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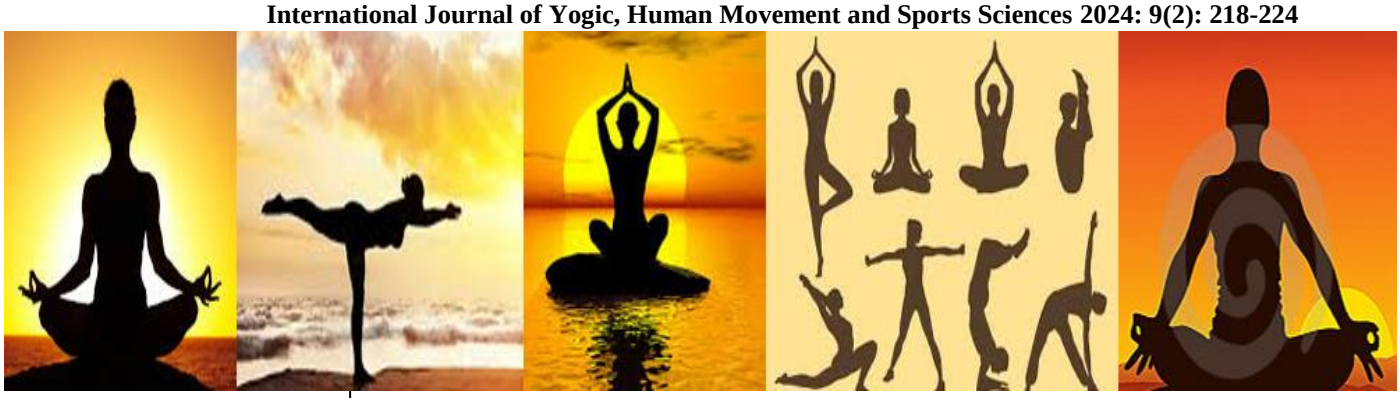

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The effect of hypoxic training on some antioxidants and the 800-meter running achievement for advanced athletes

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Abstract
The hypoxic training method relies on the exercises of the lack of oxygen in tissues, especially working muscle tissues. Given the circumstances that the whole world is experiencing at this time as a result of the spread of the Coronavirus (Covid-19) and the increased use of masks to prevent this disease, the researcher intended to develop exercises according to the hypoxic method, as runners performing exercises while wearing masks to identify the effect of this training method on the level of some antioxidants in the blood such as enzymes [hexokinase (HK), superoxide dismutase (SOD)], and glutathione (GSH) and a runner's achievement (800) meters. These exercises lead to a lack of sufficient oxygen supply to the tissues, as the blood is not saturated with oxygen as a result of the use of protective masks. The research sample consisted of (6) runners representing the Anbar Governorate national team for applicants who ran (800) meters. The researcher assumed that hypoxic training would affect the level of antioxidants and performance among the research sample. The researcher used the experimental method to solve his research problem. It was concluded that hypoxic training led to a difference in the level of the studied antioxidants in the blood, as well as an improvement in the level of achievement of running (800) meters. The researcher recommended monitoring the level of antioxidants in the blood because of their importance in the energy production processes which is necessary to perform the requirements of this sporting event that requires effort and great anaerobic endurance, as well as adopting this training method to develop the achievement of runners in general, especially 800-meter runners.

Keywords: Hypoxic training method, oxygen deprivation, muscle tissue, COVID-19

Introduction
Athletics events are among the games that are widely popular all over the world because of the thrill and excitement they contain as a result of the competition that occurs between players to obtain advanced positions in the sporting event that they practice, especially the 800-meter running race, which is characterized by great fun when runners compete**.** The runner of this sporting event must possess most of the physical qualities and abilities in order to achieve optimal achievement, because its race falls within the lactic anaerobic energy production system, while its training requires exercises that fall within the anaerobic and aerobic energy production systems. Therefore, the 800-meter runner needs to exert great effort and energy, whether during training or competition, by using many training methods and techniques, including the hypoxic method, through which the runner can withstand the lack of oxygen that the working cells and tissues need to produce the energy necessary to finish the race. Especially in the last meters of the race. The importance of the research lies in the fact that it is one of the few studies that address the search for methods that are of great benefit to the athlete's health and improve his performance by studying the effect of hypoxic training on the level of completion of (800) meters and some antioxidants in the blood, especially enzymes that help in metabolic processes or enzymes that reduce injuries resulting from the accumulation of free radicals resulting from physical effort in the research sample.

Research problem
Given that the researcher is a former runner and currently a coach for short- and medium-distance runners and follows developments occurring at the global level in the science of

sports training physiology, notes that most coaches do not use the hypoxic training method, despite its importance for 800-meter runners in adapting their functional systems to withstand the deficiency in oxygen needed by working cells and tissues, especially in the final distances when exercises are repeated during training or the last meters of competition. Also, the cessation of daily life at this time due to the spread of the Corona disease (COVID-19) and the need for the research sample not to stop performing their exercises as they are going through a special preparation period close to the competition period and the necessity of wearing masks to prevent this disease, therefore, the researcher considered these reasons an important problem worthy of study and decided to develop exercises according to the hypoxic training method, which requires a tool that reduces the blood oxygen level. After noticing an appropriate opportunity for this type of training that increases the level of endurance among the research sample during performing the exercises for this training method while wearing masks to prevent disease on the one hand and to increase their physical ability to withstand the speed and strength necessary to perform the exercises or tests despite the significant lack of oxygen reaching the working tissues as a result of the low percentage of oxygen in the blood due to wearing masks on the other hand. In addition to knowing the effect of this training method on the level of some blood antioxidants such as the enzymes [hexokinase (HK), superoxide dismutase (SOD)] and glutathione (GSH), as well as increasing their ability to cover a distance of (800) meters in the shortest possible time to achieve the best achievement.

Research Aims

- Developing exercises according to the hypoxic training method for the research sample.
- Identify the effect of hypoxic training on the level of enzymes [hexokinase (HK), superoxide dismutase (SOD)] and glutathione (GSH) in the blood, and achieve (800) meters in the research sample.

Research Hypotheses

There are statistically significant differences between the pre- and post-tests in the completion of running (800) meters and the enzyme levels [hexokinase (HK), superoxide dismutase (SOD)] and glutathione (GSH) in the blood of the research sample.

Fields of Research

Human field: The Anbar Governorate team ran 800 metres.

Time domain: For the period from 3/15/2020 until 7/12/2020.

Spatial domain: Ramadi Club Stadium.

Theoretical studies

Hypoxic training method

The exercises of this training method are characterized by increasing the athlete's ability to withstand the lack of oxygen when he performs continuous physical effort, and this leads to an increase in oxygen debt, as the oxygen tension decreases as a result of the decrease in the speed of its diffusion from the blood to the muscle tissues. Which means "reducing the delivery of oxygen to the working muscles to make them work under difficult conditions represented by the lack of oxygen available for energy production, which leads to the accumulation of lactic acid during high-intensity physical effort" [1]. The importance of hypoxic training lies in performing physical exercises that prevent oxygen from reaching the working cells of all functional organs in a sufficient amount so that those functional organs adapt to withstand physical effort, whether during training or competition, especially sporting events whose training and competition require high intensity. Such as the 800-meter race, most of its exercises are part of the lactate anaerobic energy production system because most runners can finish this race in less than two minutes, therefore, this sporting event falls within the lactic system for energy production, which is characterized by "the runner's ability to perform and repeat muscular work at maximum speed and strength for a period ranging from (30-120) seconds and to withstand fatigue resulting from the accumulation of lactic acid in the muscle" [2]. The other Methods of reducing the rate of oxygen entering the body include ″placing masks over the nose and mouth, holding one's breath during training, or training in closed halls that contain small amounts of oxygen, or reducing the number of breathing times while performing exercises or training in areas high above sea level." In which the partial pressure of atmospheric oxygen decreases, which makes it difficult for oxygen to reach working tissues and thus leads to a state of lack of oxygen in the body (Hypoxia)" [3]. This state of lack of oxygen adapts the functional body systems of the runner, as it leads to "an increase in many physiological variables, including an increase in the respiratory rate, the amount of blood flow, mitochondria, the maximum oxygen consumption (VO_2max), the number of red blood cells, and the amount of hemoglobin. In addition to the adaptation of the muscular system and the circulatory system, especially the changes that occur to the blood plasma, which increase its ability to transfer appropriate oxygen to the working cells, which store a larger amount of oxygen than what they use during exercise" [4]. As a result, "the athlete's ability to bear the oxygen debt increases as a result of the resilience of his internal organs due to the lack of oxygen, and the emergence of physiological responses for adaptation to occur and helps speed up recovery while lowering the pulse rate at rest and during effort" [5]. Therefore, the benefit of this training method appears to be that it increases the level of hemoglobin in the blood and improves the efficiency of the working functional systems, especially the circulatory and respiratory systems, which leads to a delayed appearance of fatigue in runners and an endurance to the performance of competition that requires high physical skills and abilities, especially in the last meters of the race.

Antioxidants

When performing physical training, the muscles' need to consume oxygen increases by approximately (10-20) times more than at rest and this huge increase in oxygen consumption leads to an increase in free radicals as a waste of the oxygen leaking from this process, also, the changes that occur in blood dynamics after the end of physical activity and the rapid rush of blood to fill the deficiency in working cells and tissues lead to the formation of the most dangerous free radicals. In addition, (2-4%) of the oxygen treatment processes in the body, especially when using the anaerobic energy production system, lead to the formation of free radicals, whether during or after physical effort [6].

From a biochemical standpoint, antioxidants are "various compounds, some of which belong to the group of vitamins, some of which are attributed to the group of mineral elements,

and some of which are enzymes that help regulate harmful free radicals that harm the cells and tissues of the body in order to remove them or repair the damage resulting from them, Therefore, antioxidants are divided into enzymatic and non-enzymatic antioxidants [7]. Free radicals cause damage to the lipids and proteins found in cell membranes, as well as deoxyribonucleic acid and other cellular compounds. Damage to membrane lipids occurs through the oxidation of polyunsaturated lipids, known as double lipid oxidation. Free radicals are formed as a natural response of the body to training, and these antioxidants protect the cells from damage caused by them during metabolism process to produce energy in athletes, especially 800-meter runners, these antioxidants work to "remove the active species of oxygen from the body through the defence systems of antioxidants to protect the body from the occurrence of oxidative stress status resulting from a disturbance in the balance between the oxidants, which include the active species of oxygen, and the defensive systems of antioxidants" [8].

Hexokinase (HK)

The hexokinase enzyme is "one of the proteins that is classified within the main group of transport enzymes that have an important role in the metabolism of living organisms, especially the breakdown of glucose within the muscle with the help of the adenosine triphosphate (ATP) molecule [9]. This enzyme belongs to the family of hexose phosphorylates, which are six-carbon sugars. "The percentage of hexokinase enzyme in the body ranges between (1.5 - 24 ng/ml), it is found in all cells of the body, especially liver cells, to carry out the process of phosphorylation and produce energy by converting glucose into (glucose-6-phosphate) using (ATP)" [10]."Phosphates play a role in regulating the hexokinase enzyme during breathing, especially when the access of oxygen and glucose to working cells decreases. This enzyme also plays a major role when the concentration of glucose in the blood increases and works in the opposite direction when glucose concentrations are low, one of its most important functions is that it metabolizes glucose in the liver to maintain the continued breakdown of glycogen to supply the cells with energy.

When the level of oxygen in the blood decreases, the hexokinase enzyme also helps to transfer phosphate from (ATP) to restore the lost phosphate from glucose during the metabolic process to form other glucose in processes that are part of the anaerobic glucose lysis system" [11]. Therefore, the enzyme hexokinase is very important in the chemical reactions of metabolism to produce energy, especially for athletes who need continuous energy to perform physical effort that is proportional to the intensity of training, whether during training or competition.

Super Oxide Dismutase (SOD)

This enzyme is classified as a "mineral-binding protein that neutralizes some free radicals with the help of some minerals such as selenium, copper, zinc, and manganese." Therefore, it is an important antioxidant that works to re duce oxidative stress and protect the cell membrane from damage resulting from the presence of the superoxide radical, which increases the speed and activity of the reactions of converting the negative superoxide radical into hydrogen peroxide ($H2O_2$)" [12]. "The percentage of superoxide dismutase enzyme in the body ranges between (165 - 240 U/ml), and there are two types of this enzyme: The first type is linked to the element copper and works to protect the cell cytoplasm, as free radicals are produced as a result of the activities of various metabolic processes. As for the second type, it is linked to the element zinc, which is effective in protecting the mitochondria of cells, which are the main site of energy production, as well as containing the genetic information of the cells)" [13]. Therefore, the main function of the SOD enzyme is to restore cell vitality and reduce the speed of their destruction because it neutralizes the free radicals responsible for them by decomposing the toxic products of cellular metabolism by removing the oxygen radical (O_2) and accelerating the rate of its transformation into (H_2O_2).

Glutathione (GSH)

Glutathione is one of the non-protein compounds containing thiols that provides major protection against severe oxidation cases, as it is called the miracle of antioxidants. It is a peptide composed of the linkage of three amino acids {Glutamate, Cysteine, and Glycine} [14]. The thiol group works to "remove free radicals, and the percentage of glutathione in the body ranges between (3.8 - 5.5 Umol/L). Glutathione exists in two forms: the reduced form (GSH) and the oxidized form, which is formed as a result of the oxidation of the (SH) group, forming a double sulfur bond compound (GSSG)) In most human cells, the ratio (GSH/GSSG) is (1/10)" [15]. Glutathione is "a water-soluble antioxidant that is formed within the body and differs from non-enzymatic dietary antioxidants such as selenium and vitamins (A, C, E). It can be formed in the body from amino acids, mainly in the liver, and it has a major role in protecting the cell from oxidative damage, as glutathione, with the presence of the enzyme (GPX), constantly reduces (H_2O_2) to water while oxidizing the reduced glutathione and converting it to the oxidized form, glutathione can interact directly with free radicals such as {(O_2), (OH), (LO), (LOO)} as the sulfur group loses a hydrogen atom, which leads to the production of a radical [(GS) thiyl] that can join with another radical to form a molecule. (GSSG)" [16]. Glutathione performs many vital processes, including transporting amino acids, defending the body from toxins, and metabolism, especially for athletes who need continuous energy during sports training or competition, it also "contributes to the formation of proteins and nucleoids, as well as increasing the effectiveness of some enzymes by being present as a substrate or co-enzyme for some enzymatic processes in the cell, such as the synthesis of DNA from the amino acids that make it up, with the help of the enzyme (Glut amyl Cysteine Synthase) and the enzyme (GSH Synthase) using two molecules of (ATP), the process of its synthesis takes place mainly in the liver, and glutathione also works as an assistant to the enzyme (GPx Glutathione transfer)" [17].

Research methodology and field procedures

Research methodology

The researcher used the experimental method by designing one group with two tests, pre and post-tests, for its suitability to the nature of the research problem.

Research Sample

The research sample was tested intentionally with (6) runners representing the Anbar Governorate team, running (800) meters for the applicants. Table 1 shows the homogeneity of age and variables under study.

Table 1: Showing the homogeneity of the research sample

Variables	Measuring Unit	Mean	Standard deviation	Median	Kurtosis*
age	Year	23.33	2.658	23.50	- 0.192
training age	Year	5.166	2.136	5.00	0.233
Enzyme HK	ng / ml	18.22	1.055	17.90	0.919
Enzyme SOD	U / ml	206.83	9.967	205.50	0.404
Glutathione	Umol / L	4.98	0.248	4.95	0.363
800m achievement	Second	121.5	2.178	121.25	0.344

*The distribution is moderated if the values of kurtosis are less than (±3)

Pre-Tests

Pre-measurements of the biochemical variables under study were conducted in the Al-Shifa Laboratory, while the achievement was tested at the Ramadi Sports Club Stadium on (3/17/2020) according to the following.

Measurement of enzymes

Blood samples (10 CC) were taken in the Al-Tameez Laboratory for Medical Analysis from each sample to measure the level of the enzymes under study in the blood, and the blood plasma (serum) was isolated using a centrifuge (SentriFuge). The device rotates at varying speeds and times at room temperature, and these speeds and times are proportional to the characteristics of examining each enzyme individually. The plasma samples are then placed in an ELISA dish and then treated with chemicals specific to each enzyme (Kits). It is treated in two forms (a standard solution and a control solution), each separately, and then the absorbance is read with a spectrophotometer (Spectro Photo Meter) according to special wavelengths depending on the type of enzyme**.** The absorbance of the hexokinase enzyme was read at a wavelength of (490) nanometers**.** The enzyme superoxide dismutase was detected at a wavelength of (450) nanometers, while the color change of glutathione was monitored and read on a spectrophotometer at a rate ranging between (412 - 450) nanometers**.** Then the results of the device were recorded, statistical equations specific to each enzyme were entered, and the results of those equations were recorded and adopted as a measure of the level of concentration of each enzyme in the blood of the research sample.

Completion test (800) meters

- **The goal of the test:** Is to measure the achievement of running (800) meters.
- **Tools used:** Playground, stopwatches, timers, registration form, shooting gun.
- **Description of performance:** The test begins from the legal position of the start of middle-distance races, as the runners take their place behind the starting line, and when the start signal is heard, the clock is started and the runners run each in their own field for a distance of (800) meters, and the stopwatch is stopped as soon as the runner reaches the finish line.
- **Scoring:** The scorer records each runner's time on the scoring form, rounded to the nearest tenth of a second.

The main experience

The research sample applied exercises according to the method of hypoxic exercises, which was characterized by reducing the percentage of oxygen entering the lungs through wearing masks by the research sample, and this leads to a lack of oxygen reaching the blood, the working cells and tissues of the body. The runners ran continuously according to the method of high-intensity interval training, with an intensity between above average and below maximum for a period not exceeding half an hour, considering the principle of gradual increase in load, thus, the training volume with a lack of oxygen ranged between (30 - 50%) of the total volume for the main part of the time of each training unit, which is one hour, with an emphasis on not using hypoxic training for successive training units. Moreover, these training units amounted to three units out of a total of six units per week, so the training units included in the training curriculum prepared by the researcher according to the hypoxic training method were (24) training units**,** the researcher was careful not to use these exercises for a long period of time, which would not be appropriate to the physiological and physical level of the sample, for fear of some damage occurring that accompanies the lack of oxygen reaching the body's functional systems, such as runners suffering from headaches, fainting, etc, plus, the runners monitor the level of their running technique to not reach a state of abnormal fatigue that affects the work of the functional devices, thus, disrupting the technical performance of the running steps as a result of a decrease in their physical fitness**,** the researcher chose the timing of the hypoxic training at the beginning of the research sample entering the special preparation period and relatively long before the competition period because the exercises of this training method affect the actual and technical performance of the runners during the competition**.**

Post Tests

The post-tests were conducted in the same manner as the pretests, as the researcher took the measurements and the test under study on (5/18/2020).

Statistical Means [18]

Mean, Median, Standard Deviation, Kurtosis, T-Test.

Presentation, analysis and discussion of the results

Presentation and analysis of the results

Table 2: Statistical treatments of pre and post-tests of research variables

Variables	Pre-test		Post-test		X Variance	S Variance	T-test Cal.	Results
	X	S	X	S				
Enzyme HK	18.22	1.055	19.73	1.104	1.516	0.087	17.425	Significant
Enzyme SOD	206.83	9.967	219.33	9.750	12.50	0.620	20.161	Significant
Glutathione	4.98	0.248	4.35	0.362	0.633	0.061	10.377	Significant
800 m achievement	121.5	2.178	117.93	2.399	3.566	0.253	14.095	Significant

The results of Table (2) for the pre- and post-measurements of the research variables (hexokinase enzyme, superoxide dismutase enzyme, glutathione, 800-meter competition) indicated that different differences were recorded between the pre- and post-measurements amounting to (1.516, 12.50, 0.633, 3.566), respectively**,** while the deviations of these differences were (0.087, 0.620, 0.061, 0.253), respectively, and thus the value of (T-test) calculated for the research variables reached (17.425, 20.161, 10.377, 14.095), respectively**,** when compared to the tabular score of (3.365) at the significance level (0.01) and the degree of freedom (6 - 1 = 5) to obtain the significance of the differences between the pre and post-tests, it was found that the differences were significant in favor of the post-test because the calculated (T) values are greater than their tabulated values for all variables**,** the percentage of hexokinase and superoxide dismutase enzymes increased in the blood, and the level of performance improved after the research sample performed the hypoxic training method exercises, while the percentage of glutathione in the blood decreased as a result of the sample applying this training method.

Discussion of the results

The researcher attributes the significance of the differences in favor of the post-measurements in the levels of enzymes in the blood to the hypoxic training method, which included exercises with an intensity reaching less than maximum, especially the exercises that the research sample performed with a lack of oxygen as a result of them wearing masks when performing these exercises, the concentration of the hexokinase enzyme in the blood increased as a result of the working cells' need to provide enough energy to perform high-intensity exercises that fall within the anaerobic energy production system because "Applying high-intensity anaerobic exercises leads to changes in the level of hexokinase enzyme concentration in the blood because training that focuses on the anaerobic side works mainly to increase the capacity of anaerobic enzymes" [19]. Given the important and essential role of the hexokinase enzyme in the metabolic process of decomposing and returning glucose, especially in exercises whose performance depends on the delivery of oxygen in small proportions to the cells of working functional organs, therefore, the role of this enzyme comes in helping to decompose glycogen to produce the glucose necessary to supply those cells with full energy because" In anaerobic training, the percentage and capacity of glucose enzymes increase, which is accompanied by many chemical reactions during the metabolism process to produce energy, such as the breakdown of glycogen stored in the body to produce glucose and use it directly to produce energy **.**The importance of the hexokinase enzyme also appears in chemical reactions to control the process of anaerobic glucose degradation because it is the enzyme responsible for the first reaction in the glycogen degradation system within the muscle [20]. Nevertheless, the continuous processes of glycogen degradation through this enzyme lead to an increase in the availability of glucose to fill the deficiency occurring in metabolic processes when there is a lack of oxygen, especially in exercises that continue to be performed for a long period of time at a high intensity, as in the basic exercises for 800-meter runners, "Anaerobic training or continuous, high-intensity effort leads to an increase in glucose as a result of the major role played by the hexokinase enzyme during the chemical reactions related to the breakdown of glycogen and glucose anaerobically" [21].

The researcher attributes the increase in the concentration of the enzyme superoxide dismutase (SOD) in the blood of the research sample to its increased activity in the muscles after they performed the units of the experimental method, especially those that relied on them wearing masks to reduce the percentage of oxygen reaching the working cells, as well as the consumption of oxygen present in the tissues, The body's defense systems work to make this very important enzyme available as a reaction to get rid of free radicals, especially superoxide radicals resulting from energy production reactions, as "Increasing oxygen consumption as a result of physical effort increases the effectiveness and activity of the (SOD) enzyme in fighting the oxidation process and the formation of free radicals, as the level of this enzyme often increases after strenuous exercise because of its important role in eliminating free radicals resulting from metabolic processes to produce energy" [22]. This was proven by the results of the research sample in an increase in the percentage of this enzyme in the blood after they performed exercises of relatively high intensity accompanied by a lack of oxygen, which led to the difficulty of sufficient oxygen reaching the cells responsible for producing energy to perform these exercises, as "Training according to the anaerobic energy production system leads to an increase in the activity of the (SOD) enzyme and an increase in its concentration in the blood" [23].

Also, "the (SOD) enzyme's activity increases when the athlete is exposed to high-intensity exercise, as it works to reduce oxidative stress and protect the cell membrane from damage resulting from the presence of superoxide radicals" [24]. Therefore, the researcher believes that the increase in the rate and effectiveness of the (SOD) enzyme in the research sample appeared as a result of oxidative stress resulting from the accumulation of abundant oxygen atoms, as the activity of this enzyme led to the elimination of free radicals Generated from energy production reactions that working cells need to perform the required physical effort despite the lack of oxygen access to them.

As for glutathione, the researcher attributes the decrease in its level in the blood in the post-measurement to the exercises that the research sample performed according to the hypoxic method, which was characterized by continuous physical effort with relatively high intensity**.** This was accompanied by a lack of sufficient oxygen supply to the working cells to perform their role in producing the energy necessary to perform these difficult exercises, which increased the effectiveness of glutathione within the muscles, which led to the consumption of a lot of it and thus a decrease in the amount of its transmission into the blood, as "Continuous exercise with an intensity less than maximum leads to a significant decrease in the level of glutathione in the blood plasma as a result of its consumption by the skeletal muscles, which causes a decrease in its export and transfer from the muscles to the blood" [25]. Also, "increasing the reductive activity of glutathione makes it work to repel stray oxygen atoms, which reduces oxidative stress as a result of its interaction with the largest number of free radicals" [26]. This led to a decrease in the level of glutathione in the blood of the research sample as a result of their performance of hypoxic exercises, which depend on the lack of oxygen reaching the fully functioning cells. Because "exercises that last for a relatively long period lead to a decrease in the level of glutathione because reduced glutathione is oxidized as a result of interaction with increasing amounts of free radicals, and the release of the oxidized form of them into the blood is

evidence of oxidative stress" [27].

The researcher believes that the hypoxic training method and the hypoxic exercises it included had an important role in the variation in the level of antioxidants in the blood to compensate for the deficiency in glucose and oxygen reaching the working cells, especially in the training units in which the research sample wore masks, as "Physical training for a certain period increases the rate of glucose decomposition by increasing the duration of the training, and this decomposition takes place with the help of a group of enzymes whose rate and activity increase depending on the size and intensity of the training load. The amount of glucose that comes out of the liver in cases of high exercise reaches (7-10) times that of the normal condition, and this increase must be accompanied by an increase in the concentration and activity of enzymes in order for the decomposition process to take place" [28].

The researcher attributes the development of the level of achievement (800) meters to the exercises performed by the research sample according to the hypoxic training method, which worked to adapt the cells of the body's functional systems, especially the respiratory, circulatory, and muscular systems which withstand the lack of oxygen and increase the effectiveness of the circulatory system to deliver the largest possible number of antioxidants to reduce free radicals represented by oxygen left behind by metabolic processes and to produce the energy necessary for the runners to perform the training unit exercises, especially those units in which the runners wear masks that reduce the level of oxygen, in addition, the role of antioxidants in helping to produce glucose, which cells need to complete their work in producing the necessary energy in an integrated manner, antioxidants are important for athletes in order to protect their bodies and get rid of dangerous free radicals resulting from chemical reactions that occur within the muscles to produce the energy needed to perform the strenuous exercises included in the hypoxic training method, which is characterized by performing exercises characterized by a lack of oxygen reaching the cells of those working muscles.

Conclusion and recommendations

Conclusion

1. Hypoxic training exercises led to an increase in the concentration of the enzyme hexokinase (HK) and the enzyme superoxide dismutase (SOD) in the blood of the research sample.
2. The hypoxic training method led to a decrease in the level of glutathione (GSH) concentration in the blood of the research sample.
3. Exercises according to the hypoxic training method lead to the development of the level of achievement in running (800) meters.

Recommendations

Using hypoxic exercises for 800-meter runners because of their important role in increasing the ability of the body's functional systems to withstand the high intensity that runners need, whether during training or competition.

1. The necessity of using masks as training methods that obstruct the delivery of oxygen-saturated blood to the working muscles during training so that they adapt to perform their contractions continuously and naturally when performing physical effort, depending on the intensity and volume of training required.
2. Coaches must monitor the activity of the enzymes under study because of their role in protecting the functional systems of players' bodies from the danger of increased amounts of free radicals resulting from metabolic processes to produce energy.
3. Conduct research to study the effect of the hypoxic method on enzymes or other physiological variables.

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