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The difference between lactic acid accumulation in the blood, the time of the appearance of the anaerobic threshold and the number of times of breathing before, after and after the lactic effort contributed to the enduring the special strength of the arms and the achievement of (200) meters freestyle swim

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ABSTRACT

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The purpose of the research was to identify the difference in the accumulation of lactic acid in the blood, the time of the appearance of the anaerobic differential threshold, the number of times to breathe before and after the lactic effort in (200) meters freestyle, and to identify the level of muscular strength tolerance of the arms and the time of achievement of (200) meters of freestyle, and to identify the relationship and contribution of the difference in the level of lactic acid in the blood, the time of the appearance of the anaerobic differential threshold, and the number of times to breathe before and after the lactic effort with the endurance of the force and the time of achievement of (200) meters of freestyle, and the descriptive approach was adopted in the style of Relational studies, on a sample of (28) swimmers from Baghdad Governorate clubs participating in the sports season (2024-2025), the research sample was randomly selected to reach (24) swimmers with a percentage of (85.714%) of their original population, and after determining the measurements and tests under research, the descriptive study was conducted by applying it to the research sample and then processing the results by (SPSS) system The conclusions and applications are that the decrease in the difference in the accumulation of lactic acid in the blood before and after the lactic effort is related to and contributes to the increase in the level of the endurance of the special muscular strength and affects it directly, and it is associated with and contributes to the decrease in the achievement time of (200) meters of freestyle, and does not affect it, and that the increase in the difference in the level of the appearance of the anaerobic difference before and after the lactic effort is related to and contributes to the increase in the level of the endurance of the special muscular strength and is associated with and contributes to the decrease in the completion time of (200) meters of freestyle swimming and affects each of them positively. It is necessary to pay attention to the planning and application of training curricula that take into account the integration of adaptation in the positive effect of both the accumulation of lactic acid in the blood, the time of the appearance of the anaerobic threshold, and the number of breathing times, because of its positive role in increasing.

Keywords:
Physiological indicators, lactic effort, strength endurance, 200-meter freestyle performance

Research Problem and Importance:

The evaluation of the training status of swimmers depends on the measurement of biochemical and physiological indicators, considering that they are highly objective to judge the condition of swimmers and players of other sports games and events, as is well known, as well as finding the relationships between these indicators is very necessary in supporting the knowledge of coaches and increasing their capabilities in planning sports training and applying them according to health conditions without harming the condition of swimmers at a distance of (200) free distance, especially if the time duration of the effect of effort in training on Perhaps one of the most biochemical and physiological factors that researchers tend to measure in swimmers is the lactic acid index, the time of appearance of the anaerobic threshold and the number of times they breathe, and the importance of measuring it is one of the necessities for swimmers whose game is characterized by lactic effort, which requires a special tolerance of strength, to avoid the phenomenon of overtraining and the chemical injuries resulting from it.

"The importance of the anaerobic (lactic acid) system in the types of sports that require maximum exertion is evident." (Mufti, 2010)

Also, "endurance sports lead to disturbances in a wide range of processes that increase cellular pressure, and cellular metabolic dysfunction to eventually cause one or more of these disorders to chemical fatigue, defined as leading to the inability to generate the required mechanical response." (Allen & Lamb, 2008) (Lamb, 2009)

"Lactic acid is defined as the end product of the second anaerobic energy system, which rapidly separates to release the hydrogen ion (H+) and the residual substance combines with sodium or potassium salts to form a salt called lactate." Raysan & Abul-Ala, 2016)

"Vital organizations represent the first line of defense in the blood for any change in the pH value and they work over a very short period of time (a fraction of a second) to reduce the pH value, while the second line of defense is the respiratory system, which works to remove (CO2) within several minutes and then remove carbonic acid (H2Co2) from the body, and there is an inverse relationship between the concentration of lactic acid and the level of bicarbonate." (Ahmed, 2019)

"Hydrogenase dehydrogenase (LDH) helps in the elimination of lactic acid, and the increase in the concentration of this enzyme is accompanied by an increase in the elimination of lactic acid, as it is a dehydrogen, and then converts lactic acid into pyruvic acid, and beta-endorphins (blood morphine) act as a chemical transporter, and is involved in many physiological processes, and helps

to increase the secretion of some hormones such as glucagon and insulin." (Goldberger & Gurney, 2011)

The term "anaerobic threshold" is used in the field of physiological preparation to denote a specific state of fatigue that the player reaches during physical performance, and the timing of its appearance in players varies according to their physical and functional state that they have reached, and many scientists define it as an increase in the intensity of physical load, at which the rate of transfer of lactic acid from the muscles to the blood increases to a degree more than the rate of its elimination and has a direct connection to the lactic acid system (anaerobic capacity) and the oxygen consumption system (Aerobic capacity)". (Bahaa El-Din, 2000)

The "anaerobic threshold or lactate threshold (AT) is defined as the level of physical load intensity at which the rate at which lactic acid in the muscles is transported to the blood exceeds the rate at which the blood is eliminated." Essam, 2015)

"Because the anaerobic differential threshold serves as the turning point among the energy systems on which the athlete relies is determined according to the training intensity and performance time, which are important physiological indicators in evaluating the training status of the athlete, and several training approaches were based on the codification of difficulties in the training load by multiplying the time of their appearance by the required percentage difficulty, which is one of the modern training exercises in the world of sports training that many have researched." (Chad, 2005)

"In the frequency of breathing rate, the period of return to normal (recovery period) depends on the physical and training condition of the individual." (Bahaa El-Din, 2008)

"As the body's need for more oxygen in the case of physical exertion to oxidize nutrients to rebuild atopia molecules, there are significant changes in the volume of both inhalation and exhalation." (Mohammed, 2000)

"It has been observed that muscle stress leads to an increase in the amount of carbon dioxide in the blood, so in order for the body to get rid of this excess amount of this gas, it is necessary to increase the rate and depth of breathing." (Ayesh, 2002)

Endurance is defined as "the ability to maintain a high level of strength for as long as possible in the face of fatigue and perform the highest number of repetitions." (Fatima et al., 2017)

Endurance is defined as "a composite capability that combines the elements of strength and endurance, and therefore, in light of this complex relationship that combines the elements of strength and endurance as performance requirements in force endurance, its concept is synonymous with

muscular endurance, which describes the biological ability to cope with fatigue that occurs during the implementation of force endurance." (Mahmoud, 2014)

"Speed endurance can be used to develop muscle contraction compatibility, and repetition methods are used with a high number of sets, a few repetitions within these groups, with a training intensity higher than (85%) and an increase in exercise time to develop speed endurance." (Sports coach, 2014)

"The lack of supply of the body's energy currency (ATP) may be the underlying cause of fatigue, and the poor ability to produce ATP is determined by the biochemical mechanisms of the accumulated metabolites and biological control within the cell system that cannot be isolated or placed in isolation" (Swartz & Other, 2017)

Also, "ATP stores become more difficult to protect with endurance exercises, as a result of increases in inosine phosphate (IMP), a byproduct of the breakdown of adenosine monophosphate (AMP), which appears to occur secondary as a residue of the endogenous reactant and glycogen, that increased inosine phosphate (IMP) can exacerbate metabolic stress due to reduced adenine nucleotide aggregation and energy charge, and here comes the role of the MCT1 gene) to control residues and to return muscles to normal mechanical function, and metabolic balance may also be challenged by disrupting the activities of many enzymes involved in oxidative phosphorylation and glycolysis." (Green & Other, 2018)

"When an athlete becomes more adept at training, the energy requirement during training decreases or decreases compared to a low-level athlete." **(**Bahaa El-Din, 2000)

From the above, it is clear that attention should be paid to measuring these biochemical and physiological indicators by finding the effects of the burdens of physical exertion inflicted by the training of (200) meters freestyle swimmers, as the measurement should be oriented towards finding the differences after and before exertion considering the stability of the state of rest as a level for each swimmer, and then knowing its relationship and contribution and its impact on the special endurance of strength and the time of completing the swim of this distance, and through the field researcher's follow-up of the training and competitions of swimmers' clubs in Baghdad Governorate. She noticed that swimmers suffer from a clear decrease in the special endurance of the muscular strength of the arms, especially before the end of the training units and at the critical speed of the end of the (200) meters freestyle, which focused her attention on this problem and sought to study it in the field by adopting the modernity in biochemical, physiological and physical tests, so that the importance envisaged from studying this problem is that the trainers take it upon themselves when planning the

trainings to adopt these values, which if improved will have positive repercussions on the physical condition of the swimmers of this distance.

Research Objectives:

1- Identifying the difference in the accumulation of lactic acid in the blood, the time of the appearance of the anaerobic differential threshold, and the number of times to breathe before and after the lactic effort in (200) meters freestyle.

2- Identifying the level of muscular strength endurance of the arms and the completion time of (200) meters freestyle.

3- Identify the relationship and contribution of the difference in the level of lactic acid in the blood, the time of the appearance of the anaerobic differential threshold, and the number of times to breathe before and after the lactic effort with force endurance and the time of accomplishing (200) meters freestyle.

Research hypotheses:

1- The difference in the level of lactic acid in the blood, the difference in the appearance of the anaerobic threshold and the difference in the number of times breathing before and after the lactic effort is related to the ability to withstand the special muscular strength of the arms.

2- It is related, contributes and affects the difference in the level of lactic acid in the blood, the difference in the time of appearance of the anaerobic differential threshold, and the difference in the number of times breathing before and after the lactic effort with the time of accomplishing a distance of (200) free meters.

Research Limitations:

Human Limits: A Sample of Swimmers of Baghdad Governorate Clubs for the Sports Calendar (2024-2025).

Time Limits: For the period extending from (1/2/2025) to (8/2/2025).

Spatial boundaries: Baghdad/Zeyouna/Olympic People's Pool.

Research Methodology and Field Procedures:

Research Methodology:

The descriptive method, which is defined as "the method that describes a phenomenon according to a specific research plan that includes describing the phenomena, gathering facts and information

about them, evaluating these phenomena in the light of what they should be, in the light of more appropriate criteria, and suggesting the steps that should be taken." (Magdy, 2019)

Finding solutions to the current problem also required the researcher to adopt the method of relational studies from this descriptive method, as the method of relational studies in the research method is defined as "research that seeks to determine the relationship between two or more measurable variables". (Mohammed & Osama, 2017)

Research Population and Sample:

The boundaries of this available community are represented by the swimmers of the Baghdad Governorate clubs participating in the sports season (2024-2025), who are (28) swimmers, who are from the elite level of applicants in these clubs, the research sample was deliberately selected after excluding (4) swimmers because they were not included in the specificity of the research due to injuries and their interruption from training and competitions, so that the research sample would be (24) swimmers representing (85.714%) of their original community, and they are with a time age ranging from (20-25) years, and with a training age of (7-9) years. With a body mass index ranging between (21-23) kg/m2, the reasons for the researcher's orientation to this community were that they represent the specific group in the research problem community themselves, and they are available to the researcher for easy contact with them and ensure their presence by virtue of their commitment to regular training in the Olympic People's Pool.

Procedures and measurement:

To measure each of the research variables, the researcher relied on the lactic effort by continuously working on the stationary bike for (90) seconds with the maximum high effort exerted by the swimmer, which is of the type (life fitness) with the capacity of (9700) American (Aerobic Hand and Leg) mechanical with an electronic digital screen to monitor the speed and stabilize the resistance of each laboratory by multiplying the weight of the tested swimmer (mass) in kilograms × 0.075 = the required resistance, and each indicator is measured before and after the effort, and then finding the difference in values as follows:

First: Two tests of the difference in the level of lactic acid concentration in the blood before and after the lactic effort:

The researcher adopted the portable lactic-pro measuring device, and took the measurement at rest before performing the lactic voltage according to the measurement conditions of this device, and then

the laboratory performs the voltage on the stationary bicycle for the continuous load for (90) seconds, and after (5) minutes after this voltage, the portable (Lactic-pro) device is whistled with its listed tape, and the laboratory (thumb) is swallowed with the needle of the device, and a sample of blood is taken with the (cut) placed in the device to obtain the reading, in a unit of measurement (millimeters). mol/L), according to the following equation:

Difference due to exertion = Lactic acid concentration level in the blood after lactic exertion – The level of lactic acid concentration in the blood at resting time before exertion.

Second: Anaerobic Threshold Difference Difference:

The researcher adopted the system of the (Fitmate pro) device and the player performs the effort on the stationary bicycle and records the readings directly before and after the lactic effort with a unit of measurement (the second and its parts), according to the following equation.

Effort difference = the time of appearance of the anaerobic differential threshold after the lactic effort – the time of the appearance of the anaerobic differential threshold with the resting time before the effort.

Third: Two tests measuring the difference in the number of times breathing for the exertion dimension and before it:

In order to rely on the objectivity and accuracy of the measurement, the researcher fixed the number of breathing times before performing the anaerobic differential threshold time test and immediately after its completion, by recording the reading from the (Fitmate pro) device. In a unit of measurement (number of times), according to the following equation:

Effort difference = number of times you breathe after lactic exertion – number of times you breathe at rest time before exertion.

As for the test of special muscular strength, the test was adopted as Appendix (1) with a unit of measurement (number of times), and a test to measure the time of completion of a distance of (200) meters of freestyle swimming with a unit of measurement (minutes and their parts).

Since the selections under study are instrumental and objective, and those in charge of them are specialists, the specificity of this research does not require conducting scientific foundations or survey experiments, because it overcomes the expected obstacles in the main survey study.

Main Survey:

After identifying the tests and measurements based on the measurement technology for the biochemical and physiological indicators under research, the researcher measured the research sample of (24) swimmers, as on Saturday (1/2/2025), the difference of biochemical and physiological indicators was measured within the measurement determinants before the lactic effort of (90) seconds continuous and after this effort, and on Saturday (8/2/2025) the application of the test of endurance of special muscular strength, the completion of a swimming distance of (200) free distance.

Statistical Methods:

The researcher verified the processing of the study data using the Social Statistical Package System (SPSS) version (V26) by automatically extracting the values of percentage, arithmetic mean, standard deviation, torsion coefficient, multiple coefficient of (regression), contribution percentage, test (F) of conformity quality, and slope (effect) of the (T) test of multiple regression.

Results and Discussion:

Table (1) shows the statistical parameters of the studied variables

Torsion	Standard deviation	Arithmetic mean	Sample Number	Unit of Measurement	Variables
-0.89	0.929	9.92	24	Millimole	**Blood Lactic Level Difference**
-0.091	4.082	30.33	24	Tha	**Difference in the appearance of the anaerobic differential threshold**
-0.448	2.09	34.75	24	Number	**Difference in the number of breaths**
0.001	1.06	16.58	24	Number	**BEARING THE SPECIAL MUSCULAR STRENGTH of the arms**
-0.639	0.181	1.939	24	The minute	**COMPLETION TIME OF (200) FREESTYLE SWIMMING**

Table (2) shows the multiple correlation coefficient, contribution percentage, and standard error of estimation for both force tolerance and speed tolerance

Standard Error of Grading	Percentage of Contribution	Multiple regression coefficient ^{2}(R)	Affected	Influential
0.212	0.96	0.965	**BEARING THE SPECIAL MUSCULAR**	**Difference in biochemical and physiological**

			STRENGTH of the arms	indicators before and after lactic effort
0.00514	0.954	0.96	COMPLETION TIME OF (200) FREESTYLE SWIMMING	Difference in biochemical and physiological indicators before and after exertion

Table (3) shows the quality of the multiple regression model matching for both force tolerance and velocity tolerance

Significance	Grade (SIG)	Calculated Value(F)	Average Squares	Degree of Freedom	Total Squares	Contrast	Influential	Affected
D	0.000	184.864	8.311	3	24.934	Decline	Difference in biochemical and physiological indicators before and after exertion	BEARING THE SPECIAL MUSCULAR STRENGTH of the arms
			0.045	20	0.899	Errors		
D	0.000	159.642	0.004	3	0.013	Decline	Difference in biochemical and physiological indicators before and after exertion	COMPLETION TIME OF (200) FREESTYLE SWIMMING
			0.000	20	0.001	Errors		

* The significance level is (0.05) n = 24 D if the value of the score (Sig) is ≤ (0.05)

Significance	Grade (SIG)	Value (t) Calculated	Standard Error	Beta β	Variables

Moral	0.000	7.11	1.273	9.052	**Fixed limit**	
Moral	0.000	5.208	0.081	0.423	**Lactic acid accumulation difference**	**BEARING THE SPECIAL MUSCULAR STRENGTH of the arms**
Moral	0.000	6.729	0.032	0.216	**Anaerobic Differential Threshold Differences**	
Insignificant	0.152	1.491	0.062	0.093-	**Difference in breathing times**	
Moral	0.004	3.215	0.031	0.099	**Fixed limit**	
Insignificant	0.163	1.449	0.002	0.003	**Lactic acid accumulation difference**	**COMPLETION TIME OF (200) FREESTYLE SWIMMING**
Moral	0.000	7.832	0.001	0.006	**Anaerobic Differential Threshold Differences**	
Insignificant	0.23	1.238	0.002	0.002-	**Difference in breathing times**	

Table (4) shows the effect of the multiple regression model for both force tolerance and velocity tolerance

Significance level (0.05) N = 24 (t) value if the score of (Sig) ≤ (0.05)

The results of the research mentioned in Tables (2) mentioned in this research show that there is a significant relationship and a contribution to the difference in the level of each of the physiological indicators before and after the lactic effort with the level of the ability to bear the specific muscular strength of the arms in the (200) meters freestyle swimmers, with a contribution rate of (0.96), while the rest of the percentage of (0.4) was for random factors that were not researched, and for the time of completion of the distance of (200) freestyle swimming with a contribution rate of (0.954) and the rest of the percentage of (0.446)The results of Table (3) proved the good match quality of the multiple regression models for both strength endurance and the time of accomplishing the distance of (200) freestyles, as for the effect of the difference in the level of lactic acid in the blood, the difference in the time of appearance of the anaerobic difference threshold, and the difference in the number of breathing times before and after the lactic effort mentioned in Table (4).The results show that the lower the difference in the level of lactic acid in the blood, the more it directly affects the increase in the level of muscular strength endurance as well as the less time to accomplish the distance of (200) freestyles, and the researcher attributes the appearance of these results to the fact that the swimmers got rid of the

accumulation of lactic acid after exertion, which came as a result of the good work of vital organizations in achieving metabolic balance, and this gives an indication of the appropriateness of the good application of the second system of energy training, and that the greater the difference in the time difference between the appearance of the anaerobic differential threshold, the more The researcher attributes the appearance of this result to the effectiveness of the swimmers' response to the moment of refraction in switching to the aerobic system in enduring force and increasing the duration of the special endurance in the lactic system prevailing in swimming this distance, and it is supposed to suit the completion time of (200) freestyles. which witnessed shortcomings despite the need for speed training to prolong the duration of their endurance in swimming, which gives an indication of the good and suitability of the training for swimmers for the ability to endurance of strength and its inadequacy for swimmers' training for the ability to endure speed, as for the difference in the number of breathing times before and after the lactic effort, it did not show a significant effect despite its association and contribution to both the ability to endurance of strength and the time of completing the distance of (200) freestyles, and it was supposed to be interested in respiratory training because of its role In ridding the body of carbon dioxide gas, which is a stimulus to increase the number of times you breathe, the two regression models give an indication that each of these indicators is directly proportional to the increase in the level of endurance of the special strength of the arms, and the decrease in the time of completing the distance of (200) freestyles, and with a difference in the effect of each of them.

"A decrease in the concentration of lactic acid in the blood indicates an improvement in the functional status of athletes and their ability to continue physical performance." (Sawka & Other, 2004)

As a result, the player's movement slows down and decreases despite the player's willpower and his attempt to deliver these signals, and as a result of this accumulation, the nervous system begins to get tired, especially the motor neurons, which leads to irregular and unsmooth access of nerve signals to the muscles well, and the level of neuromuscular compatibility decreases and the level of performance decreases." (Mowaffaq et al., 2017)

Also, "pyruvic acid is converted into lactic acid, which then spreads out of the muscle cells into the meniscus and blood, so a lot of muscle glycogen practically becomes lactic acid, but in this process large amounts of ATP are formed without the consumption of (O2), which can be used as a quick source of energy when a short-to-medium-term muscle contraction is required, but it is less fast than the phosphogenic system and is equivalent to about half its speed, and under ideal conditions the

system can Lactic acid provides maximum muscle activity for (1.3-1.6) minutes as well as (8-10) seconds with the phosphogenic system." (John, 2001)

"The process of releasing energy in the case of increased acidity in the blood is temporarily difficult due to the deactivation of the enzymes responsible for energy production." (Ahmed and Hussain, 2017)

In other words, "when muscles are trained, they use carbohydrates as their primary source of energy, especially in high-intensity training, and this results in lactic acid as waste products for this work, which then breaks down and is converted directly into lactate and hydrogen ions, and transports lactate from the muscles to the blood." (Mohammed, 2013)

Also, "it should not be exaggerated to give athletes, such as beginners and intermediates, more than (20) minutes per session of speed training consistently, and no more than three times a week, this plan aims to increase the speed by about (0.1) miles per hour in subsequent exercises, and when the required point of this increase is reached, he can run three miles in those (20 minutes)), and his aerobic system develops, and there is no need to train the athlete's body to run long distances faster than that." (Ayed & Faras, 2020)

"Training also leads to physiological changes that include the body's systems, and the level of athletic performance improves whenever these changes are positive, in order to achieve the physiological adaptation of the body's systems and then to the physical load." (Baha, 2018)

"The anaerobic differential threshold is related to the determinants of the chemical reactions of the intermediate compound lactic acid acid, which begins to appear in the first energy system after (16) seconds of high voltage, and when the mechanism of re-reacting its chemical reactions within the cell and reducing its proportion is different, this difference in the balance of proportions causes an imbalance that leads to the stress of the vital organizations that work to continue the supply of energy and the beginning of the appearance of the anaerobic differential threshold." (lauralee ,2004)

"Breathing problems during physical exertion are represented by shortness of breath, and an increase in its rate to a degree that hinders the continuation of physical performance" (Bahaa El-Din, 2000)

Abstracts and Applications:

1- The small difference in the accumulation of lactic acid in the blood before and after the lactic effort is related to and contributes to increasing the level of special muscular strength endurance and

directly affects it, and it is related to and contributes to the lack of time to achieve the (200) meter freestyle swim and affects both positively.

2- Increasing the difference in the level of the appearance of the anaerobic threshold before and after the lactic effort is related to and contributes to increasing the level of special muscular strength endurance, and is related to and contributes to the decrease in the time of accomplishing the (200) meters freestyle swim and has a positive effect on each of them.

3- Increasing the difference in the level of the difference in the number of breathing times before and after the lactic effort is related to and contributes to increasing the level of special muscular endurance capacity, and is related to and contributes to the decrease in the time of accomplishing the (200) meters freestyle swim and affects each of them positively.

4- It is necessary that the duration of interval rest periods in the training followed by swimmers should be positive for the intensity of (80%) that does not allow full recovery, for the intensity of (85%) rest to allow for complete recovery, for the intensity of (85%) to be positive for the intensity of (85%) does not allow for full recovery, for the intensity of (90%) the positive rest period of (90%) does not allow for complete hospitalization, and for the intensity of (95%) rest that allows for relative hospitalization, to enable swimmers in the distance of (200) meters of freestyle swimming to develop the studied biochemical and physiological indicators. Because of its role in developing achievement.

5- It is necessary to pay attention to the planning and application of training curricula that take into account the integration of compatibility in the positive effect of the accumulation of lactic acid in the blood, the time of the appearance of the anaerobic differential threshold, and the number of times of breathing, because of its positive role in increasing the level of special muscular strength endurance and the reduction of the time to accomplish the (200) meter freestyle swim if this is rationed with the appropriate effort in their training.

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Appendix (1) Explaining the Muscular Endurance Test (Endurance of the Strength of the Muscles of the Arms): (Hazza, 1413)

The objective of the test: to measure the strength tolerance of the muscles in the arms.

Tools: Mind.

Performance Description: The tester stands under the penis, giving the signal to start, the tester begins to stretch with the arms to lift his body until he reaches his chin above the bar, then descends his body until the arms are fully extended as he was in the starting position and repeats the previous performance as many times as possible without stopping.

Registration: Each correct and complete contraction in which the tester reaches the chin above the bar is calculated.

*** Unit of measurement:** Number of times.