

## A Correlation Study Between Aerobic Capacity and Breathing Pattern in Obese Adults

Sakshi Arora\* and Srishti Arora

Department of Physiotherapy, School of Medical and Allied Sciences, Galgotias University, India

\*Corresponding Author: Sakshi Arora, Department of Physiotherapy, School of Medical and Allied Sciences, Galgotias University, India.

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### Abstract

**Objectives:** To evaluate the correlation between the aerobic capacity and breathing pattern in obese adults.

**Methods:** Thirty young obese adults in the age group of 18-25 (college students) were selected for the study. Weight in kilos divided by height in square metres was used to calculate body mass index. The aerobic capacity was predicted by YMCA-3 min step test. The breathing pattern was assessed with the breathing hi-lo test.

**Results:** YMCA 3 min step test shows highly significant negative correlation with breathing pattern,  $r = -0.310$ ,  $p < 0.05$ . BMI shows highly significant negative correlation with breathing pattern,  $r = -0.565$ ,  $p < 0.05$ . In contrast, BMI shows highly significant positive correlation with YMCA 3 min step test score,  $r = -0.565$ ,  $p < 0$ .

**Conclusion:** The findings indicate that in young obese people, there was a strong inverse relationship between aerobic capacity and breathing pattern. These results highlight the significance of obese people's poor cardiorespiratory fitness, which may play a role in the later onset of cardiovascular co-morbidities in middle life.

**Keywords:** Obesity, BMI, Aerobic Capacity, Breathing, YMCA 3 min step test

### Introduction

Obesity is a chronic disease characterized by excessive accumulation of body fat that is harmful to individuals. Obesity is defined by the National Institutes of Health (NIH) using the BMI [1]. The World Health Organization claims that obesity has become a global pandemic that affects individuals of all ages. Obesity causes structural and metabolic changes that increase a person's risk for developing a number of ailments, such as cardiovascular disease, lung disease, metabolic abnormalities, and obstructive sleep apnea [2]. In 2007 the National Family Health Survey showed that in India the prevalence of obesity in males is 12.1% whereas in females is 16% [3]. Obesity has shown to have deteriorating effects on respiratory function. Patients who are obese have increased respiratory rates as compared with normal subjects. Due to the

quantity of adipose tissue in the visceral cavity, around the rib cage, and on the belly, obesity has an adverse influence on lung function. They often breathe quickly and shallowly, which is also typical of people with neuromuscular diseases and chest wall abnormalities. The way body fat is distributed may also have an impact on how obesity affects lung function. Generally speaking, upper body obesity is thought to be more dangerous for cardiovascular and metabolic health than lower body obesity [4]. The physical fitness of an individual is reflected by the aerobic capacity. The aerobic capacity is measured by maximal oxygen consumption ( $VO_2$  max). The body mass index, body fat percentage, and body muscle mass are all impacted by the decrease in physical activity. However, body weight has a significant impact on the absolute value, hence it is often stated as ml/kg/minutes. The variables affecting body

composition and aerobic capacity are closely related [5]. A majority of studies have shown that obese individuals perform more poorly on cardiorespiratory fitness tests than the normal individual [6].

**Materials and Methods**

Thirty obese adults in the age group of 18-25 college students from Galgotias University, Greater Noida, U.P. participated and underwent a basic screening assessment. The subjects were made aware about the type of study and requested to give the consent form prior to the study.

**Experimental design**

Aerobic capacity is measured by YMCA 3 min step test. The breathing pattern was assessed by hi-lo test. The measurement of height was measured with measuring tape mounted vertically to the wall and perpendicular to the floor. The subject stood with his back and foot against the wall. The midline of the body was positioned in line with the measuring tape behind the subject the measurement was taken. Participants wore light clothes and had their weight assessed using a weighing machine. All the measurements were taken and noted down. BMI was measured by Quetelet’s Index.

**Assessment of breathing pattern [7]**

The breathing pattern was assessed with the breathing hi-lo test. In this test the individuals were in the standing position and the examiner placed one hand on chest and other on the stomach, asked the patient to breathe normal and assess the breathing pattern (thoracoabdominal and abdominothoracic breathing pattern).

**Measurement of YMCA 3 min step test score [8]**

Maximal aerobic capacity was predicted using the YMCA Step Test. Bench stepping is a safe, established technique for measuring an adult’s maximum oxygen consumption during submaximal activity. A 12-inch wooden stepping stool, a stopwatch, and a pulse oximeter were also utilized. After a short presentation and practice session, the step test started. For three minutes, the individuals were instructed to step continuously in four-step cycles of up-up-down-down. Following the test, the individuals remained standing while the pulse rate was recorded for a full minute. The subject’s test result is determined by their overall one-minute post-exercise heart rate. The Statistical Package for Social Science (SPSS) version

22 was used for data analysis. To compare the parameters, Pearson correlation was used.

**Results and Discussion**

Thirty young obese adults in the age group of (20.6 ± 0.89) were subjected to participate in this research (Table 1). Obesity in terms of BMI (31.25 ± 1.2) (Table 1). The percentage of participants (N = 30) having thoracoabdominal breathing pattern (N = 14) is 46.6% and abdominothoracic breathing pattern (N = 16) is 53.3% (Table 2). The result of statistical analysis of YMCA 3 min step test and breathing pattern is shown in table 3. YMCA 3 min step test shows highly significant negative correlation with breathing pattern, r = -0.310, p < 0.05 (Table 3 and Graph 1).

BMI measures of obesity (31.25 ± 1.2) BMI shows highly significant negative correlation with breathing pattern, r = -0.565, p < 0.05 (Table 4 and Graph 2). In contrast, BMI shows highly significant positive correlation with YMCA 3 min step test score, r = -0.565, p < 0.05 (Table 5 and Graph 3). Descriptive data (mean ± standard deviation) of the measured variable including BMI and age in table 1.

Variables	Mean ± SD
BMI (kg/m <sub>2</sub> )	31.25 ± 1.2
Age	20.6 ± 0.89

**Table 1:** Descriptive data related to measured variables in obese adults (n = 30).

Breathing Pattern	% of Participants
Thoracoabdominal (1)	46.6
Abdominothoracic (2)	53.3

**Table 2:** Percentage of participants having thoracoabdominal and abdominothoracic breathing pattern out of total no. of participants (n = 30).

The present study was primarily designed to evaluate the relationship between the aerobic capacity and breathing pattern in obese adults. Data showed a significant result that there is a negative correlation between aerobic capacity and breathing pattern. An epidemic illness is obesity. It is characterized by the buildup of extra body fat. It is described using BMI terminology. The WHO classified the body fatness on the basis of BMI and

is considered healthy if BMI is >18.5, overweight if BMI is >25, obese if BMI is >30 and morbidly obese if BMI is >40. Weight gain leads to many metabolic and structural changes which make the obese individual more susceptible to several diseases including pulmonary, cardiovascular, sleep apnea and metabolic alterations.

		<b>Breathing Pattern</b>
YMCA 3 min step test	R	-0.310
	P	<0.05

**Table 3:** Comparison of YMCA 3 min step test and breathing pattern.

**Graph 1:** Graphical representation of participants having thoracoabdominal and abdominothoracic breathing pattern.

		<b>Breathing Pattern</b>
BMI	R	-0.565
	P	<0.05

**Table 4:** Comparison of BMI and breathing pattern.

**Graph 2:** Scatter Diagram Showing Relationship between YMCA 3 minute step test score and breathing pattern.

		<b>YMCA 3 min step test score</b>
BMI	R	0.620
	P	<0.05

**Table 5:** Comparison of BMI and YMCA 3 min step test score.

**Graph 3:** Scatter Diagram Showing Relationship between BMI and breathing pattern.

Obesity alters the proper functioning of respiratory system due to the accumulation of fat around the rib cage and abdomen. Obese people are noted to breathe quickly and shallowly, which is also noticed in neuromuscular problems. VO2 max is a unit of measurement for aerobic capacity. Obesity has an impact on VO2max because it raises body weight, which modifies the absolute value. Influence on aerobic ability. In milliliters per kilogram per minute, VO2max is calculated. In our investigation, we discovered a substantial inverse relationship between Breathing Pattern and Obesity ( $r = -0.565, p < 0.05$ ). In contrast, a very significant direct correlation (HR in bpm) has been shown between the 3 minute step test score and obesity ( $r = 0.620, p < 0.05$ ). This demonstrates the startling consequences of body fat accumulation on heart rate. A large quantity of body fat impairs pulmonary and cardiac function. Particularly with any strenuous activity, the heart function is changed. The severity of the functional impairment will increase with BMI. According to Prabha Setty, *et al.* there is a very substantial negative link between obesity and VO2 max [9]. Vazgen Minasian, *et al.* likewise found a strong negative correlation between boys' and girls' aerobic fitness levels and body fat percentage. Juhee Kim, *et al.* reported a cross-sectional inverse relationship between physical fitness and overweight among school-aged children [6]. Limitation of the study: Less number of individuals participated in the study. Significance of study: The present study helps to evaluate the correlation between the aerobic capacity and breathing pattern

in obese adults. This study will help to prevent the abnormalities before arriving and also treat the patients with the already developed abnormalities by exercise and training.

### Scope for future research

Large number of individuals can be approached for data collection.

Effects of gender can be in cooperated in the future studies to observe physiological difference.

### Conclusion

- There was a significant negative correlation between aerobic capacity and breathing pattern in young obese adults.
- These results highlight the significance of obese people' poor cardiorespiratory fitness, which may play a role in the later onset of cardiovascular co-morbidities in middle life.

### Conflict of Interest

No financial interest or any conflict of interest exists.

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