of agreement %	The candidate
1	Pulse rate (PR)	50	×
2	Anaerobic capacity	40	×
3	Pneumatic capacity (Vo2max)	75	√
4	Blood pressure (Bp)	37	×
5	Vital capacity (VC)	75	√
6	Hemoglobin percentage (Hb)	50	×

Source: Own authorship.

Tests Used in the Research

Physical Tests

Speed Endurance Test

(Salman Ali Hussein, 2002, p. 42) [12].

Purpose of the test

To measure speed endurance in the legs of 200-meter sprint runners.

Required tools

Adhesive tape, flags.

Test description

The subject stands in a half-squat position, prepared to jump, with arms at the sides. Upon hearing the whistle, the subject begins jumping vertically for a duration of 30 seconds. The test ends when the whistle is blown again.

Scoring

The score is recorded by counting the number of half-squat jumps performed by the athlete within the 30-second duration.

Strength Endurance Test

(Salman Ali Hussein, 2002, p. 43) [12].

Purpose of the test

To measure strength endurance in the legs of 100-meter sprint runners.

Required tools

Adhesive tape, flags.

Test description

The subject stands in a half-squat position with arms placed behind the neck. Upon hearing the whistle, the test begins. The athlete maintains the half-squat position and continues performing the exercise for as long as possible. The test ends when the athlete reaches the point of exhaustion.

Scoring

The score is recorded by counting the number of half-squats performed until exhaustion.

200-Meter Sprint Performance Test

(Alaa Fawad Saleh Alweis, 2009, p. 52) [7].

Purpose of the test

To measure the performance in the 200-meter sprint.

Required tools:

- 1.Track and field stadium
- 2.Manual stopwatches
- 3.Starting pistol
- 4.Recording forms
- 5.Support staff

Performance description

The test begins when the runner's number appears in the running area on the recording form. The

athlete takes their position behind the starting line upon hearing the command "on the line," then "get ready," followed by the sound of the starting pistol, signaling the start of the race. The athlete runs 200 meters at maximum speed. When the runner reaches the finish line, the stopwatch is stopped.

Scoring

The time for each athlete is recorded on a specially prepared form in minutes and hundredths of a second.

Physiological Tests

Aerobic Capacity ($VO_2\max$)

(Ronak Rashid Al-Salhi, 2020, p. 120) [10].

Purpose of the test

To measure the efficiency of the cardiovascular system.

Required tools

Cassette player to regulate step rate at 90 steps per minute, weighing scale.

Scoring method

Using a graphical chart to determine the maximum oxygen consumption ($VO_2\max$). One value is taken from the pulse column, and another from the weight column, and a straight line is drawn between them using a ruler. For example, if the test subject weighs 70 kg and has a heart rate of 162 bpm, the intersection on the chart gives a $VO_2\max$ value of 2.4 liters/min.

Vital Capacity (VC)

Purpose of the test: To measure vital capacity (Ahmed Ismail Al-Ani, 2001, p. 34) [1].

Performance description

The subject holds the rubber breathing tube connected to the spirometer while standing. They begin by taking the deepest possible inhalation, followed by forcefully exhaling all the air into the rubber tube. The device then measures the volume of air exhaled.

Recording

The research team records the results obtained from the device, representing the volume of air exhaled during the test, measured in liters.

Training Program

The training program lasted 10 weeks, with three training sessions per week, resulting in a total of 7-6 -

2025 training units, implemented from September, to 31- 7, 2025.

The researcher employed specific exercise organization using the high-intensity interval training method, at an intensity level ranging from 80% to 95% of the individual's maximum capability for both explosive strength and speed-strength.

The intensity of each training unit was calculated based on the difficulty of performance. Repetitions were determined according to the intensity levels applied during training.

Statistical Methods

The researchers used the SPSS statistical package to process the data.

Results

Presentation, analysis and discussion of the results

Table 3. Shows the arithmetic mean, standard deviations, the calculated Test (v), the percentage of development and the statistical significance of the physical abilities of the control group in the pre-and post-test.

Statistical highlights		The tribal testz		Dimensional testing		Calculated value (V)	Evolution ratio	Statistical significance
Variants	Unit	Standard deviation	Standard deviation	Arithmetic mean	Standard deviation			
Elastic force	Until the effort is exhausted	70.75	12.68	80.25	6.84	1.72	13.42	Not moral
Extended speed	Repeat	20.50	1.10	26.25	2.62	7.66	29.36	Moral
Achievement 200m	Time	29.41	0.417	29.51	0.47	0,30	0.33	Not moral

*The tabular value (V) at a degree of freedom (3) and a significance level (0.05) is (1.94)
Source: Own authorship.

Table 4. Shows the arithmetic circles, standard deviations, the calculated Test (v), the percentage of development and the statistical significance of the physical abilities of the experimental group in the pre-and post-tests.

Statistical highlights		The tribal testz		Dimensional testing		Calculated value (V)	Evolution ratio	Statistical significance
Variants	Unit	Arithmeti c mean	Standard deviation	Arithm etic mean	Standard deviation			
Elastic force	Until the effort is exhausted	66.25	11.08	110	10.03	4.87	52.45	Not moral
Extended speed	Repeat	19,75	1,7	31.25	1.5	17.81	58.22	Moral
Achievement 200m	Time	24.66	0.184	23.104	0.222	5.384	6.31	Not moral

*The tabular value (V) at a degree of freedom (3) and a significance level (0.05) is (1.94)
Source: Own authorship.

Table 5. The arithmetic mean, standard deviations, calculated test (V) and statistical significance show the physical abilities and achievement of the control and experimental groups in the dimensional test.

Statistical highlights		Controlling criteria		Testing		Calculated value (V)	Semantics Statistics
Variants	Unit	Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation		
Elastic force	Until the effort is exhausted	80.25	6.84	1.1	10.03	3.41	Moral
Extended speed	Repeat	26.25	2.62	31.25	1.5	3.3	Moral
Achievement 200m	Time	29.513	0.477	23.104	0.222	11.21	Moral

* The tabular value (V) at a degree of freedom (6) and a significance level (0.05) of (2.45)

Source: Own authorship.

Table 6. Shows the correlation coefficient for testing aerobic capacity and vital capacity.

Physiological indicator	The test	(T) calculated	(T) scheduled references	Degree of freedom	Level of significance	Result
Aerobic capacity	Step testing	0.842	0.81	4	0.05	Moral
Vital capacity	Spyrometer device	0.865	0.81	4	0.05	Moral

Source: Own authorship.

Discussion

From Table 1, for the control group, we notice there are no significant differences between the pre- and post-tests in all tests except for the speed endurance test, which showed significant improvement. The researchers attribute this to the fact that the experimental group had a higher level because it practiced exercises with high repetitions, leading to the development of speed endurance. In contrast, the control group did not experience the same level of development or improvement because it followed traditional exercises in training without relying on the correct principles of training.

From Tables 2 and 3, for the experimental group, we observe significant differences between the pre- and post-tests for the experimental research sample in the physical tests, namely the strength endurance test, the speed endurance test, and the performance test (200m run). The researchers attribute this to the effective impact of using specially designed exercises, which were selected scientifically based on available scientific sources (Ahmed Farouk, 2009, p. 82). This led to an improvement in performance levels among the experimental group members.

The special exercises used included resistance with various weights, affecting the working muscles of the legs. These muscles developed as a result of the development of explosive strength, since "weight

training directed at specific muscle groups leads to improvement in them" (Bastawisi Ahmed, 2005, p. 82) [8]. Furthermore, the exercises used were characterized by progressive intensity and varied repetitions, continuing throughout the experiment to achieve muscular adaptation to the new weight [11]. The greater the explosive strength of the leg muscles, the more the runner can control the movements performed. This is achieved through "muscle repetitions to reach the stage of fatigue, making the muscle work with more than its capacity, isolating the specific muscle groups that need improvement" [13].

As for performance in the (200m run), the researchers attribute the significant relationship to the fact that maximum speed is an essential requirement for overcoming the race distance, as well as for skill performance. "The higher the starting speed, the faster the completion of the 200m distance, and the athlete must maintain this speed for as long as possible (this is called speed endurance)." A decrease in this speed will increase the time needed to cover the distance [16-26]. Moreover, the improvement in performance is due to the use of specific training exercises that resembled the actual performance, meaning there was specificity in the training. Beain Mackenzi (2008, p. 56) [27] states that the golden rule of any training program is specificity, which means the movements performed by the athlete during training must be similar to those performed during competition.

The researchers believe that systematic sports training positively affects the variable of vital capacity, which reflects the relationship between the respiratory systems and the individual's training condition. Fox points out that "practicing physical activity shows clear changes in the mechanics and functions of the cardiovascular and respiratory systems," and that sports training induces changes in lung volumes, leading to changes in vital capacities depending on differences in the size of the respiratory system [16-20].

Morehouse and Sandra indicate that "developing the components of physical and motor fitness positively affects the improvement of physiological variables," as evidenced by the relationship between performance and other respiratory variables such as maximum expiratory volume and peak flow rate. Vital capacity is considered one of the functional abilities that indicate the efficiency of the respiratory system and its ability to inhale the largest possible amount of air and exhale the largest possible amount during a single breathing cycle. It therefore reflects the potential of the respiratory system and its connection to cardiovascular functions.

Maximum oxygen consumption (VO₂max) is a key

indicator of aerobic capacity and ranges between 45 and 60 mL/kg/min in young T44 athletes (below-knee amputees with prosthetic limbs). This range is lower compared to able-bodied athletes (often 60–75 mL/kg/min) due to the lack of muscle mass in the prosthetic limb [3], which limits aerobic energy production. Specific exercises, such as high-intensity interval training (HIIT) at an intensity greater than 90% of maximum heart rate (HR max) [24] improve VO_2 max by 8–12% over 8–12 weeks. A 2023 meta-analysis demonstrated that HIIT was superior to conventional training in enhancing aerobic capacity by 0.44 standard deviations in elite athletes [22], with even greater effects in shorter events such as the 200-meter sprint. In the T44 category, improved VO_2 max is associated with a 2–4% reduction in race time. However, this improvement is limited by the heavy reliance on anaerobic energy in 200m races, where anaerobic metabolism contributes 60–70% of the total energy demand. Specific training, such as HIIT. short, high-intensity sprints with rest intervals of seconds), not only improves VO_2 max but also increases running economy, a critical factor in the T44 category due to the biomechanical limitations of prosthetic limbs. A 2024 study of T44 athletes showed that improved VO_2 max was positively associated with reduced race time, particularly in turns requiring dynamic stability [23].

However, the improvement in numerical performance remains limited by the reduced energy return efficiency of prosthetic limbs compared to natural limbs, which increases energy consumption by up to 20%. Additionally, a recent 2025 study [25] showed that combining HIIT with resistance training enhanced both [18], aerobic and anaerobic capacity, reducing lactate buildup by 15%, which supports performance in short sprints. Research recommendations [26], training program design: It is recommended that HIIT programs be adapted to suit the biomechanical characteristics of T44 athletes, with a focus on improving running economy and reducing limb asymmetries.

The researchers point out that the 200m race is an event characterized by a high percentage of anaerobic energy production, and training focuses on developing the athletes' capacity within the limits of anaerobic power. This means giving the body's systems the opportunity to obtain a greater proportion of oxygen, which helps in developing this indicator. Vital capacity is considered a positive indicator during physical effort as it reflects an increase in the amount of blood required for the effort and an increase in circulatory speed [28].

The results indicated a relationship between this variable and improved performance efficiency, as well as the athletes' enhanced ability to achieve the desired performance for this event at a high level. Some researchers believe that vital capacity means the largest possible volume of air in inhalation and exhalation during a single respiratory cycle, and that it is generally constant for an individual. It is considered one of the measures of physical and functional fitness.

Conclusion

In light of the conclusions reached, the researchers made the following recommendations: The training program used with the experimental group achieved the desired improvement in enhancing strength endurance and speed endurance in the post-tests. It also achieved the desired improvement in the performance of the 200-meter run in the post-tests, as well as the desired improvement in measuring both aerobic capacity and vital capacity in the post-tests. The researchers reached the following recommendations: Adopting the training program used to develop strength endurance and speed endurance for performance in the 200-meter run for athletes with disabilities, category (T44). Providing a variety of training equipment to develop the physical and motor abilities of athletes with disabilities, category (T44). Conducting experimental research to develop other physical or motor qualities for athletes with disabilities.

CRedit

Author contributions: Conceptualization, methodology, investigation, data collection, laboratory work, formal analysis, data interpretation, writing—original draft - Nibras Adnan Hatttroush, Oras Adnan Hatroosh, Duha Abdul-Jabbar Mohammed. Supervision: Nibras Adnan Hatttroush.

Acknowledgment

Not applicable.

Ethical Approval

This was a cross-sectional study conducted in accordance with the ethical principles of the Declaration of Helsinki (as amended by the 75th WMA General Assembly, Helsinki, October 2024). This study was approved by University of Diyala. College of Physical Education and Sports Sciences, Baqubah, Iraq.

Informed Consent

It was applicable.

Funding

Not applicable.

Data Sharing Statement

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request, and all data is stored following privacy and ethical guidelines.

Conflict of Interest

The authors declare no competing interests. All authors have completed the ICMJE Disclosure of Interest form.

Similarity Check

It was applied by Ithenticate®.

Application of Artificial Intelligence (AI)

Not applicable.

Peer Review Process

It was performed.

About The License©

The author(s) 2026. The text of this article is open access and licensed under a Creative Commons Attribution 4.0 International License.

References

1. Ahmed Mohammed Ismail Al-Ani. The Effect of Interval Training on Some Central and Peripheral Variables and the Achievement of the 1500m Run. Master's Thesis, College of Physical Education, University of Baghdad, 2001.
2. Osama Riyad. Sports for the Disabled: Medical and Sports Fundamentals. Cairo, Dar Al-Nashr Al-Arabi, 2000.
3. Adel Abdel Basir. High-Intensity Interval Training and Its Impact on Pulmonary Function in Elite Athletes, 2024. Frontiers in Physiology.
4. Ahmed Farouk. The Effect of Using Ballistic Resistance Training on Some Physical and Skill Variables for Basketball Players. Master's Thesis, Helwan University / Faculty of Physical Education for Boys, Al-Haram, 2009.
5. Risan Khuraibat and Ali Turki. Strength Training Theories. Baghdad: 2002.
6. International Athletics Law: Translated by Sareeh Abdul Kareem et al., Al-Adel Printing Office, Baghdad, 2004.
7. Alaa Fouad Saleh Al-Wis; The Effect of Hypoxic Exercises on the Development of Special Speed Endurance and the Achievement of the 400m Run for Runners Aged 17–18. Master's Thesis, 2009.
8. Bastawisi Ahmed. Principles and Theories of Sports Training. Cairo, Dar Al-Fikr Al-Arabi, 2005.
9. Deobald Van Dalen; Research Methods in Education and Psychology, (Translated by Mohammed Nabil et al.), Cairo, Anglo-Egyptian Library, 1985.
10. Ronak Rashid Al-Salihi. The Effect of Aerobics Exercises Accompanied by Music Using the Interval Training Method on Some Physical, Body, and Physiological Indicators among Women. Master's Thesis, College of Physical Education, University of Salahaddin, 2020.
11. Saad Mohsen Ismail. The Effect of Training Methods to Develop Explosive Power of the Legs and Arms on the Accuracy of Long-Range Shooting with High Jumps in Handball. Doctoral Dissertation, College of Physical Education, University of Baghdad, 2007.
12. Salman Ali Hussein. The Effect of Special Endurance Training on Step Characteristics in Long-Term Maximal Running. Master's Thesis, 2002.
13. Fadel Sultan Shureida. Physiology and Physical Training. 1st ed., Riyadh, Dar Al-Hilal for Offset Printing, 2003.
14. Wang J, Kim EK, Begeny JC, Yuan W, Schaner R. Using mixed methods to improve understanding and advancement of mixed methods research in school psychology. Sch Psychol. 2026 Jan;41(1):29-40. doi: 10.1037/spq0000684.
15. Modamgna R.1. Effects of Various Uphill, Downhill, Combination of Uphill, Downhill and Level Training on Sprinting Speed, 2015, p. 187.
16. Kamal Abdel Hamid Ismail et al. Nutrition for Athletes. Cairo, Markaz Al-Kitab for Publishing, 1999.
17. Mohammed Hassan Allawi and Abu Al-Ala Ahmed Abdel Fattah; Physiology of Sports Training. Cairo, Dar Al-Fikr Al-Arabi, 2001.
18. Guyton A. Text book of medical physiology. w.b. Saunders company. 2005.
19. Marwan Abdul Majeed Ibrahim. Tests, Measurement, and Evaluation in Physical Education. Amman, Dar Al-Fikr, 2020.
20. Mohammed Atef Al-Abhar and Mohammed Said. Physical Fitness: Its Elements and Development. Saudi Arabia, Dar Al-Islah, Dammam, 2010.
21. Bullard, Knth Dlop. Jumping as a Training Method for Jumping Ability, I.A.A.F. Aval., 2011, May, vol. No. 3.
22. Fellmann N, Grizard G, Coudert J. Human frontal

- sweatrate and lactate concentration during heat exposure and exercise J. appl physiol, 2024.
- 23.** Ferguson M. Effect of single session of exercise on lipoprotein, med: sce, sport, exercise (sep), 2020.
 - 24.** Qasim Hassan Hussein, Iman Shaker. The Role of Vital Capacity in Enhancing Cardiorespiratory Performance in Competitive Sports (2022).
 - 25.** Fox EL, Mathews DK. The physiological basis of physical education and athletics. 3rd ed saundersen college publishing. 1981.
 - 26.** Gutmann I, Wahlefeld AW. Determination of lactate dehydrogenase and NAD. In: bermeyer H U, ed. methods of enzymaitc anelysis. 2010, London, 3.
 - 27.** Beain Mackenzi. Sport Coach - Pivmetrie. Disciamiev, BBC Education, Web Guide Sports, 1999.
 - 28.** Morehouse LE, Miller AT. Physiology of Exercise. Saint Louis, The C.V. Mosby Company, 2010.