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CERTAIN RESPIRATORY GASES' RESPONSE AFTER PERFORMING A CUMULATIVE AEROBIC EFFORT

Shatha Hazim Gorgees
Assistant Professor, University of Mosul, Faculty of Education for Women, Department of Physical Education and Sports Sciences, Email: Shatha.h.al-sada@uomosul.edu.iq

Abstract

The present study aims to identify the response of a number of blood gases after performing a cumulative aerobic effort in order to identify the differences between the pre and post-tests in a number of blood gases after performing a cumulative aerobic effort. The researcher assumed that there are statistically significant differences in the number of blood gases after cumulative aerobic effort and there are statistically significant differences between the pre and post-tests after performing a cumulative aerobic effort. The researcher used the descriptive approach in a comparative method for its suitability for the nature of the present study. The research sample consists of (12) students from faculty of Physical Education and Sports Sciences at University of Al-Qadisiyah in Al-Diwaniyah, who are practicing sports and are in good health. They are intentionally chosen from those who could complete the test well.

The researcher used the arithmetic mean, standard deviation, (t-Test) for related samples, and variation coefficient. The (SPSS) version (11.0) was used for the purpose of statistical data processing.

抽象的

本研究旨在确定进行累积有氧运动后多种血气的反应，以便确定进行累积有氧运动后多种血气测试前后的差异。研究人员假设累积有氧运动后的血气数量存在统计学上的显着差异，并且在进行累积的有氧运动后测试前后之间存在统计学上的显着差异。研究人员在比较方法中使用了描述性方法，因为它适合本研究的性质。研究样本包括 (12) 名来自 Al-Diwaniyah 的 Al-Qadisiyah 大学体育和运动科学系的学生，他们正在从事体育运动并且身体健康。他们是从那些能够很好地完成测试的人中特意挑选出来的。

研究人员使用了相关样本的算术平均值、标准差、（t-Test）和变异系数。 (SPSS) 版本 (11.0) 用于统计数据处理。

Introduction

1.1 The significance of the present study

In some sports activities, endurance 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 fixed muscle work that this

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About the authors：Shatha Hazim Gorgees

Email: Shatha.h.al-sada@uomosul.edu.iq

activity contains are among the most important factors that control the adequacy of the work of the circulatory and respiratory systems. When the sports activity is characterized by less intensity, a longer period of time, and a less constant amount of muscular work, the main factor for continuing performance in this case is the functional aspect of the heart, blood vessels, blood, and lungs (Abdulfattah, 2000).

The term aerobic effort is synonymous with the term aerobic metabolism. Metabolism refers to a group of successive chemical processes that occur in the human body. Aerobic refers to the presence of oxygen. Accordingly, aerobic metabolism refers to that series of chemical processes that require the presence of oxygen. In the presence of oxygen, fats and glycogen are decomposed into carbon dioxide, water, and sufficient energy to manufacture ATP (Radhwan, 1998). 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. Energy is produced inside the muscle cell in energy houses (mitochondria) (Abdulfattah, and Sayed, 2003).

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 to (3-4 ml/ liter) (Abdulfattah, 2003). The oxygen needed for these processes is taken from the atmosphere through the activity of the respiratory and circulatory systems. Thus, the success of such processes requires the ability to do three processes, including taking in oxygen, transporting oxygen, and Utilizing oxygen (Radhwan, 1998).

The main function of blood is the continuous supply of oxygen for cell survival. During rest, a normal male consumes approximately (300) ml of oxygen per minute, which 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%) with 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 and Editor, 2011). Hence, the significance of the present study is reflected in identifying the respiratory gases that are transmitted through the blood to the muscles working in the aerobic system and how they fit to perform an aerobic effort.

The research problem

Through the researcher's review of the scientific sources in the files and in scientific journals of the exact specialization, she noticed that there is a lack of research that tackle blood gases due to the difficulty of measuring them due to the lack of measurement devices in a number of faculties. The researcher decided to conduct a study of a number of blood gases And linking it to a cumulative aerobic effort with multiple speeds and slopes.

The Objectives of the present study

1. Identifying the response of a number of blood gases after performing a cumulative aerobic effort.
2. Identifying the differences between the pre and post-tests in a number of blood gases after performing a cumulative aerobic effort.

The hypotheses

1. There are statistically significant differences in the number of blood gases after cumulative aerobic effort.
2. There are statistically significant differences between the pre and post-tests after performing a cumulative aerobic effort.

The research Domains

1. The human domain; Students from the Faculty of Physical Education and Sports Sciences at University of Al-Qadisiyah.
2. The spatial domain; Physiology laboratory in the Faculty of Physical Education and Sports Sciences at University of Al-Qadisiyah.
3. The temporal domain; From 10/11/2019 to 28/11/2019.

The research Methodology

The researcher used the descriptive comparative method as it fits the nature of the present study.

The research Sample

The research sample consists of (12) students from the Faculty of Physical Education and Sports Sciences at University of Al-Qadisiyah in Al-Diwaniyah, practicing sports and have a good health. The sample was deliberately chosen from those who could complete the test well. The variation coefficient showed an acceptable homogeneity among the research sample members as shown in Table (1).

Table (1) Statistical parameters of some specifications of the research sample

Variables (measurement unit)	Arithmetic mean	Standard deviation	Variation coefficient
Age(year)	20,722	1,487	7,178
Height(cm)	174,556	5,903	3,382
Weight(kg)	74,794	9,946	13,298

Devices and tools

• An American-made Treadmill Trackmaster.
• An American-made Medical Scale Detector.
• 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.

Data collection methods

The researcher used tests and measurements as means to collect data, which included the following:
1. They don’t have any disability or chronic diseases that may affect their performance in the test.
2. If the variation coefficient value is less than 30%, this means that the sample is homogeneous (Al-Tikriti and Al-Ubaidi, 1999).

Physical tests

The researcher used a test that measures aerobic effort, which depends on the increase in speed and gradient in increasing the intensity of the test using a treadmill device.

Aerobic Voltage Test (Bruce Test)

The test aims to reach to the maximum extent of laboratory oxygen consumption, which is an effort that is performed on the treadmill. It depends on speed and regression.

Tools

Electric treadmill with standard speed and regression.

Preparation for the test

A warm-up process is performed for a period of (5) minutes by climbing on the treadmill and walking or light jogging at a speed of (6 km/h and a 4% regression). Then, a rest period of (5) minutes is given.

Specifications of the test

The test consists of seven stages, each of which has a speed and a slope. It takes three minutes to perform each stage as shown in Table (2).

Table (2) Bruce Test Phases

Characteristics/test stages		Total time	Regression%	Speed (km)
1	Frist stage	3-1	10	2,74
2	Second stage	6-3	12	4,02
3	Third stage	9-6	14	5,47
4	Fourth stage	12-9	16	6,67
5	Fifth stage	15-12	18	8,05
6	Sixth stage	18-15	20	8,8
7	Seventh stage	21-18	22	9,7

Physical measurements

2.4.2.1 Measurement of body length and mass

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

Functional Variables

Functional variables were measured in a laboratory manner by means of an open gas analyzer with a Metabolic Measurement System of the Mini CPX System type. First, the data for each sample member, namely height, weight, date of birth, and gender is input. Then, the device is calibrated to take an average of five readings.

(Breath by breath average of 5 breaths, every 1 breaths). The type of test performed is determined after making sure that the device is calibrated. After that, the special mask for breathing is put on the face of the sample member and installed with a special net on the head. Then, the sample member is asked 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. Then, the device automatically starts taking readings which appear on the computer screen that is prepared for this purpose. At the end of the test, the Stop button is pressed. The study variables included the following:

Oxygen Volume (VO2) (L)

Relative volume of oxygen ($\dot{V}$O2) (ml/kg/min)

Volume of carbon dioxide (VCO2) (liter)

Heart rate (HR) (beats/minute)

Respiratory Exchange Ratio (RER)

Phase time (□) (minutes)

Ratio of phase time to total time (%) = (phase time/total time of the test) x 100.

The Experiment

It is the time taken by the research sample member to reach the specified ratio. For the purpose of finding a kind of familiarization between the sample member and the treadmill, the researcher gave the sample members an opportunity to practice on the device a week before they were brought to the main experiment. Most of the research sample members run for the first time on this device. Accordingly, they were trained on the treadmill device quickly between (8-10) km m/hour approximately, with a gradual increase in the regression from (1-5%) for the purpose of familiarization with the device.

The main experiment

To obtain the objectives of the present study, the researcher conducted the test on the members of the research sample individually from 10/11/2019 to 28/11/2019, (except for the period of familiarity with the treadmill). The researcher took care of the following points:

1. The test was conducted at a normal temperature of (20-22) C by controlling it by heating and cooling devices. The relative humidity level was (34%-36%).
2. To ensure that all members of the research sample were exposed to the same period of time 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 member and another was (5-10) minutes. The experiment included two moving devices. One of them is for warming up and the other is for performing the test.
3. Giving a rest period of (5 minutes) between the warm-up period and the start of the test.
4. The researcher was keen that the work team be the same for all functional measurements.
5. The research sample members performed the test according to the scientific conditions of the test.

2.7 Statistical treatments

The following statistical methods were used:

Variation coefficient

The T-test for related samples

The Arithmetic mean
Standard Deviation (Al-Tikriti and Al-Ubaidi, 1999).
The (SPSS) version (11.0) was used for the purpose of statistical data processing.

The results

3.1 Presentation, discussion, and analysis of the results

Table (3) Arithmetic means, standard deviations, regressions, and T-test values for all the variables

Stage time/ min	**20,011**	**1,638**	**-4,3,45-**	**0,000**
Stage time/ total time %	**99,767**	**2,322**	**2,436-**	**0,021**
O2 volume	**4,108**	**0,617**	**0,745-**	**0,462**
Relative O2 volume ml/kg/min	**56,491**	**7,218**	**0,836-**	**0,409**
CO2 volume/l	**4,189**	**1,165**	**0,455**	**0,653**
RER	**1,012**	**0,243**	**1,363**	**0,181**
Heart beats/ HR/ Beat/Min	**189,059**	**11,845**	**0,672**	**0,506**

The table shows the arithmetic means, standard deviations, the T-test value, and the significance value for all the research variables.

Statistical features
Variables
Functional arithmetic mean
Q¯ standard deviation
± p significant T-test value
It is evident from Table (3) that:

There are significant differences for the test in the variables of (stage time per minute and the ratio of stage time to total time). The calculated T-values were (-4,345, -2.436, respectively) and the value of significance was (0.000, 0.021), which is less than (0.05).
There are no significant differences for the test in the variables of (VO2, relative VO2, VCO2, and RER/HR). The calculated T-values were (-0.745, -0.836, 0.455, 1.363, and 0.672) respectively and the value of significance was (0.462, 0.409, 0.653, 0.181, and 0.506), which is greater than (0.05).
As for the (HR, VO2) variables, they were not significant. These results are similar to the study of (Lukaski et al.) who concluded when comparing the three tests (Bulk, Bruce, and Alisted) in the (HR, VE, and VO2) variables that there are no significant differences in the studied variables among the three tests (Lukaski et al. 1989).
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 regulators, causing an increase in both the number and depth of breathing. (Birch et al) indicate that neurological control The volume of breathing is controlled by the spontaneous activity of the inspiratory and expiratory respiratory centers in the medulla oblongata and the pons region in the brain, which are connected with the respiratory muscles through the nerve connections. As for chemical control, it is done through the chemical receptors that respond to pressures of oxygen, carbon dioxide, and sodium bicarbonate ion concentration during graded exercise (Birch et al. 2005).
It was that the increase in (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 of (CO2) and hydrogen ion (H +). in the blood (Foss and Keteyian, 1998).
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, and noted that there was no significant difference between these tests except that 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. This value varies from one test to another (Feather, 2011).
As for the (VO2) variable represented by the value of the two variables (VO2) per liter and per kg, it is notice 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) with the increase of heat load Accompanying the continuation of exercise, which results in an increase in blood flow under the skin. This causes arteriovenous transport to reduce the arteriovenous difference. Thus, the oxygen consumption that can be achieved during exercise can decrease with increasing length of test time (Froelicher et al. 1974).
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 and Broks, 1999) indicate that the (RER) value expresses the relative contribution of the source used to produce energy as fuel. When the value is (0.7) it indicates the oxidation of fats, when the value

increases more than (0, 7), this 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; Bergman and Broks, 1999).

It is a similar result to the study of (Nielson, 2009) when a graded test on a treadmill was used to measure (VO2max and RER) on a graded test on a treadmill. The RER value for men was (1.16) and for women (1.13). (Nielson,2009).

Conclusions and recommendations

Conclusions

Bruce's test caused a significant change in the stage time variable.

Bruce's test caused significant change in the stage -time-to-total-time variable (%).

Bruce's test did not cause a significant change in the variable of volume of 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 volume variable of carbon dioxide (VCO2) liter.

Bruce's test did not cause a significant change in the variable of relative exchange ratio (RER).

Bruce's test did not cause a significant change in the variable of heart rate (HR) beats/min.

Recommendations

The researcher recommends the following:

1. Using other tests to measure the volumes of respiratory gases and comparing them to Bruce's test.
2. Applying the tests used in the present study to measure the studied variables on other samples such as (children or females and different ages).
3. Comparing tall and short sample members using the test applied in the present study.

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