Original Article

Screening and Impact of Non-Pharmacological Interventions for Gastroesophageal Reflux Disease in Eastern Province of Saudi Arabia

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ABSTRACT

Background: Gastroesophageal reflux disease (GERD) is a prevalent gastrointestinal condition influenced by lifestyle factors such as obesity and diet. While proton pump inhibitors (PPIs) are widely used, concerns about long-term use have increased interest in non-pharmacological interventions.

Objective: To evaluate the prevalence of GERD and the effectiveness of non-pharmacological strategies, including lifestyle changes and natural remedies, among adults in the Eastern Province of Saudi Arabia.

Methods: A cross-sectional study was conducted from January to March 2025 using an online survey. Adults aged 18 years and older were screened with the GERD-Q questionnaire. Data on demographics, lifestyle practices, and symptom management approaches were collected. Statistical analyses included t-tests, ANOVA, and Pearson correlations.

Results: Of 567 respondents, 171 met inclusion criteria (GERD-Q ≥ 8). Most were females (60.8%), aged 30–50 years, and over 70% were overweight or obese. Common interventions included avoiding lying down after meals (73.2%) and elevating the bed head (64.3%). Fewer than 18% used natural remedies such as honey, melatonin, and pomegranate, with limited perceived benefit. No significant differences in symptom severity were found between users and non-users of individual interventions. While Participants using combined treatment (both pharmacological and non-pharmacological) reported higher symptom scores ($p = 0.0003$), likely reflecting more severe GERD. Correlations between symptom scores and age, BMI, and lifestyle factors were weak.

Conclusion: Given the limited effectiveness observed for individual non-pharmacological interventions in the Eastern Province, personalized treatment approaches and further research are critically needed to optimize GERD management in this population.

Keyword: Gastroesophageal reflux disease (GERD), Lifestyle modification, non-pharmacological treatment, Natural Remedies.

Introduction

Gastroesophageal reflux disease (GERD) is a chronic, often recurring condition that occurs when stomach contents flow back into the esophagus. This backward flow, or reflux, can cause symptoms like heartburn, acid regurgitation, chest discomfort, and sometimes even difficulty swallowing or a persistent cough [1].

GERD not only affects daily comfort and quality of life but also places a significant burden on healthcare systems worldwide [2]. Recent studies show that GERD is becoming increasingly common across the globe, with prevalence estimates ranging from 15% to 25%. In Western countries, the rates can reach as high as 30%, while lower but still significant rates are seen

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in Asian populations [3,4]. In Saudi Arabia, estimates vary widely, with reported prevalence ranging from 15% to 45.4%, depending on the region [5]. One study from the Eastern Province found a GERD prevalence of 20.6%, underscoring the condition's impact in that area [4]. The rising numbers are closely linked to lifestyle and environmental changes, most notably the global increase in obesity. Defined as having a body mass index (BMI) over 30 kg/m², obesity has been shown to exacerbate GERD symptoms by increasing pressure inside the abdomen and affecting the function of the lower esophageal sphincter (LES). Several large-scale studies from the U.S., U.K., Norway, and Spain have confirmed a clear connection between excess weight and GERD, with some even suggesting a dose-dependent effect, meaning the higher the BMI, the worse the symptoms [6,7]. Obesity doesn't just increase symptom severity; it may also raise the risk of complications like Barrett's esophagus, which can lead to esophageal cancer [8]. Beyond obesity, several lifestyle factors can also contribute to GERD. These include smoking, high-fat diets, frequent caffeine and chocolate consumption, eating late at night, and a sedentary lifestyle [9]. Hormonal influences, especially higher estrogen levels in premenopausal women and those using hormone replacement therapy, have also been linked to GERD [10]. Together, these influences illustrate how GERD is driven by multiple, often modifiable, factors emphasizing the need for holistic, non-drug-based management strategies. While proton pump inhibitors (PPIs) are the standard treatment for GERD, concerns have been raised about their long-term use. Extended use has been associated with issues like nutrient deficiencies, increased infection risk, and possible kidney problems [11]. As a result, non-pharmacological approaches are gaining attention either as supplements to medication or as standalone treatments, especially for those with milder symptoms or a preference for conservative care. Changes in lifestyle and diet such as losing weight, quitting smoking, adjusting meal timing, elevating the head during sleep, and avoiding known trigger foods have been shown to help in many studies [12]. There is also growing interest in natural and alternative remedies. For example, Manuka honey has anti-inflammatory and soothing effects on the esophagus. Melatonin may strengthen the LES and support mucosal protection, while pomegranate known for its antioxidants—has been explored for its potential digestive benefits. However, its acidity might limit its use for some patients [13,14]. These emerging therapies reflect a shift toward more integrative care, but more rigorous studies are needed to confirm their effectiveness and safety. Despite the global attention GERD receives, there's still a lack of localized research in Saudi Arabia, particularly regarding non-pharmacological interventions. With GERD being so prevalent in the Eastern Province and Western-style habits becoming more common, tailored strategies for screening and management are essential. Understanding local eating patterns, physical activity, and cultural perceptions of natural treatments can help shape more personalized and effective care plans. Therefore, this study aims to screen individuals in the Eastern Province for GERD and evaluate how various non-pharmacological approaches including lifestyle changes, behavioral adjustments, and natural remedies affect symptom control and disease outcomes. The goal is to provide practical, evidence-based insights that can support both public health initiatives and clinical practices in better managing GERD in this population.

Methods

Study Design and Setting: This study employed a cross-sectional design to screen for GERD and evaluate the impact of non-pharmacological interventions among adults in the Eastern Province of Saudi Arabia. Data collection was conducted between January and March 2025.

Target Population: The target population included adult residents of the Eastern Province aged 18 years and above. Participants were screened for GERD symptoms using the GERD-Q questionnaire and assessed for their use of non-pharmacological strategies such as dietary modifications, weight control, smoking cessation, and other lifestyle changes.

Sampling Method: A convenience sampling method was used for recruitment, targeting participants from various cities within the province including Dammam, Al-Khobar, Dhahran, Al Jubail, and Al-Ahsa. Efforts were made to ensure diversity in age, gender, BMI, and health behaviors to allow for a broad understanding of GERD and its non-pharmacological management within the region.

Sample Size Calculation: The minimum required sample size was determined using the standard formula for estimating proportions in large populations, assuming a 95% confidence level, 5% margin of error, and 50% prevalence. The calculation resulted in a minimum sample of 385 participants, ensuring representativeness and adequate statistical power. Additional participants were recruited to account for non-responses and incomplete data.

Recruitment Process: Participants were recruited online through a self-administered electronic survey using Google Forms. The survey link was distributed via social media platforms such as WhatsApp, X (formerly Twitter), Instagram, and Telegram. The questionnaire was available in both Arabic and English to enhance accessibility. Notably, the Arabic version of the questionnaire was officially translated and reviewed by an accredited translation center to ensure linguistic accuracy and cultural appropriateness. Recruitment efforts included:

• Distribution through community networks and university groups.

• Sharing the survey in public health and wellness forums to reach individuals interested in lifestyle-related topics.

Inclusion and Exclusion Criteri: Participants were eligible for inclusion if they were 18 years or older, currently residing in the Eastern Province of Saudi Arabia, provided informed consent, reported symptoms suggestive of GERD, and had a GERD-Q score of 8 or higher. Individuals who did not meet these criteria—including those under 18, non-residents, those who did not consent, or participants with a GERD-Q score below 8—were excluded from the study.

Data Collection: Questionnaire Development, the questionnaire consisted of three sections:

1) Demographic Information – including age, gender, BMI category, occupation, education, and lifestyle habits.

2) GERD Screening – using the GERD-Q, a validated tool that assesses the frequency of GERD-related symptoms.

3) Non-Pharmacological Interventions – evaluating the use and effectiveness of lifestyle modifications such as dietary changes, smoking cessation, weight control, sleep position, and use of natural remedies. This section was developed based on findings from previous clinical trials and relevant literature to ensure evidence-based content and contextual relevance.

Data Collection Period: Data were collected from January to March 2025 to provide an up-to-date snapshot of GERD prevalence and lifestyle intervention patterns in the Eastern Province.

Ethical Considerations: The study received ethical approval from the Institutional Review Board at King Faisal University (Approval Number: KFU-REC-2025-APR –ETHICS3238). Participation was voluntary, and informed consent was obtained electronically before beginning the questionnaire. All data were anonymized and treated with strict confidentiality following the principles of the Declaration of Helsinki.

Statistical Analysis

Data were cleaned, managed, and coded using Microsoft Excel 2019 (Microsoft Corporation, Redmond, WA). Missing data were handled using listwise deletion, where cases with any missing values were excluded from the analysis. Statistical analysis was performed using R (RStudio, version 1.4.1106; RStudio, Inc). Descriptive statistics (frequencies, percentages, and means) were used to summarize participant characteristics and responses. Independent t-tests and one-way ANOVA were conducted to compare GERD symptom scores across treatment and intervention groups. Pearson's correlation was used to assess relationships between age, BMI, and symptom severity. A p-value ≤ 0.05 was considered statistically significant.

Results

A total of 567 participants were initially recruited. After applying exclusion criteria, including age restrictions and GERD-Q scoring, the final sample comprised 171 individuals with likely GERD. As shown in (Table 1), the majority (50.9%) were aged between 30–50 years, with an equal distribution in the 18–30 and 50–75 age groups (24.6% each). Females represented 60.8% of the participants, and nearly all were Saudi nationals (99.4%). Educational levels were generally high, with 79.5% holding a bachelor's degree or higher. Regarding BMI, 39.2% were overweight and 33.3% were classified as obese, indicating that over 70% of the sample had above-normal body weight. (Table 2) outlines the participants' lifestyle practices related to GERD management. Symptom improvement was commonly reported with physical activity (64.3%), avoiding lying down after meals (73.2%), and elevating the bed head (64.3%). However, regular physical activity was low, with only 5.8% exercising daily. Only 19.9% practiced stress management techniques, and just 28.1% reported improvement from it. Most participants were non-smokers, and only 15.1% of smokers believed smoking worsened their symptoms. (Figure 1) illustrates the six most frequently avoided food items among participants with GERD. Spicy foods were the most commonly reported trigger, avoided by 84 participants, followed closely by fatty foods (81 participants) and acidic foods (61 participants). Caffeinated drinks such as tea and coffee were avoided by 50 participants, while carbonated beverages and chocolate were reported as triggers by 42 and 16 participants, respectively. (Figure 2)

illustrates the distribution of GERD among the study population. Out of 567 participants, 171 (33.9%) were identified as having GERD based on the GERD-Q scoring system, while 333 (66.1%) were classified as non-GERD. This observed prevalence is consistent with regional data and highlights the significance of GERD as a prevalent gastrointestinal condition among adults in Saudi Arabia. The usage and perceived benefits of common natural remedies are shown in (Table 3). Honey, melatonin, and pomegranate products were used by fewer than 18% of participants each. Perceived full symptom relief was rare—only 1.5% for honey, 7.8% for melatonin, and 4.8% for pomegranate. Most participants reported either partial or slight improvement. (Table 4) summarizes the t-test results comparing the severity of symptoms between users and non-users of interventions. None of the interventions yielded statistically significant differences ($p > 0.05$). While melatonin users had the highest mean score (11.19), the effect was insignificant ($p = 0.3132$). The comparison of GERD symptom severity across treatment groups is demonstrated in (Table 5). Participants using both pharmacological and non-pharmacological treatments had the highest symptom scores (mean = 11.14). A statistically significant difference was found when compared with the non-pharmaceutical-only group ($p = 0.0003$). (Table 6) shows the correlation between various lifestyle behaviors and GERD symptom scores. All correlations were weak. The most notable was a weak positive correlation for raising the bed head ($r = 0.19$) and a weak negative correlation with physical activity ($r = –0.14$), suggesting minor associations with symptom severity. The correlations between age, BMI, and GERD symptom scores are summarized in (Table 7). Age and BMI had a weak positive correlation ($r = 0.28$), while neither showed a meaningful association with symptom severity.

Discussion

GERD is one of the most encountered gastrointestinal disorders worldwide, often linked to modern lifestyle patterns such as high-fat diets, sedentary behavior, and rising obesity rates. In light of growing concerns surrounding the long-term pharmacologic management of GERD, particularly with PPIs, there has been increased interest in understanding the role and effectiveness of non-pharmacological interventions. This study sought to screen for GERD among adults in the Eastern Province of Saudi Arabia and evaluate the impact of lifestyle modifications and natural remedies on symptom severity. This study included 567 participants, with 171 meeting GERD-Q criteria. Most were Saudi, female, aged 30–50, and over 70% were overweight or obese. Common strategies included avoiding lying down after meals, elevating the head of the bed, and engaging in physical activity, although daily exercise was uncommon. Stress management was limited, and individuals avoided spicy, fatty, and acidic foods the most. Fewer than 18% used natural remedies, with minimal full relief. Symptom severity showed no significant difference across interventions but was higher in those using both medications and lifestyle changes ($p = 0.0003$). Correlations with age, BMI, and behaviors were weak. The demographic trends observed in this study, particularly the predominance of middle-aged, educated females, mirror findings from other studies in Saudi Arabia and globally. For instance, a study by Alkhathami et al. [15] found similar age and gender distributions among GERD patients in Riyadh, where females were more likely to report symptoms and seek non-pharmacological solutions [15]. The high rates of overweight and obesity in this sample also reflect broader national and global trends linking increased BMI with GERD. Previous research by El-Serag et al. [16] and Hampel et al. [17] demonstrated that obesity can raise intra-abdominal pressure and weaken the lower esophageal sphincter (LES), promoting reflux [16,17]. While our study also found this association, the correlation between BMI and symptom severity was weak ($r = –0.04$), possibly due to variations in how individuals perceive or report their symptoms. Avoidance of specific trigger foods, especially spicy and fatty meals, was one of the most common practices reported in this study. This aligns with research from the United States and East Asia, indicating that spicy, greasy, and acidic foods are frequently cited as exacerbating GERD symptoms [18,19]. However, as in our findings, symptom improvement from dietary changes remains subjective and varies between individuals. In contrast to promising reports from smaller trials and experimental studies, the natural remedies examined in our study—honey, melatonin, and pomegranate showed limited use and effectiveness. A study by Kandil et al. [20] suggested that melatonin may enhance LES tone and reduce acid exposure, yet our results showed no statistically significant benefit in terms of symptom reduction [20]. This may be attributed to variations in dosage, duration of use, and inconsistent adherence among participants. Standardizing administration methods and exploring these variables in controlled trials would provide more definitive conclusions. Interestingly,

Table 1: Demographic Characteristics of Participants.

Variable	Category	Count	% of Total
Age	18–30 yrs	42	24.6%
	30–50 yrs	87	50.9%
	50–75 yrs	42	24.6%
Gender	Female	104	60.8%
	Male	67	39.2%
Nationality	Saudi	170	99.4%
	Non-Saudi	1	0.6%
Education	Bachelor's	136	79.5%
	< High School	3	1.8%
	High School	19	11.1%
	Postgraduate	13	7.6%
BMI Category	Normal	43	25.1%
	Obese	57	33.3%
	Overweight	67	39.2%
	Underweight	4	2.3%

Table 2: Lifestyle Behaviors, Stress Management, and Smoking Status.

Variable	Yes (%)	No (%)	Non-smoker (%)
Physical activity helps	64.3	35.7	
Avoid lying after meals	73.2	26.8	
Improved after avoiding lying down	74.3	25.7	
Raise bed head	64.3	35.7	
Improved after raising bed	62.6	37.4	
Practices stress control	19.9	80.1	
Improved with stress control	28.1	71.9	
Smoking worsens symptoms	15.1	6.8	78.1

Quitting smoking helps	25.2	5.0	69.8

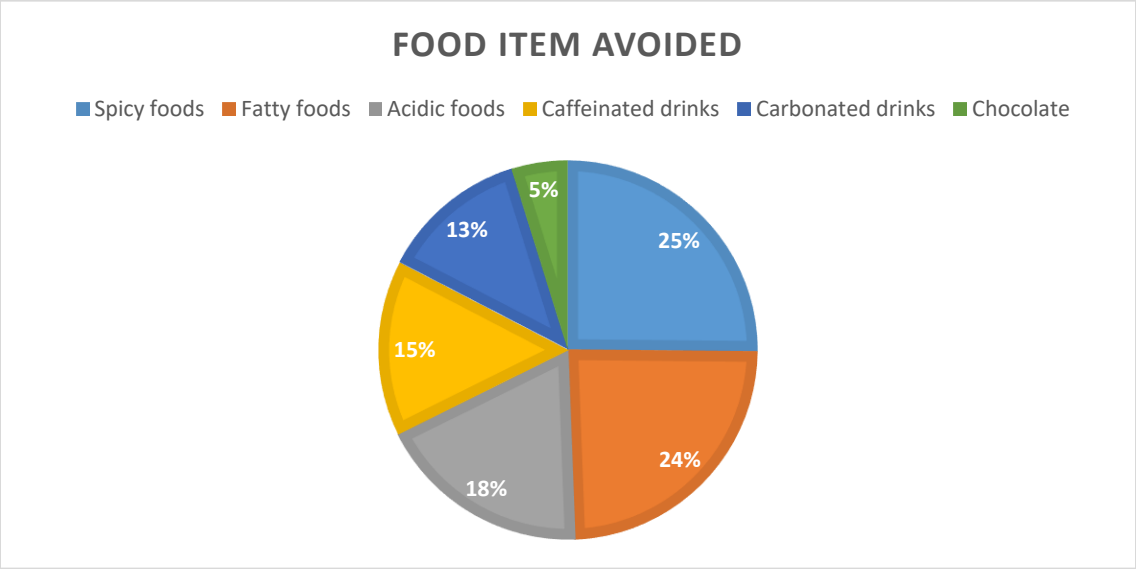

Figure1: Top Avoided Food Items Reported by GERD Patients.

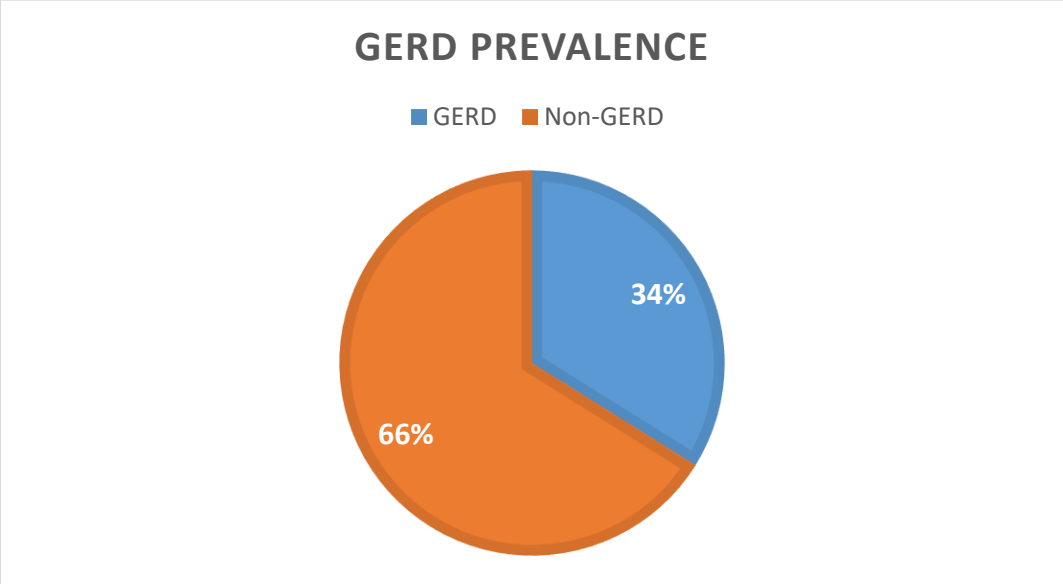

Figure2: Prevalence of GERD and Non-GERD Among Study Participants.

Table 3: Use and Perceived Effectiveness of Natural Remedies.

Remedy	Use (%)	No Improvement (%)	Slight Improvement (%)	Partial Improvement (%)	Full Improvement (%)
Honey	17.5	50.0	22.1	26.5	1.5
Melatonin	15.8	51.6	20.3	20.3	7.8
Pomegranate	17.5	50.8	22.2	22.2	4.8

Table 4: Independent Samples t-Test: Effect of Interventions on Symptom Severity.

Intervention	Mean (Users)	Mean (Non-users)	P-value
Avoiding Trigger Foods	10.85	10.39	0.2817
Using Honey	11.07	10.65	0.4327
Using Melatonin	11.19	10.64	0.3132
Using Pomegranate Products	10.50	10.77	0.5783
Smoking Cessation	10.71	11.43	0.4946

Table 5: GERD Symptom Score by Treatment Group.

Group	Mean Score	P-value vs Both
Both (Pharma + Non-Pharma)	11.14	–
Non-Pharma only	8.81	0.0003*
Pharma only	10.25	0.4099
None	10.20	0.8231

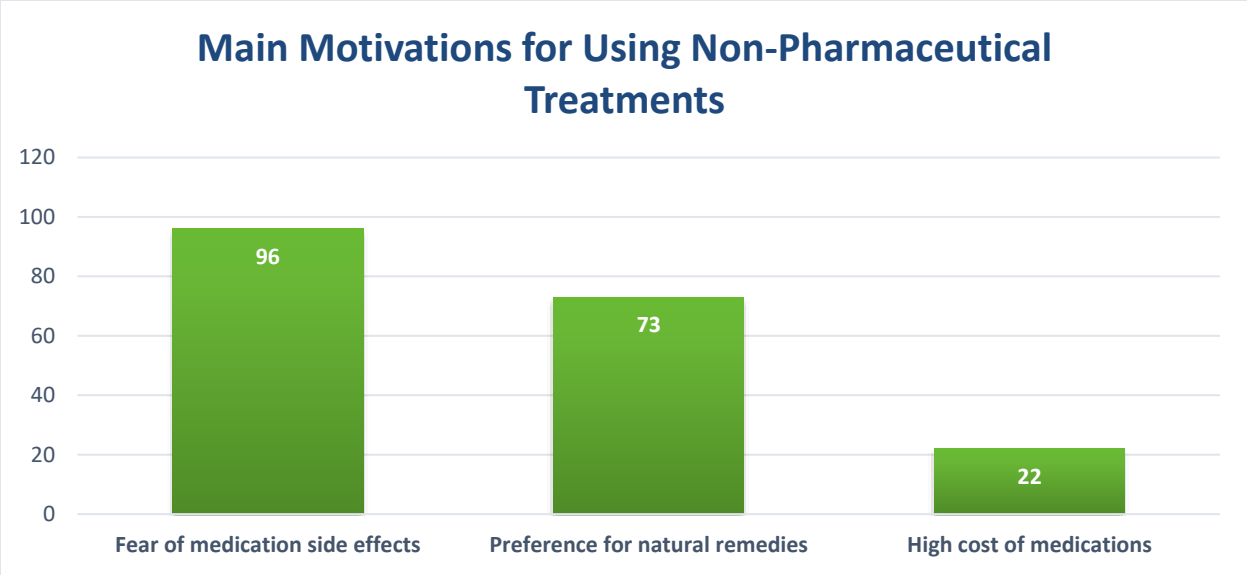

Figure 3: Main Motivations for Using Non-Pharmaceutical Treatments.

Table 6: Correlation Between Lifestyle Practices and Symptom Severity.

Lifestyle Factor	Correlation with Symptoms
Avoiding Trigger Foods	+0.08 (weak positive)
Physical Activity Helps	–0.14 (weak negative)
Smoking Cessation Helps	–0.10 (weak negative)
Stress Management Helps	+0.01 (negligible)
Avoid Lying After Meals	+0.12 (weak positive)
Raise Bed Head	+0.19 (weak positive)

Table 7: Correlations between age, BMI, and GERD symptom scores.

Variable 1	Variable 2	Correlation
Age	BMI	+0.28
Age	Symptom Score	–0.07
BMI	Symptom Score	–0.04

participants using both pharmacological and non-pharmacological interventions reported the highest symptom scores. This finding likely reflects symptom severity as a motivating factor for multi-modal treatment rather than an indication of treatment inefficacy [21]. It highlights the need to tailor management plans based on individual disease severity and response to interventions. One important implication of this study is the need to promote not only awareness of non-pharmacological GERD interventions but also consistent practice. While many participants believed that physical activity or avoiding lying down after meals improved their symptoms, very few engaged in these behaviors regularly. Public health efforts could focus on behavioral change models and culturally sensitive educational campaigns to encourage consistent lifestyle modification. Additionally, the weak correlations observed between lifestyle factors and GERD symptom severity suggest that while these strategies may offer benefits, they are not uniformly effective for all individuals. Personalized management plans taking into account symptom frequency, BMI, dietary habits, and stress levels may be more beneficial than blanket recommendations. This study contributes valuable data on GERD in the Eastern Province of Saudi Arabia, a region underrepresented in the literature. The inclusion of both traditional lifestyle strategies and emerging natural remedies broadens the scope of practical applications.

Strengths, Limitations and Recommendations: This study presents several strengths. It addresses a regional gap by focusing on GERD in the Eastern Province of Saudi Arabia, providing localized insights into symptom prevalence and management strategies. The use of the validated GERD-Q tool ensures reliable symptom screening, while the bilingual and culturally adapted questionnaire enhances accessibility and participation. Additionally, the inclusion of participants from multiple cities across the province improves the geographic representativeness of the findings. The study also offers valuable data on the real-world use and perceived effectiveness of various lifestyle and natural interventions, informing both clinical practice and public health strategies. However, the study has several limitations. First, its cross-sectional design limits the ability to establish causal relationships between lifestyle interventions and GERD symptom improvement. Second, data were self-reported, which may introduce recall and reporting bias. Third, convenience sampling may affect the generalizability of the findings to the broader population. Additionally, the low number of users for certain natural remedies reduced the statistical power to detect significant effects. Finally, the study did not assess the frequency or duration of intervention use, limiting the interpretation of adherence and effectiveness. Future research should consider longitudinal or interventional designs to evaluate symptom changes over time and assess adherence to lifestyle modifications. Incorporating objective measures and standardized metrics for intervention use would strengthen data accuracy. Expanding sampling methods and including diverse populations could also improve the generalizability and applicability of findings.

Conclusion

In conclusion, non-pharmacological strategies—particularly dietary and positional changes—are widely used for GERD management in the Eastern Province of Saudi Arabia. Despite perceived benefits, their effectiveness was not strongly supported by statistical analysis, highlighting the need for individualized care and further research to identify which patients benefit most.

Conflict of Interest

None

Funding

None

References

1. Dunbar KB. Gastroesophageal reflux disease. Ann Intern Med. 2024;177(8):ITC113-ITC128.
2. Kellerman R, Kintanar T. Gastroesophageal reflux disease. Prim Care. 2017;44(4):561-573.
3. Eusebi LH, Ratnakumaran R, Yuan Y, Solaymani-Dodaran M, Bazzoli F, Ford AC. Global prevalence of, and risk factors for, gastro-oesophageal reflux symptoms: a meta-analysis. Gut. 2018;67(3):430-440.
4. Al Ghadeer HA, Alabbad ZE, AlShaikh SB, Ahmed SU, Bu-Khamseen AA, Alhashem AT, et al. Prevalence of gastroesophageal reflux disease and associated risk factors in the Eastern Region, Saudi Arabia. Cureus. 2021;13(11):e19599.
5. Alsuwat OB, Alzahrani AA, Alzhrani MA, Alkhathami AM, Mahfouz MEM. Prevalence of gastroesophageal reflux disease in Saudi Arabia. J Clin Med Res. 2018;10(3):221-225.
6. El-Serag HB, Graham DY, Satia JA, Rabeneck L. Obesity is an independent risk factor for GERD

symptoms and erosive esophagitis. Am J Gastroenterol. 2005;100(6):1243-1250.
7. Richter JE, Rubenstein JH. Presentation and epidemiology of gastroesophageal reflux disease. Gastroenterology. 2018;154(2):267-276.
8. Deboever N, Jones CM, Yamashita K, Ajani JA, Hofstetter WL. Advances in diagnosis and management of cancer of the esophagus. BMJ. 2024;385:e074962.
9. De Giorgi F, Palmiero M, Esposito I, Mosca F, Cuomo R. Pathophysiology of gastro-oesophageal reflux disease. Acta Otorhinolaryngol Ital. 2006;26(5):241-246.
10. Kang A, Khokale R, Awolumate OJ, Fayyaz H, Cancarevic I. Is estrogen a curse or a blessing in disguise? Role of estrogen in gastroesophageal reflux disease. Cureus. 2020;12(10):e11180.
11. Sandhu DS, Fass R. Current trends in the management of gastroesophageal reflux disease. Gut Liver. 2018;12(1):7-16.
12. Velanovich V. Nonmedical treatment of gastroesophageal reflux disease. Gastroenterol Hepatol (N Y). 2015;11(5):343-345.
13. Gośliński M, Nowak D, Mindykowski R, Kulewski W, Popławski C. Application of Manuka honey in treatment patients with GERD. Food Sci Nutr. 2023;12(1):172-179.
14. Bang CS, Yang YJ, Baik GH. Melatonin for the treatment of gastroesophageal reflux disease; protocol for a systematic review and meta-analysis. Medicine (Baltimore). 2019;98(4):e14241.
15. Alkhathami AM, Alzahrani AA, Alzhrani MA, Alsuwat OB, Mahfouz MEM. Risk factors for gastroesophageal reflux disease in Saudi Arabia. Gastroenterology Res. 2017;10(5):294-300.
16. El-Serag H. Role of obesity in GORD-related disorders. Gut. 2008;57(3):281-284.
17. Hampel H, Abraham NS, El-Serag HB. Meta-analysis: obesity and the risk for gastroesophageal reflux disease and its complications. Ann Intern Med. 2005;143(3):199-211.
18. Ness-Jensen E, Hveem K, El-Serag H, Lagergren J. Lifestyle intervention in gastroesophageal reflux disease. Clin Gastroenterol Hepatol. 2016;14(2):175-182.e1-3.
19. Fujiwara Y, Arakawa T. Epidemiology and clinical characteristics of GERD in the Japanese population. J Gastroenterol. 2009;44(6):518-534.
20. Kandil TS, Mousa AA, El-Gendy AA, Abbas AM. The potential therapeutic effect of melatonin in gastro-esophageal reflux disease. BMC Gastroenterol. 2010;10:7.
21. Tanvir F, Nijjar G, Aulakh S, et al. Gastroesophageal reflux disease: new insights and treatment approaches. Cureus. 2024;16(8):e67654.