REVIEW ARTICLE

Diaphragmatic Breathing as an Adjunctive Approach in Gastroesophageal Reflux Disease: Narrative Review of Its Mechanistic Basis and Clinical Evidence

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ABSTRACT

Background: Gastroesophageal reflux disease (GERD) is a chronic gastrointestinal condition defined by reflux of stomach contents into the esophagus, leading to cardinal symptoms such as heartburn and regurgitation, thereby negatively impacting patients' quality of life. Several underlying mechanisms contribute to GERD, with dysfunction of the anti-reflux barrier playing a key role in reflux. Even though proton pump inhibitors are commonly prescribed, a considerable proportion of patients do not achieve symptom relief. Diaphragmatic breathing (DB) has emerged as an adjunct non-pharmacological therapy that may strengthen the anti-reflux barrier by enhancing crural diaphragm function.

Objective: To synthesize the effects of DB in GERD, with a focus on clinical outcomes and underlying mechanisms.

Methodology: PubMed and Scopus databases were searched using predefined keywords "diaphragmatic breathing AND gastroesophageal reflux disease" and "abdominal breathing AND gastroesophageal reflux disease". 7 clinical trials relevant to our study were retrieved. These trials comprised DB interventions, with measured outcomes such as symptom severity, Quality of life, reflux-associated cough, belching severity, sleep quality, medicine use, and lower esophageal sphincter pressure.

Results: DB has been found to reduce reflux symptoms, improve certain extra-esophageal manifestations, and decrease the use of proton pump inhibitors and antacid demand. It may also reinforce the anti-reflux barrier primarily by improving crural diaphragm function, potentially increasing lower esophageal sphincter pressure. Whereas several individual studies observed improvement in quality of life, these findings were not consistently supported by a recent meta-analysis, likely due to study heterogeneity.

Conclusions: Findings indicate that DB is a safe and inexpensive non-pharmacological intervention for GERD. However, the current evidence is constrained by methodological differences, small sample size, and limited long-term follow-up, highlighting the need for large-scale, well-designed multi-center trials to evaluate its long-term efficacy. (*Adv Mind Body Med.* 2026;40(5):43-47)

Keywords: Breathing exercises, Complementary therapies, Gastroesophageal reflux, Physical therapy modalities

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INTRODUCTION

Gastroesophageal reflux disease (GERD) is a disorder in which acid contents from the stomach flow back to the esophagus, leading to troublesome symptoms and adverse consequences.[1] Current global estimates show that about 825.6 million people were affected by GERD in 2021.[2] Clinically, it manifests primarily with heartburn and regurgitation; non-esophageal manifestations like prolonged cough, asthma, laryngitis, and sinusitis may also be observed.[3] Repeated exposure of esophageal mucosa to refluxed gastric contents promotes mucosal inflammation (esophagitis) and injury. Gradually and eventually, this can alter the typical stratified squamous epithelium of the distal esophagus with specialized columnar epithelium, a condition known as Barrett's esophagus, which is a premalignant state linked to the risk of esophageal cancer.[4]

The lower esophageal sphincter and crural diaphragm act together to prevent reflux; disruption of their coordination is linked to the development of GERD.[5] It is believed that multiple interrelated mechanisms rather than a single cause contribute to the development of GERD. Transient lower esophageal sphincter relaxations (TLESRs), abnormalities in esophageal motility, impaired esophageal clearance, and

Table 1. Studies Included in the Narrative Review

Author (Year)	Study Design	No. of Participants	Population	Intervention	Session Duration	Intervention Duration	Body Position	Outcome Measures	Key Findings
Eherer et al. (2012)	Randomised controlled trial	19	Non-erosive reflux disease or healed esophagitis	Abdominal breathing exercises	≥30 min/day after an initial 1-hour training session	4 weeks (9-month follow-up)	Standing, sitting, or supine	Oesophageal acid exposure, quality of life and medication use	Reduced acid exposure, improved quality of life and reduced medication use
Ong et al. (2018)	Controlled cohort study	36	Adults with PPI-refractory GERD and troublesome supragastric belching	Standardized diaphragmatic breathing	30-min weekly supervised session + home practice (5 min, 3×/day)	4 weeks (4-month follow-up)	Supine, sitting, and standing	Belching severity, reflux symptoms, and quality of life	Reduced belching severity, improved reflux symptoms and quality of life, with benefits sustained at 4-month follow-up
Halland et al. (2021)	Randomised controlled trial	33	Adults with upright GERD and healthy controls	Diaphragmatic breathing	Single training session; 10-min diaphragmatic breathing	Acute study (48-hour physiological assessment)	Supine and sitting	LES pressure, reflux episodes, and oesophageal acid exposure	Increased LES pressure, reduced postprandial reflux events; no significant change in total acid exposure
Ahmadi et al. (2021)	Randomised controlled comparative study	75	Moderate to severe gastroesophageal reflux disease	Diaphragmatic breathing versus aerobic exercise	75 breaths/session; 5 sessions/day, 5 days/week	8 weeks	Supine	Lower oesophageal sphincter pressure and quality of life	Increased LES pressure and improved quality of life; greater benefits than aerobic exercise.
Niu et al. (2024)	Randomised controlled trial	60	Adults with GERC	Deep diaphragmatic breathing training	20 min, twice daily	8 weeks	-	Cough resolution, reflux symptoms, sleep quality, and quality of life	Improved cough resolution, reflux symptoms, sleep quality, and quality of life.
Mosa et al. (2024)	Quasi-experimental study	100	Adults with non-erosive gastro-esophageal reflux disease	Abdominal breathing	15–20 min, 2–3 times/day	4 months	Standing, sitting, or lying	GERD symptoms, antacid consumption, sleep quality, and GERD-related quality of life	Reduced GERD symptom severity and frequency, reduced antacid consumption, improved sleep quality, and improved GERD-related quality of life.
Sadiq et al. (2025)	Randomised controlled trial	22	Adults with gastroesophageal reflux disease	Abdominal breathing	5 min, 5 times/day	4 weeks	Supine	GERD-related quality of life and on-demand PPI usage	Improved GERD-related quality of life and reduced on-demand PPI usage.

Abbreviations: GERD, gastroesophageal reflux disease; GERC, gastroesophageal reflux-induced chronic cough; LES, lower oesophageal sphincter; PPI, proton pump inhibitor.

delayed gastric emptying are acknowledged as key contributing factors. In addition, symptoms are not solely dependent on acid exposure and are modulated by both peripheral and central neural pathways.[6]

Routinely, GERD is generally managed with proton pump inhibitors (PPIs) along with lifestyle modifications. However, not all patients achieve satisfactory symptom control, and many continue to experience symptoms despite therapy. Some studies suggest that even with PPI treatment, 40% of patients fail to achieve symptom relief.[7,8] Consequently, there has been increasing interest in additional strategies that can act on underlying mechanisms of GERD rather than focusing only on acid suppression.

The anti-reflux barrier is mainly formed by the lower esophageal sphincter (LES) and the crural diaphragm, with the latter serving as an external sphincter that helps enhance LES pressure.[9]

Diaphragmatic breathing (DB), also referred to as abdominal or deep breathing, is a conscious breathing technique in which the diaphragm is actively engaged. This leads to noticeable outward movement of the abdomen with relatively minimal chest expansion during inspiration.[10] It represents techniques to increase diaphragmatic activation and improve muscle tone. As part of respiratory physiotherapy aimed at the diaphragm, its application has been proposed to improve anti-reflux barrier function. Moreover, clinical studies have reported increases in LES pressure following DB interventions.[11]

In this review, the term DB comprises various breathing methods, particularly deep breathing measures, which generally involve diaphragmatic activation and specific abdominal breathing exercises as reported in clinical studies. Therefore, the objective of this narrative review is to synthesize the available studies on DB as an adjunct non-pharmacological strategy for managing GERD, with special attention to the underlying physiological mechanisms and clinical implications.

METHODOLOGY

A literature search was conducted in the PubMed and Scopus databases for clinical studies published between 2012 and 2025 using the predefined keywords "diaphragmatic breathing AND gastroesophageal reflux disease" and "abdominal breathing AND gastroesophageal reflux disease". Clinical studies published in the English language that evaluated the effects of diaphragmatic breathing in patients with GERD were included. Review articles, systematic review, and meta-analysis were excluded from clinical evidence synthesis. Seven clinical studies met the eligibility criteria and are summarized in Table 1.

PATHOPHYSIOLOGY OF GERD

GERD is a multifactorial disorder, involving anti-reflux barrier dysfunction, TLESRs, hiatal hernia, esophageal motility abnormalities, delayed gastric emptying, and changes in mucosal integrity and sensory perception.

Anti-Reflux Barrier Dysfunction

The LES is the key element of the anti-reflux barrier at the gastroesophageal junction. It creates a high-pressure zone at the gastroesophageal junction, helping limit the backflow of stomach content into the esophagus. A decline in LES resting pressure may permit gastric pressure to exceed esophageal pressure, thereby facilitating reflux.[12]

Transient Lower Esophageal Sphincter Relaxations (TLESRs)

TLESRs are an involuntary relaxation of the LES that occurs independently of swallowing and is characterized by a marked reduction in LES pressure. This is a widely accepted pathway of reflux episodes in healthy individuals and subjects with GERD.[13] However, when an individual has GERD, the incidence of reflux events following a TLESR is greater than in a healthy subject.[14]

Hiatal Hernia

Hiatal hernia is often associated with GERD and modulates the mechanisms underlying reflux. Findings from ambulatory manometry and pH monitoring show that individuals with hiatal hernia exhibit increased esophageal acid exposure and a greater frequency of reflux episodes than patients without hiatal hernia. It is speculated that reflux occurs due to low LES pressure, swallow-induced LES relaxations, and activities such as straining or deep inspiration rather than increased TLESRs.[15] In addition, GERD patients, particularly those with hiatal hernia, may exhibit delayed esophageal acid clearance, resulting in sustained prolonged acid exposure into the esophagus.[16]

Impaired Esophageal Peristalsis

Acid clearance from the esophagus largely depends on esophageal peristalsis. Impaired peristaltic movement in the esophagus allows gastric contents to remain in the esophagus for a long period. Thus, reduced esophageal motility is linked to prolonged acid exposure in GERD patients.[14]

Delayed Gastric Emptying

Reflux could be further affected by delayed gastric emptying (DGE). When emptying slows, gastric volume increases and the stomach remains distended for a long time after meals, which can lead to increased reflux episodes. According to studies, DGE is directly associated with transient LES relaxation, which could be induced by gastric distention, thus facilitating reflux.[17,18]

Impaired Esophageal Mucosal Defense and Visceral Hypersensitivity

Impaired esophageal mucosal defense is also involved in the pathogenesis of GERD. Chronic acid exposure can disrupt epithelial structure, leading to dilated intercellular spaces and increased paracellular permeability. This may allow luminal acid to enter the intercellular spaces, thus further contributing to symptom generation.[19] Visceral hypersensitivity is also involved in the perception of symptoms. Acid exposure can stimulate sensory pathways within the esophageal mucosa and transmit signals to the central nervous system. This is particularly relevant in non-erosive reflux disease (NERD), in which patients may present with typical reflux symptoms despite normal or only mildly increased esophageal acid exposure.[20]

MECHANISTIC ROLE OF DIAPHRAGMATIC BREATHING IN GERD

The LES and crural diaphragm form a high-pressure zone around the gastroesophageal junction, thus restricting the backflow of intragastric contents into the esophagus. Studies of high-resolution manometry have revealed that during inspiration, gastroesophageal junction pressure increases due to the contraction of the crural diaphragm, which contributes to the anti-reflux barrier. GERD patients exhibit less inspiratory pressure augmentation of the gastroesophageal junction and greater separation of the LES from the crural diaphragm, suggesting impaired diaphragmatic function.[21] Given the mechanical role of the diaphragm in regulating gastroesophageal junction pressure during inspiration, interventions that improve crural diaphragm function may help in GERD management.

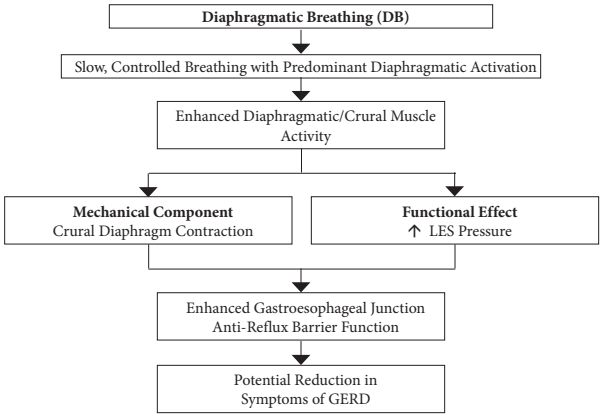
In this context, DB has been linked with elevated inspiratory LES pressure and decreased postprandial reflux events in patients with GERD. These effects have been ascribed to an increased pressure gradient between the LES and the stomach, which is thought to reinforce the anti-reflux barrier.[22] Furthermore, a comparative study also reported that DB increased the LES pressure compared to aerobic exercise, suggesting a possible physiological impact of targeted diaphragmatic activation to influence gastroesophageal junction function.[23]

Overall, these results suggested a beneficial contribution of DB to the functional competence of the gastroesophageal junction due to increased diaphragmatic contribution to sphincter pressure and decreased frequency of reflux events. However, the precise physiological mechanism is not yet well understood, especially regarding the particular function of the crural diaphragm and its long-term influence on gastroesophageal junction dynamics.[22,23]

Clinical Evidence of Diaphragmatic Breathing in Gastroesophageal Reflux Disease

Multiple studies have explored the significance of DB in patients with GERD, as shown in Table 1. Overall, it seems to offer some benefits in terms of symptoms and patient-

Figure 1. Physiological Mechanism of Diaphragmatic Breathing in GERD



reported results. Even so, the existing evidence is limited, and its findings are not uniform across different study types.

One of the first randomized controlled trials (RCTs) by Eherer et al. investigated the effects of standardized abdominal breathing exercises among patients with GERD. These breathing techniques were linked to a reduction in esophageal acid exposure and an enhancement in disease-specific quality of life. Furthermore, a reduction in PPI use was observed during the follow-up over 9 months.[24]

Specific subgroups of GERD patients have also been described by other evidence. The study by Ong et al. evaluated the effect of DB in patients with PPI-refractory GERD associated with excessive supragastric belching, a clinical condition in which belching can lead to reflux symptoms. It was found that DB attenuated belching episodes, improved reflux symptoms, and overall quality of life.[25]

Besides typical reflux symptoms, effects of DB on extra-esophageal conditions have also been studied. DB was used as an add-on to standard treatment in patients with reflux-related persistent cough in a clinical study, as reported by Niu et al. The study findings have shown greater relief in cough symptoms and improvements in reflux symptom scores and sleep quality. These findings suggest DB may help in the extra-esophageal manifestations of GERD.[26]

A quasi-experimental investigation was performed by Mosa et al. to study the effect of DB on subjects with a non-erosive form of GERD over the course of four months. A gradual reduction in the incidence and severity of GERD symptoms was observed over time. Further improvements in sleep quality and quality of life, along with reduced use of antacids, were noted during follow-up. However, this study comprises educational and lifestyle interventions, making it difficult to establish a firm conclusion about the effect of abdominal (diaphragmatic) breathing alone.[27]

A recently published RCT by Sadiq et al. examined the efficacy of abdominal (diaphragmatic) breathing through the 4-week intervention period in patients with GERD. Subjects assigned to the intervention group were instructed to perform structured abdominal breathing exercises regularly, and outcomes were evaluated using a condition-specific quality of life scale and as-needed PPI use. The study found improvement in quality-of-life scores and a reduction in on-demand PPI use compared to baseline.[28]

Although the above clinical studies reported encouraging findings, a recent meta-analysis demonstrated a modest improvement in GERD symptoms with DB but no significant improvement in quality of life. However, substantial methodological heterogeneity across the included studies, including variations in GERD diagnostic criteria, intervention protocols, comparator groups, and outcome assessment methods, limits the strength and generalizability of the current evidence.[29]

DISCUSSION

The findings of this review suggest that DB could serve as an effective adjunctive therapy for GERD. It can contribute to improvement in GERD symptoms, reflux-related chronic cough, excessive belching, and sleep quality, and may reduce the demand for PPIs and antacids. The reflux suppression effect of DB is likely explained by improved crural diaphragm function. This may help improve LES competency, strengthen the anti-reflux barrier, and thereby limit reflux. Although these findings are encouraging, recent evidence needs to be interpreted cautiously. While several studies have shown an improvement in quality of life, a recent meta-analysis found no significant improvement in this parameter. Notably, substantial heterogeneity across studies, inconsistency in diagnostic criteria, outcome measures, and DB protocols limit the certainty of available evidence. Similar methodological limitations were identified within the studies included in this review, such as small sample sizes and heterogeneous intervention protocols.

Future research should investigate the influence of body position on the effectiveness of DB in GERD. The effects of DB performed in the prone position remain unexplored. In yoga, DB is also practiced in *Makarasana* (Crocodile Pose), a prone relaxation posture; however, its effects on clinical and physiological outcomes in patients with GERD have not yet been investigated. Future studies should also systematically compare the effects of DB performed in the supine, sitting, standing, and prone positions to identify the body position that provides the greatest clinical and physiological benefits. Additionally, the optimal duration and frequency of DB required to achieve sustained clinical benefits should be established.

Future multi-center RCTs with longer follow-up should also use standardized DB protocols and incorporate objective physiological assessments, including LES pressure, high-resolution manometry, and ambulatory pH-impedance monitoring, alongside validated GERD-specific patient-reported outcome measures.

CONCLUSION

Taken together, DB could be a potential adjunctive therapy for GERD, supported by evidence of reduced reflux symptoms and the potential to support anti-reflux barrier function. Methodological heterogeneity, small sample size, and limited follow-up remain key limitations of current evidence. Large, well-designed multi-centric trials are warranted to determine the long-term efficacy of DB.

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AUTHOR CONTRIBUTIONS

All authors contributed to the study design, data collection, manuscript drafting, and revision, and approved the final version.

COMPETING INTERESTS

The authors declare no conflict of interest regarding this manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

CONSENT FOR PUBLICATION

Not applicable

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