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The Relationship between Maximum Oxygen Consumption (VO_2 Max) and Body Fat Percentage of the Male Secondary School Pupils (15-18 Years)

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Abstract: The purpose of this study was to find out the type of relationship between VO_2 max and percentage of body fat in male secondary school students. The research sample consisted of 30 male students studying at Al-Khawarizmi High School in Tlemcen. Their average age was 16.56 ± 0.69. We based our research on books and scientific journals, site visits, and personal meeting. We used the descriptive approach. The test was carried out and the measurements were taken at the institution's yard and the doctor's office respectively. We used the running test for one mile to measure the maximum oxygen consumption. The skin folds were taken in three areas: the chest, abdomen and mid-thigh, to estimate the proportion of fat in the body. The results showed that the relationship between maximum oxygen consumption and body fat percentage was strongly reversed at a significant level of 0.01, with Pearson correlation coefficient -0.597.

Key words: Maximum oxygen consumption, body fat percentage, the running test for one mile, skin folds.

1. Introduction

In recent years, the world has witnessed an urban development that has been closely linked to increasing the degree of machine dependence in most of the day. Some research has confirmed that there has been a fundamental transformation in the world at the standard of living and lifestyle [1, 2]. This development has been influenced by two main axes: the restrictions on population in the 21st century, increasing the number of working hours, etc., which led them to switch to a fast and simple diet. And this food is often on the calories and does not fit with the daily needs for them, as well as the development of industrial and cultural societies, which stimulates this pattern encourages physical inactivity [3].

There is no doubt that this development has removed many obstacles, but it also had a negative impact, as it caused them physical inactivity, and therefore the individual consumes more energy than the spending, and this led to the increase in weight, thus, the human will suffer from the rise of obesity. Some studies have reported that there are currently increasing obesity and related problems, such as cardiovascular disease [2, 4, 5]. Another study found that high obesity leads to undesirable consequences. It is a risk factor for coronary heart disease. It has been associated with a hardened coronary artery stiffness in young people aged 15-34 who were autopsied after death [6]. We do not hide that the heart and blood vessels play an important role in the process of transferring oxygen to the muscles working to do the necessary contractions, that is, the safety of the heart and the circulatory system leads to an increase in the consumption of oxygen, but the latter is affected by the high level of obesity, where one study with improvement aerobic fitness decreases fat ratio [7]. This means that there is a relationship between lipid ratio and cardiorespiratory fitness. Some studies have confirmed that body composition is closely related to maximum oxygen consumption [8, 9].

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From the above we asked the following question: Is there a strong inverse relationship between oxygen consumption and body fat percentage of male students?

2. Materials and Methods

After getting the approval from the Directorate of Education of Tlemcen State and by the students, the skin thickness measurements were taken to the students on 26/10/2016 starting at 9 am, with the help of the research team and the doctor. The next day the running test was conducted for one mile in the yard allocated for the share of physical education and sports.

The research sample consisted of 30 students aged between 15 and 18 years. The mean age was 16.56 ± 0.69 (Table 1).

2.1 Tests

To measure the maximum oxygen consumption we used the running test for one mile, and to estimate VO_2 max we applied the equation [10].

To measure the proportion of fat in the body, we measured the thickness of skin folds in three areas: chest area, abdomen and mid-thigh, and applied the formula [11] to estimate the percentage of fat .

2.2 Scientific Bases of Tests

The results obtained in Table 2 show that the two tests have high stability and reliability. The stability coefficient of the running test is 0.88 and the coefficient of reliability is 0.94. This is considered a high coefficient. The coefficient of reliability was 0.99, which is also a very high coefficient.

2.3 Basic Study

2.3.1 Statistic Analysis

We used the SPSS version 22 to conduct statistical analysis. Before we measured the Pearson correlation coefficient, we applied the Kolmogorov-Smirnov test to calculate the normal distribution of the data. We noticed that all data were normally distributed, and then we used the Pearson correlation coefficient.

3. Results

In the results obtained in Table 3, the mean ± SD of oxygen consumption was 37.07 ± 2.70. As for the body fat percentage, the mean was 19.40 and the standard deviation was 2.10. The correlation coefficient is -0.597, where it is a strong negative value at a probability value of 0.000 which is smaller than 0.01. Therefore, we reject the null hypothesis and accept the alternative hypothesis that there is a strong inverse relationship between VO_2 max and the body fat percentage.

Table 1 Demographics of the study participants.

N	Age	Height	Weight
	Mean ± SD	Mean ± SD	Mean ± SD
30	16.56 ± 0.69	177.46 ± 5.13	80.98 ± 6.04

Table 2 Coefficient of stability and reliability of the tests.

Tests	Stability coefficient	Reliability coefficient
One mile test	0.88	0.94
Body fat percentage	0.99	0.99

Table 3 The correlation coefficient between VO_2 max and the ratio of fat in the body.

Tests	*N*	df	Mean ± SD	*r* for VO_2 max	*r* for BFP	Sig.
One mile test	30	29	37.07 ± 2.70		-0.597	0.000
Body fat percentage	30	29	19.40 ± 2.10	-0.597		0.000

$\alpha = 0.01$

4. Discussion

The purpose of this study was to determine the type of relationship between the maximum oxygen consumption and the percentage of fat in the body, where we note through the results obtained a strong inverse relationship was -0.597 at a significant level 0.01.

The reason for the inverse relationship between the maximum oxygen consumption and the body fat percentage is that to improve respiratory fitness, physical activity must be increased, particularly aerobic physical activity. In aerobic exercises or activities, the body relies on glucose and fat as energy sources for muscle contractions to perform the activity to be done, if the consumption of glycogen stores moved the body to use fat as an energy source and thus decreases in the body, this means that the aerobic activity improves the maximum oxygen consumption and reduces the body fat. We also see that the high body fat leads to its accumulation on the wall of the blood vessels, thus decreasing the diameter of the blood vessel. This leads to a reduction in the volume of oxygenated blood that passes through it. A small amount of oxygen for the working muscles, one study recommended the need to increase aerobic activities to reduce the level of obesity among the blind [12].

Other research results have confirmed that with lower body fat, aerobic fitness increases [13, 14]. This thesis is consistent with what Al-Hazza said in one of his studies, which confirmed that the level of cardio-respiratory fitness is negatively affected by lipids [15]. Several studies have confirmed that increased obesity leads to reduced fitness and cardiovascular fitness [16-18].

The results of the study were consistent with the results of several studies. A study was conducted in Malaysia, the research team found an inverse relation between the maximum oxygen consumption and the body fat ratio of -0.402 at a significant level of 0.05 [9]. Another study was conducted in Palestine in 2010, and a moderate negative relationship was found between the maximum oxygen consumption and the body fat percentage of -0.43 [19]. A Polish study found a weak inverse relationship between the maximum oxygen consumption and the body fat percentage was -0.23 at a significant level of 0.05 [20].

5. Recommendations

- Encourage students to increase their daily activity rate.
- Control the level of obesity and fitness cardio respiratory of pupils periodically.
- Conduct awareness campaigns to raise the risk of high obesity and low cardiovascular fitness.
- Propose programs to reduce obesity and raise the level of cardiovascular fitness.

Conflicts of Interest

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript, we also confirm that this research has not been published before.

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