RESEARCH PAPER

Comparative Effects of Diaphragmatic Breathing and Modified Inspiratory Muscle Training on Forced Expiratory Volume and Gerd Impact Scale in Patients with Gerd

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ABSTRACT

INTRODUCTION: Gastroesophageal reflux disease is frequently occurring digestive system disorder and incidence has been increasing year by year. Gastroesophaseal reflux disease is caused by disorder in they movement of upper digestive tract and gastric acid reflux in the esophagus. There are two main reason of acid reflux; first increase abdominal cavity pressure and second weakened anti- reflux mechanism.

AIM: Aim of the study is to compare the effectiveness of diaphragmatic breathing exercise and modified inspiratory muscle training exercise among the patients with gastroesophageal reflux disease.

BACKGROUND: Breathing exercises can improve the symptoms of patients with gastro- esophageal reflux disease (GERD), but their specific effect and function are disputed. To evaluate and conduct a meta-analysis on the effect of breathing exercises on patients with GERD.

METHOD: A prospective randomized controlled study was performed. Patients with non- erosive GERD or healed esophagitis without large hernia and/or previous surgery were included. Patients were randomized and allocated either to active breathing training program or to a control group. Quality of life (QoL), pH-metry, and on-demand proton pump inhibitor (PPI) usage were assessed at baseline and after 4 weeks of training. For long-term follow-up, all patients were invited to continue active breathing training and were further assessed regarding QoL and PPI usage after 9 months.

CONCLUSION: We show that actively training the diaphragm by breathing exercise can improve GERD as assessed by pH-metry, QoL scores and PPI usage. This non- pharmacological lifestyle intervention could help to reduce the disease burden of GERD. To some extent, breathing exercises can relieve the symptoms of patients with GERD.

Keywords: *Gastroesophageal reflux disease (GERD), GERD impact scale, forced expiratory volume, diaphragmatic breathing exercise, modified inspiratory muscle training exercise.*

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INTRODUCTION

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Gastroesophageal reflux disease is frequently occurring digestive system disorder, and incidence has been increasing year by year. Gastroesophaseal reflux disease is caused by disorder in the movement of upper digestive tract and gastric acid reflux, in the esophagus. There are two main reason of acid reflux; first increase abdominal cavity pressure and second weakened anti- reflux mechanism. Lower-esophageal sphincter, crura of diaphragm, angle of his and phrenoesophageal membrane, together form barrier against gastroesophageal reflux. The most common symptom are heart burn and regurgitation but frequent symptom such as chronic cough, pharyngodynia, hoarseness of voice, dyspnoea, dysphasia, belching.

GERD is a chronic condition where stomach contents, including acid, flow back up into the esophagus causing symptoms like heartburn and potentially leading to complications if left untreated.

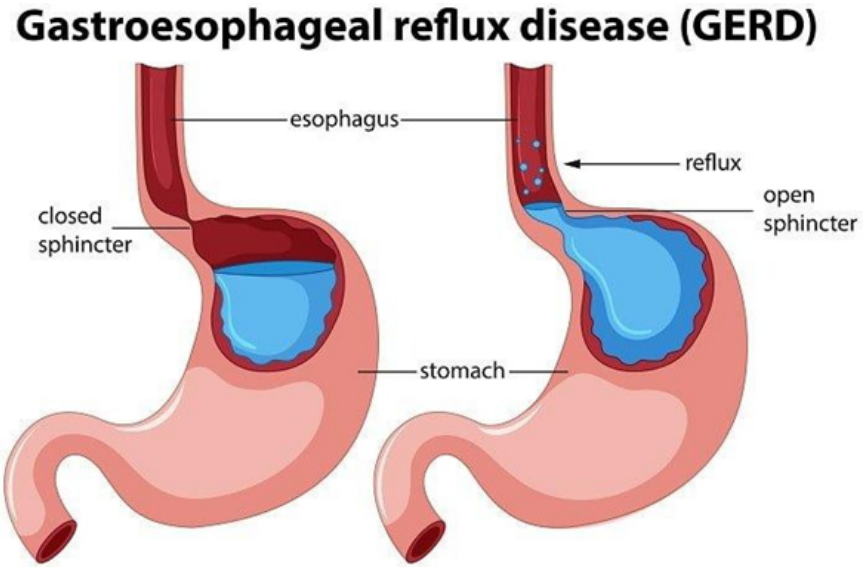


Figure 1

Breathing exercise on GERD

During breathing exercise crura of the diaphragm increase tension over the lower esophageal sphincter, which leads to proper closing of lower esophagus.

Thus, training of the diaphragm with breathing exercise could decrease reflux and reduce symptom of GERD.

Modified inspiratory muscle training exercise on GERD

Crura of diaphragm fibers surrounding the esophageal musculature are one of the fundamental component of anti-reflux barrier and these actively contract during inspiration. IMT could train the crura fibers therefore positively influencing anti-reflux barrier. It seems it is able to increase pressure generated by LES, reduce spontaneous release of LES acid exposure.

Anatomy: Lower esophageal sphincter is about 2-3 cm and situated in the lower part of esophagus, at the junction of the stomach and esophagus. Supporting structures for the LES is crura of diaphragm, angle of his and phrenoesophageal membrane.

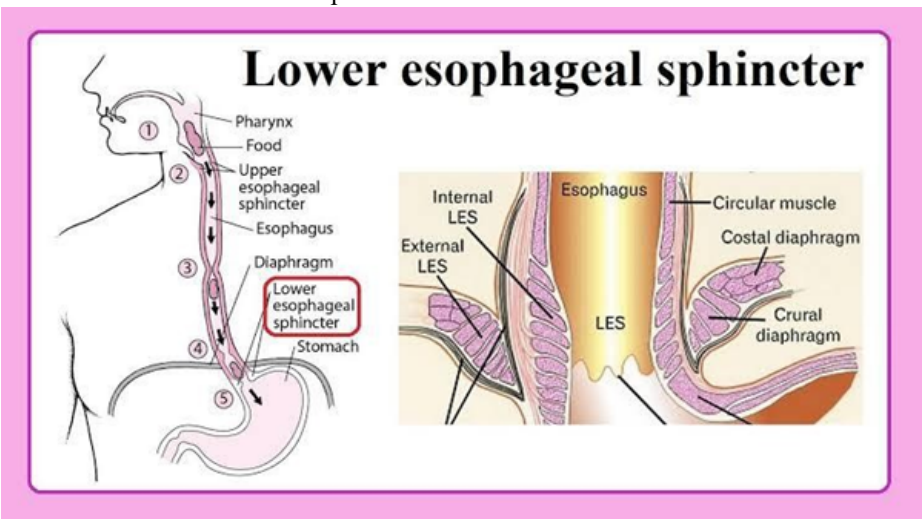


Figure 2

Physiology:
Hydrochloric acid secreted in the stomach for digestion and killing mycobacteria. Weakened LES and increased abdominal pressure cause backflow of HCL into the esophagus (which is not supposed to exposure of acid) which cause heart burn, chronic cough, dysphonia etc. Initially it will erode the mucous layer of esophagus, on later if it not address it will lead to Adenocarcinoma of Barrett's oesophagus.

GERD involves the failure of the anti-reflux barrier, primarily lower esophaseal sphincter, allow stomach contents to flow back into the esophagus, leading to oesophageal damage.

AIM OF THE STUDY:
Aim of the study is to compare the effectiveness of diaphragmatic breathing exercise and modified inspiratory muscle training exercise among the patients with gastroesophageal reflux disease.

OBJECTIVE OF THE STUDY:
To evaluate the effectiveness of the diaphragmatic breathing exercise and modified inspiratory muscle training exercise on GIS among the patients with gastroesophageal reflux disease.

To evaluate the effectiveness of the diaphragmatic breathing exercise and modified inspiratory muscle training exercise on FEV among the patients with gastroesophageal reflux disease.

BACKGROUND OF THE STUDY:
Gastroesophaseal reflux disease (GERD) is one of the most common diseases, but is still a challenge to prevent or reduce the symptoms. Different medical treatments are used, first of all antacids, proton pump inhibitors (PPI's), however these are sometimes ineffective and long-term intake can lead to underestimated complications. Recently some studies investigated the role of inspiratory muscle training (IMT) in the medical treatment of GERD. It seems that IMT is able to increase the pressure generated by the lower oesophageal sphincter (LES), reduce spontaneous releases of LES, acid exposure, use of PPl and improve symptoms and quality of life for GERD patients. Breathing exercises can improve the symptoms of patients with gastroesophageal reflux disease (GERD), but their specific effect and function are disputed. To evaluate and conduct a meta-analysis on the effect of breathing exercises on patients with GERD.

Antonio Moffa et al. (2019): m-lMT is a low-cost therapy without side effects. It could be useful in association with PPI or alone for selected GERD cases and for mild NERD forms, in association with diet. Further studies are required to prove the effects of m-IMT on GERD symptoms and decide the best treatment schedule.

Kaijie Qiu et al. (2020): To some extent, breathing exercises can relieve the symptoms of patients with GERD.

NEED OF THE STUDY:
The need of the study is investigating the effect of diaphragmatic breathing exercise and modified inspiratory muscle training exercise among the patients with gastroesophageal reflux disease. Understanding the impact of diaphragmatic breathing exercise and modified inspiratory muscle training exercise can provide valuable insights into tailored rehabilitation strategies for patients with GERD. Furthermore, existing studies offer conflicting evidence regarding the most effective approach, necessitating further investigation for more conclusive results. By examining these factors comprehensively, this study aims to contribute novel perspectives and evidence-based guidelines to enhance the management and outcomes of GERD in population, ultimately improving their quality of life while reducing the symptoms of GERD.

HYPOTHESIS:

NULL HYPOTHESIS(H0):
There is no significant difference between the effect of diaphragmatic breathing exercise and modified inspiratory muscle training exercise among the patients with gastroesophageal reflux disease.

ALTERNATIVE HYPOTHESIS(H1):
There is a significant difference between the effect of diaphragmatic breathing exercise and modified inspiratory muscle training exercise with or without changing position among the patients with gastroesophageal reflux disease.

REVIEW OF LITERATURE:

1. **AJ Eherer et al.,2012,** We show that actively training the diaphragm by breathing exercise can improve GERD as assessed by pH-metry, QoL scores and PPI usage. This non-pharmacological lifestyle intervention could help to reduce the disease burden of GERD as assessed by pH-metry.
2. **Maryam Sadiq et al.,2025,** The study concludes that abdominal breathing exercises can improve the GERD symptoms as assessed by QoL score and on demand PPI usage. It advocates for an alternative treatment option for GERD patients that is more efficacious as compared to no breathing exercises and has less potential side effect as compared to continuous PPI use, enabling us to lead our way towards revolution in medicine providing more effective and less invasive treatment options to facilitate our patients.
3. **Amin Hosseini et al.,2022,** Diaphragmatic breathing training can alleviate symptoms and improve quality of life in patients with GERD.
4. **Magnus Halland et al., 2021,** In patients with upright GERD, DB reduces the number of postprandial reflux events pressure by increasing the difference between LES and gastric pressure. These

data further encourage studying DB as therapy for GERD.

5. **Kaijie Qiu et al.,2020**, To some extent, breathing exercises can relieve the symptoms of patients with GERD.
6. **Raphael Martins et al.,2017**, IMT can promote benefits for cardiac autonomic control, however the heterogeneity of populations associated with different protocols, few studies reported in the literature and the lack of randomized controlled trials make the effects of IMT on cardiovascular autonomic control inconclusive.
7. **Antonio Moffa et al.,2020,** m-IMT is a low-cost therapy without side effects. It could be useful in association with PPI or alone for selected GERD cases and for mild NERD forms, in association with diet. Further studies are required to prove the effects of m-IMT on GERD symptoms and decide the best treatment schedule.
8. **M. CASALE et al.,2016,** Among the non-surgical, non-pharmacological treatment modalities, the breathing training on diaphragm could play an important role in selected patients to manage the symptoms of GERD.
9. **Lucie Zdrhova et al.,2023,** Current knowledge suggests the potential of breathing exercises in the treatment of GERD; however, long-term efficacy, patient selection, and the role of HRM in tailoring physiotherapeutic approaches requires further research.
10. **Mehdi Ahmadi et al.,2021,** AE had no effects on LES pressure but can improve QOL of the patients. DB had more effects on QOL than AE, so injured or disable patients with reflux who cannot do AE, can benefit from DB to improve their reflux symptoms.
11. **Hassnaa Eid Shaban Mosa et al.,2024,** Abdominal breathing offers better therapeutic improvements in all patients' outcomes such as reduced severity and frequency of GERD symptoms, reduced antacid consumption, increased sleep quality, and increased satisfaction with life quality. Healthcare professionals are encouraged to incorporate abdominal breathing into treatment protocols for patients with non-erosive GERD.
12. **Hassnaa Eid Shaban Mosa et al.,2023,** Belly breathing presenting better therapeutic improvements in all patients out comes as reduction of GERD symptoms severity and frequencies, little anti acid consumption, better sleep quality and more satisfaction with health-related quality of life.
13. **Stylianos Syropoulos et al.,2025,** IMT seems to provide promising effects in strengthening the antireflux valve mechanism, as it increases MIP and diaphragmatic excursion. This systematic review established a bibliographic gap for the contribution of IMT in the antireflux valve mechanism. More evidence is needed to support the importance of IMT as a non- pharmacological intervention for GERD patients.
14. **Miguel Angelo Nobre e Souza et al.,2013,** The main results of our study show that both average and inspiratory EGJ pressures are increased, and tLESR rate, the proximal esophagus acid exposure, as well as the GER symptoms are reduced in GERD patients by IMT.
15. **Siti Chandra Widjanantie et al.,2023,** MDT in adults after COVID-19 with GERD enhanced diaphragmatic excursion and MIP and decreased symptoms of gastroesophageal reflux by 8.60 points of GERDQ. Respiratory symptoms and other side effects were comparable between the groups.

METHODOLOGY:

- **Study design**: Randomized controlled trial
- **Study setting**: Vels School of Physiotherapy, Thalambur
- **Study type:** Comparative study
- **Sample size**: 30
- **Study duration**: 4 Weeks

SELECTION CRITERIA:

- **INCLUSION CRITERIA:**
  - Age above 18 years
  - Patient using acid suppressive therapy
  - Reflux was proven by positive pH-metry.
  - Patient have symptom such as heart burn, regurgitation, and acid regurgitation.
  - Patient treated by PPI or acid suppressant effectively and symptoms recur after withdrawal.
- **EXCLUSION CRITERIA:**
  - Hiatal Hernia (>2cm)
  - Patients with erosive esophagitis
  - Previously undergoing anti-reflux surgery
  - Patients with secondary GERD (other factor can cause or aggravate esophagitis, such as surgery, pregnancy, drugs etc.)
  - Previous operation at the LES

OUTCOME MEASURES:

- GERD impact scale
- Forced expiratory volume

MATERIALS USED:

1. Spirometer machine
2. Mouth piece

3. Laptop

4. Pillows

Figure 3: (Spirometer Machine)

Figure 4: (Mouth Piece)

Figure 5: (Laptop)

Figure 6: (Pillows)

PROCEDURE:

In this experimental study, 30 subjects with GERD who fulfilled the inclusion and exclusion criteria were selected, then the participants were allocated to one of the two groups, according to the inclusion criteria and exclusion criteria. Group A (Diaphragmatic breathing exercise) with 15 peoples (n=15) and Group B (Modified inspiratory muscle training exercise) with 15 peoples (n=15). Both of the groups perform the exercises all days in a week for a duration of 4 weeks. The pre and post-test was taken by using the outcome measures like GERD impact scale and forced expiratory volume.

GROUP A:

In the experimental group, pre-test and data of the patients with GERD was recorded before the first session. The players were asked to undergo the GERD impact scale and forced expiratory volume.

Patients started the exercise in a supine position. One hand was placed on the chest and the other hand on the abdomen above the navel. Instructions were given to inhale through the nose and exhale with the mouth open, moving only the abdomen. The metaphor of inflating and deflating a balloon in the abdomen was given to aid patient in performing this maneuver. The goal was to feel the abdomen rise and fall with each breath, while the chest and shoulders remained still. Importance was placed on complete inflation and deflation of the abdomen. Inhalation and exhalation were made to be slow, with the patient counting to 4 with each inhalation and exhalation. Inhalation was then maintained at 4 counts, and exhalation gradually extended to 8 counts. If a participant had difficulty prolonging exhalation, breathing out was done through pursed lips instead. When assessed by the speech therapist to be competent in performing the above maneuvers, participants progressed to doing the same exercise while sitting and then standing. Patients were given homework to practice, and was recommended to perform 30 breaths or for 5 minutes 3 times daily, and for 5 minutes when symptomatic. Each participant was seen for either up to 4 sessions, or until the speech therapist judged that the participant could perform diaphragmatic breathing as taught in supine and upright positions.

DIAPHRAGMATIC BREATHING EXERCISE:

POSITION OF THE PATIENT: Supine lying/Semi-fowler

PROCEDURE: Ask patient to place dominant hand over abdomen and non-dominant hand over chest. Inhale through nose and while inhaling abdomen should bulge out and exhale through mouth.

HOLD TIME: 3-5 seconds

DURATION: 30 breath or 5 min. 3 time per day.

Figure 7: (Diaphragmatic Breathing Exercise)

GROUP B:

In the experimental group, pre-test and data of the patients with GERD was recorded before the first session. The players were asked to undergo the GERD impact scale and forced expiratory volume.

m-IMT schedule is composed of 4 different exercises:

Exercise number 1: Supine position. Inhale slowly from the nose thinking of making a minimum supply. Suspend the breath for about 3s. Exhale from the nose by performing an expiratory act as long as possible and avoiding a state of contraction of the abdominal muscles.

Exercise number 2: Repeat exercise number1 after positioning the fingertips few centimetres away from the last costal arch. Apply constant pressure inwards and upward during the expiratory phase. Check the tension status of the abdominal and cervical muscles. Try to keep the physiological curves of the spine as much as possible.

Exercise number 3: Repeat exercise number 2, expiring from the mouth with maximum mandibular destabilization keeping the tongue well laid on the oral floor.

Exercise number 4: Sitting position. Bring the lingual apex on the retro-incisal papilla. Keeping lips open, perform swallowing acts for 3min."

MODIFIED INSPIRATORY MUSCLE TRAINING EXERCISE:

POSITION: Supine lying / Sitting position

PROCEDURE: Inhale slowly from the nose thinking of making a minimum supply. Suspend the breath for about 3s. Exhale from the nose by performing an expiratory act as long as possible and avoiding a state of contraction of the abdominal muscles.

DURATION: 30 min. Twice a day (before lunch and before dinner), all day in a week

Long Sitting Supine

Figure 8: (Modified Inspiratory Muscle Training)

DATA ANALYSIS AND INTERPRETATION

The study conducted on 30 subjects with gastroesophageal reflux disease to compare effect of diaphragmatic breathing exercise and modified inspiratory muscle training exercise. The data was carefully collected and calculated. All the parameters were assessed using the statistical package for social science (SPSS). The descriptive statistics (mean and standard deviation) and inferential statistics (paired sample t-test and independent samples t- test)

Descriptive Statistics

- Mean & Standard deviation for Continuous variables, namely age, GERD impact scale, forced expiratory volume.

Inferential Statistics

- Intra Group Analysis – Paired Samples t-test
- Inter Group Analysis – Independent Samples t-test

Paired Samples t-test

Hypotheses:

- Null Hypothesis, H0: μd = 0
- (i.e., there is **no significant effect** of **Treatment A (or B)** in terms of measures, namely GERD impact scale and forced expiratory volume.)

Alternate Hypothesis, H1: μd > 0 (*Right-tailed test*)

- (i.e., there is **significant effect** of **Treatment A (or B)** in terms of measures, namely GERD impact scale and forced expiratory volume.)

In this case, μd = mean difference between Pre and Post-test scores;

d = difference **= Post Test Score - Pre-Test Score**

Level of significance, α = 0.05

Test to be applied: Paired Sample t-test

$$t=\frac{\mu_d-0}{s_d/\sqrt{n}}$$

Test Statistic:

1. **Independent Samples t-test Hypotheses**:

Null hypothesis, H0: μ1 = μ2

(That is, there is no significant difference between two treatments (A & B) in terms of changes in measures, namely GERD impact scale and forced expiratory volume.)

Alternative hypothesis, H1: μ1 ≠ μ2 (*Two-tailed test*)

(That is, there is significant difference between two treatments (A & B) in terms of changes in measures, namely GERD impact scale and forced expiratory volume.)

Level of significance: α = 5% or 0.05

Test to be applied: Independent Samples t-test

Test Statistic:

$$t=\frac{\bar{X}_1-\bar{X}_2}{S\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}$$,where S =Pooled S.D = $$\sqrt{\frac{(n-1)s_1^2+(n-1)s_2^2}{n_1+n_2-2}}$$

Table 1: Comparison of Gerd Impact Scale and Forced Expiratory Volume Score Between Pre-Test and Post-Test Within Group A.

GROUP A	PRE TEST		POST TEST		t-TEST	SIGNIFICANCE
	MEAN	SD	MEAN	SD		
GIS	16.93	6.37	4.87	2.83	11.817	0.0001
FEV	69.47	3.29	72.07	3.61	15.921	0.0001

The above table reveals the mean, standard deviation (S.D), t-test and p value of the GERD impact scale and forced expiratory volume score between pre-test and post-test within group

A. This table shows that there is highly significant difference between pre-test and post-test value of GERD impact scale in group-A (*P<0.0001) and there is no significant difference between pre-test and post-test values of forced expiratory volume in group-A(*P<0.0001).

GRAPH -1: Comparison of Gerd Impact Scale and Forced Expiratory Volume Score Between Pre-Test and Post-Test Within Group-A

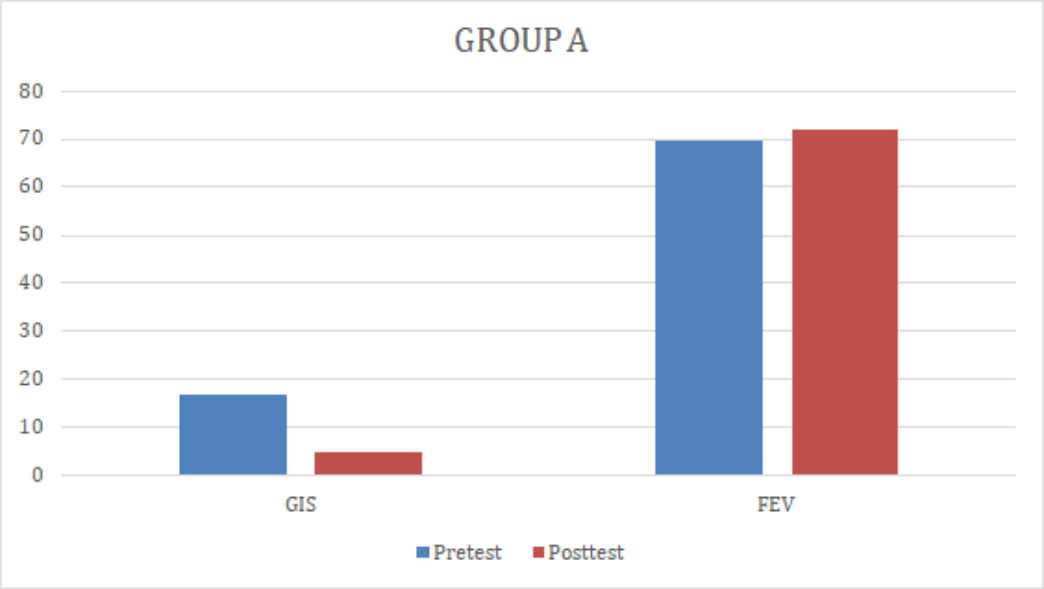


Table 2: Comparison of Gerd Impact Scale and Forced Expiratory Volume Score Between Pre-Test and Post-Test Within Group-B

GROUP B	PRE TEST		POST TEST		t-TEST	SIGNIFICANCE
	MEAN	SD	MEAN	SD		
GIS	18.00	4.46	8.20	2.43	13.640	0.0001
FEV	69.73	3.26	74.93	3.24	15.921	0.0001

The above table reveals the mean, standard deviation (S.D), t-test and p value of the GERD impact scale and forced expiratory volume score between pre-test and post-test within group

B. This table shows that there is significant difference in pre-test and post-test values of GERD impact scale and forced expiratory volume score in group B (*P<0.0001), (*P<0.0001).

GRAPH-2: Comparison of Gerd Impact Scale and Forced Expiratory Volume Score Between Pre-Test and Post-Test Within Group-B

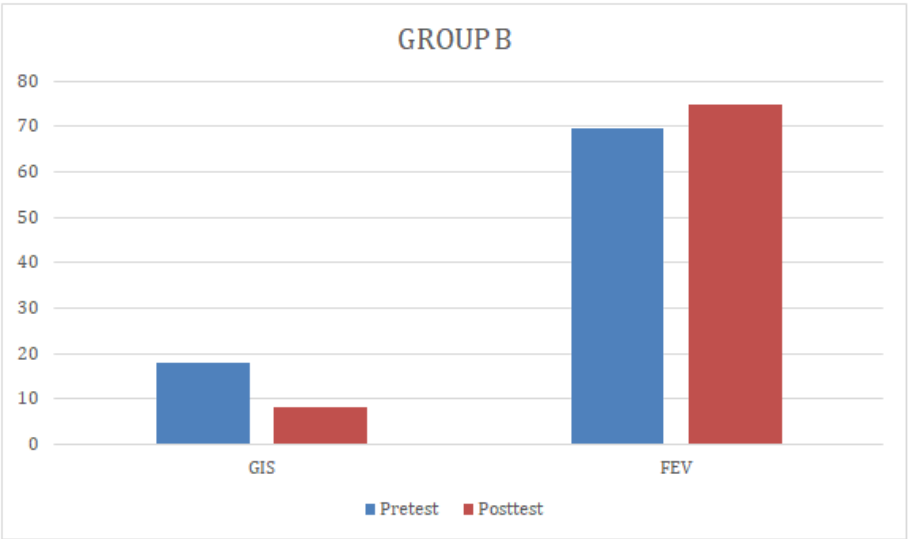


Table-3: Comparison of Pre-Test and Post-Test Values of Gerd Impact Scale In Between Group-A and Group-B.

GERD IMPACT SCALE	GROUP-A		GROUP-B		t-TEST	SIGNIFICANCE
	MEAN	SD	MEAN	SD		
PRE TEST	16.93	6.37	18.00	4.46	0.531	0.5995
POST TEST	4.87	2.83	8.20	2.43	3.466	0.0017

The above table reveals the mean, standard deviation (S.D), t-test and p value of the GERD impact scale pre-test and post-test values in group-A and group-B. This table shows that, there is significant difference in pre-test and values of the GERD impact scale in between group-A and group-B (*P >0.5). In group-A shows significant decrease

in the post-test mean values, which is lesser than group-B (*P<0.0017).

GRAPH 3: Comparison of Pre-Test and Post-Test Values of Gerd Impact Scale In Between Group-A and Group-B

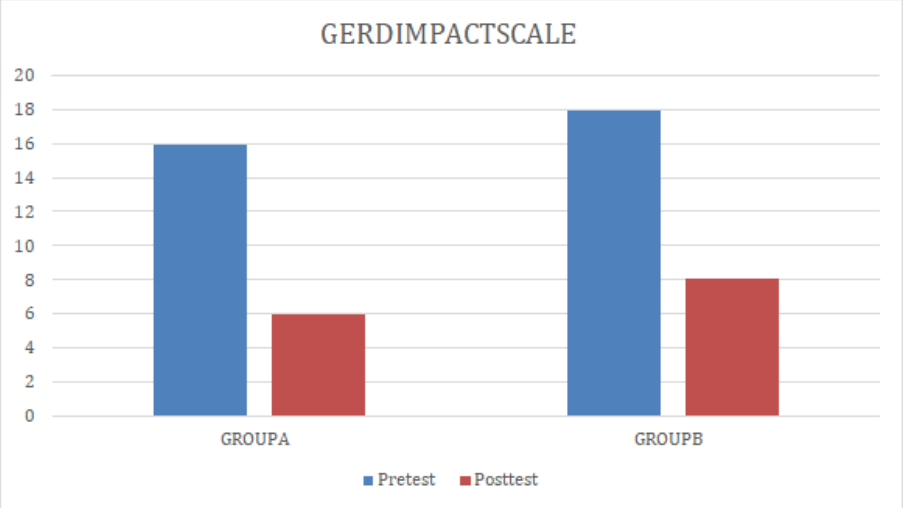
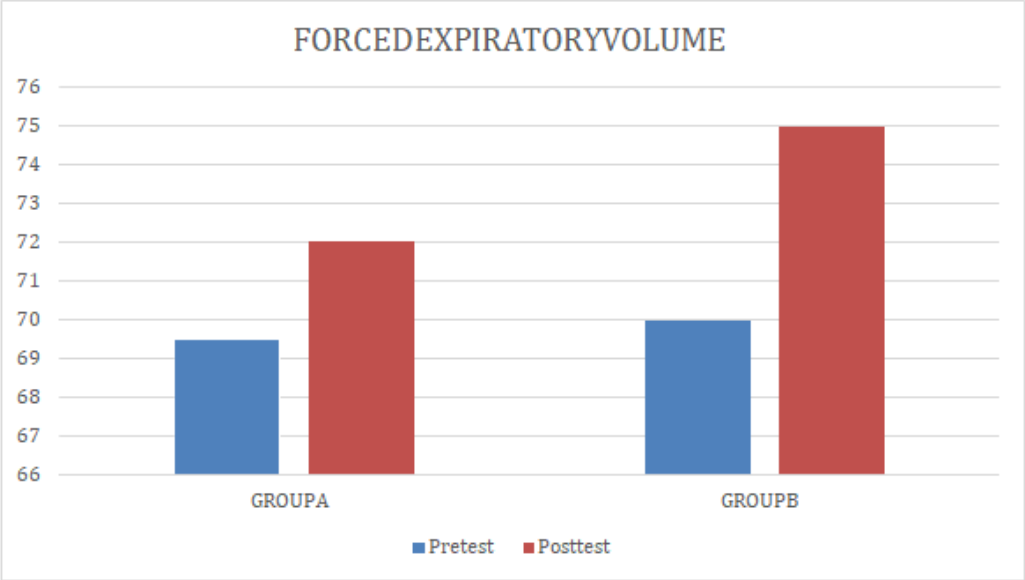


Table 4: Comparison of Pre-Test and Post-Test Values of Forced Expiratory Volume In Between Group-A and Group-B.

FORCED EXPIRATORY VOLUME	GROUP-A		GROUP-B		t-TEST	SIGNIFICANCE
	MEAN	SD	MEAN	SD		
PRE TEST	69.47	3.29	69.73	3.26	0.222	0.8253
POST TEST	72.07	3.61	74.93	3.24	2.287	0.0299

The above table reveals the mean, standard deviation (S.D), t-value and p-value between pre- test and post-test within group–A and group-B. There is significant difference between the pre- test and post-test value of forced expiratory volume scores in group – A and group-B.

GRAPH 4: Comparison of Pre-Test and Post-Test Values of Forced Expiratory Volume In Between Group-A and Group-B



RESULT

30 Subjects were included in this study. The statistics were done by using the statistical package for social science (SPSS) version 26.0 to see the effectiveness of both the diaphragmatic breathing exercise and modified inspiratory muscle training exercise on patients with GERD. There is evidence of significant difference within the group-A (Diaphragmatic breathing exercise) was noted on GIS score p-value is 0.0001, and the group -B (Modified inspiratory muscle training exercise) was noted on FEV score p-value. is 0.0001. There was significant difference when compared between pre-test and post-test difference in group-A and group-B on GIS and FEV score was 0.0017 and 0.0299 respectively, at the duration of 4 weeks.

In Table 1, On comparing mean values of pre-test and post-test of GIS (**P<0.0001) and FEV (*P<0.0001) in group-A, shows highly significant improvement in the

post-test mean of GIS but there is no significant difference in the post-test mean of FEV.

In Table 2, On comparing mean values of pre-test and post-test of GIS (*P<0.0001) and FEV (*P<0.0001) in group-B, shows significant improvement in the post-test mean of GIS and FEV.

In Table 3, On comparing mean values of pre-test (**P<0.5995) and post-test of GIS between group -A and group-B, shows highly significant improvement in post-test (**P<0.0017) mean in group-A but there is significant improvement in group-B.

In Table 4, On comparing mean values of pre-test (*P>0.8253) and post-test of FEV between group-A and group-B, shows no significant improvement in post-test (*P<0.0299) mean in group-A but there is significant improvement in group-B.

Hence, this study proves that there is statistical difference when compared between the groups, diaphragmatic breathing exercise and modified inspiratory muscle training exercise.

DISCUSSION

In this present study, the main objective of the clinical trial was to find out the effectiveness of diaphragmatic breathing exercise versus modified inspiratory muscle training exercise in gastroesophageal reflux disease. The study result was interpreted on the basis of outcome measure were used in this study. According to the result, the average changes obtained on self- reported outcome obtained by the subjects in the both groups (GERD impact scale and forced expiratory volume), group A (Diaphragmatic breathing exercise) and group B (Modified inspiratory muscle training exercise). There is a significant difference on reduce the symptoms of GERD and there is improvement in the functional activity of GERD patient receiving the intervention. The results of the present study indicate a significant decrease in symptoms of GERD and improve functional activity in both groups. However, the diaphragmatic breathing exercise were more effective in decreasing the symptoms of GERD and improvement in the functional activities among the patients with GERD.

Gastroesophageal reflux disease is frequently occurring digestive system disorder, and incidence has been increasing year by year. Gastroesophageal reflux disease is caused by disorder in they movement of upper digestive tract and gastric acid reflux in the esophagus. There are two main reason of acid reflux; first increase abdominal cavity pressure and second weakened anti- reflux mechanism. Lower esophageal sphincter, crura of diaphragm, angle of his and phrenoesophageal membrane, together form barrier against gastroesophageal reflux. The most common symptom are heart burn and regurgitation but frequent symptom such as chronic cough, hoarseness of voice, dyspnoea, dysphasia, pharyngodynia, belching.

Group-A (Diaphragmatic breathing exercise**):** In this present study**,** it shows diaphragmatic breathing exercise is highly effective on reducing symptoms of GERD and improve the functional activity of the patients with GERD (**P<0.0017)

Diaphragm is the dome shaped muscle which lies in transverse plane and it separate and both the thoracic cavity and abdominal cavity. Esophagus passes through the esophageal hiatus and lower esophageal sphincter lies at the esophageal hiatus. While performing diaphragmatic breathing exercise, diaphragm descend down and increases tension in diaphragm as well as lower esophageal sphincter. This results in proper closing of lower esophagus and it prevent the acid reflux (Andrew Ming-Liang Ong et al. 2018).

Group-B (Modified inspiratory muscle training exercise): In this present study, it shows modified inspiratory muscle training exercise is effective in reducing symptoms of GERD but less effective compare to diaphragmatic breathing exercise(*P<0.0299).

Modified inspiratory muscle training exercise include diaphragm and others inspiratory muscles. It trains crura of diaphragm and helps in proper closing of lower esophageal sphincter and it prevent symptoms of gastroesophageal reflux disease.

Crura of diaphragm fibers surrounding the esophageal musculature are one of the fundamental components of anti-reflux barrier and these actively contract during inspiration. IMT could train the crura fibers therefore positively influencing anti reflux barrier. It seems it is able to increase pressure generated by LES, reduce spontaneous release of LES acid exposure (Antonio Moffa et al. 2019).

CONCLUSION

This study concludes that, GROUP A (Diaphragmatic breathing exercise) is effective in reducing the gastroesophageal reflux disease symptoms. Thus, this study hereby accepts the alternative hypothesis is that there is significant difference between the diaphragmatic breathing exercise and modified inspiratory muscle training exercise on patients with GERD.

LIMITATION OF THE STUDY

- Duration of study is only 4 weeks.
- The study has a small sample size.
- This study has not measured body mass index of participants.
- Selected age group of 18 years and above (both male and female)

RECOMMENDATION:

- Lower esophageal sphincter strengthening can be measuring using FEV.
- Multiple groups can be included for the study.

- Duration of the study can be longer to see the long-term effectiveness.

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