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Acute effects of 800 m middle distance running on oxygen saturation and some metabolic parameters in adult females.

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Abstract

The purpose of this study is to investigate acute effects of 800 meters middle distance running on oxygen saturation and some metabolic parameters in adult females. Twenty female volunteers preparing for sports academy were included in the study. The mean age of the participants was 19.72 y, mean height was 160.00 cm and mean body weight was 52.45 kg. All the participants completed a middle distance running exercise 2 h a day and 4 days in a week over the period of 8 months. Choice Med Finger pulse oximeter was utilized in order to measure capillary oxygen saturation of the participants before and after the running test. Inbody-720 bioelectrical impedance analyzer was used for the measurement of metabolic parameters. Paired Sample T-test was conducted for the comparison of the participants' mean measurements before and after running. The values of SO_2 pre-test: 98.09 ± 1.01 post-test: 96.36 ± 1.17, Mineral pre-test: 2.93 ± 0.23, post-test: 2.90 ± 0.23, bone mineral content pre-test: 2.43 ± 0.19, post-test: 2.40 ± 0.20 were found to be statistically significant ($p<0.01$). When the acute effects of 800 m middle distance running on capillary oxygen saturation and metabolic parameters in adult females are considered, it can be stated that there have been serious decreases in values of SO_2, mineral and bone mineral content compared to those measured before running. It can be suggested that in order for female middle distance runners to protect themselves from low bone mineral density, mineral-rich diets and mineral supplements may be useful.

Keywords: Metabolic, Saturation, Inbody, Oximeter, Exercise.

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Introduction

Body composition usually refers to the existence of fat, bone, muscle cells, other organic substances and extracellular fluids in proportion to one another. Despite the similarities in the organs and components of the body, every individual has a different physical composition. The major factors affecting the body composition that are closely related to human life are gender, muscle, physical activity, illness and nutrition [1]. The fat mass in the body and the lean body mass come together to form the body composition, which is an important physical fitness parameter. Important factors affecting body composition can be listed as muscle structure, physical activity level and eating habits [2,3]. The athletes who are in a good shape in terms of physical performance have a high percentage of lean body mass but low body fat levels. For this reason, the percentage of water in athletes is high. Approximately 70% of the body weight of athletes with high performance is composed of water depending on the ratio of muscle development. Because females have less muscle mass and fatter than males, the amount of water in females is less than that of males [4].

The ideal composition of the body is an important function of any sport branch. Fat cells, when they are present in the body too much, do not contribute to energy production (ATP) and cause energy consumption for the transport of fat. As a result, sportive performance is associated with a low body fat levels as well as a high free fat ratio [5-8].

BIA is easy, non-invasive, relatively inexpensive and can be performed in almost any subject because it is portable and it allows estimation of several factors of human body composition [9].

The principle of BIA involves passing a small single- or multiple-frequency alternating current (1-10 μA) through the body and measuring the resulting impedance composed of resistance, capacitive reactance, and the Phase angle (PhA). As the body's electrical conductivity depends on its composition (fat and water content), the Total Body Water (TBW), as well as the Intra- and Extracellular Water content (ICW and ECW, respectively) can be estimated. PhA represents the phase difference between voltage and current and is related to the number of healthy cells in the body. Experimental results further allow calculation of Fat Mass (FM), Fat-Free Mass (FFM), and cell mass by using a regression equation based on measuring values. Furthermore, it is possible to determine the water content and muscle mass for specific body parts such as arms, legs, and the trunk [10].

The pulse oximeter determines the percentage of oxygenated hemoglobin in the arterial blood, and the result obtained through this method is referred to as functional oxygen saturation [11,12].

The purpose of this study is to investigate the acute effect of the 800 m middle-distance running on oxygen saturation and some metabolic parameters in adult females and to develop recommendations in the light of the findings.

Material and Method

Twenty female volunteers preparing for sports academy were included in the study. The mean age of the participants was 19.72 y, mean height was 160.00 cm and mean body weight was 52.45 kg. All the participants completed a middle distance running exercise 2 h a day and 4 d in a week over the period of 8 months. It was ensured that all the participants had no food or drink until at least 3 h before the measurement. It was also ensured that all the participants had no food or drink after 800 m running test. During measurements, the subjects used their maximal capacities. Before the tests, a health report was obtained from all participants stating that they had no health problems that would hinder their involvement in the study. The participants were supported to have an increased level of motivation and willingness by explaining them the purpose and significance of the study.

Measurements

Oxygen saturation measurement: Choice med finger pulse oximeter was used in the measurement of capillary oxygen saturation. Three measurements were taken and the mean value was recorded as pre-test and post-test.

An apparatus for measuring physical parameters such as the saturation percentage of oxygen in blood, the pulse oximeter is built into the finger clip, and therefore the device is small, lightweight and very portable, as well as more reliable [13].

Metabolic measurements

Inbody-720 bioelectrical impedance analyzer was utilized for the metabolic measurements of the participants. Measurements were taken with as few clothes as possible. It was ensured that the feet were not wet, and the claws and heals were positioned on the electrodes. Electrode handles on the device were hold by the subjects while hanging their arms sideways during the measurement.

Statistical analysis

SPSS-16 statistics software was used to analyse the data obtained from the measurements. Paired sample t-test was conducted for the comparison of the mean values obtained from the measurements before running and after running. The level of significance was chosen to be 0.01 and 0.05 for the interpretation of the differences between the variables.

Results

Mean age of the participants in the research was found to be 19.72 y, mean height was 160.00 cm, mean body weight was 52.45 kg and mean body mass index was 20.44 kg/m^2. In addition, no statistically significant difference was determined in terms of the following values of total body water pre-test: 30.26 ± 2.18 and post-test: 30.29 ± 2.08, intracellular fluids pre-test: 18.88 ± 1.34 and post-test: 18.90 ± 1.25, extracellular fluids pre-test: 11.40 ± 0.85 and post-test: 11.38 ± 0.84, body cell mass pre-test: 27.03 ± 1.92 and post-test: 27.08 ± 1.81, skeletal muscle mass pre-test: 22.62 ± 1.74 and post-test: 22.65 ± 1.65, protein pre-test: 8.17 ± 0.57 and post-test: 8.17 ± 0.53, soft tissue mass pre-test: 38.91 ± 2.78 and post-test: 38.96 ± 2.65, lean body weight pre-test: 41.36 ± 2.97 and post-test: 41.34 ± 2.87 ($p>0.05$). The values of SO_2 pre-test: 98.09 ± 1.01 and post-test: 96.36 ± 1.17, mineral pre-test: 2.93 ± 0.23 and post-test: 2.90 ± 0.23 and bone mineral content pre-test: 2.43 ± 0.19 and post-test: 2.40 ± 0.20 were found to be statistically significant (p<0. 01, Tables 1 and 2).

Table 1. *Means of anthropometric measurements of the subjects.*

Variables	Mean	sd
Age (y)	19.72	1.90
Height (cm)	160.00	2.50
Body mass (kg)	52.45	4.99
BMI (kg/m^2)	20.44	1.57

Table 2. *Comparisons of the means of the pre-test/post-test measurements of the subject's oxygen saturation and metabolic values.*

Variables	Measurements	Mean/sd	t	p
SO_2 (%)	Pre-test	98.09 ± 1.01	5.13	0.000**
	Post-test	96.36 ± 1.17		
Total body fluids (L)	Pre-test	30.26 ± 2.18	-0.61	0.54
	Post-test	30.29 ± 2.08		
Intracellular fluids (L)	Pre-test	18.88 ± 1.34	-0.78	0.44
	Post-test	18.90 ± 1.25		
Extracellular fluids (L)	Pre-test	11.40 ± 0.85	1.00	0.32
	Post-test	11.38 ± 0.84		
Body cell mass (kg)	Pre-test	27.03 ± 1.92	-0.95	0.35
	Post-test	27.08 ± 1.81		
Skeletal muscle mass (kg)	Pre-test	22.62 ± 1.74	-0.68	0.49
	Post-test	22.65 ± 1.65		
Mineral (kg)	Pre-test	2.93 ± 0.23	2.89	0.009**
	Post-test	2.90 ± 0.23		
Protein (kg)	Pre-test	8.17 ± 0.57	0.00	1.00

	Post-test	8.17 ± 0.53		
Bone mineral content (kg)	Pre-test	2.43 ± 0.19		
	Post-test	2.40 ± 0.20	3.30	0.003**
Soft tissue mass (kg)	Pre-test	38.91 ± 2.78		
	Post-test	38.96 ± 2.65	-0.75	0.46
Lean body weight (kg)	Pre-test	41.36 ± 2.97	0.32	0.75
	Post-test	41.34 ± 2.87		

**p<0.01

Discussion

Mean age of the participants in the research was found to be 19.72 y, mean height was 160.00 cm, mean body weight was 52.45 kg and mean body mass index was 20.44 kg/m^2. In addition, no statistically significant difference was determined in terms of the following values of total body water pre-test: 30.26 ± 2.18 and post-test : 30.29 ± 2.08, intracellular fluids pre-test: 18.88 ± 1.34 and post-test: 18.90 ± 1.25, extracellular fluids pre-test: 11.40 ± 0.85 and post-test: 11.38 ± 0.84, body cell mass pre-test: 27.03 ± 1.92 and post-test: 27.08 ± 1.81, skeletal muscle mass pre-test: 22.62 ± 1.74 and post-test: 22.65 ± 1.65, protein pre-test: 8.17 ± 0.57 and post-test: 8.17 ± 0.53, soft tissue mass pre-test: 38.91 ± 2.78 and post-test: 38.96 ± 2.65, lean body weight pre-test: 41.36 ± 2.97 and post-test: 41.34 ± 2.87 (p>0.05).

The values of SO_2 pre-test: 98.09 ± 1.01 and post-test: 96.36 ± 1.17, mineral pre-test: 2.93 ± 0.23 and post-test: 2.90 ± 0.23 and bone mineral content pre-test: 2.43 ± 0.19 and post-test: 2.40 ± 0.20 were found to be statistically significant (p<0. 01).

Information on body composition is very useful in clinical medicine, sport medicine, and other health-related fields [14].

In the present research conducted to investigate the acute effect of middle distance running on oxygen saturation and some metabolic values; SO_2, mineral and bone mineral content values were observed to have decreased significantly compared to the values obtained before running (p<0.01). However, no statistically significant difference was found regarding the values of total body water, intracellular fluids, extracellular fluids, body cell mass, skeletal muscle mass, protein, lean body weight and soft tissue mass.

Oxygen saturation pre-test value was found to be 98.09 ± 1.01% and post-test value was 96.36 ± 1.17% in the study. The increase in muscle activity increases energy production and consumption compared to the level at rest, resulting in a significant increase in blood flow to the working muscles and in O_2 use. During a physical activity with an increasing intensity, the amount of O_2 used increases linearly to a certain level, depending on the type and intensity of the exercise being performed. Increased use of O_2 leads to accelerated metabolic processes [15].

The findings in the literature claiming that the use of hemoglobin-dependent oxygen during intense exercises leads to a decrease in capillary oxygen saturation support the findings of the present study.

Mineral pre-test value was 2.93 ± 0.23 and post-test value was 2.90 ± 0.23, bone mineral content pre-test value was 2.43 ± 0.19 kg and post-test value was 2.40 ± 0.20 kg in the study.

There is a continuous destruction and reconstruction process in the bones within the structure-function relationship, which is called remodelling [16]. The positive effect of regular physical activity on Bone Mineral Density (BMD) is reported to begin at childhood. There have been studies showing that exercising, especially for bones, increases bone mass [17,18]. Weight transfer and physical activity stimulate growth plates and, their effect on bone leads to bone growth resulting in a stronger bone structure [19].

In the light of this information, it is possible to claim here again that an increase in bone mineral content is a result of the chronic effect of exercise. In the study, it was found out that the acute effect of exercise resulted in a decrease in mineral and bone mineral content values.

In the study, no significant difference was observed in the body fluids after the exercise compared to the values before the exercise. Another research reported that potassium and sodium concentrations were effective in determining the interstitial and intracellular fluid volume changes, and did not find a significant change in potassium and sodium levels after a 45 min exercise in cycling ergometer with an intensity of 60% [20]. In that sense, the present study is similar to that of Mallie et al. [20].

In conclusion, when the acute effect of middle-distance running on capillary oxygen saturation and some metabolic parameters in females are considered, it can be stated that it leads to a decrease in the values of SO_2 (%), mineral and bone mineral content. This decrease can be attributed to the increased oxygen demand during exercise and to the nutrients consumed as a result of energy requirement. Therefore, adding mineral supplements to daily nutritional programs can be supportive for athletes.

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