



Immediate effect of diaphragmatic strengthening in breath holding test on obese class I students

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Abstract

Background: Obesity is often defined according to World Health Organization simply as a condition of abnormal or excessive fat accumulation in adipose tissue, to the extent that health may be impaired. Patient who are obese have increased respiratory rate, decreased total lung capacity, total lung volume etc compared to normal. Breath holding capacity is defined as the matters as the exchange of gases in the lungs during breath holding, the effects of hyperventilation and O₂ inhalation on breath holding time, and the inter-relation of barometric pressure and breath holding ability. Diaphragmatic breathing exercise helps strengthen your diaphragm muscle, an important muscle that helps you breathe. The POWER breathe may be recommended to because of weak diaphragm muscle. It used to help strengthen the diaphragm by breathing against adjustable level of resistance.

Objectives: The purpose of the study was to find out the immediate effect of diaphragmatic strengthening for breath holding test in obese class I students.

Methodology: Study Design - Experimental study design. Subjects were selected based on inclusion and exclusion criteria with purposive sampling technique. Subject with obesity BMI 25kg/m²-29.9kg/m² were taken. Breath holding test was used to assess the pre and post effect of diaphragmatic strengthening using POWERbreathe device at load 5.

Result: The result were analyzed by using paired t test. The statistical significant analyzed was (p<0.001). Mean pre BHT of obese class I students was 24.57, mean post BHT of obese class I students was 32.3. Comparison of pre and post BHT in obese class I students using paired t test, p value obtained was (<0.0001) which is statistically significant.

Conclusion: The study concluded that immediate effect is seen after diaphragmatic strengthening in breath holding test on obese class I students.

Keywords: breath holding, diaphragmatic strengthening exercise, power breathe device, obesity

Introduction

Obesity is often defined according to World Health Organization simply as a condition of abnormal or excessive fat accumulation in adipose tissue, to the extent that health may be impaired [1]. A common population measures of obesity is the body mass index (BMI). A person with BMI of 30kg/m² or more is generally considered as obese [2].

Prevalence of obesity is found in India to be 44.7% among women and 33% among men. Obesity is found to be more among females than males. Among adults within the age group of 20-40 yrs. of age around 72.9% [3]. As obesity is a condition of abnormal or excessive fat accumulation of adipose tissue, lipid storing cells adipocytes comprise adipose tissue. These adipocytes release endocrine regulating molecules. These molecules are: energy regulating hormone (leptin), cytokines (TNF alpha and IL6) insulin sensitivity regulating agents (adiponectin, resistin and RPB4), prothrombotic factor (plasminogen activator inhibitor) and blood pressure regulating agents. Adipose tissue is increased due to enlargement of adipose cell due to excess of intracellular lipid deposition as well as due to increase in no. of adipocytes.

Major factors can contribute to obesity including lifestyle choices, medical condition like PCOS, Asthma etc, age, medications and genetics. Other contributing factors are: lifestyle habits, social factors, addictions (smoking, alcohol) [4].

Obesity has major effects on pulmonary function. Patient who are obese have increased respiratory rate compared to normal. The mean respiratory rate of obese person ranged from 16-20 breaths/min., while that of normal subjects ranged from 10-12 breaths/min. Effect of obesity on lung volume is decrease in respiratory reserved volume. Another effect on lung volume is there is a increase in thoracic or mediastinal fat in obese patients [5].

The mass loading of the ventilatory system induced by obesity, specifically on the abdominal component of the Chest wall, increases the static balance within the respiratory system. The lung function shows restrictive pattern with a reduction in lung volumes which in massive obesity amounts to 20 to 30 percent of total lung capacity (TLC) and vital capacity (VC). The obesity implies a heavy load for the respiratory muscles may leads to respiratory complications. In obese subjects the diaphragm is in upper position, which results in a low functional residual capacity (FRC) [6].

Effects of obesity are hyperinsulinemia, type 2 diabetes mellitus, hypertension, hyperlipoproteinemia, atherosclerosis, non-alcohol fatty liver disease, osteoarthritis, cancer [4]. Complications of obesity in adults is concluded that obesity and other risk factors of non-communicable disease are now emerging problems in the countries. Clinicians are reminded to look for the

complication in obese patient and institution intervention emphasizing the benefits of weight loss in obese patients^[7]. Breath holding capacity is defined as the matters as the exchange of gases in the lungs during breath holding, the effects of hyperventilation and O₂ inhalation on breath holding time, and the inter-relation of barometric pressure and breath holding ability^[8]. The cardiopulmonary reserve is interpreted by the duration of breath holding. Normal value of cardiopulmonary reserve indicates >25 seconds^[9]. Diaphragmatic breathing is a type of breathing exercise that helps to strengthen the diaphragm, an important muscle that helps in inspiration^[10]. Diaphragmatic breathing has a lots of benefits - It helps to relax, lowering the harmful effects of stress hormone cortisol on your body, it lowers the heart-rate, it helps to lower the blood pressure, it improves the core muscle stability, it helps to cope with the symptoms of post-traumatic stress disorder (PTSD), It improves body's ability to tolerate intense exercise.

The diaphragm is dome shaped respiratory muscle at the base of the rib-cage, right below the chest. During inspiration the diaphragm and the other respiratory muscles around the lungs contract to increase intra-thoracic pressure which helps to increase thoracic expansion, lung function etc. While inhalation most of the work is done by diaphragm. During inhalation the diaphragm contracts so that the lungs can expand into extra-space and let in as much air as necessary. Muscles in between ribs are the intercostal muscles, raises the ribcage in order to help diaphragm let enough air into the lungs^[10].

The ventilatory muscles are a very important role in helping to make your breathing effective. The most important muscle of these is diaphragm. This is the muscle found underneath the ribs. The diaphragm is usually a strong and efficient muscle. The POWER breathe may be recommended to because of weak diaphragm muscle. It used to help strengthen the diaphragm by breathing against adjustable level of resistance^[11].

Objectives

1. To find out the immediate effect of diaphragmatic strengthening for breath holding test in obese class I students.
2. To find out the effect of diaphragmatic strengthening on obese class I students.
3. To find out the immediate effect of diaphragmatic strengthening exercise in Breath holding capacity.

Materials and Methods

An ethical approval was taken by the ethical committee of the institution before undertaking the study and a written consent was taken from the subjects explaining the entire procedure of the study before recruiting them in the study.

Study design- Experimental study

Sample size: A total of 56 participants were recruited in the study. Sample size was calculated considering an allowable error of 20% with the confidence interval set at 95% by the following formula based on the results.

Inclusion criteria

- Both males and females
- Subjects age group - 19 to 24 yrs.
- Subjects of Obese class I (25kg/m²-29.9kg/m²)
- Subjects who was willing to participate

- College going students

Exclusion criteria

- Subjects who was having other respiratory conditions (asthma).
- Subjects having positive neuro-muscular signs.
- Subjects with connective tissue and cognitive disorder.
- Subjects below and above obesity class I.
- Subjects who was having cardiac problems.
- Subjects who was unwilling to participate.

Procedure

- Subject was selected according to the inclusion criteria and excluded according to the exclusion criteria by purposive sampling method.
- The procedure was explained in detail to the subject.
- Informed consent for participation of subjects in the study was obtained.
- Demographic data was taken and complete assessment was done.
- Sabrasez Breath holding pretest was calculated.
- Diaphragmatic strengthening using power breath device was given and post breath holding test was calculated.

Intervention

Diaphragmatic strengthening exercise

1. The subject should sit comfortably with back supported.
2. The shoulders should be relaxed.
3. The POWER breathe device is on its lowest resistance setting i.e on load 5.
4. Then diaphragmatic breathing was told to perform for 4-5 times/3sets
5. Tell the subject to holding the device in hand, place the mouthpiece fully into mouth so that the outer shield is between lips and gums.
6. Keeping the mouth piece in the mouth and nose clip was used to pinch the nostrils together.
7. Then using the device diaphragmatic breathing was told to perform for 10 times at load 5.
8. Before using the device diaphragmatic breathing should be demonstrated and practiced for 3-4 times/3sets.

Statistical analysis

Statistical analysis was performed by using the SPSS software version 16.00 (SPSS, Inc. Chicago. IL). Data were expressed as Mean ± SD. The result were analyzed by using the paired t test.



Fig 1

Results

Table 1: Baseline Characteristics

Characteristics	Mean ± SD
Age	21.7 ± 1.2
Male	19
Female	37
Weight	73.9±8.8
Height	163.4 ± 9.3
BMI	27.6 ± 1.54
PRE BHT	24.5 ± 4.7
POST BHT	32.3 ± 4.5

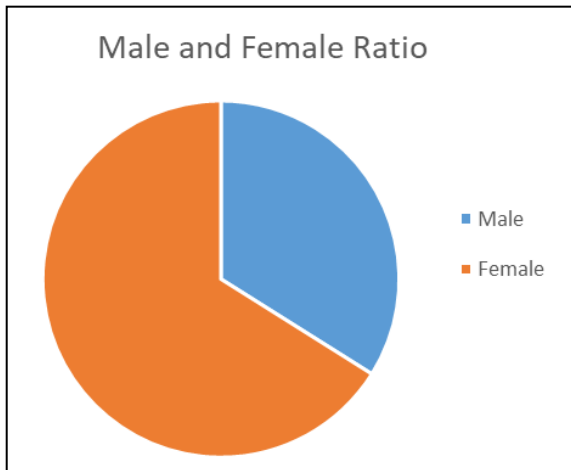


Fig 1

Table 2: Comparison of PRE and POST Breath Holding Test

Outcome	Means	SD	T value	P value
PRE	24.5	4.78	26.61	<0.0001
POST	32.3	4.55		

In Table No.2 Comparison of pre and post breath holding test in obese class 1 students using paired t test p value obtained was <0.0001 which is statistically significant.

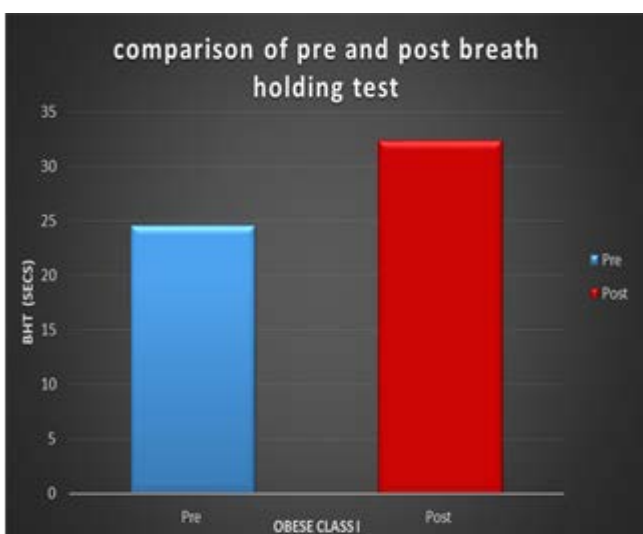


Fig 2: Comparison of PRE and POST Breath Holding Test

There was a statistically significant difference in pretest and posttest value by using power breathe device for diaphragmatic strengthening exercise in breath holding test on obese class I students.

Discussion

The present study an experimental study was conducted to see the immediate effect of diaphragmatic strengthening. This study was aimed to find out the immediate effect of diaphragmatic strengthening in breath holding test on obese class I students. All individuals were evaluated using body mass index BHT (As per WHO guidelines).The present study shows statistically significant result in obese class I students (p<0.0001) therefore the result was statistically significant. Alison Mc Conell *et al* (2013) stated in there study that the breathing muscles are a very important role in helping to make your breathing effective. The most important muscle of there is diaphragm. The diaphragm is usually strong and efficient muscle, but occasionally it can become weak. This may occur after surgery, underlying lung condition, repeated chest infections or because of dysfunctional breathing pattern. The POWER breathe device may recommended because of weak diaphragm muscle. It used to help strengthen the diaphragm by breathing against adjustable level of resistance. [11] Diaphragmatic breathing is a type of breathing exercise that helps to strengthen the diaphragm muscle. It is an important muscle for inspiration. During inspiration the diaphragm muscle contracts to increase the intra- thoracic pressure which leads to increase in thoracic expansion, lung function and Breath holding capacity.

One of the similar research carried by Shima Hussein Ahmed Roshdy *et al.* (2019) found that POWER breathe device was effective in rehabilitation in post liver transplantation and helped in improvement of quality of life, and enhances patients compliance and independence. It concluded that the inspiratory muscle training by IMT device for one month in post liver transplantation patient significantly improved the diaphragmatic strength [12].

Another research carried out by SR Kulkarni, E Fletcher *et al.* (2010) studied that pre-operative inspiratory muscle training preserves post-operative inspiratory muscle strength. Where the study revealed that 2 weeks inspiratory muscle training before surgery using a inspiratory muscle trainer (POWER breathe) showed significant increase in inspiratory muscle strength pre-operatively and preserves it postoperatively [13].

In the present study the main objective was to to find out the immediate effect of diaphragmatic strengthening in breath holding test on obese class I students. The prevalence of age related obesity in the study was mean age of 19-24 years and out of that 19 male and 37 female. Thus, the study result showed a significant difference within the group.

Limitations and suggestion

- The limitations of the study are that only obese class I students were included in the study.
- The male and female subjects were not separated.
- As Diaphragmatic MMT was not taken so the particular resistance was not set as it was not the objective of the study.

- Further, research might be carried out in obese class II students, large sample size, different age group or by using different outcome measure.

Conclusion

The study concluded that immediate effect is seen after diaphragmatic strengthening in breath holding test on obese class I students.

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