Effect of Breathing Exercises on Health Outcomes among Patients with Gastro esophageal Reflux Disease

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Abstract

Background: Gastroesophageal reflux disease (GERD) is linked to impaired diaphragm function due to reduced coordination or strength of diaphragmatic contractions. Breathing exercises have been shown to improve esophageal function and reduce acid reflux, thereby enhancing health outcomes, symptom control, quality of life, medication adherence, and sleep quality in patients. **Aim:** It aimed to evaluate the effect of breathing exercises on health outcomes among patients with gastro esophageal reflux disease. **Study design:** A quasi-experimental pretest-posttest comparison study design was implemented to achieve the aim of the current study. **Setting:** The study was conducted in gastroenterology out-patient clinics at Benha University Hospital affiliated to Qalyubia Governorate, Egypt. **Subjects:** A purposive sample of eighty patients with gastro esophageal reflux disease and selected from the previously mentioned setting over a period of six months of data collection. **Tools:** Data were collected using four tools, **(I)** A structured interview questionnaire, **(II**) Patients' knowledge assessment, **(III)** Patients' practice assessment for breathing exercises and **(IV)** Patients' health outcomes assessment. **Results:** The study showed that there was statistically significant improvement in the total knowledge and practice levels of the studied patients post breathing exercises implementation compared with pre exercises implementation. Also, there were high statistically significant differences between pre and post breathing exercises implementation concerning patients' health outcomes including clinical symptoms severity and frequency as well as sleep quality. **Conclusion:** The study findings indicated that patients' knowledge and practice significantly improved following the implementation of breathing exercises, which was accompanied by marked improvements in all health outcomes. These improvements included a reduction in the severity and frequency of symptoms and enhanced sleep quality, with highly statistically significant differences ($p < 0.001$). **Recommendations:** It is recommended that breathing exercises should be integrated with the treatment protocols of patients with gastroesophageal reflux disease.

Key words: Breathing exercises, gastroesophageal reflux disease, and health outcomes.

Introduction

Gastroesophageal reflux disease (GERD) is one of the most common diseases of the upper gastrointestinal tract that raises the risk of complications and reduce the quality of life. It develops when the reflux of stomach and duodenal content into esophagus cause gastrointestinal discomfort with esophageal mucosa damage and extra esophageal manifestations **(Bertin et al., 2026)**. GERD occurs when there is an imbalance between the normal defense mechanisms of the esophagus and offensive factors such as acid and other digestive juices and enzymes in the stomach. In addition to increase intra abdominal cavity pressure, weakness of anti

reflux mechanism and lower esophageal sphincter (LES) dysfunction **(Sasikumar, 2024).**

Patients with GERD can present with a variety of symptoms that is classified as either typical (such as heartburn, non-cardiac chest pain and regurgitation) or atypical which include laryngitis, prolonged sore throat, hoarseness, persistent chronic cough, asthma, dental erosion and sleep alterations **(Domingues & Moraes-Filho , 2021).** The diagnosis of GERD is primarily based on symptoms when alarm symptoms are absent. Patients with typical symptoms can be diagnosed and treated empirically using proton pump inhibitors (PPIs). While patients with extraesophageal symptoms require more diagnostic tests such as endoscopy, PH monitoring and esophageal manometry (**Katz et al., 2022)**. Management of GERD is typically approached in a graded manner, beginning with lifestyle modifications which are considered the cornerstone of treatment that could help in relieving stress, anxiety, improving sense of wellbeing and decreasing GERD symptoms, in addition to pharmacological therapy and surgical intervention **(Chhabra & Ingole, 2022)**.

Another option of GERD treatment includes breathing exercises which shown that can decrease acid reflux and subsequent damage (**Mosa et al., 2024),** through preventing esophagus from opening and allowing stomach acid to back up, strengthen the crural diaphragm tone , increase lower esophageal spchincter (LES) pressure and intra-abdominal pressure , enhance diaphragm motor function, strengthen the gastro esophageal junction, alleviate the symptoms and sensation of stomach pain caused by esophageal hyperalgesia as well as improve the efficacy of drug therapy **(Qiu et al., 2020)**.

Nurses play a crucial role in prevention and management of GERD in adult patients by providing education about the disease, best diet habits, symptoms, complications, diagnosis and treatment as well as promoting healthy behaviors such as controlling substance use and diet, taking the right medications, avoiding or lessening the severity of symptoms and seeking medical attention **(Ali & Atiyah ,2025)**. Additionally, coaching patients on breathing exercises become the main nursing focus to avoid the recurrent attacks of reflux episode, decrease disease aggressiveness, proper management and prevention of its complications on patients' health outcomes and sleep quality **(Alruwaili ,2024)**.

Significance of the study:

Gastroesophageal reflux disease (GERD) is a common digestive disorder that affects negatively all dimensions of patient health, diminshe patients' quality of life and elevate the risks of complications as Barrett's esophagus and esophageal adenocarcinoma **(Xie et al., 2024)**. The incidence of GERD is high in the worldwide as it may affects 8-30 % of an adult population **(Alzahrani & savarino, 2024)** and 60-70 million Americans annually **(Boulton & Dettmar, 2022)**.

Recent studies in Egypt indicate a high prevalence of gastroesophageal reflux disease with reporting rates about 22.6% among Egyptian medical students, linked to stress and family history **(Ahmed et al., 2024)**. The number of patients diagnosed with GERD at Benha University Hospital in the year (2024) was about 220 patients **(Benha University Hospital Statistical Office, 2024).**

Aim of the study:

This study aimed to evaluate the effect of breathing exercises on health outcomes among patients with gastro esophageal reflux disease.

Study hypotheses:

H1- Patients' knowledge and practice scores post implementing breathing exercises could be higher significantly than pre breathing exercises.

H2- Patients' health outcomes could be improved significantly post implementing breathing exercises than pre breathing exercises.

Subject and methods:

Study design: Quasi-experimental design study was used to conduct the study. It is defined as an empirical interventional study used to estimate the causal impact of an intervention on its target population without random assignment **(Cham et al., 2024)**.

Setting: The study was conducted in gastroenterology out-patient clinics at Benha University Hospital.

Subject: A purposive sample of 80 patients diagnosed with gastroesophageal reflux disease was recruited from the gastroenterology outpatient clinics at Benha University Hospital. The sample size was determined based on the previous year's census of patient admissions to the gastroenterology clinics at Benha University Hospital **(Benha University admission office census, 2024),** using the following formula **(Thampson, 2012):**

$$n = \frac{N \times p\,(1-p)}{\left(\left(N-1 \times \left(d^2 \div z^2\right)\right) + p\,(1-p)\right)}$$

Where: N = Population size is 220,p = Ratio provides a neutral property is equal to 0.12, d = the error rate is equal to 0.05, z = Class standard responding to the level of significance equal to 1.96**.** Based on these parameters, the required sample size was determined to be 80 patients.

Tools of data collection:

<u>Tool I:</u> A structured interview questionnaire: The researcher designed this Arabic questionnaire after reviewing related recent literatures and scientific refrences. It was adapted from **(Chen et al., 2023**; **Mahmoud & Ali, 2025**; **Yuan & Larsson, 2022).** It involved the following three parts

Part I: Patients' personal data: This part was developed to obtain patients' personal data such as age, gender, marital status, educational level, working status, nature of work, residence and telephone number as well as body mass index .

Part II: Patients' medical history: This part included questions regarding presence of family history of geastroesophageal reflux disease, time of diagnosis, comorbidities, gastrointestinal symptoms, medication history and hospitalization due to complications of gastroesophageal reflux disease.

Part III: Gastroesophageal reflux disease (GERD) triggering factors and assessment questionnaire :This part aimed to assess patients' triggering factors for GERD and included questions related to When symptoms usually worsen, foods that trigger GERD (type and frequency) ,eating large meals, eating before bedtime, elevation of the head of the bed while sleeping, drinking beverages that trigger GERD such as (tea, coffee, carbonated drinks, alcohol, or citrus juices), wearing tight clothes especially around the waist, practicing exercises, smoking and smoked substance.

<u>Tool II:</u> Patients' knowledge assessment : It was adapted from **(Alshaikh et al., 2021; Sankari et al., 2025)** and aimed to assess the patients' knowledge pre and post breathing exercises implementation. It consisted of the following two parts:

Part I: Concerned with patients' knowledge about gastroesophegeal reflux disease , it included (11) questions related to definition, types, causes, risk factors, signs and symptoms, complications, diagnostic methods, treatment methods and ways of prevention as well as correct sleeping position for GERD patients and warning signs require seeking medical advice.

Part II: Concerned with patients' knowledge about breathing exercises. It include (7) questions related to definition, benefits, indications, contraindications and types as well as the correct frequency and appropriate time for performing breathing exercises daily.

The questionnaire tool contained (18) questions about gastroesophageal reflux disease and breathing exercises. All knowledge items were multiple choice questions. The patients were asked to select one correct answer for each question pre and post program implementation.

Scoring system:

Two scoring levels for questions were used. Each question was ranged from 0-1 scores. The score was distributed as follow; each correct answer was scored (1) and each incorrect answer was scored (0), the total possible score of knowledge ranged from 0 to 18 score. It was calculated then converted into percent and categorized as the following:

Satisfactory level : ≥75% (≥14 score)

Unsatisfactory level: <75% (<14 score)

<u>Tool III:</u> Patients' practice assessment for breathing exercises:

It was adapted from (**Norelli et al., 2023)** to assess patients' practice and compliance with breathing exercises. It included the following two parts:

Part I : Breathing exercises performance checklist: It aimed to assess patients' practice related to implementation of breathing exercises including belly or diaphragmatic breathing exercise and box breathing exercises for the purpose of reducing frequency and severity of GERD symptoms as well as improving sleep pattern.

Scoring system: Three points likert scale of responses was used as the following: Two for completely correctly done, one for incompletely done and zero for not done. The total score for patients' practice observational checklist ranged from 0-22 score. It was calculated then converted into percent and categorized as follows:

Good level >75% (> 16 score)

Fair level 50-75% (11-16 score)

Poor level <50% (<11score)

Part II: Self reported compliance: (A question about patient's compliance with performing breathing exercises that was reported 5 times per day, 5–10 minutes per session, over 8 weeks).

Scoring system: Three-points Likert scale of response was used as follows : Zero for not complying at all, one for complying with some extent (partial compliance) and two for completely complying with the learned exercises performance.

<u>Tool IV:</u> Patients' health outcomes assessment: It was used to assess effect of breathing exercises implementation on health outcomes among patients with gastroesophageal reflux disease: It included two parts as the following:

Part I : GERD clinical symptoms severity and frequency assessment: It adapted from **(Mosa et al., 2023)** to assess the severity and frequency of GERD symptoms pre and post breathing exercises implementation .It Included (17) questions about presence of heartburn, regurgitation, dysphagia, nausea, vomiting, epigastric pain, difficult breathing, sore throat, chest pain, chronic cough, hoarseness, sleep disturbance, belching or

burping, abdominal bloating, dental erosions, sinusitis and otitis media.

Scoring system:

For symptoms severity: Four-points Likert scale of response was used as follows : None = 0, mild =1, moderate =2, and severe = 3.

For symptoms frequency: Four- points Likert scale of response was used as follows: Zero for never, one for sometimes (symptoms appear from 1 to 2 days /week), two for often (symptoms appear in 3 to 4 days /week), and three for always (symptoms appear in > 4 days / week).

Total GERD symptoms score combined severity and frequency)

(Based on sum of all symptom scores: Severity × Frequency)

If using multiple symptoms (17 symptoms)
Each total symptom score = 0–9
Total maximum = 17 × 9 = 153

Category	% of Max Score	Score Range (0–153)
Mild	0–50%	0 – 76
Moderate	51–75%	77 – 115
Severe	76–100%	116 – 153

Part two : Pittsburgh Sleep Quality Index (PSQI): This tool was developed by **(Buysse et al., 1989)**, adapted and translated into Arabic by the researcher to assess the quality and patterns of sleep among patients with GERD within the past month pre and post breathing exercises implementation.

Scoring system:

Each component of sleep quality is scored from 0 to 3. In all cases, 0 score for not during the past month, 1 score for once a week, 2 score for twice a week and 3 score for three or more times a week. The seven component scores were then added to yield a global PSQI score with a range of 0-21 points, higher scores indicate worse sleep quality. A PSQI total score from (0-7) indicate good sleep quality; from (8-14) indicate average sleep quality and from (15-21(indicate poor sleep quality.

Tools validity: The face and content validity of the tools were checked through a jury consisting of five experts from the Medical and Nursing fields. Three professors and two assistant professors of medical surgical nursing from Faculty of Nursing, Benha University to ensure the comprehensiveness, clarity, consistency, appropriateness, relevance, accuracy, simplicity, applicability and the proposed suitability of tools' content. The consensus among experts regarding the knowledge questionnaire was 98%, the observational checklist and patients' health outcomes assessment sheet was 99 % for most items.

Tools reliability: All tools of the study were tested statistically the reliability of the knowledge assessment questionnaire, patients' practice regarding breathing exercises, symptoms scale and Pittsburg sleep quality index were estimated using cronbach's alpha test to be (alpha= 0.806, 0.797, 0.857, 0.83 respectively). This only proves that this tool is an instrument with good reliability.

Pilot study:

A pilot study was conducted on 10% of the study subjects (8 patients). It was carried out to assess the usefulness, applicability, clarity and execution time required for each tool to be filled by the researcher, as well as to evaluate the feasibility of fieldwork and identify any potential difficulties that the researcher could encounter and impede the collection of data. The pilot study was done two weeks before starting the study and required modifications were done. So, the

pilot sample was excluded from the study sample and substituted with others.

Field of work:

Data collection of the current study was carried out through six months period (from the beginning of May 2025 to the end of October 2025). It was collected according to the policy of the study setting. The researchers visited the setting three days (Sunday, Tuesday and Thursday) per week during morning and afternoon shifts. Before data collection, the researcher introduced herself to patients and explained the purpose of the study to obtain their approval and cooperation which is needed for conducting this study. The researcher gave information to the studied patients about GERD and breathing exercises, their purposes, advantages, technique and expected effect using some illustrating pictures, booklet and video films. The study was conducted through four phases:

Assessment phase: It was carried out for all studied patients by the researcher to collect data regarding their personal data, medical history and GERD triggering factors using **(tool I)** then the studied patients were assessed for their knowledge concerning GERD and breathing exercises using **(tool II).** Also, the researcher assessed the studied patients' practice of breathing exercises and their compliance with these exercises **(tool III)** as well as patients' health outcomes including GERD clinical symptoms severity and frequency assessment and sleep quality **(tool IV)** as a base line data assessment. The tools were collected by the researcher preprogram implementation for each patient individually in the waiting room of gastroenterology outpatient clinics and took about 30 - 45 minutes.

Planning phase: Once the initial assessment finished, the program was designed based on individual patients' teaching needs. The researcher set up teaching plan covering general and specific objectives. This program was developed from recent literatures, revised and modified based on the experts' comments, in order to be implemented using various methods. The program resources and facilities were allocated (printed material and location or site of session that best serve the learner). The researcher determined the timetable of sessions with the patients for starting program sessions.

Implementation phase: The program implementation had been carried out in gastroenterology outpatient clinics and was conducted in 3 sessions (two theoretical sessions and one practical session)**.** Each session lasted about 30-45 minutes/ day for average number of three to four patients/session considering patients' appointment, including periods of discussion according to the patients' progress and feedback. Motivation, problem solving and reinforcement techniques were used to enhance active participation of the patient in the educational sessions. Patients were asked to follow the exercise every 5 to 10 minutes within three to four times daily.

- **1st session:** (introductory session) explanation of the program contents, its purpose and impact on his condition and expected outcomes and give an explanation about the definition, types, causes, risk factors, signs and symptoms, complications, diagnostic methods, treatment methods, ways of prevention of gastroesophageal reflux disease as well as the correct sleeping position for GERD patients and warning signs require seeking medical advice.

- **2nd session:** Completion of the theoretical part and give an explanation about the definition, benefits, indications, contraindications, types, correct frequency and appropriate time for performing breathing exercises daily.
- **3rd session:** Include applying breathing exercises as (belly or diaphragmatic breathing exercises and box breathing exercises).

- Different teaching and learning methods were used during the sessions which included; discussion, demonstration and re-demonstration, instructional media include mobile videos and printed handout with pictures, which was presented in clear and concise form to learn patients breathing exercises techniques. The program colored booklet was given to each studied patient in order to help them for reviewing and support teaching.

- Patients were informed about the time of the next session at the end of the sitting via scheduling a meeting with them on the same day for his/her follow-up appointment.

- Each session was started by a summary about what has been discussed in the previous session and the objectives of the new session, using simple Arabic language, also the session ended by a summary of its contents and feedback was obtained from the patients to ensure that he/ she got the maximum benefit.

- For further explanation to ensure proper execution of each step, the researchers role-play and videotape for the belly and box breathing exercises technique after researcher initial demonstration in front of the patients and before having them re-demonstrate it.

- At the end of all sessions, the researcher asked the studied patients about their opinion on the program and their benefits from the subject. As well as patients were informed that they will be evaluated by the researcher. During their follow-up, researcher was contact weekly by phone calls to follow their compliance the exercise for continuous four weeks.

Evaluation phase: It aimed to evaluate the effect of breathing exercises on health outcomes among patients with gastroesophageal reflux disease. The researcher evaluated patients' knowledge and practice immediately and 2 months post implementing breathing exercises using the same data collection tools (tool II & tool III) as well as patients' health outcomes was evaluated one and two months post breathing exercises implementation using (tool IV).

Results:

Table (1): Illustrates the personal data among the studied patients, shows that the age of 40.% of them was 40-<50 years with a mean age of 40.30 ± 1.01 years. Concerning gender and marital status, 60% of the studied patients were female and 70% were married . As for educational level, 82.4% of the studied patients had intermediate qualification, moreover 61.2% were working and the nature of their work required physical effort among 69.4% of them. Also 55 % were living in rural area.

Table (2): shows the distribution of the studied patients according to GERD triggering factors. 70% of patients reported worsening symptoms when lying down. 100% of patients consumed GERD-triggering foods, mainly fatty foods among 90%, and 80% consumed them twice daily. Moreover, all participants ate large meals during the day, and 70% ate large meals before bedtime, with 85.7% doing so less than two hours before sleep. 50% of the patients elevated the head of

the bed while sleeping, and all consumed triggering beverages, with equal distribution between those drinking less than five cups and five cups or more daily. None of patients practiced exercise. Regarding smoking, 60% were non-smokers, while 30% were regular smokers; among smokers, 75% used cigarettes and 25% used shisha.

Figure (1): Illustrates that there was a statistically significant difference in total knowledge levels between the pre- and post-breathing exercise implementation periods.

Figure (2): Illustrates that there was a statistically significant difference in total practice levels between pre and post breathing exercises implementation periods.

Figure (3): Illustrates that there were statistically significant differences regarding clinical symptoms severity and frequency between pre and post breathing exercises implementation periods, in term of improvement in symptoms severity and frequency level with ($p = < 0.001^{**}$ & 0.004^{*}).

Table (3): Reveals a significant improvement in sleep quality among the studied patients following the implementation of breathing exercises. Showing a marked decrease in mean scores from pre-exercises to one month and two months post-exercises implementation. Besides, the total sleep quality score also decreased significantly from 13.39 ± 2.32 pre-exercises to 4.61 ± 2.00 at two months post exercises implementation.

Table (4): Demonstrates that there was a statistically significant positive correlation between patients' total knowledge and total practice scores both pre and post two months of breathing exercises implementation. Additionally, a significant positive correlation was observed between clinical symptoms and sleep quality scores during both study periods.

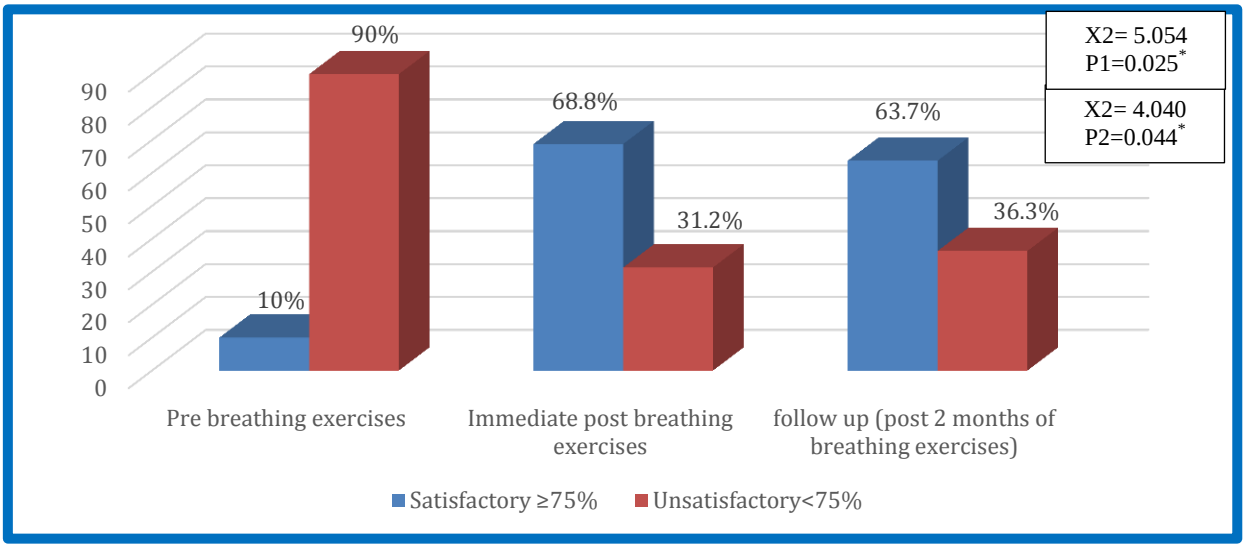
Table (1): Distribution of the studied patients regarding their personal data (n=80).

Patients' personal data	(No.)	%
Age (in years)		
20- < 30	24	30.0
30- < 40	16	20.0
40- < 50	**32**	**40.0**
50 - 60	8	10.0
$\bar{x}$ **± SD**	40.30 ± 1.01	
Gender		
Male	32	40.0
Female	**48**	**60.0**
Marital status		
Married	**56**	**70.0**
Not married	24	30.0
Educational Level		
Read and write	7	8.8
Intermediate qualification	**66**	**82.4**
High qualification	7	8.8
Working status		
Working	**49**	**61.2**
Not working	31	38.8
Nature of work (n=49)		
Require physical effort	**34**	**69.4**
Require mental effort	15	30.6
Residence		
Rural	**44**	**55.0**
Urban	36	45.0

Table (2): Distribution of the studied patients according to gastroesophageal reflux disease (GERD) triggering factors (n=80).

Patients' gastroesophageal reflux disease (GERD) triggering factors	(No.)	%
When do your symptoms usually worsen		
When lying down	**56**	**70.0**
At night	24	30.0
Consume foods that trigger GERD		
Yes	**80**	**100.0**
If yes, the type of foods that trigger GERD (n= 80)		
Fatty foods	**72**	**90.0**
Spicy foods	8	10.0
Frequency of consuming these foods per day		
Twice daily	**64**	**80.0**
Three times or more daily	16	20.0
Eat large meals during the day		
Yes	**80**	**100.0**
Eat large meals before bedtime		
Yes	**56**	**70.0**
No	24	30.0
Timing of eating before sleep (n=56)		
Less than two hours	**48**	**85.7**
Two hours or more	8	14.3
Elevate the head of your bed while sleeping		
Yes	**40**	**50.0**
No	40	50.0
Drink GERD triggering beverages such as tea, coffee, carbonated drinks, alcohol, or citrus juices		
Yes	**80**	**100.0**
Number of cups of these beverages / daily		
Less than 5 cups	**40**	**50.0**
5 cups or more	**40**	**50.0**
Wear tight clothing, especially around the waist		
Yes	24	30.0
No	**56**	**70.0**
Practicing exercise		
No	**80**	**100.0**
Smoking		
No	**48**	**60.0**
Occasionally	8	10.0
Regularly	**24**	**30.0**
If yes, type of smoked substance (n=32)		
Cigarettes	**24**	**75.0**
Shisha	8	25.0

Figure (1): Difference of the studied patients regarding their total knowledge level about gastroesophageal reflux disease and breathing exercises pre and post breathing exercises implementation (n=80.)

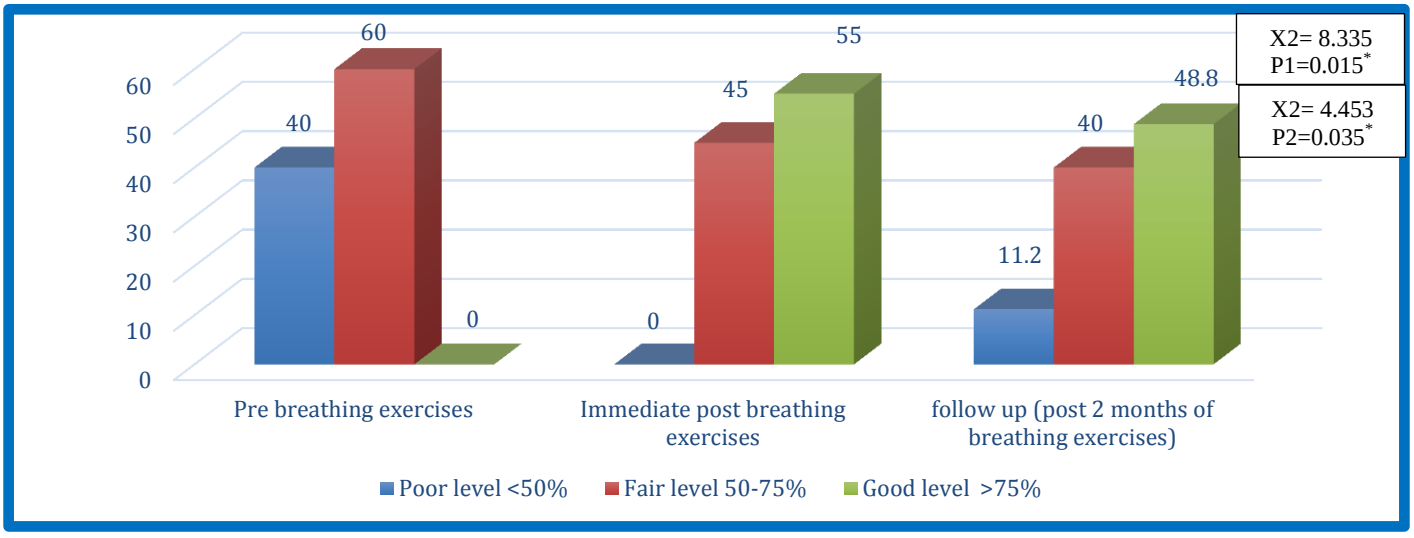


(*) Significant at p ≤0.05.

(1) Difference between total knowledge pre and immediately post breathing exercises implementation

(2) Difference between total knowledge pre and 2 months post breathing exercises implementation

Figure (2): Difference of the studied patients according to their total practice level of breathing exercises pre and post exercises implementation (n=80).

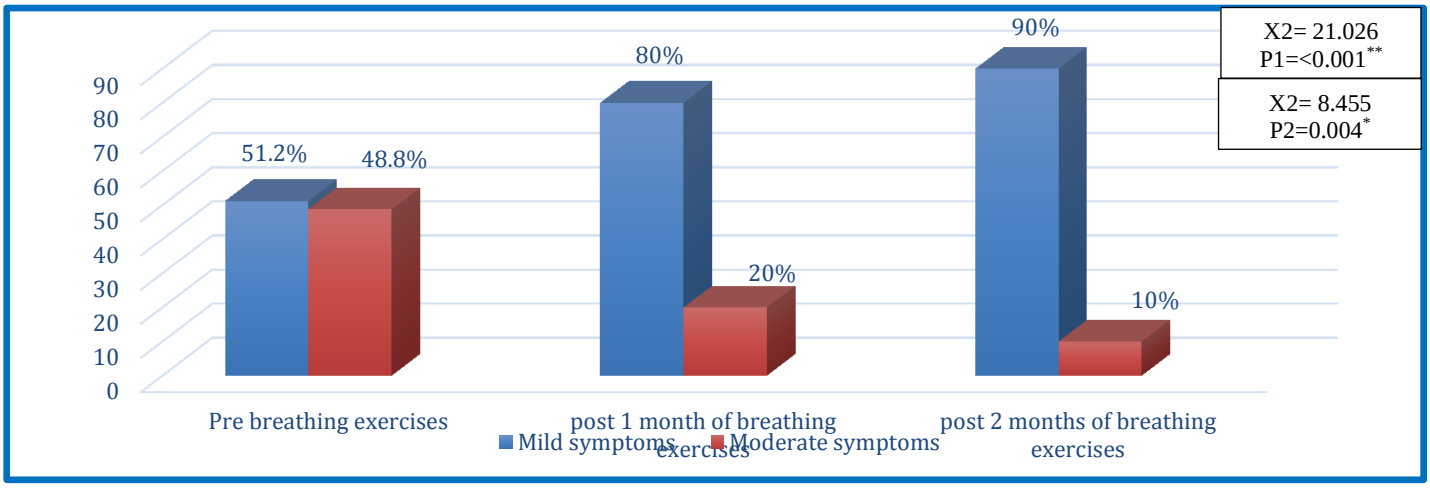


*** Statistically Significant at p ≤0.05.**

(1) Difference between total practice pre and immediately post breathing exercises implementation

(2) Difference between total practice pre and 2 months post breathing exercises implementation

Figure (3): Difference of the studied patients regarding their total level of clinical symptoms severity and frequency pre and post breathing exercises implementation (n=80).



*** Statistically Significant at p ≤0.05.** **** Highly Statistically Significant at p ≤0.001.**

(1) Difference between total level of clinical symptoms pre and 1 month post breathing exercises implementation

(2) Difference between total level of clinical symptoms pre and 2 months post breathing exercises implementation

Table (3): Difference of the studied patients' mean score regarding sleep quality pre and post exercises implementation (n=80).

Sleep quality	Pre breathing exercise (n=80)	Post 1 month of breathing exercises (n=80)	Post 2 months of breathing exercises (n=80)	t-test P value (1)	t-test P value (2)
	Mean ±SD	Mean ±SD	Mean ±SD		
Subjective sleep quality	2.20 ± 0.60	1.30 ± 0.46	0.90 ± 0.54	26.665 <0.001**	25.214 <0.001**
Sleep latency	2.30 ± 0.46	1.50 ± 0.67	0.80 ± 0.75	17.776 <0.001**	26.665 <0.001**
Sleep duration	1.90 ± 0.30	1.10 ± 0.54	0.60 ± 0.49	17.776 <0.001**	25.214 <0.001**
Sleep efficiency	1.60 ± 0.49	1.00 ± 0.45	0.20 ± 0.40	10.886 <0.001**	25.400 <0.001**
Sleep disturbances	2.20 ± 0.60	1.30 ± 0.64	0.70 ± 0.56	26.665 <0.001**	26.665 <0.001**
Use of sleep medication	1.55 ± 0.73	1.12 ± 0.90	0.93 ± 0.66	17.776 <0.001**	25.214 <0.001**
Daytime dysfunction	1.80 ± 0.60	0.99 ± 0.46	0.60 ± 0.49	3.744 <0.001**	5.096 <0.001**
Total	13.39 ± 2.32	8.21 ± 2.34	4.61 ± 2.00	39.655 <0.001**	57.848 <0.001**

***Statistically significant at p ‹0.05** ****Highly significant at p ‹0.001.** **t test: paired t test**

(1) Difference between sleep quality pre and post I month of breathing exercises

(2) Difference between sleep quality pre and post 2 months of breathing exercises

Table (4): Correlation matrix between patients' total knowledge, practice, clinical symptoms and sleep quality pre and post 2 months of breathing exercises (n=80).

Variables	Study periods	Total Knowledge score		Total practice score		Total clinical symptoms score		Total sleep quality	
		r	P value	r	P value	r	P value	r	P value
Total knowledge score	Pre breathing exercises	-	-	0.225	0.045*	-0.257	0.021 *	-0.239	0.033 *
	2 months post breathing exercises	-	-	0.962	<0.001**	-0.293	0.008*	-0.321	0.004*
Total practice score	Pre breathing exercises	0.225	0.045*	-	-	-0.653	<0.001**	-0.260	0.009*
	2 months post breathing exercises	0.962	<0.001**	-	-	-0.435	<0.001**	-0.568	<0.001**
Total symptoms score	Pre breathing exercises	-0.257	0.021 *	-0.653	<0.001**	-	-	0.251	0.025*
	2 months post breathing exercises	-0.293	0.008*	-0.435	<0.001**	-	-	0.475	<0.001**
Total sleep quality	Pre breathing exercises	-0.239	0.033 *	-0.260	0.009*	0.251	0.025*	-	-
	2 months post breathing exercises	-0.321	0.004*	-0.568	<0.001**	0.475	<0.001**	-	

***Statistically significant at p ≤0.05.** ****Highly significant at p ≤0.001**

Discussion

Gastroesophageal reflux disease (GERD) is among the most prevalent chronic esophageal disorders worldwide, with its incidence having significantly risen over the past five decades. It is characterized by distressing symptoms resulting from increased exposure of the esophagus to gastric acid and may be classified based on the presence or absence of mucosal damage. GERD is associated with a reduced health-related quality of life and may lead to serious complications **(Bertin et al., 2026).**

The management of GERD has a considerable impact on patients' daily lives and places a significant burden on both healthcare systems and society. Management strategies include lifestyle modification, pharmacologic therapy, and surgical interventions. Breathing exercises are an effective, low-cost and non-pharmacological treatment for GERD, aimed at improving lower esophageal sphincter function, strengthening the diaphragm muscle and enhancing the anti-reflux barrier. These exercises significantly improve quality of life; reduce reflux episodes and lower reliance on proton pump inhibitors **(Qiu et al., 2024)**.

The present study aimed to assess the effect of breathing exercises on health outcomes among patients with gastroesophageal reflux disease.

Related to age, the current study revealed that, less than half of the studied patients their age ranged from 40-<50 years with a mean age of 40.30 ± 1.01 years. From the researcher's point of view, the increased prevalence in this age group could be attributed to age-related physiological changes, including reduced lower esophageal sphincter tone and delayed gastric emptying as well as lifestyle-related risk factors such as occupational stress, irregular eating habits, obesity, and decreased physical activity, all of which contribute to the development and exacerbation of GERD symptoms. This result is in agreement with **Mosa et al., (2023)** who conducted a study entitled "Belly Breathing Effectiveness on Sleep and Life Quality among Patients with Non-Erosive Gastroesophageal Reflux" and stated that mean age of studied patients was 42.56±9.14 years.

As for gender, the results of the present study revealed that more than half of the studied patients were females. This finding possibly due to hormonal influences (especially estrogen and progesterone), pregnancy-related changes, and differences in symptoms perception and reporting compared to men**.** This finding is in the same line with **Hasuna & Fayasari, (2025)** who carried out a study about " Sleep Quality, Stress Level, and Eating Patterns are Associated with the Incidence of Gastroesophageal Reflux Disease among University Students in Yogyakarta" and founded that nearly three quarters of the studied patients were females.

Concerning marital status, the present study revealed that more than two thirds of the studied patients were married. From the researcher's point of view, marital and family responsibilities may contribute to psychological stress which is known to exacerbate reflux symptoms. This finding aligns with **Alqassab et al., (2024)** whose study entitled "Prevalence and risk factors of gastroesophageal reflux disease among adults attending primary healthcare in Bahrain" and founded that more than two thirds of the sample were married. But this finding differs from **Sankari et al., (2025)** who conducted a cross-sectional study to assess "The Level of Knowledge about Gastroesophageal Reflux Disease (GERD) in the Riyadh Population" and reported that slightly less than two thirds of the participants were single.

Concerning of educational level, the current study's findings showed that most of the studied patients had intermediate qualifications. From the researcher's point of view, low or moderate educational levels may influence health awareness, dietary practices, awareness of GERD triggers and preventive behaviors as well as adherence to lifestyle modifications recommended for GERD management. This finding differs from Alatawi **et al., (2025)** who carried out a cross sectional study about "Prevalence and Lifestyle Factors Associated With Gastroesophageal Reflux Disease Symptoms Among Adults in Saudi Arabia" and reported that most of the participants had low level of education.

In relation to working status and nature of work, the present study revealed that slightly less than two thirds of the studied patients were working and the nature of their work required physical effort among more than two thirds of them. From the researcher's point of view, work requiring significant physical effort often involves heavy lifting or strained postures, which increase intra-abdominal pressure (IAP) which in turn forces stomach acid upward against the lower esophageal sphincter (LES). These results are supported with **Mosa et al., (2023)** who reported that more than half of the studied sample were working and their work required physical effort.

As for residence, the current study's findings showed that more than half of patients were living in rural areas. From the researcher's point of view, this finding may be related to differences in lifestyle patterns, dietary habits, healthcare accessibility and health awareness between rural and urban populations, which may influence the prevalence and severity of gastroesophageal reflux disease. This finding is consistent with **Ali et al., (2024)** who conducted a study about "Effect of Teaching Guidelines on Outcomes of Patients with Laryngopharyngeal Reflux Disease" and reported that slightly less than three quarters of studied group were living in rural areas.

Regarding worsening of symptoms, the results of the present study revealed that more than two thirds of the studied patients reported worsening of GERD symptoms when lying

down. This may be due to the loss of gravity effect in the supine position, which facilitates the backflow of gastric acid into the esophagus and prolongs acid exposure leading to worsening of symptoms. This finding is consistent with **Sankari et al., (2025)** who reported that lying down immediately after meals acts as a key factors influencing GERD risk.

Considering consuming triggering foods, the results of the present study revealed that all patients consumed GERD-triggering foods, mainly fatty foods and the most of them consumed these foods twice daily. From the researcher's point of view, this may return to the effect of fatty meals in delaying gastric emptying and decreasing lower esophageal sphincter pressure, which increases reflux episodes. These findings are consistent with **Nair et al., (2020)** who conducted a study about "Gender differences in GERD: symptom perception and prevalence" and reported that most of the studied patients were consuming fatty food that was significantly associated with increased GERD symptoms.

As for eating large meals, the results of the present study revealed that all patients ate large meals during the day, and more than two-thirds ate large meals before bedtime and the most of them ate less than two hours before sleep. This may be due to gastric over distension caused by large meals, which increases intragastric pressure and promotes reflux, especially when lying down shortly after eating. These findings are consistent with **Mosa et al., (2024)** who studied "Efficacy of abdominal breathing on sleep and quality of life among patients with non-erosive gastroesophageal reflux" and noted that nearly two thirds of studied GERD patients were night eater.

But, these results differ from **Alharbi et al., (2025)** whose study entitled "The Impact of Gastroesophageal Reflux Disease on Quality of Life among Obese Individuals in the Eastern Province of Saudi Arabia" and founded that more than two thirds of the participants were not eating large.

As regard to head-of-bed elevation, the results of the present study revealed that half of the studied patients elevated the head of the bed while sleeping. This finding possibly reflects partial awareness of non-pharmacological measures for controlling GERD symptoms. Elevating the head of the bed helps reduce nocturnal reflux by preventing acid backflow. This finding is congruent with **Fox & Gyawali (2023)** who conducted a study about "Dietary factors involved in GERD management" and reported that sleeping with raising the head of the bed is an effective lifestyle modification for reducing nighttime reflux symptoms.

Regarding triggering beverage consumption, the results of the present study revealed that all patients consumed triggering beverages as coffee, carbonated drinks and alcohol. This finding may be due to the effect of caffeinated and carbonated beverages in increasing gastric acid secretion and relaxing the lower esophageal sphincter. This finding is consistent with **Nair et al., (2020)** and **Alatawi et al., (2025)** who reported that high consumption of caffeinated beverages was significantly associated with GERD symptoms

Regarding practicing exercise, the results of the present study revealed that none of the patients practiced exercise. This finding possibly due to sedentary lifestyle patterns, which may contribute to delayed gastric emptying and increased risk of obesity, thereby worsening GERD symptoms and increasing patients' inability to practice exercise. This finding is in agreement with **Sadafi et al., (2024)** who conducted a study about "Risk factors for gastroesophageal reflux disease: A population-based study" and reported that low

physical activity associated with increased incidence of GERD. On the other hand, this finding disagrees with **Wang et al., (2025)** who conducted a study about "Association of healthy lifestyle behaviors with incident gastroesophageal reflux disease in a large population-based prospective cohort" and reported that higher levels of physical activity were associated with a lower risk of developing GERD symptoms.

Regarding smoking, the results of the present study revealed that less than two thirds of the studied patients were non smokers and less than one-third of the patients were regular smokers, three quarters of smokers used cigarettes while a one quarter of them used shisha. Smoking may aggravate GERD symptoms by decreasing lower esophageal sphincter pressure and reducing salivary bicarbonate secretion.

This study findings is supported by **Somaili et al., (2025)** who conducted a study about " Prevalence of gastroesophageal reflux disease among university students who smoke electronic cigarettes in Jazan, Saudi Arabia" and showed that more than three quarters of the smoker participants had GERD while, only one quarter of non-smokers participants suffered from it.

Concerning patients' total knowledge about gastroesophageal reflux disease (GERD) and breathing exercises, the present study showed that there was a statistically significant difference in total knowledge levels between pre and post breathing exercises implementation periods. From the perspective of the researcher, this improvement reflects the positive effect of the structured theoretical sessions on patients' understanding of GERD and its management strategies as well as awareness of breathing exercises. This finding supports the first hypothesis.

This study finding is supported by **Ali & Atiyah (2025)** who reported in their study which entitled "Effectiveness of an educational program about lifestyle habits on patients' knowledge with gastroesophageal reflux disease" that the educational program was effective in significantly enhancing patients' knowledge about lifestyle habits related to GERD with a significant difference between pre and post program implementation.

Concerning patients' total practice of breathing exercises, the present study revealed a statistically significant difference in total practice levels between pre- and post-breathing exercises implementation periods. Where, none of the studied patients demonstrated a good level of practice before the implementation of breathing exercises, while a noticeable proportion achieved a good level of practice after exercises implementation. This finding supports the first hypothesis. This improvement indicates that the application of practical or training sessions regarding breathing exercises had a positive impact on enhancing patients' practical performance and compliance with breathing exercises.

This finding is supported by **Niu et al. (2024)** who studied "Positive effect of deep diaphragmatic breathing training on gastroesophageal reflux-induced chronic cough: a clinical randomized controlled study" and founded that patients' practice level of diaphragmatic breathing exercises improved significantly after the training period compared to pre-training levels, reflecting progressive improvement in the correct execution of breathing techniques over time.

Regarding gastroesophageal reflux disease clinical symptoms severity and frequency, the results of the current study illustrated that there were statistically significant differences regarding clinical symptoms severity and frequency between pre

and post breathing exercises implementation periods, in term of improvement in symptoms severity and frequency level, which supports hypothesis two. From the researcher's point of view, this progressive improvement suggests that breathing exercises may contribute to reducing reflux-related symptoms over time, likely by improving diaphragmatic function and reducing intra-abdominal pressure, which can help limit reflux episodes.

This finding is consistent with **Zdrhova et al., (2023)** who reported in their study entitled "Breathing Exercises in Gastroesophageal Reflux Disease: A Systematic Review " that there was a significant reduction in reflux symptoms severity and frequency among the studied group who continued practicing breathing exercises.

Concerning patients' sleep quality pre and post breathing exercises implementation, the current study revealed that there was a significant improvement in sleep quality among the studied patients post rather than pre breathing exercises implementation with highly statistically significant differences ($p<0.001$). From the researcher's point of view, this indicate that the training sessions of breathing exercises had a substantial positive effect on improving both patients' aspects of sleep and overall sleep quality.

This finding aligns with **Steinmane & Fernate (2025)** who conducted a study about "The effect of breathing exercises on adults' sleep quality: an intervention that works" and reported that daily practice of breathing exercises for at least 4 weeks was associated with significant improvements in Pittsburgh Sleep Quality Index (PSQI) scores.

Regarding correlation between patients' total knowledge and total practice scores, this study demonstrated that there was a statistically significant positive correlation between patients' total knowledge and total practice scores both pre and post two months of breathing exercises implementation. This finding is congruent with **Ali et al., (2024)** who founded that there was a statistically significant positive correlation between patients' knowledge and reported practices at both the pre-intervention and follow-up stages.

Regarding correlation between clinical symptoms and sleep quality, this study revealed that there was a significant positive correlation between clinical symptoms and sleep quality scores during both study periods. This finding is congruent with **Ren et al., (2026)** who conducted a study about "Association between Gastroesophageal Reflux and Sleep Disorder: A Systematic Review and Meta-analysis" and founded that there was a significant positive correlation between severity of clinical symptoms and sleep quality in patients with GERD during the study periods.

This finding is also matched with **Hsieh et al., (2025)** who conducted a retrospective study about "Associations Between Sleep Quality, Anxiety, Depression, and Gastroesophageal Reflux Disease in a Tertiary Hospital Sleep Center" and founded that there was a significant positive correlation ($p < 0.001$) between sleep quality and GERD symptoms.

Concerning correlation between patients' total knowledge and practice scores and clinical symptoms, this study revealed that there were statistically significant negative correlations between both total knowledge, practice scores and clinical symptoms as well as sleep quality during both study periods, indicating that higher levels of knowledge and better practice were associated with reduced symptoms severity and improved sleep quality.

These findings are matched with **Mosa et al., (2024)** who founded that there was a significant

negative correlation between total patients' practice levels and GERD symptoms severity and frequency over time, while simultaneously improving sleep quality.

Conclusion

The study findings indicated that patients' knowledge and practice significantly improved following the implementation of breathing exercises, which was accompanied by marked improvements in all health outcomes. These improvements included a reduction in the severity and frequency of symptoms and enhanced sleep quality, with highly statistically significant differences ($p < 0.001$).

Recommendations

In the light of the findings of the current research, the following recommendations are suggested:

- Encouraging nurses to integrate breathing exercises with the treatment protocols of patients with gastroesophageal reflux disease.
- Manual pamphlet about breathing exercises should be accessible to nurses as a reference to be distributed among patients with gastroesophageal reflux disease.
- Continuous in-service nursing training programs pertaining to breathing exercises should be designated and presented in special training sessions to all patients with gastroesophageal reflux disease.
- Awareness enhancement program regarding gastroesophageal reflux disease triggering factors and its management and as well as adherence to regular breathing exercises through mass media should be disseminated by authorized personnel.
- Study replication with large probability sample and different geographical area is recommended to confirm breathing exercises practice efficacy.

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