

A Comparative Study of Pulmonary Function between Exercising and Non-Exercising Obese Adults

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Abstract: Background: Obesity has a deleterious effect on various body systems. Taking into consideration the respiratory system, for people with similar grades of obesity it is expected that they will have a similar effect on the respiratory parameters. When two groups, namely the exercising and non-exercising obese individuals with similar grades of obesity are compared for their PFT parameters, it gives us information regarding the effect of exercise on the respiratory system in presence of obesity. Methodology: After taking consent all the obese individuals were divided based on the inclusion and exclusion criteria in the respective groups. PFT was done for both these groups and the outcome measures namely FEV1, FEV1/FVC and Inspiratory Capacity (IC) were compared. Results: The results showed that the Inspiratory Capacity was higher for the exercising group also being statistically significant. The other two values were higher for the exercising group but statistically not significant. Conclusion: The difference in the Inspiratory Capacity shows that regular exercises have a beneficial effect on the respiratory system in obese individuals.

Keywords: Obesity, Pulmonary Function Test, Respiratory System, Exercise

1. Introduction

Obesity, being a global health issue, is expanding worldwide at an alarming rate. According to WHO, it is defined as abnormal or excessive fat accumulation that presents a risk to health. Worldwide obesity has nearly tripled since 1975 and approximately 1.9 billion adults aged 18 years and above are overweight, out of which 650 million adults are obese, says a WHO report. Rajeev Ahirwar et al[17], [18]. Obesity in India has reached epidemic proportions in the 21st century, with morbid obesity affecting 5% of the entire country's population. A study in the Indian Journal of Endocrinology and Metabolism says the percentage of rural Indians who were overweight grew from 2% in 1989 to 17.1% in 2012[19].

Body Mass Index (BMI) is one of the most commonly used measure of obesity. It takes into consideration the weight and height of the person. BMI above 30kg/m^2 is considered to be obese. There is a wide spectrum of ill-effects caused by obesity. One of the targets is respiratory system, which often goes unnoticed until serious complications occur or the person faces some serious discomfort. Obesity causes an increased deposition of adipose tissue around the abdomen and the visceral cavity. This can increase the load on the chest wall and in turn affect the pulmonary function. This respiratory affection can become serious if obesity progresses. Parameters of respiratory system can be measured by various means out of which Pulmonary Function Test (PFT) being one of the most accurate measure is used to assess the lung volumes, capacity, flow rate, etc. Another aspect of health which is fitness has now become the need of the hour. It has been proven that a regular exercise program is beneficial for an individual to remain fit and healthy in all aspects. In obese individuals the

deposition of adipose tissue will hamper the pulmonary efficiency.

For people with similar grade of obesity it is expected that they will have similar effect on the respiratory parameters. Thus, by comparing the PFT parameters between the exercising and non-exercising obese individuals the study will let us know the effect of exercise on the respiratory system.

Previous studies have found an association between exercise and improved lung function in obese individuals using outcome measures such as PEFr, PFT, tension-time index etc. But all of these being international studies, such a research needs to be done on Indian population. Hence this study aims to prove the association between exercise and lung function by using outcome measures like PFT on Indian population.

2. Methodology

This is across sectional study with the study population being obese adults according to the Asian criteria. The study was conducted during a period of 6 months from September 2019 to February 2020 through convenient sampling for a sample size of 54, with 27 subjects in each group at the Central Research Lab of K J Somaiya College of Physiotherapy, Sion.

Inclusion Criteria: Asymptomatic females/males with BMI 30kg/m^2 and above, between the age group of 20-50yrs. For the Exercising group: exercising at least since 6 weeks, ≥ 5 days/week, 30-45 mins/session and for the Non-exercising group: Age and gender matched subjects not exercising

regularly and not involved in any regular culturaland sports activity. Also, individuals willing to participate in the study.

Exclusion Criteria:Smokers,individuals diagnosed of any known respiratory conditions, subjects contraindicated for pulmonary function test (eg. pregnancy, recent head or chest surgeries, etc.) and individuals practicing pranayama or any breathing exercises on regular basis.

Outcome measures being thepulmonary function test parameters: (1) Forced Expiratory Volume in 1 second (FEV1), (2) Forced Expiratory Volume in 1 second/ Forced Vital Capacity (FEV1/VC),(3) Inspiratory Capacity (IC).

After obtaining approval for the study from the Institutional Ethics Committee, consent was taken from all the subjects shortlisted through convenient sampling based onBody Mass Index as well as the other inclusion and exclusion criteria. Pulmonary function test was conducted for all the subjects wherein a mouthpiecewas made to be held snugly, so as to not let any air go out through the sides.The person was told to inspiredeeply followed by a long complete forcefulexpiration, and then to inspire again through the mouthpiece. Three to fivetrials were taken and the best reading was chosen. This was recorded in form of a printed report which specified predicted and actual values of FVC, FEV1, their ratio, and Inspiratory Capacity.

Parameters were compared for both the groups and statistical tests were conducted. Results of the test were noted.

3. Statistical tests and Data analysis

- Comparison of FEV1, FEV1/FVC and Inspiratory Capacity between exercising and non-exercising obese adults was done by GRAPHPAD INSTAT 3.10.
- The values of FEV1 and Inspiratory Capacity passed normality and hence, unpaired t test was done.
- The values of FEV1/FVC did not pass normality and hence, Mann Whitney test was done.
- Mean and standard deviation was calculated forthe age and BMI as well.

4. Results

The study consisted of 54 subjects, 27 in each group with BMI more than or equal to 30kg/m² and from age group of 20-50 yrs.

Table 1: Mean ± SD for various PFT parameters in the exercising and the non-exercising groups

	Exercising Group	Non-exercising Group
FEV1	79.89 ± 13.3	75.89 ± 17.55
FEV1/FVC	98.19 ± 9.09	94.48 ± 14.35
Inspiratory Capacity	84.59 ± 12.28	76.92 ± 19.61

Table 2: Mean ± SD for age and BMI in the exercising and non-exercising groups

	Exercising Group	Non-exercising Group
Age	37.03 ± 11.35	34.15 ± 10.22
BMI	31.74 ± 2.59	33.65 ± 4.21

When the mean values of percentage predicted of FEV1 werecompared for both the groups, the values for the exercising group were higher than the non-exercising group but statistically not significant, with the p value of 0.175.

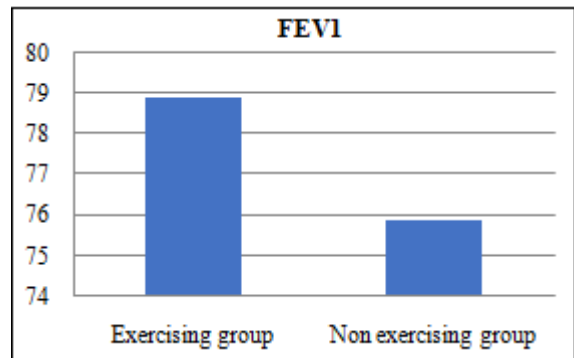


Figure 1: The above graph shows the mean values of FEV1 for the exercising and non-exercising groups

When the mean values of percentage predicted of FEV1/FVC were compared for both the groups, the values for the exercising group were higher than the non-exercising group but statistically not significant, with the p value of 0.26.

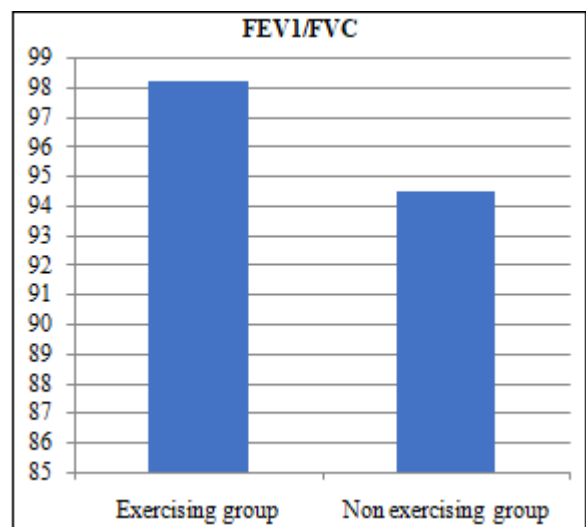


Figure 2: The above graph shows the mean values of FEV/FVC for the exercising and non-exercising groups

When the mean values of percentage predicted of Inspiratory Capacity were compared for both the groups, the values for the exercising group were higher than the non-exercising group and statistically significant, with the p value of 0.0462.

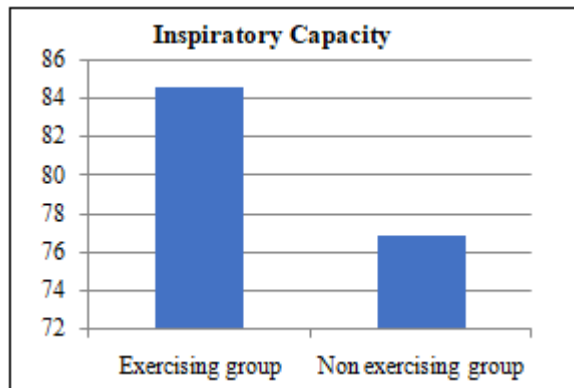


Figure 3: The above graph shows the mean values of Inspiratory Capacity for the exercising and non-exercising groups

5. Discussion

This research aims to study the parameters namely Inspiratory Capacity, FEV₁ and ratio of FEV₁/FVC in the exercising and the non-exercising obese adults. It also compares these parameters between both the groups.

Obesity interferes with respiratory function by decreasing lung volumes and affecting the lung expansion. Thiago et al [8]. For this study, PFT was done for 54 obese adults, to study their respiratory status.

Comparison of Inspiratory Capacity showed the values for the exercising group were higher than the non-exercising group and statistically significant, with the p value of 0.0462.

Comparison of FEV₁ and the ratio of FEV₁/FVC showed that the values for the exercising group were higher than the non-exercising group but statistically not significant, with the p value of 0.175 and 0.26 respectively.

This also shows that obesity being a restrictive type of condition hampers the inspiratory parameters more than the expiratory parameters.

Previous study shows that prolonged aerobic exercises improve aerobic capacity and have a favourable effect on lung function. But this is due to the high intensity of exercise which will show significant results. Arwa Rawashdeh et al [2].

In this study, when clinically reviewed, the values for the exercising group were higher than the non-exercising group even in the presence of obesity, which shows that exercise does have a positive effect on the respiratory system.

Abdominal obesity plays a major role in restricting the lung expansion and the lung function. Christopher et al [4]. Out of all the types, abdominal obesity affects the respiratory system the most. Subjects in this study were not classified or screened for the type of obesity and hence, the affection of pulmonary function will be varied for different individuals.

Since this study was a cross-sectional study and not an intervention-based study the exercise protocol was pre-decided and not closely regulated. Thus, some of the results

of this study being insignificant can be due to inconsistency in the intensity of exercise.

The other aspects not considered in this study were physical activity level, environment and lifestyle of individuals. These factors have a great impact on the body conditioning and will affect the pulmonary functioning of a person. Y J Cheng et al [16]. Since, they were not considered in this study it may affect the results.

According to previous studies, it is seen that severely obese adults, with BMI of 45 or above, will have a greater reduction in FVC and FEV₁ when compared with their age matched controls. A M Li et al [5].

The BMI criterion for this study is 30 kg/m² and above, which means the subjects included ranged from mild to severe obesity. The mean BMI for exercising obese being 31.74 and the mean BMI for non-exercising obese being 33.65 signifies majority of subjects being in the mild obese category and hence the affection of the respiratory parameters will not be very high.

Further research can be done to know which particular exercises work best to benefit the respiratory muscles along with helping the BMI to reach within the normal range. More knowledge can be gained through further research as to which selective exercises have an effect on a particular PFT parameter.

6. Conclusion

On comparing the mean values of Inspiratory Capacity between both the groups, the values of exercising group were higher than the non-exercising group and statistically significant. This proves that regular exercises have a positive effect on the respiratory muscles and if adapted early in the course can act as a preventive measure against ill effects of obesity.

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