



A STUDY OF MAXIMAL OXYGEN CONSUMPTION [VO₂MAX] IN OBESE AND NON OBESE INDIVIDUALS AT TERTIARY HEALTH CARE CENTER

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ABSTRACT

Introduction: Maximal Oxygen Consumption (VO₂ Max) is the maximal attainable rate of oxygen consumption during exercise using large muscle groups. It indicates the aerobic capacity.

Aims and Objectives: study of Maximal Oxygen Consumption [VO₂max] in Obese and non obese individuals at tertiary health care center.

Materials and Methods: This was a cross-sectional study carried out in the apparently healthy adults during the one year period i.e. March 2018 to March 2019 so during the one year period there were 100 volunteers enrolled to study. All details of the patients like age, sex, Weight, height, BMI was calculated. All the volunteers were undergone Oxygen Consumption [VO₂max] in Obese and non obese individuals. The data was entered to excel sheet and analyzed by unpaired t-test and chi-square test and calculated by SPSS 19 version test.

Result : In our study we have seen that The average age was comparable i.e. 39.17±2.39 and 40.13± 3.45 (t=0.54 ,p>0.05);and the proportion of Male : Female was also comparable i.e. 1.78 as to 1.38 (X²=2.34,df=1,p>0.05) , Average BMI In both the groups were comparable i.e. 23.41± 1.98 and 24.38± 2.15 (t=0.27,df=98,p>0.05) . The Maximal VO₂ (L/min) was significantly higher in Obese Group i.e. 3.92± 2.34 as compared to Normal i.e. 2.87± 2.45 (t=5.98,p<0.05) where as VO₂max/resting VO₂ (mL/kg per minute) was 33.2± 1.94 and 48.32± 1.76 (t=6.13,p<0.05); VO₂max/resting VO₂ was 11.9±2.65 and 13.9±3.75 (t=8.92,p<0.001) was significantly higher in Normal as compared to Obese respectively ; Max O₂ pulse (VO₂/HR X 10³) 18.67± 3.52 and 16.13±2.48 (t=6.29,p<0.05) was significantly higher in Obese.

Conclusion : It can be concluded from our study that VO₂Max was significantly higher in Normal individuals as compared to Obese hence obesity may be responsible for the cardio respiratory functions

KEYWORDS : VO₂max, Obese, non-obese

INTRODUCTION:

Maximal Oxygen Consumption (VO₂ Max) is the maximal attainable rate of oxygen consumption during exercise using large muscle groups. It indicates the aerobic capacity. VO₂ max is internationally accepted parameter and first choice in measuring a person's cardiopulmonary status (1). It is one of the most widely obtained variables in exercise physiology. It is deemed to have implications for both health and exercise performance. It is a measure of the functional limit of the cardio respiratory system and single most valid index of maximal exercise capacity (2). The absolute value of VO₂ max is one of the best indices of an individual's cardio respiratory fitness to transport oxygen to working muscles. It is useful when changes in maximal aerobic capacity of children are assessed during the period of pre-puberty to adolescence. An increase in VO₂ max is a common method of demonstrating a training effect in endurance training studies (3). Factors that influence VO₂ max are Mode of exercise, Hereditary, State of training, Gender, Body size and composition, Age, Altitude, Temperature, ageing, disease, muscle mass, age, sex and body mass index. A person's state of aerobic training contributes significantly to the VO₂ max it normally varies between 5 and 20% depending on a person's fitness at the time of testing. In some cases of very sedentary individuals or long term bed rest, it has been increased by 100% (4).

Obese have higher absolute VO₂ max expressed per unit surface area as compared to non-obese. However, VO₂ max per kg of body weight was actually less in obese than in non-obese indicating reduced aerobic capacity. In obese it is probably because of the excessive amount of body fat that appeared to exert an unfavorable burden as well as hindering action towards cardiac function, it fails to uptake sufficient amount of oxygen due to deposition of proportionately high amount of fat. The journey from early life obesity to cardiovascular disease will be evident by slow regression of their cardio respiratory efficiency. Cardio respiratory efficiency refers to the ability of the circulatory and respiratory system to supply oxygen to skeletal muscles during sustained physical activity. VO₂ max is the maximum capacity to transport and utilize oxygen during incremental exercise. It is also known as aerobic capacity, which reflects physical fitness of a person (5).

MATERIALS AND METHODS

This was a cross-sectional study carried out in the apparently healthy adults during the one year period i.e. March 2018 to March 2019 so during the one year period there were 100 volunteers enrolled to study. All details of the patients like age, sex, Weight, height, BMI was calculated. All the volunteers were undergone Oxygen Consumption

[VO₂max] in Obese and non obese individuals. The data was entered to excel sheet and analyzed by unpaired t-test and chi-square test and calculated by SPSS 19 version test.

Table 1: Distribution of the patients as per the age and sex

	Obese (n=50)	Normal (n=50)	P-value
Age	39.17±2.39	40.13± 3.45	t=0.54 ,p>0.05
Sex			
Male	32	29	X ² =1.92,
Female	18	21	p>0.05
Average BMI	28.13± 3.72	23.46±1.82	t=5.63,p<0.01

The average age was comparable i.e. 39.17±2.39 and 40.13± 3.45 (t=0.54 ,p>0.05);and the proportion of Male : Female was also comparable i.e. 1.78 as to 1.38 (X²=2.34,df=1,p>0.05) , Average BMI In both the groups were comparable i.e. 23.41± 1.98 and 24.38± 2.15 (t=0.27,df=98,p>0.05)

Table 2: Distribution of the patients as per following parameters.

Parameters	Obese (n=50)	Normal (n=50)	p-value
Maximal VO ₂ (L/min)	3.92± 2.34	2.87± 2.45	t=5.98,p<0.05
VO ₂ max/resting VO ₂ (mL/kg per minute)	33.2± 1.94	48.32± 1.76	t=6.13,p<0.05
VO ₂ max/resting VO ₂	11.9 ± 2.65	13.9 ± 3.75	t=8.92,p<0.001
Max O ₂ pulse (VO ₂ /HR X 10 ³)	18.67± 3.52	16.13± 2.48	t=6.29,p<0.05

The Maximal VO₂ (L/min) was significantly higher in Obese Group i.e. 3.92± 2.34 as compared to Normal i.e. 2.87± 2.45 (t=5.98,p<0.05) where as VO₂max/resting VO₂ (mL/kg per minute) was 33.2± 1.94 and 48.32± 1.76 (t=6.13,p<0.05); VO₂max/resting VO₂ was 11.9 ± 2.65 and 13.9 ± 3.75 (t=8.92,p<0.001) was significantly higher in Normal as compared to Obese respectively ; Max O₂ pulse (VO₂/HR X 10³) 18.67± 3.52 and 16.13± 2.48 (t=6.29,p<0.05) was significantly higher in Obese.

DISCUSSION:

Increase in body mass leads to obesity. Obesity is defined as abnormal or excessive fat accumulation in adipose tissue, to the extent health may be impaired (6). Early life obesity is developed due to modern sedentary life style and faulty food habits (6). It has become one of the leading global public health problems and one of the underlying causes

of non communicable chronic diseases. It has become one of the leading causes of morbidity and mortality in both developed and developing countries⁽⁷⁾. Obesity in adult is defined as having a body mass index (BMI) that is 25-30 kg/m². The normal range of BMI is between 18.5 and 24.99 (kg/m²)⁽⁸⁾. Overall picture in India is less 6% in the population. There are substantial differences in the prevalence of obesity by age, race and socio-economic status^(8,9). Studies have shown that overweight and obesity are associated with medical disorders such as hypertension, diabetes, cardiovascular diseases, stroke, certain cancers, premature mortality, and respiratory diseases⁽¹⁰⁾. People are prone to develop cardiovascular diseases and other chronic diseases at young age of their life because of early life obesity⁽¹¹⁾.

In obese individuals, more body weight is seen for particular height but fat mass and fat free mass are ignored. Increased body mass index reflects high body fat and fat free mass and they have different association with cardiovascular fitness. Physiological effects of overweight on height and body composition in relation to cardiovascular fitness needs further research. Least documents available between the body fatness and aerobic fitness for Indian community Assessment of cardio respiratory fitness by the maximum rate of oxygen consumption (VO₂ max) by Bruce protocol is the most commonly used exercise stress test⁽¹²⁾. VO₂ max by Bruce protocol is reliable and valid test for functional assessment of cardiovascular system^(12,13).

In our study we have seen that The average age was comparable i.e. 39.17±2.39 and 40.13± 3.45 (t=0.54 ,p>0.05);and the proportion of Male : Female was also comparable i.e. 1.78 as to 1.38 (X²=2.34,df=1,p>0.05) , Average BMI In both the groups were comparable i.e. 23.41± 1.98 and 24.38± 2.15 (t=0.27,df=98,p>0.05)

The Maximal VO₂ (L/min) was significantly higher in Obese Group i.e. 3.92± 2.34 as compared to Normal i.e. 2.87± 2.45 (t=5.98,p<0.05) where as VO₂max/resting VO₂ (mL/kg per minute) was 33.2± 1.94 and 48.32± 1.76 (t=6.13,p<0.05); VO₂max/resting VO₂ was 11.9 ± 2.65 and 13.9 ± 3.75 (t=8.92,p<0.001) was significantly higher in Normal as compared to Obese respectively ; Max O₂ pulse (VO₂/HR X 10³) 18.67± 3.52 and 16.13± 2.48 (t=6.29,p<0.05) was significantly higher in Obese.

This was similar to **Chaithanyakumari Marrigunta et al**⁽⁴⁴⁾ they showed highly significant lower values of mean Vo2max/kg body weight (37.98±4.45 vs 48.63±4.48; P<0.001) and VO2max/kg lean body mass (60.77±7.19 vs 68.06±7.17; P<0.001) of young obese participants as compared to young normal weight participants

CONCLUSION :

It can be concluded from our study that VO₂ Max was significantly higher in Normal individuals as compared to Obese hence obesity may be responsible for common cardio respiratory conditions.

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