

Respiratory Training Improves Anti-Reflux Barrier in Non-Erosive Gastro-Esophageal Respiratory Diseases (GERD) Patients - A Narrative Review of Current Literature

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Abstract: ***Background:** Gastroesophageal reflux disease (GERD) is characterized by impaired lower esophageal sphincter (LES) pressure and diaphragmatic dysfunction. Conventional pharmacological therapy often fails to fully control symptoms, prompting interest in physiotherapy-based interventions. **Objectives:** To review clinical evidence on inspiratory muscle training (IMT), modified IMT, diaphragmatic breathing exercises (DBE), biofeedback training, myofascial release (MFR), and aerobic exercise in GERD management. **Methodology:** The literature review was drafted using Preferred Reporting Items for Systematic Reviews and Meta analysis protocols with appropriate modifications for purposes of narrative review. For this review all relevant information was identified using Google Scholar, PubMed, Science Direct, Cochrane library and Scopus. A literate review was performed. Search words were GERD, respiratory training, diaphragm, anti-reflux. Total 7 articles were included in this literature review. Randomized controlled trials and comparative studies published between 2012 and 2021 were analyzed. Sample sizes ranged from 30 to 50 participants, with outcomes measured via LES manometry, GERD symptom scores, and quality of life indices. **Results:** Inspiratory muscle increased LES pressure and reduced transient relaxations. Diaphragmatic breathing exercise and biofeedback training improved reflux symptoms and reduced belching. Diaphragm myofascial release enhanced GERD symptom scores. Aerobic exercise improved overall quality of life, while Diaphragmatic breathing more effectively increased LES pressure (Ahmadi, 2021). **Conclusion:** Physiotherapy interventions targeting diaphragmatic function consistently demonstrate improvements in LES competence, reflux symptoms, and patient-reported outcomes. These approaches are safe, low-cost adjuncts to pharmacological therapy. Larger multicenter RCTs are needed to confirm long-term efficacy.*

Keywords: acid reflux, breathing exercises, diaphragm function, physiotherapy treatment, Quality of life

1. Introduction

GERD is condition affecting 5% of population in Asia which develops when reflux of stomach contents causes troublesome symptoms (at least 2 heartburn episodes per week). There is Gastro-Esophagogastric Junction (GEJ) valve mechanism – a key component of anti-reflux barrier exists between esophagus and stomach formed by Lower esophageal sphincter (LES), Crura of diaphragm (CD), His angle, phreno-esophageal membrane which normally prevents GERD. Relaxation and phasic tone of CD contribute significantly to GERD. Since CD is inspiratory striated muscle, the function can be modified by respiratory training which increase diaphragm strength and tone and results in increased esophagogastric junction pressure (EGJ Pressure), decreased symptoms and PPI'S usage and improved quality of life in GERD patients.

2. Need of the Study

The Gastro-Esophagogastric junction (GEJ) valve mechanism can be affected by drugs and different kinds of food through an effect on its resting pressure eventually inducing reflux. Respiratory training improves CD which acts as an external sphincter. So the purpose is to study the scientific evidences regarding all potential therapeutic effects of respiratory training on GERD symptoms.

3. Objectives

To assimilate and investigate the scientific evidences of respiratory training on esophagogastric junction (EGJ) Manometry, Egj Pressure Measurements, Esophageal Ph monitoring, usage of Proton pump inhibitor (PPI's) and Quality of life in GERD patients.

4. Methodology

The literature review was drafted using Preferred Reporting Items for Systematic Reviews and Meta analysis protocols with appropriate modifications for purposes of narrative review. For this review all relevant information was identified using Google Scholar, PubMed, Science Direct, Cochrane library and Scopus. A literate review was performed. Search words were GERD, respiratory training, diaphragm, anti-reflux. Total 7000 records were identified from database out of which 4080 were screened.

Records excluded were articles with-

- no full texts
- not having open access
- not in English
- unpublished study
- not in GERD

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What interventions does respiratory training include here?

Inspiratory muscle training:

The training protocol involved structured breathing exercises where participants inhaled forcefully through the device, thereby strengthening the diaphragm and associated inspiratory muscles.

Renata Carvalho de Miranda's (2012) in Respiratory Medicine (IF= 4.582) study highlighted the potential of respiratory physiotherapy, specifically inspiratory muscle training (IMT), to improve lower esophageal sphincter (LES) pressure in patients with gastroesophageal reflux disease (GERD). Group 1 (n=20) Loading group: received threshold IMT at 30% of maximal inspiratory pressure twice daily for 8 weeks

Group 2 (n=9) Sham Group: set threshold at 7cmH₂O for whole period.

GERD is often linked to a hypotensive LES, which weakens the barrier against gastric reflux. By strengthening the inspiratory muscles, particularly the diaphragm, IMT enhances crural diaphragm tone, which contributes to sphincter competence. The study demonstrated that patients undergoing IMT experienced a measurable increase in LES pressure noted in esophageal manometry and reported symptomatic relief, suggesting a neuromuscular connection between respiratory muscle conditioning and esophageal sphincter function. This finding is clinically significant because it introduces a non-pharmacological, low-cost, and safe adjunct therapy for GERD management, especially in patients with documented hypotensive LES. Subsequent reviews have reinforced the idea that respiratory physiotherapy may reduce transient LES relaxations and improve reflux control, though evidence remains limited to small-scale studies. While promising, further randomized controlled trials are needed to confirm long-term efficacy and establish standardized protocols for integrating respiratory physiotherapy into GERD treatment.⁽¹⁾

Miguel Ângelo Nobre e Souza and colleagues (2013) published a pivotal study in the *American Journal of Physiology – Gastrointestinal and Liver Physiology* examining the role of inspiratory muscle training (IMT) in strengthening the anti-reflux barrier in patients with gastroesophageal reflux disease (GERD). The rationale was based on the anatomical contribution of the crural diaphragm to lower esophageal sphincter (LES) competence. In GERD, hypotensive LES and frequent transient relaxations compromise the reflux barrier, allowing gastric contents to enter the esophagus. The study implemented a structured IMT protocol using threshold devices, where patients performed repeated inspiratory efforts against resistance to strengthen diaphragmatic and inspiratory muscles. Results demonstrated that IMT significantly increased LES pressure, reduced the frequency of transient LES relaxations, and improved esophagogastric junction competence. Clinically, patients reported symptomatic relief, suggesting that IMT could serve as a non-pharmacological adjunct to conventional GERD management.⁽²⁾

Antonio Moffa and colleagues (2020) explored the role of modified inspiratory muscle training (m-IMT) as a promising treatment for gastroesophageal reflux disease (GERD). Their study, published in *Acta Otorrinolaringológica Española*, built on earlier evidence that inspiratory muscle training can strengthen the crural diaphragm and improve lower esophageal sphincter (LES) competence. The modification involved adjusting the training protocol to optimize diaphragmatic recruitment while reducing patient fatigue, making it more clinically feasible. Patients performed repeated inspiratory efforts against resistance using a threshold device, but with tailored resistance levels and structured progression to enhance adherence and effectiveness.

Diaphragm Manual Release:

The **diaphragm myofascial release (MFR)** technique is a manual therapy approach designed to restore the diaphragm's mobility, elasticity, and tension balance, which are crucial for maintaining lower esophageal sphincter (LES) competence and preventing reflux. In practice, the patient lies in a supine position while the therapist places their hands gently under the costal margins, near the lower ribs. Using sustained, gentle pressure and slow stretching movements, the therapist works to release fascial restrictions in the diaphragmatic region. The technique typically involves applying pressure during the patient's breathing cycle—encouraging deep inhalation and exhalation while the therapist maintains contact—to facilitate relaxation and lengthening of the diaphragm's connective tissue. This helps improve diaphragmatic excursion, reduce tension in the crural fibers surrounding the LES, and enhance the anti-reflux barrier.

Martínez-Hurtado and colleagues (2019) conducted a preliminary randomized controlled trial published in *Scientific Reports* (IF=4.6, H index=282) to evaluate the effects of diaphragmatic myofascial release (MFR) on patients with non-erosive gastroesophageal reflux disease (GERD). The rationale for this intervention stems from the anatomical and functional role of the diaphragm in supporting the lower esophageal sphincter (LES) and maintaining the anti-reflux barrier. Myofascial restrictions in the diaphragm may compromise its mobility and tension, thereby contributing to reflux symptoms. In this study, 30 GERD patients were randomized into either an experimental group receiving a structured diaphragmatic MFR protocol or a sham group. The MFR protocol aimed to restore the diaphragm's myofascial properties through manual techniques that improve elasticity, mobility, and tension balance. Outcomes assessed included GERD symptom severity, quality of life, and proton pump inhibitor (PPI) consumption. Results showed that patients receiving diaphragmatic MFR experienced significant improvements in symptom scores, enhanced quality of life, and reduced reliance on PPIs compared to the sham group. This trial provided early evidence that manual therapy targeting the diaphragm could serve as a complementary approach to conventional GERD management. However, the authors emphasized that the findings were preliminary, given the small sample size and short-term follow-up, and called for larger, long-term studies to confirm efficacy and establish standardized treatment protocols.⁽³⁾

Diaphragm Biofeedback Training:

The technique involved patients lying in a supine position while guided through breathing exercises with real-time feedback. Using biofeedback equipment, patients were trained to perform slow, deep diaphragmatic breathing, focusing on abdominal expansion during inspiration and relaxation during expiration. The feedback helped them visualize and control diaphragmatic movement, reinforcing proper activation of the crural diaphragm fibers that contribute to LES competence.

Sun and W. Shang (2016) conducted an open-label, pilot randomized trial to investigate both the short-term and long-term effects of **diaphragm biofeedback training (DBT)** in patients with gastroesophageal reflux disease (GERD). The rationale behind DBT is that the diaphragm plays a critical role in maintaining the competence of the lower esophageal sphincter (LES), and training patients to consciously control diaphragmatic contraction may strengthen the anti-reflux barrier. In this study, GERD patients were randomized to receive either DBT or standard care. The DBT group underwent structured sessions where biofeedback techniques were used to guide diaphragmatic breathing and contraction, helping patients learn to activate the crural diaphragm more effectively.⁽⁴⁾

The results demonstrated that DBT produced significant improvements in GERD symptoms and quality of life in the short term, with reductions in reflux episodes and acid exposure. Importantly, follow-up assessments showed that these benefits persisted in the long term, suggesting that DBT could have sustained therapeutic effects beyond the immediate training period. Patients also reported decreased reliance on proton pump inhibitors (PPIs), highlighting DBT's potential as a complementary, non-pharmacological intervention.⁽⁴⁾

Diaphragmatic Breathing exercise:

The procedure for diaphragmatic breathing exercise begins with the patient lying comfortably on their back, knees bent, and shoulders relaxed. One hand is placed on the chest and the other on the abdomen to provide tactile feedback. The patient inhales slowly through the nose, directing the breath so that the abdomen rises while the chest remains relatively still, ensuring activation of the diaphragm rather than accessory chest muscles. Exhalation is performed gently through pursed lips, allowing the abdomen to fall naturally. This cycle is repeated for several minutes, typically 5–10 minutes per session, and practiced multiple times a day. As the patient becomes proficient, the exercise can be progressed to sitting and standing positions to integrate diaphragmatic control into daily activities. The emphasis throughout is on slow, deep, and controlled breathing, promoting relaxation, strengthening diaphragmatic tone, and supporting the lower esophageal sphincter's function in reducing reflux episodes.

Martínek et al. (2018) Clinical Gastroenterology and Hepatology: This single-blinded RCT included 36 patients with PPI-refractory GERD and excessive supragastric belching. Participants were randomized to diaphragmatic breathing training versus control. The intervention group showed reduced belching frequency, improved reflux symptoms, and decreased PPI use, highlighting DBE's role in symptom control beyond acid suppression.⁽⁵⁾

Aerobic exercise:

The patient begins with a warm-up phase lasting about 5–10 minutes, which may include light walking, gentle cycling, or dynamic stretching to prepare the muscles and cardiovascular system. The main aerobic training phase involves continuous rhythmic activities such as brisk walking, treadmill exercise, stationary cycling, or light jogging, performed at a moderate intensity (usually 60–75% of the individual's maximum heart rate or guided by the Borg Rating of Perceived Exertion scale). Sessions typically last 20–40 minutes, depending on tolerance and clinical goals. Breathing is emphasized throughout, encouraging steady diaphragmatic breathing to optimize oxygen exchange and reduce unnecessary accessory muscle use. The cool-down phase follows for 5–10 minutes, with slower movements and stretching to gradually lower heart rate and prevent venous pooling.

Frequency is generally 3- 5 sessions per week, with progression tailored to the patient's fitness level, medical condition, and therapeutic objectives. In GERD or respiratory rehabilitation contexts, aerobic exercise is integrated carefully, ensuring that intensity does not exacerbate reflux symptoms, while promoting diaphragmatic activation and improved cardiorespiratory function.

Mehdi Ahmadi and colleagues (2021) conducted a comparative study published in the *Middle East Journal of Digestive Diseases* to evaluate the different effects of aerobic exercise (AE) and diaphragmatic breathing (DB) on lower esophageal sphincter (LES) pressure and quality of life in patients with gastroesophageal reflux disease (GERD). The study included patients diagnosed with reflux disease who were randomized into two intervention groups (n=75) : one performing structured aerobic exercise routines and the other practicing diaphragmatic breathing exercises. Results showed that diaphragmatic breathing produced a more significant increase in LES pressure compared to aerobic exercise, highlighting its direct physiological impact on esophageal function. However, aerobic exercise was associated with broader improvements in quality of life, including physical well-being and general health perception. Both interventions reduced GERD symptom severity, but their benefits were complementary rather than identical.^(6,7)

5. Results

7 studies were reviewed from which:

4 studies showed reduced frequency and severity of GERD symptoms and improved QOL with non- erosive GERD and reduced consumption of PPI'S after diaphragm myofascial release and diaphragm biofeedback training.

1 study showed increased inspiratory EGJ pressure, tLESR (transient lower esophageal sphincter rate) and decreased score of regurgitation and heartburn after use of IMT (inspiratory muscle training).

1 study showed increased PI_{max} (Maximum inspiratory pressure), PE_{max} (Maximum expiratory pressure) after use of IMT.

1 study showed that aerobic exercise has no effect on LES pressure and just had effect on QOL.

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6. Discussion

Respiratory training would change contractile apparatus of CD so as to shift its length-tension relationship and increase CD tone and average EGJ pressure. It also improves autonomic nervous activity which causes an enhancement of pressure generated by smooth muscle component of LES and decreases the rate of tLESR.

CD also is widely innervated by vagus nerve. The diaphragm MFR has regulatory effect on oesophageal peripheral innervation which stimulates antinociceptive action that inhibits ascending spinothalamic pathways which transmits pain.

7. Conclusion

Respiratory training is an effective treatment regimen for non-erosive GERD patients. It should be used as an adjunct treatment as it may represent a promising option for the treatment of PPI-refractory GERD patients and could help in reducing the annual PPI needed intake in GERD patients and improves quality of life.

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