

## **The effect of anaerobic differential threshold training on some physical and physiological variables of volleyball players**

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### **Abstract**

The research aims to identify: the effect of anaerobic differential threshold exercises on some physical and physiological variables, lactic acid in the blood, fatigue and muscle pain, for volleyball players, the experimental method was used, the research sample was chosen by the deliberate method The Of (9) players A Volleyball Players as a basic sample, and the results showed the effect of training in the direction of the anaerobic differential threshold, which had a positive effect on the physical variables under investigation, as statistically significant differences were found between the pre and post measurements in favor of the post measurement, and the training helped in the direction of the anaerobic differential threshold on the speed of transporting lactate into and out of cells The different body, leading to a delay in reaching muscle fatigue, and the exercises using the anaerobic differential threshold had a positive effect on the physiological variables of the volleyball players under investigation, where statistically significant differences were found between the pre and post measurements in favor of the post measurement.

**Key words:** *Anaerobic differential threshold, Physiological variables, Physiological variables*

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### **Introduction**

There is no doubt that the repercussions of the era ruled by science and technology imposed on us one path that has no alternative to its behavior in the pursuit of progress, which is the path of scientific research, which has become one of the most important necessities of modern society to reach the highest levels in all areas of life, by identifying what God has given to man. From different capabilities and energies in an attempt to achieve the maximum possible benefit from modern scientific theories and develop them to serve the community. The sports field has been greatly affected by modern technology in the field of molecular

biology, where the physiology of sports and training is no longer limited to just physiological changes at the level of vital organs only, but the nature of modern studies has evolved until it reached the level of studying those changes at the cell level and what is inside the cell From ligands, muscle filaments, mitochondria, and enzymes, this was a natural development that accompanies the rapid development of scientific discoveries in the field of molecular biology. (Abu El-Ala, 2003), where modern sports training depends mainly on modern scientific knowledge and information, and differences on taking into account the individual between players in

physical, psychological, kinetic and physiological abilities, in addition to the importance of subjecting sports training programs according to the different levels of athletes in order to achieve the optimal development of the players. (Selivanov) Therefore, studies and research in the sports field are considered one of the important aspects that help high sports achievements, which can only be achieved through the application of the results of modern scientific theories reached by research, in order to identify the various biochemical and physiological changes at the level of different cells and tissues of the body, which are related and affected by physiological and functional aspects, which vary from one athlete to another. (Abu El-Ela, 2003) (Stegmann, 2010) The process of sports training is essentially a physiological process that aims to improve the efficiency of the physiological organs of the body, and thus improve the level of physical performance, and therefore there are some principles and physiological foundations on which the sports training process depends in order to achieve its goals, where training takes place. The athlete has various physiological changes that include all body systems, and the more positive these changes are, the greater the level of physical performance. The biochemical changes are among the physiological changes associated with sports training, which occur at the level of different cells and tissues of the body. The anaerobic threshold is an increase in the intensity of physical work to a certain degree, after which the lactic acid is transferred from the muscles to the blood in a degree that exceeds the rate of its

elimination, as the lactic acid accumulates inside the muscle fiber and then moves to the blood, and when this amount increases until it reaches (4) (m/mol, it will have reached the level of the anaerobic threshold. (Baha, 2008) Therefore, the anaerobic threshold is a stage that has specific characteristics for each player, and it has a great relationship with anaerobic energy production systems, and it also has a relationship to the player's physical efficiency and training condition, which is thus, it differentiates between a player and another in the ability to continue performing with high efficiency. (Emad, 2005) and that the method of determining the anaerobic threshold through the concentration of lactic acid in the blood is one of the valid criteria for determining the intensity of exercise, and it is considered one of the tests that can be used as a guide in identifying the appropriate training intensity for each player (Peter, 2001) between them and this is due to the different metabolic reaction of the individual, so a clear development appeared in determining the anaerobic threshold that the production and removal of lactic acid were taken into account according to the individual differences taken between the athletes. (Vanhall, 2000) This, given the importance of scientific development and modern technical progress in the field of technology and physiology. Which the international arena witnessed in recent years, and many of its applications were reflected in the sports field. The researcher found the necessity of employing this modern technology to overcome the problem of muscle fatigue for volleyball players to reach the higher levels. The problem of

muscle fatigue is one of the physiological manifestations associated with sports training. It is a complex and multifaceted physiological phenomenon. The mechanism of its occurrence varies according to the type, degree and intensity of the muscular work performed and its duration. Muscular fatigue of volleyball players appears in the low production efficiency; Especially in the last games of the match, the inability of the players to continue to maintain their level of performance throughout the match period, and the failure to finish it at a good technical and functional level, as well as the player's lack of mastery and Accuracy in various skills, and his inability to carry out the tactical requirements, whether during defense or attack, in addition to behaving incorrectly in the sudden and changing situations presented by the course of play. (By Mohannad, 2005) (Simeon is, 2006) Volleyball glbt - friendly players A Must Have Physical And the physiological fitness for a That enables the Them To Perform The Required Movements, Whether In Defense Or Attack, which is Requires The - availability Of A Great Ask Question Of Speed, color :as a well color :as Strength And Endurance. (Rose, 2015) The game of volleyball is one of the team games that requires high physical and skill abilities to reach achievement, and the skills of the game need special determinants that the volleyball player must have in order to be able to perform them at A high level, as most of the movements of the volleyball game You need to jump and jump as it is a (quick ability) and the success in performing the game skills depends on the player's physical competence and other factors

(Dania, 2004). It also requires exerting a high effort during the implementation of the basic skills and the offensive and defensive skills they contain. Perhaps the difference in the levels of global teams is the element of strength and speed is clear during the course of the match and becomes the decisive when the level of performance of the teams converge, as well as the high efficiency in the implementation of different tactical plans in During the course of the match, as well as the state of creativity, development and innovation in the methods and means of sports training using scientific foundations and principles and what it requires of scientific planning to prepare a comprehensive training curricula, and from here the importance of research appears in an attempt to reach results that reveal the impact of training using the proposed anaerobic threshold in some physical variables. and functional for volleyball players, which helps the coach in designing and preparing training programs to raise the level of players and achieve the best results. An area of excellence for an athlete over another depends on his physical competence, which in turn depends on his functional competence. The involvement of anaerobic capacity and stress in training programs is necessary to perform basic skills in the game of volleyball, and by noting a lot of training programs and by looking at relevant sources and personal meetings With the coaches and players of the game, it was Note that the training programs, although varied, did not address the proposed stresses by using the anaerobic threshold and dedicating special programs for them, which may develop, develop and positively affect

the physical and functional aspects of the players, better than some training programs. Research importance: The research acquires its importance from several aspects, the most important of which is the following: There is a scarcity of research that dealt with the physiological effects of using the anaerobic threshold load intensity, which is diagnosed by the concentration of lactic acid in the blood. The information obtained from this research will be an attempt to develop the physical performance of players and coaches in the field of sports training, proper planning of training programs and load rationing, which helps players to reach high levels. The results of this research will shed light on the importance of benefiting from the regulation and diagnosis of the intensity of physical exercise using the anaerobic threshold load intensity, which is based mainly on the principle of individual differences.

Research objective: The research aims to identify: The effect of anaerobic threshold exercises on some physical and physiological variables, lactic acid in the blood, fatigue and muscle pain, for volleyball players.

#### *Research hypotheses*

- 1- There are statistically significant differences between the tribal and remote measurements of the experimental group during and after the performance of the anaerobic threshold load intensity in some physical variables in favor of the post measurement.
- 2- There are statistically significant differences between the pre- and post-measurement of the experimental group during and after performing the anaerobic threshold load intensity in the physiological variables,

lactic acid in the blood, and fatigue and muscle pain in favor of the post-measurement.

#### **Literature review**

Anaerobic threshold: It is defined as the level of physical load at which the rate of transfer of lactic acid from the muscles to the blood increases to a degree greater than the rate of its elimination, meaning that it is the transition point from the stage of Obtaining energy sources from aerobic metabolic processes to the stage of obtaining energy sources from processes Anaerobic metabolism (Mohannad, 2005).

#### **Methodology**

Research Methodology: The experimental method was used by designing a pre and post measurement for one experimental group, due to its relevance to the type and nature of the research.

Research sample: The research sample was chosen in a deliberate way from volleyball players registered in the Iraqi Volleyball Federation, and the sample size was (15) players, with (9) players as a basic sample, (6) players as an exploratory sample, and the researcher conducted homogeneity and parity for the two groups to neutralize them which would influence the results and it was proven that the two samples are homogeneous and equivalent.

Devices and tools used in the research: The nature of this research requires the use of these tools, including:

- Medical scale for measuring weight.
- A rheostat for measuring length.
- Lactic acid analysis slides.
- Polar watch to measure the pulse rate.

- Centrifuge) to separate blood components.
- Accusport to measure lactate.
- Treadmill device to implement the content of physical activity.
- A set of special glass tubes to put blood and preservatives in.
- A set of approved syringes, the size of (3) cm, in addition to antiseptic materials.
- An ice box containing crushed ice to place the blood serum tubes until they are transported to the laboratory

#### *Methods of measuring research variables:*

##### - Lactic acid

The Accusport device was used to measure the concentration of lactate in the blood of the research sample, and the following steps were taken in the measurement:

- The device was turned on by pressing the power key (on), then feeding the device the code number of the pack of slices used to measure lactate.
- A slide was taken from the slide tray and placed in the hole at the bottom of the device, then the edge of the lower device was opened to reveal the slide placed in the device.

A drop of blood was placed from the finger of each athlete by the skeptic on the yellow part in the middle of the slide, and immediately after closing the lower edge of the device, (the screen will remain shown for 60 seconds, but soon the countdown to zero begins), and when the count reaches zero, the device sounds a whistle, showing the value of lactate in blood.

##### - Anaerobic threshold

The anaerobic threshold was determined for the research sample by testing the maximum

stability state of lactate by following the following steps:

- The player starts doing a warm-up for a period of (10 minutes) and upon completion he stands on the moving belt to start the test by running for a period of (5 minutes at a speed of 9 km/h) maintaining his speed until the end of the (5 minutes).

Immediately after completion, the researcher reads the pulse rate through the heart rate device, and gives the player a rest period of (10) minutes, then a blood sample is taken after (3) minutes to be analyzed using the AccuSport device to give the value of lactate in the blood.

- The player repeats the run again for a period of (5 minutes at a speed of 10.8 km/h) so that the previous step is repeated (3) times, and each time the speed increases (the players ran at a speed of 12.6 km / h and then 14.4 km / h).

By this, the player has performed (4) times on the moving belt, where after every (5) minutes of running the pulse rate is recorded, as well as the measurement of lactic acid and running speed, and thus (4) readings of the pulse rate are obtained, (4) Lactic acid readings, (4) different speeds.

- The previous data was represented in two forms, the first represents the relationship between running speed and pulse rate, and the second represents the relationship between pulse rate and the value of lactic acid, and thus the test gives two values, the first is the pulse rate at the lactate value (4 mmol) (L4), and the second is the running speed At a lactate value (4 mmol) (V4).

The functional variables under research: The researcher measured the functional variables under research, which are represented in the

absolute and relative maximum oxygen consumption, pulse rate before and after exertion, vital capacity and systolic and diastolic blood pressure through the following functional measurements:

- Measuring the maximum absolute and relative oxygen consumption, pulse rate before and after exertion using the Cardio Respiratory device.
- Measurement of vital capacity using a dry spirometer.
- Measuring systolic and diastolic blood pressure using a sphygmomanometer

The level of physical performance: As a result of the discrepancy between studies and scientific references in determining the physical requirements of handball, the researcher was interested in a survey of the opinion of specialized experts to determine the most appropriate physical tests to measure the level of physical performance of the research sample, which were as follows:

- Back and frontal running test (252m) to measure speed endurance.
- Test (332m) to measure endurance performance.
- Flexion test of the arms from an inclined prone to measure the force endurance.

Execution of tribal measurements:

Tribal measurements were made for the research sample in the time period from (25/3/2010) to (29/3/2010).

**Application of the training program:** The training program was implemented for a period of (8) weeks during the time period from (3/4/2010) to (2/6/2010), and the training program was designed in the direction of the anaerobic threshold, adopting the new international design presented by Peter. (2001) (65), and the researcher adopted it on the basis of determining the deviation point of the heart rate. Peter J. (2001): Lactate threshold training, pub. Human kinetic USA

This design consists of three areas that show the level of intensity, the corresponding pulse rate and the ratio of working time to rest, which are:

- Aerobic work area (A1 - A2), in which the power supply is based on aerobic processes.
- The endurance zone (E1 - E2), its limits slightly above and below the anaerobic threshold.
- The anaerobic work area (An1-An2), in which the energy supply is based on anaerobic processes.

**Table (1) The training areas used in the research**

training areas	intensity	pulse rate	Ratio of working time to rest time
A <sub>1</sub> -A <sub>2</sub>	*%90-75	155-120	1:1
E <sub>1</sub> -E <sub>2</sub>	*% 102-95	180-155	1:1- 2:1
An <sub>1</sub> -An <sub>2</sub>	*%112-105	180 – HR <sub>max</sub>	2:1

\* Pulse rate at the point of heart rate deviation. □

The degrees of pregnancy were distributed over the training weeks during the stages of the training program as follows.

1. The degree of average load [84% - 60%]
2. High load degree \*[99%-85%]
3. Maximum Load Degree \*[120%-100%]



4. Implementation of dimensional measurements. same order of measurements and what was done during the tribal measurements
5. The dimensional measurements of the research sample were carried out in the time period from (5/6/2010) to (7/6/2010) in the *Statistical treatments:* The researcher used the statistical package (SPSS) version (23).

## Results

**Presentation and discussion of the results of the experimental group during and after performing the anaerobic threshold load intensity in some physical variables.**

**Table (2) the significance of the differences and percentage between the tribal and dimensional measurements in the physical variables**

physical variables	measuring unit	Application	average	The difference between the two averages	improvement rate		
(%)Values Z bearing speed	indication w	Tribal	79.56	6.12	7.69	2,677	0.01
performance w		after me	73.44				0.01
endurance		Tribal	108.89	8.67	7.96		
endurance force	K	after me	100.22			2.666	0.05
		Tribal	23.22	- 4.11	- 17.70		

It is clear from Table No. (2) that there are statistically significant differences between the tribal and remote measurements in the physical variables in favor of the post measurement, where the value of (Z) is significant at the level of significance (0.05), and the rates of improvement in the obese variables ranged between -17.70 -, 7.96%) in favor of the dimensional measurement. The researcher attributed the existence of statistically significant differences in favor of the dimensional measurement and the improvement in the level of physical performance of the regulated training program and its endurance

exercises for different speeds, as well as the work of the same joint muscles in different situations aimed at delaying the accumulation of lactic acid and speeding up its disposal. The speed of recovery, which had a clear positive effect in improving speed endurance and performance endurance, which led with the anaerobic threshold exercises that are regulated in the absence of oxygen to a clear positive effect on the development of the level of physical performance. These results agree with both Essam Abdel- Khaleq (2003) and Muhammad Marzouk (2001) that the lower the intensity in the repeated, successive,

similar exercises, the greater the player's ability to use air oxygen, and thus work takes the character of endurance speed and performance. The level of physical performance in terms of functional and membership are closely related to each other in any process of development and development, and the upgrading and development of the level of performance is the important base in building and progressing the level of players, as well as an essential duty to reach high levels of achievement for volleyball players. This agrees with Imad El-Din Abbas (2005) that the development of the level of physical

performance is the first basic pillar on which the acquisition and mastery of motor and skill performance is built, as the handball player needs to develop and develop aerobic energy to be a good background to facilitate the production of anaerobic energy that the player depends on when performing physical, skill, or tactical movements.

Presentation and discussion of the results of the experimental group during and after performing the anaerobic threshold load intensity in the physiological variables, lactic acid in the blood, fatigue and muscle pain in favor of the post-measurement

**Table (3) the significance of the differences and the percentage between the tribal and remote measurements in the physiological variables**

variable		measuring unit	Tribal measurement	Measuring dimensional	The difference between the two averages	improvement rate		
(%) blood pressure	Values Z	indication					0.001	0.001
							0.001	0.001
		systolic	millimeter of mercury	117.5	114.5	3.000	2.553	2.536
vital capacity	extrovert	millimeter of mercury	77.5	75	2.500	3.226	0.001	0.001
	milliliter	4775	4950	-175,000	3.665	2.534	0.001	0.001
pulse							0.00	0.001



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	Comfort	beats/s	70.5 70	66.5	4.000	5.674	0.001	0.001
	Effort	beats/s	121	120.5	-4.500	3.719	0.001	0.001
Maximum oxygen consumption	before effort	liter/s	0.805	0.955	-0.150	18.634	0.001	0.001

It is clear from Table No. (3) that there are statistically significant differences between the tribal and remote measurements in the functional variables in favor of the dimensional measurement, where the value

of (Z) is significant at the level of significance (0.05), and the rates of improvement in the obese variables ranged between (2.553%, 21.672%) in favor of dimensional measurement.

**Table (4) the significance of the differences and the percentage between the tribal and dimensional measurements in the biochemical variables**

biochemical variables	measuring unit	Application	average	The difference between the two averages	improvement rate (%)	Values Z	indication
blood lactate	mmol/liter	Tribal	11.96	5.46	45.59	2.666	0.01
		after me	6.51				
Anaerobic threshold	n/s	Tribal	165.33	12.77	7.72	2,680	0.01
		after me	152.56				

It is clear from Table No. (4) that there are statistically significant differences between the tribal and remote measurements in all biochemical variables in favor of the post measurement; Where the value of (Z) was statistically significant at the level of significance (0.05), and the rates of improvement in the biochemical variables ranged between (7.72%, 45.59%) in favor of the post-measurement. These results are suggested to the program using the anaerobic difference, which affected the vital capacity, the pulse during rest, the pulse during the effort, and the maximum absolute and relative oxygen consumption

before and after the effort, and where the results indicated that there are differences between the pre and post measurements in all research variables. The researcher also attributed the improvement in The pulse rate is due to the effect of the program, which led to the expansion of blood capillaries, an increase in the metabolic rate and an increase in the amount of blood that carries nutrients and oxygen to all cells of the body. The researcher also attributes the improvement in the absolute and relative maximum oxygen consumption to the training program, as the anaerobic threshold exercises are performed. This results in an

improvement in the efficiency of the oxygen delivery process to tissues, as well as an efficiency in the muscle's ability to consume it as a result of the increase in the size of the heart, especially the left ventricle, which performs the task of pushing blood into the aorta, which distributes it to the smaller and smaller arteries to reach all parts of the body. As a result of this increase in the size of the ventricle on the left, the stroke volume increases, and accordingly the cardiac impulse increases, thus increasing the amount of oxygen. A link to the muscles Bahaa El-Din Salama (2008) states that performance in anaerobic exercises is related to the activity of oxidative enzymes in mitochondria, where endurance training helps in increasing these enzymes, which helps to increase oxygen consumption, and whenever the muscles are able to extract oxygen from the blood, this helps in increasing the proportion of consumption. While the researcher believes that the improvement in biochemical variables is due to the effects of the proposed program, which helped to speed up the transfer of lactate from the blood and muscles to the heart and non-working muscles, and to increase the flow of Oxygen-laden blood to the muscles, as well as increasing the efficiency of the working muscles involved in performance for the longest possible period. Without reaching muscle fatigue, it helped to quickly convert lactate to pyruvic and quickly get rid of it, thus helping to continue sports performance for the longest period. According to these results and in line with them, Passarella et al (2008), Simeon (2006), Peter (2001), Vanhall (2000) indicate that the improvement in

biochemical parameters is due to the presence of high-intensity training effects, which reduce the percentage of lactic acid, decrease its presence in the blood and quickly get rid of it, which leads to maintaining the level of performance as long as possible and delaying the rapid onset of fatigue.

### Conclusions

- 1- The training effects in the direction of the anaerobic threshold had a positive impact on the physical variables under study, as there were statistically significant differences between the pre and post measurements in favor of the post measurement.
- 2- Training in the direction of the anaerobic threshold helped in the speed of transporting lactate into and out of the various cells of the body, which leads to a delay in reaching muscle fatigue.
- 3- The heart rate, body temperature, pain and muscle fatigue increase when using the anaerobic threshold load intensity and this increase is related to the length of the performance period and the intensity of the physical load together.
- 4- The exercises, using the anaerobic threshold, had a positive effect on the physiological variables of the volleyball players under study, where statistically significant differences were found between the pre and post measurements in favor of the post measurement.

### Recommendations

- 1- The necessity of rationing the intensity of the physical load and determining the anaerobic threshold through the concentration of lactic acid in the blood and

taking into account the individual differences between the players.

- 2- When giving a physical load, the pulse rate, the level of lactic acid concentration in the blood and body temperature should be used to monitor the physiological state of the players during their physical load.
- 3- The importance of relying on the individual anaerobic threshold level in predicting the training status of volleyball players, as well as rationing training loads for players with different physical levels in the optimal preparation and employment for them according to their abilities.
- 4- The importance of relying on the individual anaerobic threshold level in predicting the training status of volleyball players, as well as rationing training loads for players with different physical levels in the optimal preparation and employment for them according to their abilities.
- 5- 5. Conducting more comparative studies between different hospitalization methods to identify the best appropriate hospitalization methods to restore the efficiency of the various body systems and reach the normal state.

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