Study of the shuttle movement of blood lactate in athletes

Dr. Nawaf Alshammari

Associate professor, Ph.D. College of Basiuwaitc education, Kuwait.
dr.nawaf_@hotmail.com

Abstract: The bioenergy study is one of the important topics in sport. The vital energy in the human body is the source of movement and muscle contractions, the athletic performance of all kinds. The body contains different systems for the production of fast or slow energy depending on the needs of the muscle and the nature of sports performance. Therefore, training energy production systems and raising its efficiency leads to raising the body efficiency in the production of energy. Eating food full of carbohydrates before or during the high-intensity exercise increases the concentration of the Kerbs cycle rates. It was also proved that the components of the Kerbs cycle is neither commensurate with the intensity of the exercises nor the amount of energy consumed and also during the high-intensity short-term exercise and supposed to increase rates of lactate over the pyruvate. As it may be accompanied by a significant increase in the rate of the components of Kerbes cycle and therefore these beliefs must be redrafted again and hence the researcher has shown the importance of the relationship of the components of the products of anaerobic and aerobic (Lactate / pyruvate) aldolase and (PDH - LDH) enzymes and find out how they affect the high intensity short - term exercises versus long - term exercises. The study aimed at identifying the relationship between the shuttle movement of lactate / pyruvate and the Glycolysis enzymes, during the physical effort in 400-meter-jogging race, 3000-meter-running race, running on the Treadmill series. The researcher used the semi-experimental approach using the (before - after) measurement of one group. The research sample included the Kazhma Kuwaiti Club players in (2017) with the ages of 18-21 years. the number of the research society reached (13) player. The most important results were that the production of energy during the sports effort begins with anaerobic Glycolysis, a pyruvate product that turns into lactate in the case of hypoxia under the influence of (LDH) Enzyme and resulting lactate either loaded on transport proteins (MCTs) to white fiber, which is re-converted into pyruvate and used to enter the Krebs cycle or seep into blood and act as analogous to hormones (for Aktermun) by influencing the metabolism of energy.
[Nawaf Alshammari. **Study of the shuttle movement of blood lactate in athletes.** *Researcher* 2018;10(1):50-58]. ISSN 1553-9865 (print); ISSN 2163-8950 (online). http://www.sciencepub.net/researcher. 8. doi:10.7537/marsrsj100118.08.

Keywords: Study; shuttle; movement; blood; lactate; athletes

Research problem and introduction: -

The bioenergy study is one of the important topics in sport. The vital energy in the human body is the source of movement and muscle contractions, the athletic performance of all kinds. The body contains different systems for the production of fast or slow energy depending on the needs of the muscle and the nature of sports performance. Therefore, training energy production systems and raising its efficiency leads to raising the body efficiency in the production of energy. One can get the energy compounds in the form glucose, fatty acids and amino acids which will be stored by the body and converted into energy. This energy is used to build Adenosine Triphosphate (ATP), a chemical source full of energy, which causes the muscle contractions. The free energy resulting from this reaction is rapidly converted because it does not need oxygen. Thus, it is responsible for rapid muscle work such as the jogging, but the amount of ATP in the body is limited enough to perform the work of muscle fast and for a short period of time.

To continue producing the energy, the player must have sources to help build his/her body on a continuously through the Adenosine Triphosphate system (ATP-pc) which depends on phosphocreatine system and lactic acid (Anaerobic Glycolysis) system. These two systems are the systems of producing the anaerobic energy and oxygen system, which relies on carbohydrate and fatty acids metabolism, where oxygen is available, therefore this system is called aerobic energy system.

In order to transform the energy, it undergoes a series of reactions and takes arranged steps and does not move from one step to the other only by a certain enzyme. Enzymes play an effective and strong role in stimulating and accelerating the reactions required to obtain energy.

As a result of the increased physical effort, lactic acid accumulates in the muscle. While in the absence of oxygen, transferring lactic acid from the muscle to blood decreases. Here, the different anaerobic point is the increase of the physical load, which increases the rate of lactic acid transfer from the muscles to blood

more than the rate of elimination. So, It is clear that lactic acid is produced by the transformation of glycogen into glucose and then to lactic acid.

The working muscles' need for oxygen is more than the availability of oxygen which results in imbalance between the supply and the available, so lactic acid turns into hydrogen and lactate ions produced by the inability of voluntary muscles to transfer oxygen to mitochondria. Once the lactate increases in blood, the liver converts lactate to Pyruvate by the hydrolyzed enzyme (lactate dehydrogenase) (LDH), which converts lactate to pyruvate and vice versa in the KREBS CYCLE by producing a part of the protons. The resulting proton is used as a pH stabilizer in the cell against excess PH. During the anaerobic exercises and anaerobic glycolysis an increase in the activity of the creatine kinase (CK), aldolase (ALD), and myolinase enzymes which are (ATP-pc) energy enzymes that help to produce more energy without oxygen as it works to break down fraction Fructose 1-6 biphosphate Anaerobic Glycolysis. In the recent period of the anaerobic glycolysis, pyruvate rates increase significantly to enter the KREBS CYCLE within the mitochondria by pyruvate dehydrogenase enzyme (PDH). There is another enzyme that works to oxidize the pyruvate to (acetyl-ka) which starts with carbs cycle, is called Keynes pyruvate and it has another role to move the pyruvate from the cytoplasm into the mitochondria to perform metabolism (**281: 277: 1**) (**79: 78: 6**) (**341: 333: 7**).

When the physical performance period is more than four minutes, the energy system here is in the presence of oxygen. Oxygen is an effective factor during the chemical reactions of the Adenosine Triphosphate (ATP) reconstruction. The oxygen system (aerobic) is done inside the muscle cell. The chemical reactions of the aerobic system to transform energy consist of three sources for the Adenosine Triphosphate (ATP) reconstruction by oxidation of carbohydrates, fats and protein; where as carbohydrates are converted into glucose, which is absorbed by the blood and stored mostly in the liver and then converted to glycogen and stored in the liver. The main function of carbohydrates, being the main source of energy, is to provide the human body with energy (for the two anaerobic and aerobic systems). Therefore, athletes eat food full of carbohydrates to increase aerobic capacity and doing well in races that depend on the aerobic system for energy production as well as anaerobic races with high intensity. (**1: 274-280**)

It has been found that the main reason for the formation of lactate during high-intensity physical effort is the activation of the lactate dehydrogenase enzyme (LDH), which is affected by the low degree of (PH in blood) during the anaerobic effort. Then, the interaction of pyruvate is directed to lactate and vice versa. On the other hand, in high-intensity physical effort with rapid performance, the lactate dehydrogenase enzyme (LDH) is highly susceptible to adhesion of pyruvate and converting them to lactate. However, low-intensity effort and long performance increase the conversion of lactate to pyruvate and therefore it is possible to consider (lactate acid) as a source of energy in slow muscles. This shows the importance of positive rest after the effort as it helps to convert lactate from muscles and links it to the slow muscles that you use as an energy source.

Scientific citation confirmed that during sports training at intensity more than 50% of VO2MAX, the components of the KREBS CYCLE were found to increase in the skeletal muscles clearly to increase the pyruvate rates resulting from the return of the anaerobic glycolysis which gives a high amount of pyruvate involved in KREBS CYCLE inside mitochondria by pyruvate dehydrogenase (PDH). (**2: 151-153**) (**19: 264-285**) (**290: 13**) (**295: 14**) (**124: 20**).

It was previously thought that the factors of KREBS CYCLE should be present in appropriate concentrations to maintain the cycle during the high intensity aerobic training. While it is recently matched by proofs that define this theory and its completely opposite now, as the components of the KREBS CYCLE decrease significantly during the long-term training until the stress.

The researcher thinks that eating food full of carbohydrates before or during the high-intensity training increases the concentration of the KREBS CYCLE rates. It was also proved that the components of the KREBS CYCLE is neither commensurate with the intensity of the training nor the amount of consumed energy and also during the high-intensity, short-term training, in which it is supposed to increase rates of lactate over the pyruvate rates. As it may, however, be accompanied by a significant increase in the rates of the KREBS CYCLE components and therefore these beliefs must be redrafted.

Thus, the researcher found the importance of the relationship between the components of the anaerobic and aerobic constituents (lactate / pyruvate) and the aldolase (ALD), (LDH-PDH) enzymes and their effect on high-intensity short-term exercises versus long-term exercises.

Research Objectives:

This research aims to identify the relationship between the shuttle movement of lactate / pyruvate and the Glycolysis enzymes of:

level of anaerobic lactate / pyruvate in a 400 m jogging race.

level of anaerobic lactate / pyruvate in a 300 m running race.

level of anaerobic lactate / pyruvate in running on the Treadmill series.

level of energy enzymes activation (aldolase (ALD) Anaerobic Glycolysis indicator- lactate dehydrogenase (LDH) enzyme, shuttle movement indicator), (pyruvate dehydrogenase (PDH), aerobic oxidative indicator) during the physical effort in a 400 m jogging, 3000 m running,. and running on the Treadmill series).

Research differences: -

There are statistically significant differences between the anaerobic lactate / pyruvate ratio for lactate in the 400 m jogging race.

There are statistically significant differences between the anaerobic lactate / pyruvate ratio for pyruvate in the 300 m running race.

There are statistically significant differences between the aerobic lactate / pyruvate ratio for pyruvate in running on the Treadmill series race.

There are significant differences in the (Aldolase - LDH - PDH) enzymes activation for all races (400 m jogging - 3000 m running - running on the Treadmill series).

Terminology: -

Lactate

"A chemical compound produced by the anaerobic glycolysis due to the breakdown of glucose molecules in the absence of oxygen." (**21**).

Pyruvate:

"An oxidized ketone with which anaerobic glycolysis starts, and the aerobic glycolysis cycle begins with the Krebs Cycle." (**21**).

Lactate De Hydrogenase (Ldh)

"A hydrolyzed enzyme that converts lactate into pyruvate and vice versa." (**1237: 13**).

Kinase Pyruvate

"An enzyme helps with the pyruvate oxidation to acetylchol, which starts with the Krebs cycle, and has another role to carry pyruvate from the cytoplasm into mitochondrial for metabolism." (**21**).

Anaerobic Threshold - At

"Increasing the physical load intensity which increases the rate of transferring lactic acid from the muscles to blood with a higher rate of disposal." (**285: 4**).

Krebs Cycle:

"A series of chemical reactions at the end of complete oxidation." (**286: 1**).

Aerobic Glycolysis

"A series of chemical reactions after anaerobic glycolysis in the presence of oxygen." (**266: 4**).

Anaerobic Glycolysis

"Reconstruction of ATP by partial fracture of glucose or glycogen in the absence of oxygen". (**265: 4**).

Aldolase:

"An enzyme fracturing fructose 1-6 biphosphate during anaerobic glycolysis " (**230: 21**).

Caytonat

"Hydrocarbons containing a cayton group (c=0) and naturally produced from fat cracking or some amino acids." (**135: 20**).

Previous studies: -

Parry et al. (**2000**) (**16**) conducted 16 studies entitled "The effect of interruptions on the performance and energy production of high intensity exercises". The researchers used the experimental method on a sample of (**10**) Players divided into two groups, each group has (**5**) players. The first group will perform running on the argometric wheel for 30 seconds strongly less than the maximum for two weeks without rest. The second group will perform the same program for six weeks strongly less than the maximum rate of one day and then two days rest after each training unit. Samples were taken from the two groups of lateral femoral muscle before and after starting the argometric wheel. The results showed that there is a statistically significant increase in the rates of the Glycolysis enzymes (phosphofructocenease-aldolase) and also the aerobic oxidation enzymes such as citrate (coenzyme, dehydrogenase) in the two groups. As for the creatine kinase enzyme, pyruvate kinase and lactate Hydrogenase, these enzymes gave a statistically significant increase in the group that underwent only the first program (for two weeks).

2. SPRIET et al. (2000) (23) conducted a study entitled "Enzymes necessary for the production of lactate in skeletal muscles during sports training" in order to identify the effect of different intensity exercises ranging from (25-35%) on the enzymes and transformation of Pyruvate in cytoplasm of VO2MAX skeletal muscles cells in order to reach balance under the influence of (lactate hydrogease) and pyruvate dehydrogenase enzymes., It also aims at establishing a relationship between the production of lactate and the enzymes activation in blood that control the ratio of glycogen analysis to glucose analysis (glycolysis). It also transfers the products to the mitochondria and cause them to enter into krebs cycle. The results are, at the level of low-intensity exercise, the pyruvate and enzyme production rates (dehydrogenase) are low and increase lactate slightly.

3 - HOWARTH et al. (**2004**) (**14**) conducted a study entitled "The impact of endurance on the rates of Kerbs Cycle construction" in order to identify the effects of endurance exercises on the rates of the Kerbs Cycle elements negatively and positively. The scholars used the experimental approach on a sample of **eight**22-year-old players working on the argometric wheel at an intensity of **80**% of the maximum oxygen consumption for an hour per day (**5**) days per week for **7** weeks. Samples were taken from the lateral femoral

muscle at resting time and after (**5**) minutes of exercise and at the level of effort. Other samples were taken after finishing the program. The most important results were performance improvement, which led to an increase in the maximum oxygen consumption, and the Kerbs cycle elements increased during the training stages, but decreased before (**5**) minutes from the end of the training. This indicates that there is no correlation between the Kerbs cycle elements and endurance training components, which proved that the anaerobic training does not depend on the Kerbs cycle elements only.

4- ROZENDAL et al. (**2004**) (**21**) conducted a study entitled "Movement of lactate, pyruvate and potassium in the fluid between the tissues of the trapezoidal muscles during the low-intensity training of the arm movement" to study the muscle response to the training of low-intensity and static contractions. The scholars used the semi-experimental approach on a sample of (**6**) players with average age of **28: 33** years old by electrocardiogram of the trapezius muscle and measuring the blood variables during the repeated movement of the arm for (20 minutes). As well as measurements after arm stabilization at the angle of **90** degrees and pressure by **20** % of the maximum strength of the arm for **10** minutes and after recovery (**60** minutes). However, at high rates of (**65: 90**%), it was found that the discrepancy between the ATP needed by the body versus VO2MAX produced by aerobic oxidation leads to increased glycogen and glucose analysis, with high increase of (PDH, LDH) in the production of pyruvate, which are affected by both enzymes leading to the production of a large amount of lactate and also the conversion of large amounts of pyruvate to (Estel Koenzin) moves to mitochondria, which increases the need for large amounts of oxygen for muscles to be able to produce large amounts of ATP.

5- CARLSON & PERNOW (**2008**) (**10**) conducted a study entitled "The use of oxygen and the formation of pyruvate and lactate in the feet during rest and effort in healthy people" to determine the effect of oxygen and the proportion of lactate / pyruvate at rest time and during sports training. Scholars used the semi-experimental approach on a sample of 15 male members where he conducted a sports training on the foot to measure the rate of oxygen saturation and measurement of blood lactate. The main results indicated that oxygen saturation after (**25**minutes) of effort reached (**81.53%: 42.22%)** and lactate increased from (**4.45%: 8.86%) ml / mol.**

Research procedures:

Curriculum used: -

The scholar used the semi-experimental method using the measurement (before - after) for one group to suit the nature of the research.

Community Research: -

The research community was chosen in a deliberate manner from the Athletics team at Kadhmaclub of the ages of 18-21 years and the number of the search community is (13) players.

Research Sample: -

The sample was randomly selected from the research community. The sample consisted of (**8**) female players of (**61.5**%) of the original society. Only one group applied the research. The sample consisted of (**3**) female players for a 400 m jogging and 5 female players for running long distance.

Reasons for sample selection:

The presence of female players involved in a 400-meter jogging as short distances (anaerobic).

The presence of female players involved in long-distance races (aerobic).

The approval of the female players (the research sample) to apply the research on them.

The approval of the female players (the research sample) to take (**6**) blood samples before and after.

The presence of a stadium where the races are applied.

Research Tools: -

In light of the research requirements and objectives, the researcher used some devices and tools to achieve the measurements of the research are as follows:

First: Stop watches to measure the time of the nearest two parts of one hundred on the second in the following digital measurements:

400 m jogging.

3000 m running.

Treadmill series running for one hour at medium intensity.

Second: Biochemical measurements:

Centrifuge for blood separation.

measure of the lactate ratio in blood.

measure the pyruvate ratio in blood.

Measurement of energy enzymes (Aldolez - lactate dehydrogenase LDH - pyruvate dehydrogenase PDH).

Medical cotton.

White alcohol.

Test tubes to save blood samples.

A box with crushed ice to save blood.

Heparin to save blood from clotting.

Laboratory technician to take blood samples.

Syringes for blood sampling.

The Exploratory Pilot Study: -

The researcher conducted the exploratory study on a sample of the same type of research sample and outside the original sample and the number of (**3**) players on Thursday **4/12/2017** with the purpose of:

Providing a stadium to measure 400 m jogging, and 3000 m running.

Providing the Treadmill series device and its validity for measurement.

Providing a suitable place to take blood samples.

Determination of the appropriate time and place for blood sampling.

How to unload the results from the forms and its registration.

Providing the laboratory in which blood samples will be analyzed.

The researcher also checked the ability of the players to run on the Treadmill series for an hour with a medium intensity.

Basic Study:

First: The researcher met the members of the research sample for the purpose of:

Clarification of the research problem and its practical importance.

Clarifying the method of work.

Explaining how blood samples are taken and their timing.

Agreement with the members of the sample to abide by the timing of the measurements and the blood sampling.

The members of the research sample were advised to eat the breakfast meal two hours before the meeting.

Second: The researcher conducted the experiment on four days for easy measurements.

First day: Monday **8/12/2017** to measure **400** m jogging.

Second day: Monday**16/12/2017**to measure **3000** meters running.

Third day: Monday, **22/12/2017,** and the **fourth day**: Tuesday, **23/12/2017** to measure the running of Treadmill series.

The measurements and experiment were as follows:

First Day: Monday **8/12/2017**

The research sample was collected at the Kadhma Club Stadium at 8 am, as well as the presence of the doctor and his assistants.

Blood sampling were performed before training from each player individually before jogging 400 m by the specialist doctor and his assistants.

400 m jogging was performed for each player respectively.

Blood sampling were performed after training from each player individually, provided that this is after the end of the race directly.

Second day: Monday, **16/12/2017**

The research sample was collected at the Kazaa Club Stadium at 8:00 am, as well as the presence of the doctor and his assistants.

Blood sampling were performed before training from each player individually before 3000 meters running by the specialist doctor and his assistants. .

3000 meters running was performed for each player respectively.

Blood sampling were performed after training from each player individually, provided that this is after the end of the race directly.

The third day: Monday, **22/12/2017** and **the fourth day**: Tuesday, **23/12/2017.**

The study sample was divided into two days to measure the running for an hour on the walk to make it difficult to measure on one day.

The research sample was collected at the Kazma Club at 9:00 am where the doctor and two assistants were present.

Blood sampling was performed before the training from each individual player prior to running on the Treadmill series for an hour by the specialist doctor and his assistants.

The one-hour running on Treadmill series course for each player was conducted by 60% of the maximum level of the player.

blood sampling was performed for each player individually, provided that this is after the end of the running on the Treadmill series directly.

Statistical treatments used:

The researcher used the package of Statistical Programs For Social Sciences SPSS to conduct the statistical treatments appropriate to the nature of the research.

Arithmetic mean.

Standard deviation.

Analysis of variance.

The level of significance at **0,05.**

Results View and Discussion:

First: Results View:

Table (1) shows that there are no statistically significant differences in search variables.

Measurement before training	400-meter Jogging		3000-meter Running		One-hour-Running on the Treadmill series	
	m	rate	m	rate	m	rate
Lactate	1.25	0.16	1.26	0.15	1.18	0.18
Pyruvate	71.38	9.04	70.13	9.13	67.13	6.15
Lactate / Pyruvate	17.56	2.13	18.12	2.95	17.67	2.87
LDH Enzyme	297.25	45.28	303.88	34.28	294.13	35.32
Adolise Enzyme	2.43	0.47	2.63	0.93	2.56	0.56
PDH Enzyme	21.25	5.09	21.25	5.60	23.25	8.10

Table (1) Measurements before training of the search variables in the 400 m jogging - 3000 m running – Running on the Treadmill series (Lactate - Pyruvate - Lactate / Pyruvate - "LDH - Aldolese - PDH") N = 8.

Table (2) Significance of differences between the measurement before and after the training in a 400-meter jogging race in the variables under consideration.

Table (2) shows that there are statistically significant differences between the measurements before and after training in search variables (Lactate - Pyruvate - Lactate / Pyruvate - LDH - Aldoliz - - PDH ") for the benefit of the measurement the after training of the 400-meter Jogging. N = 8

Measurement of a 400-meter variable	**before**		**after**	
	m	rate	m	rate
Lactate before 1	1.25	0.16	5.05	0.41
Pyruvate before 1	71.38	9.04	154.38	10.81
Lactate / Pyruvate before 1	17.56	2.13	32.12	4.04
LDH Enzyme before 1	297.25	45.28	585.00	57.22
Adolise Enzyme before 1	2.43	0.47	5.96	1.12
PDH Enzyme before 1	21.25	5.09	29.63	4.14

Table (3): Significance of differences between the measurement before and after the training in a 3000-meter running race in the variables under consideration N = 8.

Table (3) shows that there are statistically significant differences between the measurements before and after training in search variables (Lactate - Pyruvate - Lactate / Pyruvate - LDH - Aldoliz - - PDH ") for the benefit of the measurement the after training of the 3000-meter Running.

Measurement of a 3000-meter variable	**before**		**after**	
	m	rate	m	rate
Lactate before 2	1.26	.15	4.50	.48
Pyruvate before 2	70.13	9.13	201.50	33.24
Lactate / Pyruvate before 2	18.12	2.95	21.07	4.47
LDH Enzyme before 2	303.88	34.28	580.63	47.59
Adolise Enzyme before 2	2.63	.93	5.39	.75
PDH Enzyme before 2	21.25	5.60	31.25	4.71

Table (4): Significance of differences between the measurement before and after the training in one-hour-running on the Treadmill series in the variables under consideration.

Table (4) shows that there are statistically significant differences between the measurements before and after training in search variables (Lactate - Pyruvate - Lactate / Pyruvate - LDH - Aldoliz - - PDH ") for the benefit of the measurement the after training in one-hour-running on the Treadmill series.
N = 8

Measurement of one-hour-running on the Treadmill variable	**before**		**after**	
	m	rate	m	rate
Lactate before 3	1.18	.18	3.86	.47
Pyruvate before 3	67.13	6.15	221.50	65.82
Lactate / Pyruvate before 3	17.67	2.87	17.80	5.68
LDH Enzyme before 3	294.13	35.32	560.75	43.76
Adolise Enzyme before 3	2.56	.45	3.99	.98
PDH Enzyme before 3	23.25	8.10	28.63	5.32

Table (5) shows the analysis of the differences between the search variables and the comparison of the measurements before the training (rest time) for the three stages. The results showed that there are no statistically significant differences in all the research variables in the measurements before the training.

Table (5) Analysis of variance to indicate the differences between the measurements after the training of the variables research.

variables	groups	Square's Total	Freedom degree	Squares Average	F	P
Lactate	Between groups	.025	2	.01	.454	.641
	Inside groups	.58	21	.03		
	Total	.61	23			
pyruvate	Between groups	126.08	2	63.04	.966	.397
	Inside groups	1369.88	21	65.23		
	Total	1495.96	23			
Lactate/ Pyruvate	Between groups	.60	2	.30	.041	.959
	Inside groups	151.21	21	7.20		
	Total	151.81	23			
LDH Enzyme	Between groups	260.40	2	130.20	.087	.917
	Inside groups	31443.44	21	1497.31		
	Total	31703.83	23			
Adolise Enzyme	Between groups	.19	2	.09	.215	.808
	Inside groups	9.08	21	.43		
	Total	9.27	23			
PDH Enzyme	Between groups	80.90	2	40.45	1.061	.364
	Inside groups	800.93	21	38.14		
	Total	881.83	23			

P is statistically significant when less than 0.05

Table (6) Analysis of variance to indicate the differences between the measurements after the training of the variables in question

variables	groups	Square's Total	Freedom degree	Squares Average	F	P
Lactate after	Between groups	4.95	2	2.47	10.38	*.001
	Inside groups	5.00	21	.24		
	Total	9.95	23			
Pyruvate after	Between groups	18460.65	2	9230.33	4.92	*.018
	Inside groups	39425.30	21	1877.40		
	Total	57885.96	23			
Lactate/ Pyruvate after	Between groups	879.81	2	439.91	18.43	*.000
	Inside groups	501.34	21	23.87		
	Total	1381.16	23			
LDH Enzyme after	Between groups	1098.40	2	549.20	.21	.809
	Inside groups	53759.56	21	2559.98		
	Total	54857.96	23			
Adolise Enzyme after	Between groups	10.06	2	5.03	4.66	*.021
	Inside groups	22.66	21	1.08		
	Total	32.72	23			
PDH Enzyme after	Between groups	54.38	2	27.19	1.28	.300
	Inside groups	446.95	21	21.28		
	Total	501.33	23			

Table (6) shows that P is a statistical function at a level less than **0.05**

There are statistically significant differences in the ratio of lactate for the measurement of the 400 meters jogging after the race.

There are statistically significant differences in the ratio of pyruvates for the measurement of the 3000 meters running after race and running on the Treadmill series for an hour.

There are differences with a function of the ratio of lactate / pyruvate for the measurement of 400 meters jogging race.

There are statistically significant differences in the level of the Aldolese enzyme for the measurement of the 400 meters jogging after training.

Results Discussion: -

The results of table (2) showed statistically significant differences in the search variables represented by (Lactate, **0,001 <P**), pyruvate less than 0,02 and the percentage of lactate / pyruvate is less than (**0,001 <P**). These results indicate that the lactate ratio is very high in the anaerobic effort of 400 meters jogging. This effort is less than the anaerobic threshold, where most of the energy is from the anaerobic glycolysis that ends with lactate. In this case, lactate is required to produce as many ATP molecules as are needed during this effort. Lactate becomes more reduced than pyruvate, it is also required as an antioxidant, noting that most of the tissues involved in anaerobic effort are fast fiber tissues that produce more lactate, which explains the increase of lactate significantly after a 400-meterjogging. These results agree with the view of Chary et al. (**2008**) (**11**) that lactate begins to accumulate in blood when the need for oxygen in the active or active muscles is unequal, which increases the anaerobic metabolism for producing ATP molecules quickly resulting in lactate. Therefore, Bahaa Salamah (**2008**) (**4**) thinks that when the physical work is of high intensity and a short period of time, it increases the rate of production of lactate in blood. As a result, The first hypothesis, which states that there are "statistically significant differences between anaerobic lactate / pyruvate and lactate in the 400 m jogging race," is achieved.

The results of Table (**3**) showed that there are statistically significant differences for the variables in the study of pyruvate. The increase was higher after **3000**-meter running and increased after one hour of running on the Treadmill series. Although the change of pyruvate after 3000-meter is obvious as it is produced from the effort of the aerobic effort of 3000-meter running, a period of 10: 15 minutes which does not consume all the glycogen stored in the muscles and liver and therefore the rates of pyruvate and the involvement of slow fibers in the aerobic effort increases the need for Lactate was converted into pyruvate. Therefore, the pyruvate rates were statistically significant after **3000**-meter running. Thus, the second hypothesis, which states: "There are statistically significant differences between the ratio of lactate / pyruvate for pyruvate in the **3000** meter running race.", is achieved.

The results of Table (**4**) showed that there are statistically significant differences in the search variables represented by the pyruvate. The percentage increased after an hour of walking on the Treadmill series. The pyruvate rates are supposed to decrease due to the consumption of glycogen and hence the decrease in glucose levels within the cell. On the other hand, the results proved the rates have exceeded **3000**-meter running. This can be explained by the fact that the amino acids produced by the breakdown of amino acids (proteins) can increase pyruvate rates in relation to decreasing lactate rates. This is consistent with the study of **HASHIMOTO** et al. **2008** (**13**) who refers that Amine acid increases versus in the amount of lactate decreases and leads to a rise in pyruvate rates. This indicates that metabolism follows more complex methods of exchange between lactate and pyruvate, thus achieving the third hypothesis which states: "There are statistically significant differences between aerobic lactate / pyruvate for the pyruvate in running on the Treadmill series. "

Tables (2, 3, 4, 6) show statistically significant differences in the search variables lactate / pyruvate. They increase and decrease according to the concentrations of lactate or pyruvate during the three stages with the different times. It reached its peak after **400**-meter jogging, asit produced more lactate due to the anaerobic exercise. But it decreased by **3000**-meter running due to the balance between the production of lactate and re-converting it to pyruvate for reuse in the aerobic effort by the (LDH) enzyme. However, after an hour of running on the Treadmill series, Lactate has decreased markedly due to decreased rates of glycogen breakdown to glucose while maintaining pyruvate, which consists of ways other than cell glucose. (**8: 258-264**).

As for aldolase enzyme, it works in the anaerobic medium. At the beginning of the effort in the anaerobic medium, its concentrations were at its highest value, but after **3000**-meter running, the value was reduced due to the balance between pyruvate and lactate and also to regularize the anaerobic Glycogen rates by increasing lactate concentrations. For an hour, after running on the Treadmill series, aldolase enzyme reached its lowest level, stating that the arrival of glucose levels within the cells to the lowest levels.

As for the energy enzymes (LDH, PDH), it had a level of stability and close results after the performance of the three stages in the search and there were no significant differences because the LDH enzyme is a two-way enzyme that works on lactate and turns it into pyruvate and vice versa. Therefore, it is not affected by the concentrations of lactate or pyruvate because it activates in the case of increased lactate in the direction of pyruvate according to the law of mass action and vice versa. Besides it works in all cases regardless of the concentration of lactate or pyruvate. Regarding the PDH enzyme, it converts the pyruvate into acetylcoa to begin the krebs cycle. Lactate, which is produced during the anaerobic effort, is carried on the transport proteins MCTs and transferred to other muscles, which are converted into pyruvate again and used as an energy source. This

explains the absence of statistically significant differences in the cases of the anaerobic effort. In the case of aerobic effort, Lactate production is balanced with pyruvate production rates as in 3000-meters running race. In this case, the PDH enzyme is responsible for converting the resulting pyruvate into acetylcholine within the same tissue. In the case of one-hour-running on the Treadmill series, the pyruvate does not decrease as expected but is manufactured from other sources other than glucose. Therefore, under all efforts, its function is semi-constant, which makes its concentrations stable during all efforts (**10: 328-342**).

Thus, the fourth hypothesis was partially achieved with respect to the aldolase enzyme and was not achieved for LDH-PDH.

Conclusions:

Thanks to the results of the researcher, he concluded the following:

Producing energy during the sports effort begins with the anaerobic glycolysis resulting in pyruvate that turns into lactate in the case of hypoxia under the influence of (LDH) enzyme. The resulting lactate is either transported on transport proteins (MCTs) to white fibers, which reintroduce them to pyruvate and use to enter a krebscycle or seep into the blood and act as a hormone to actarum by affecting the metabolism of energy.

During the aerobic sports effort, the start of the glycolysis produces lactate. Lactate is also converted into pyruvate under the influence of (LDH) enzyme but according to the effect of the law of mass action until reaching equilibrium.

The (PDH) enzyme converts pyruvate into acetylcholine and also inserts pyruvate into the mitochondria to enter the krebscycle until it is completely oxidized to water and carbon dioxide.

In the long-term effort, glucose produced by glycogen decreases strongly and affects lactate formation rates, but pyruvate is produced from other sources (proteins). Therefore, aldolase rates decrease while PDH) Remain constant.

During the various activities (400-m jogging–3000-m running–one-hour-running on the Treadmill series), the production and transformation of both lactate and pyruvate to each other produce what is so-called shuttle movement between them which is subject to many factors determined by the type of effort and enzymes active in each Effort.

Recommendations:

Through the conclusions reached by the researcher and in the presence of the research sample, the researcher recommends the following:

Use glucose syrup before or during the long-term training program.

Anaerobic exercises must be accompanied by aerobic exercises and vice versa.

References

1. Abu Ela Abdel Fattah 2003: physiology of training and sports, the Arab Thought House.
2. Abu Ela Abdel Fattah - Ahmed Nasr El-Din 2003: physiology of fitness, the Arab Thought House.
3. Ahmed Nasr El Din 2003: physiology of sport (theories - applications), the Arab Thought House.
4. Bahaa El Din Ibrahim Salameh 2008: Biochemical Properties of Sport Physiology, Arab Thought House, Cairo.
5. Zakia Ahmed Fathy - Mahmoud Elnaggar 2001: Physiology of sports (applications), tomorrow printer.
6. Maha Khalil and others 2017: physical effort physiology (between theory and practice), a university book published (Helwan University).

1/7/2018