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Response of number of respiratory gases after applying accumulative air voltage on students of the faculty of physical education at the University of Duhok

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***Abstract*---**The study aims: To identify the response of several gases and respiratory variables after performing a cumulative aerobic effort on students of the Faculty of Physical Education at the University of Dohuk.To identify the differences between the pre and post-test in several gases and respiratory variables after performing a cumulative aerobic effort on students of the Faculty of Physical Education at the University of Dohuk. The paper hypothesis: There are statistically significant differences in several gases, and respiratory variables, after a cumulative aerobic effort. There are statistically significant differences between the pre and post-test in several gases and respiratory variables after performing a cumulative aerobic effort. The researcher used the descriptive approach in a comparative method for its suitability and the nature of the research. They were chosen intentionally from those who could complete the test well. The researcher used the following statistical means (arithmetic mean, standard deviation, (t-Test) for related samples, coefficient of variation). The statistical package (SPSS) version (11.0) was used for statistical data processing. The paper concluded: Bruce's latest test significant change in the phase time variable. The most recent significant Bruce test in the phase-time-to-total-time variable (%). Bruce's test did not cause a significant change in the variable volume of absolute oxygen (VO2). liter Bruce's test did not cause a significant change in the relative oxygen volume variable (VO2) ml/kg/min. Bruce's test did not cause a significant change in the variable volume of absolute carbon dioxide (VCO2) liter. Bruce's test did not cause a significant change in the variable relative exchange ratio (RER). Bruce's test did not show a significant change in the variable heart rate (HR) beats/min. Bruce's test caused a significant change in the normal breath volume variable.Bruce's test caused a significant

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change in the variable number of breaths. Bruce's test caused a significant change in the pulmonary ventilation variable. The paper recommends the following: 1. Use other tests when used to measure the volumes of respiratory gases and compare them to the Bruce test. 2. Apply the tests used in the research to measure the studied variables on other samples such as (children, females, and of different ages). 3. A comparison of tall and short stature was used in the test under the current study.

***Keywords*---**air voltage, physical education, respiratory gases.

Introduction

Introduction and research importance

Endurance in some sports activities depends on the adequacy of the circulatory system (heart, blood vessels, blood) and the respiratory system, which help deliver oxygen to the working muscles. The intensity of the exercise, the duration of the activity, and the amount of constant muscular work that this activity contains are among the most important factors that control the adequacy of the work of the circulatory and respiratory systems. Functional cardiovascular, blood, and lung function (Abdel-Fattah, 57, 2000).

There is a term synonymous with aerobic effort, which is the term aerobic metabolism, as the term “metabolism” refers to a group of successive chemical processes that occur in the human body, while the term “aerobic” refers to the presence of oxygen. Accordingly, aerobic metabolism refers to that series of chemical processes that require the presence of oxygen, and in its presence, fats and glycogen are decomposed into carbon dioxide, water, and enough energy to manufacture ATP(Radwan, 1998, 171). Oxygen is an effective factor during chemical reactions to rebuild ATP, which requires hundreds of chemical reactions and hundreds of enzymatic systems, which greatly increase in complexity in this system, and energy is produced inside the muscle cell in the energy houses (mitochondria) (Abdel-Fattah, & Sayed, 2003, 213)

The development of aerobic energy systems requires the implementation of large training volumes with the use of different intensities that are more or less than the anaerobic threshold, that is, the intensity that leads to an increase in the concentration of lactic acid in the blood (3-4 mmol/liter). Abdel-Fattah, 2003, 315) and because the oxygen needed for these operations is taken from the air through the activity of the respiratory and circulatory systems, so we find that the success of such operations requires the ability to:

- Oxygen intake
- Oxygen Transportation
- Oxygen Utilization(Radwan, 1998, 171).

The main function of blood is the continuous supply of oxygen for cell survival. A normal male during rest consumes approximately (300) ml of oxygen per minute, and this need multiplies several times during strenuous exercise. Oxygen diffuses through plasma and red blood cells by merging with hemoglobin, which is saturated with up to (97-95%) oxygen when leaving the lung. One gram of hemoglobin can bind with (1,35) milliliters of oxygen, and the ratio of oxygen binding with hemoglobin relative to its solubility in plasma is estimated at 50:1, in tissues the oxygen pressure decreases, which leads to a break in the binding with hemoglobin(Rogers & Editor, 2011, 69). Hence the importance of research in identifying the respiratory gases that are transmitted through the blood to the muscles working in the aerobic system and how they are appropriate to perform an aerobic effort.

Research problem

Through the researcher's review of the scientific sources in the files and scientific journals of the exact specialty, she noticed that there is a lack of research that specializes in blood gases and breathing variables, due to the difficulty of measuring them due to the lack of measurement devices in a number of colleges. It decided to conduct a study of a number of Blood gases and respiratory variables and their association with a cumulative air effort of multiple speeds and slopes.

Research Objectives

- Identifying the response of several gases and respiratory variables after performing a cumulative aerobic effort on students of the Faculty of Physical Education at the University of Dohuk.
- Identifying the differences between the pre and post-test in several gases and respiratory variables after performing a cumulative aerobic effort on the students of the Faculty of Physical Education at the University of Dohuk

Research assignments

- There are statistically significant differences in several gases and respiratory variables after a cumulative aerobic effort
- There are statistically significant differences between the pre and post-test in several gases and respiratory variables after performing a cumulative aerobic effort.

Research Areas

- The human field: a sample of students of the Faculty of Physical Education / University of Dohuk.
- Spatial domain: Physiology laboratory in the College of the Physical Education / University of Dohuk.
- Time range: the period from 10/11/2020 to 28/11/2020

Research Methodology

The researcher used the descriptive method in a comparative method for its suitability and the nature of the research.

Sample paper

The research sample consisted of the research sample included (12) students, including the College of Physical Education / University of Dohuk who are practicing sports and have good health (*). Where the sample was deliberately chosen from those who could complete the test well, the coefficient of variation (**) showed an acceptable homogeneity among the research sample members, and Table (1) shows some information about the sample members.

Table (1)
It shows the statistical parameters of some specifications of the research sample

Variables (Measuring unit)	mean (M-)	Standard Deviation (S.D)	Variation coefficient (%)
age (year)	20,722	1,487	7,178
length (cm)	174,556	5,903	3,382
Weight (kg)	74,794	9,946	13,298

Devices and tools used

- Treadmill Trackmaster type of American origin.
- Medical Scale Detector, an American-made height, and weight measuring device.
- Monark type pulse sensor.
- Mini CPX System Metabolic Measurement System device for measuring pulmonary ventilation parameters, with all its accessories.
- A Canadian type of Vacumed spirometer to measure lung function.

Means of collecting information

The researcher used the following methods to obtain her data, as follows:

-Scientific sources.

(*) They do not have chronic diseases or any injury that prevents them from performing the test correctly.
(**) If the value of the coefficient of variation is less than 30%, this indicates the homogeneity of the sample (Al-Tikriti & Al-Obaidi, 1999, 161).
- Measurements and tests.
-A special form to collect some information about the sample to achieve the research objective.

Physical exams

The researcher used a test that measures pneumatic stress, which depends on the increase in speed and slope in increasing the intensity of the test, using a treadmill device, which is the air stress test (Bruce Test):

- Objective of the test: The test aims to reach the laboratory to the maximum extent of oxygen consumption, and this effort is performed on the treadmill, an effort that depends on the gradient of speed and gradient.
- Tools: Treadmill electric treadmill with standard speed and incline, Preparation for the test: The laboratory performs a warm-up process for (5) minutes by climbing on the treadmill and walking or light jogging at a speed (of 6 km/h and a 4% incline). Then give a rest period of (5) minutes.
- Specifications of the test: The test consists of seven stages, each stage has a speed and a slope, and it takes three minutes to perform each stage.

Table (2) shows the stages of Bruce's air voltage test.

Table (2)
Bruce Test Phases (Bruce Test) (Adams, 2002, 255)

Specification / Test stages	Total time	Slope (%)	Speed (km/h)
The first stage	1-3	10	2,74
The second stage	3-6	12	4,02
The third stage	9-6	14	5,47
The fourth stage	12-9	16	6,67
The fifth stage	15-12	18	8,05
The sixth stage	18-15	20	8,8
The seventh stage	21-18	22	9,7

Body measurements

Measurement of body length in centimeters and weight in kilograms

The length and mass of the research sample members were measured using a device (measuring length and mass) type (Detecto .). After the device is turned on and beeped, the tester stands on the device barefoot and the person conducting the measurement moves the metal plate to touch the laboratory head. After installation, the indicator that represents the length of the laboratory in centimeters is read. As for the mass measurement, after the reading settles on the electronic screen, the number represents the tester's mass in kilograms.

Functional Variables

Measurement of blood gases

Functional variables were measured in a laboratory manner by means of an open gas analyzer with a Metabolic Measurement System type. (Mini CPX System). First, the data for each laboratory is entered, namely height, weight, date of birth, and gender. The device is then calibrated to take an average of five readings (Breath by breath average of 5 breaths, every 1 breath) and we determine the type of test performed and after making sure that the device is calibrated, we put the special mask for breathing on the face of the laboratory and install it with a special net on the head and ask the laboratory whether there is any leakage of the mask from any side. The exhalation must be inside the device for the readings to be correct. The test begins by clicking on the "Start" button, and then the device starts taking readings automatically, which appear on the computer screen prepared for this purpose. At the end of the test, we click on.

The study variables included the following

- Absolute Oxygen Volume (VO2) (L)
- Relative volume of oxygen (V̇O2) (ml/kg/min)
- Volume of absolute carbon dioxide (VCO2) (liter)
- Heart rate (HR) (beats/minute)
- Respiratory Exchange Ratio (RER)
- Phase time (*) (min)
- Ratio of phase time to total time (%) = (phase time / total time of the test) x 100

(*), which is the time it takes for the laboratory to reach the specified percentage.

Measurement of respiratory variables

Respiratory variables were measured (normal breath volume (liters), pulmonary ventilation (liters/min), and several breaths (times/min) using a spirometer to measure lung function. The laboratory sits on a bench and is in a position of complete comfort. The nose clip is placed on the nose of the laboratory to close the nasal airway and make the breathing process confined to the mouth only. Breathing takes place naturally while maintaining not to open the mouth during breathing, so as not to affect It's the natural process of breathing. As the values of respiratory variables appear on the computer screen connected to the spirometer.

The pilot experiment

To find a kind of familiarization (familiarization) between the laboratory and the treadmill, the researcher gave the testers allowed the tester's device a week before they were brought to the main experiment, As most of the research sample members run for the first time on this device and accordingly they were trained on the moving treadmill at a light speed of between (8-10) km m/hour approximately, with a gradual increase in the gradient from (1-5%) for familiarity with the device.

Main experience

To achieve the objectives of the research, the researcher conducted the test on the individuals of the research sample individually from the date November 10, 2020, to November 28, 2020, (except for the period of familiarity with the treadmill) and the researcher took care of the following points:

1. The test was conducted at a normal temperature (20-22) C by controlling it by heating and cooling devices and the relative humidity level was (34%-36%).

2. To ensure that all members of the research sample were exposed to the same period between the warm-up and the start of the test, the warm-up process was arranged in an overlapping work manner so that the time between one laboratory and another was from (5-10) minutes (the experiment included two moving devices, one for warming up and the other for performing the test).
3. Giving a rest period between the warm-up period and the start of the test (5 minutes).
4. The researcher was keen that the work team be the same for all functional measurements.
5. The testers performed the test according to the scientific conditions of the test

Statistical treatments

The following statistical methods were used:

- coefficient of difference
- t-test for related samples
- Arithmetic mean
- Standard Deviation (Al-Tikriti and Al-Obaidi, 1999, 161)

The statistical package (SPSS) version (11.0) was used for statistical data processing.

View the results

Presentation, discussion, and analysis of the results

Table (3) It shows the arithmetic means, standard deviations, the (t) value, and the significance value of the variables of respiratory gases in the research.

* Significant at error rate ≤ (0.05)
It is evident from the table (3) that:

Statistical parameters /	Means	standard deviation	value (t)	Statistical significance
Phase time (min)	20,011	1,638	-4,345	0,000
Phase time to total time (%)	99,767	2,322	-2,436	0,021
The absolute volume of oxygen *(VO 2 L .)*	4,108	0,617	-0,745	0,462
The relative volume of oxygen (VO2) ml/kg/min	56,491	7,218	-0,836	0,409
The absolute volume of carbon dioxide L (VCO2L .)	4,189	1,165	0,455	0,653
Respiratory exchange ratio (RER)	1,012	0,243	1,363	0,181

Heart rate (HR) beats per minute	189,059	11,845	0,672	0,506

- The availability of significant differences for the test in the variables (stage time per minute, the ratio of stage time to total time) as the calculated (t) values were (-4,345, -2.436, respectively), and the moral value was (0.000, 0.021), which is less from (0,05).
- The absence of significant differences for the test in the variables (absolute VO2, relative VO2, VCO2, RER, HR) as the calculated (t) values were (-0.745, -0.836, 0.455, 1,363, 0.672) respectively and the value of significance (0.462, 0.409, 0.653, 0.181, 0.506) which is greater than (0.05).
  Presentation and discussion of the results of the respiratory variables for the pre and post-tests in the research

Table (4)

Statistical significance	probability amount	(t) computed value	telemetry		Tribal measurement		Variables
			p+	s-	p+	s-	
Statistical	0,00	-17,29	0,24	1,40	0,06	0,46	normal breath volume TV liter
Statistical	0,00	-11,06	8,18	36,78	1,92	15,63	number of breaths RR breath/d
Statistical	0,00	-14,67	13,33	51,28	1,04	7,17	pulmonary ventilation VE l/min

* Significant at an error rate < (0.05)

It can be seen in the table (4)

1- There are significant differences between the tribal and remote measurements in favor of the dimensional measurement of the research sample in the variables (normal breath volume, number of breaths, and pulmonary ventilation), as the value of (T) calculated for these variables was (19.47, -14, respectively). ,67, -11.06) at the probability level (0.00, 0.00, 0.00).

Discussing and analyzing the results

As it is evident from the test results that a significant change has occurred in the normal breath volume variable, whose amount is at rest (0.5 liters). Approximately This is evident in the table of homogeneity of the research sample in the third chapter of the research. On the other hand, the pneumatic test performed by the research sample on the rotating tape device was an effort to reduce fatigue, and increasing the intensity by increasing the gradient and speed led to an upward increase in pulmonary ventilation until the sample reached The end of the test and by linking the two components that are most important and most affected and affected in pulmonary ventilation through an increase or imbalance in their ratios (normal breath volume and number of breaths) in the body, Al-Tikriti and Muhammad Ali emphasized that "the physiological changes that occur in the respiratory system resulting from exercise are the increase in pulmonary ventilation that depends on the increase in the amount of breathing air as a result of the increase in the number of breaths per minute, as well as an increase in the volume of air during inhalation and exhalation (Al-Tikriti and Muhammad Ali, 1986, 260-261)

Whereas (Mohammed 2008) indicates that “physical exercise changes the speed and depth of breathing a lot and may rise to (75 times per minute) and the volume of breath is approximately from (2.5-3.5 liters/min). It is known that physical exercise increases the rate of metabolism.”, which increases the level of CO_2 in the blood, And if a change in the speed and depth of breathing, the increased need for oxygen is met and prevents the accumulation of CO_2, which raises the respiratory center, which leads to an increase in stimuli to the ends of the respiratory muscles. Muhammad, 2008, 201-202).

As for the (HR, VO_2) variables, they were not significant, and these results are similar to the study (Lukaski et al.,) which concluded when comparing the three tests (Bulk, Bruce, A-listed) in the (HR, VE, VO_2) variables that there are no significant differences. in the variables studied among the three tests (Lukaski et al., 1989, 223).

The researcher believes that the high intensity of the test led to an increase in the accumulation of lactic acid in the blood, which alerted the respiratory centers in the medulla oblongata, sensory receptors, and chemical organizations, which caused an increase in both the number and depth of breathing. And (Birch et al) points out that “the neural control over the volume of breathing is through the spontaneous activity of the inspiratory and expiratory respiratory centers in the medulla oblongata and the pons region of the brain, which are connected with the respiratory muscles by neural connections, As for chemical control, it is achieved through chemical receptors located in the aortic arch and carotid bodies that respond to changes in the molecular pressures of oxygen and carbon dioxide and the concentration of sodium bicarbonate ion during graded exercise” (Birch et al., 2005, 65).

This was confirmed by (Foss & Keteyian) that the increase (VE) in the last and acute stages of the effort is due to two factors, namely the process of lactic accumulation in the blood that stimulates the increase in (VE) as well as chemical stimuli in response to the increase (CO_2) and hydrogen ion (H^+). in the blood. (Foss & Keteyian, 1998, 189).

As for the (HR) variable, this result matches the result of (Feather) which was conducted on (8) healthy volunteers. In this study, he compared three different laboratory and field tests to determine the maximum heart rate, which noted that there was no significant difference between these tests except The value of (HRmax) varies from one test to another. It was recommended that the trainers take into account this difference in the value of (HRmax) in determining the training volumes, as this value varies from one test to another (Feather, 2011, 94).

As for the (VO2) variable represented by the value of the two variables (VO2) per liter and per kg, we note that there is no significant difference and that this result differs from what was stated by (Froelicher et al), who noted that there is a significant difference in the maximum value of (VO2) at heat load increase. This causes arteriovenous transport to reduce the arteriovenous difference and thus the oxygen consumption that can be achieved during exercise can decrease with the increasing length of test time. (Froelicher et al., 1974, 514, 516

As for the (RER) value, it is also not significant, and it is a normal value when compared with other studies that calculated the (RER) value in a graded test on a treadmill. (Gollnick, 1985; Bergman & Broks, 1999) indicates that the (RER) value expresses the relative contribution of the source used to produce energy as fuel when the value is (0.7) indicates the oxidation of fats, and when the value increases more than (0, 7) Indicates the oxidation of carbohydrates, and when the value is (1,0) or more, it indicates the use of carbohydrates without the use of oxygen.(Gollnick, 1985, 356) (Bergman & Broks, 1999, 480. It is a similar result to the study (Nielson, 2009) when a graded test on a treadmill was used to measure (VO2max and RER) on a graded test on a treadmill, as the RER value for men was (1.16) and for women (1.13). (Nielson,2009,14).

Conclusions and Recommendations

Conclusions

Bruce's latest test a significant change in the phase time variable. The latest significant Bruce test in the phase-time-to-total-time variable (%). Bruce's test did not cause a significant change in the variable volume of absolute oxygen (VO2) liter. Bruce's test did not cause a significant change in the relative oxygen volume variable (VO2) ml/kg/min. Bruce's test did not cause a significant change in the variable volume of absolute carbon dioxide (VCO2) liter. Bruce's test did not cause a significant change in the variable relative exchange ratio (RER). Bruce's test did not show a significant change in the variable heart rate (HR) beats/min. Bruce's test caused a significant change in the normal breath volume variable. Bruce's test caused a significant change in the variable number of breaths. Bruce's test caused a significant change in the pulmonary ventilation variable.

Recommendations

The researcher recommends the following:

1. Use other tests when used to measure the volumes of respiratory gases and compare them to the Bruce test.
2. Apply the tests used in the research to measure the studied variables on other samples such as (children, females, and of different ages).

3. A comparison of tall and short stature was used in the test under the current study.

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