

**“EFFECT OF BREATHING EXERCISES ON MAXIMAL OXYGEN CONSUMPTION IN OBESE WOMEN.”**

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**Abstract:**

**Introduction:** As the obesity epidemic continues to rise, research has begun to focus on the effects of excessive body weight on an individual's health status. Studies have examined obesity's role in many conditions and parameters. However there are hardly any studies to improve functional capacity in obese individuals. The present study was undertaken to find out the effect of breathing exercise training on maximal oxygen consumption in obese women by comparing the pre and post  $VO_{2max}$  achieved by performing step test.

**Methods:** In this pre-post prospective Study, 40 obese female participants were trained with breathing exercises (diaphragmatic breathing, pursed lip breathing, thoracic expansion exercises, and incentive spirometry) and their pre and post  $VO_{2max}$  was calculated by Step test. Data were analyzed by statistical methods.

**Results:** The results analyzed with paired t test and were found to be highly significant ( $p < 0.0001$ ) in improving  $VO_{2max}$  in obese individuals.

**Conclusion:** There is an increase in the functional capacity of obese women with a breathing training exercise program.

**Key words:** Obesity, Breathing Exercises, Maximal Oxygen Uptake.

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**Introduction:**

In recent survey in 2012, it was found that one in every three individuals in India is overweight. <sup>1</sup> The Indian frames are generally smaller, hips wider and legs shorter. Most urban Indian males tend to accumulate fat around the middle whereas the women around bulging waist lines and hips. Authors suggest that human obesity results from a complex interaction of factors including, Genetics, Environmental, Metabolic, Physiologic, Behavioral, Social, Racial influence, Eating patterns, Influence of physical inactivity. <sup>2</sup> Obesity is that state of the body in which weight of the body is 10% more than the ideal weight. It's one of the most essential and fast spreading condition of the 21<sup>st</sup> century. <sup>1, 2</sup> Research shows that the lesser the waist, more protection from

coronary artery diseases.

Obese people are at an increased risk of respiratory symptoms, such as breathlessness, particularly during exercise, even if they have no obvious respiratory illness. <sup>3</sup> Obesity has a clear potential to have a direct effect on respiratory well-being, since it increases oxygen consumption and carbon dioxide production, while at the same time it stiffens the respiratory system and increases the mechanical work needed for breathing. The most consistently reported effect of obesity on lung function is a reduction in the functional residual capacity (FRC). This effect reflects a shift in the balance of inflationary and deflationary pressures on the lung due to the mass load of adipose tissue around the rib cage and abdomen and in the

visceral cavity. There is an exponential relationship between BMI and FRC, with a reduction in FRC detectable even in overweight individuals.<sup>3</sup>

Studies have seen effects of dyspnea, relation with lung volumes and particularly, much of this research has examined obesity's role in elevating the risk of certain diseases, conditions, and cancers.<sup>4, 5, 6, 7</sup> Thus; there is a need to reduce the metabolic, mechanical, cardiovascular, respiratory, diseases which occur in body. Obese people are at an increased risk of respiratory symptoms, particularly during exercise, even if they have no obvious respiratory illness.<sup>3</sup> With this background in mind the present work was conducted to find out the effect of breathing exercise training on maximal oxygen consumption in obese women by comparing the pre and post  $VO_{2max}$  achieved by performing step test.

**Methodology:**

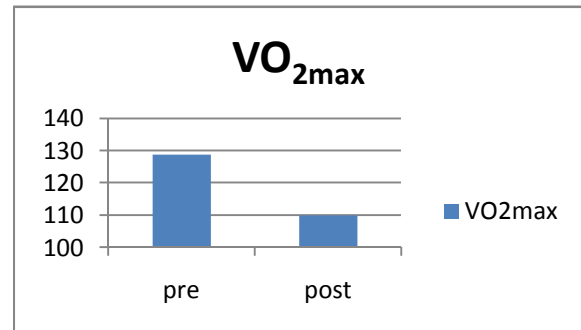
The study design used was prospective pre-post study. The work was conducted in rural population at Loni located in Ahmednagar district of Maharashtra in India. The study duration was one year. The inclusion criteria for the study were 40 normal healthy females whose BMI was between  $30.4 \pm 1.7 \text{ kg/m}^2$  with age group from 35 to 45 years who were willing to participate in the study. The exclusion criteria for the study were females with hypertension, diabetes mellitus, any pre-morbid factors, heart diseases, any recent surgeries, any oncological conditions and any condition which would alter the results of the study. The outcome measure used in the study was Maximal oxygen uptake ( $VO_{2max}$ ).

**Procedure:** Breathing exercise training was given to the subjects for 6 weeks. The breathing exercises included were diaphragmatic breathing, pursed lip breathing,

thoracic expansion exercises, and incentive spirometry exercises (sustained maximal inspirations with or without the use of an incentive spirometer). Each exercise was performed for 10 repetitions for 10 times in a day.

Step test was taken pre and post intervention and  $VO_{2max}$  achieved were calculated. The step test used was Home Step test. In this test the participant has to step up and down, one foot at a time, onto the bench for 3 minutes trying to maintain a steady four beat cycle (22-24 steps/minute). On finishing the test the number of heart beats is counted for 15 seconds. This number of beats in 15 seconds is multiplied by 4. This final value is used to assess performance.

**Data Analysis and Results:**



The graph below shows the comparison between Pre and post  $VO_{2max}$  achieved.

The table below shows the mean  $VO_{2max}$  achieved pre and post intervention.

$VO_{2max}$ achieved	Mean Values
Pre breathing exercise training	128.74(±4.22)
Post breathing exercise training	109.93(±1.76)

The results analyzed with paired t test and were found to be highly significant ( $p < 0.0001$   $t = 26.019$  with 78 df.) in improving  $VO_{2max}$  in obese individuals. The post BMI was also assessed but significant improvement was not found in them. The post BMI calculated were  $30.07 \pm 0.84 \text{ kg/m}^2$ .

**Discussion:** The results of this study shows, breathing exercise training given for 6 weeks show significant improvement in improving  $VO_{2max}$  in obese individuals. These results were comparable with previous studies. The possible physiology behind these findings may be as explained in a study titled physiology of obesity and effects on lung function by Salome et al. In their study obese subjects with marked reductions in ERV up to 20% predicted, ventilation was preferentially distributed to the upper zones of the lung, leaving the lower, dependent zones relatively under-ventilated. According to them during exercise, obese people tend to increase their breathing frequency more, and tidal volumes less than the non-obese people. Similar changes occur during bronchoconstriction in association with increasing elastic loads, represented by increasing respiratory system elastance. However, in mild to moderate obesity, tidal volumes at rest are often in the normal range, and the frequency and magnitude of regular sighs and deep inspirations appear similar to those with normal weight. This suggests that the modulation of airway smooth muscle contractility by regular tidal stretching and deep inspirations may be unimpaired in mild to moderate obesity.<sup>3</sup> Hence the improvement in functional capacity because of breathing improvement may be predicted. Another authors suggested that breathing has extraordinary healing capacity on physical and emotional levels.<sup>5, 6</sup> Research indicates that pranayama, a form of yoga, the conscious

breathing is more helpful to improve pulmonary function.<sup>5, 6</sup>

In a study, authors report no difference between the physical activity levels of metabolically healthy obese and non-metabolically healthy obese women.<sup>7</sup> Discrepancies between studies regarding physical activity levels may be explained in part by different methods used to measure physical activity because it is a complex behavior difficult to assess accurately.<sup>8</sup> Another interesting observed finding in this study is that BMI was also an independent predictor of functional capacity, even after considering the metabolically healthy obese phenotype.<sup>8</sup> This result is consistent with previous studies that have demonstrated an inverse association between obesity level and functional capacity.<sup>9, 10, 11, 12</sup> Therefore, this suggests that, even if a woman is considered as metabolically healthy obese, weight management should remain an important objective to improve functional capacity. The results of the present study also correlate to these findings.

**Conclusion:** From present study we could conclude that there is an increase in the functional capacity of obese women with a breathing training exercise program.

**Limitations and future scope:** Several limitations of the current study included were that only 40 females are taken as subjects. So, the future studies could be done on a larger population including males. Patients with co morbid factors could be included as a part of the study. As the study was undertaken in rural area many advanced instruments for analysis of  $VO_{2max}$  and pulmonary function tests were not available, hence the vast future scope.

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**Date of Submission: 22 January 2013**

**Date of Provisional acceptance: 05 February 2013**

**Date of Final acceptance: 28 February 2013**

**Date of Publication: 05 March 2013**

**Source of support: Nil; Conflict of Interest: Nil**