

Lifestyle Management of Gastroesophageal Reflux Disease (GERD): A Systematic Review

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Abstract

Gastroesophageal reflux disease (GERD) is characterized by abnormal gastric reflux into the esophagus at least once a week leading to heartburn and acid regurgitation which consequent greater burden on health-care systems. With the recognition of the side effects of the long-term use of PPIs, as nondrug methods and first-line treatments, diet and lifestyle modifications are receiving increasing attention due to their importance in the prevention and treatment of GERD. In this article, we reviewed and analyzed the current literature to elucidate which dietary and lifestyle factors are associated with GERD, provide specific and informative dietary and lifestyle recommendations for patients, and provide information for follow-up studies. We also attempt to elucidate the dietary and lifestyle differences associated with GERD. Although evidence is still lacking to support the routine use of non-pharmacological management, the non-invasive nature and minimal potential side effects of these therapies may be attractive in the management of GERD. To confirm the clinical efficacy of these non-pharmacological approaches, better-conducted, methodologically rigorous, and large-scale clinical trials are needed.

Keywords: Lifestyle management, non-pharmacological treatment, gastroesophageal reflux disease

Rezumat

Boala de reflux gastroesofagian (GERD) se caracterizează prin reflux gastric anormal în esofag cel puțin o dată pe săptămână, ceea ce duce la arsuri la stomac și regurgitare acidă, care au drept consecință o povară mai mare asupra sistemelor de sănătate. Odată cu recunoașterea efectelor secundare ale utilizării pe termen lung a IPP, ca metode nondrog și tratamente de primă linie, dieta și modificările stilului de viață primesc o atenție sporită datorită importanței lor în prevenirea și tratamentul GERD. În acest articol, am revizuit și analizat literatura de specialitate actuală pentru a elucida ce factori de dietă și de stil de viață sunt asociați cu GERD, pentru a oferi recomandări alimentare și de stil de viață specifice și clare pentru pacienți și pentru a furniza informații pentru studiile de urmărire. De asemenea, încercăm să elucidăm diferențele alimentare și de stil de viață asociate cu GERD. Deși lipsesc încă dovezi care să susțină utilizarea de rutină a managementului non-farmacologic, natura non-invazivă și efectele secundare potențiale minime ale acestor terapii, ele pot fi atractive în managementul GERD. Pentru a confirma eficiența clinică a acestor abordări non-farmacologice sunt necesare studii clinice mai bine coordonate, riguroase din punct de vedere metodologic și pe o scară mai largă.

Cuvinte cheie: Managementul stilului de viață, tratament non-farmacologic, boala de reflux gastroesofagian.

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INTRODUCTION

Gastroesophageal reflux disease (GERD) is characterized by abnormal gastric reflux into the esophagus at least once a week leading to heartburn and acid regurgitation. It is a common disease globally, with increasing prevalence, and, consequently, greater burden on healthcare systems.¹⁻² The incidence rate is increasing annually, but there are substantial differences among regions. The highest incidence, which occurs in Europe and the United States, reaches 20%, and the lowest incidence, which occurs in Asia, is approximately 10%.³⁻⁴ In 2015, the total direct economic impact of GERD and its complications was estimated to be over \$18 billion, with use of proton pump inhibitors (PPIs) accounting for \$12.4 billion, while the indirect costs driven by decreased work productivity were as much as \$75 billion.

Most patients present with repeated episodes of heartburn and/or regurgitation. Chest pain is also common, and less common symptoms include a chronic cough, asthma, dysphagia, and belching. Gastroesophageal reflux disease is caused by the dysfunction of the lower esophageal sphincter whereby frequent and/or prolonged relaxations lead to regurgitation of gastric acid.⁵ Over time, the acid leads to damage and dysplasia of the gastroesophageal mucosa. Risk factors for GERD include obesity, tobacco smoking, and genetic predisposition.⁶ Untreated GERD can lead to complications, including esophageal (esophagitis, Barrett’s esophagus, esophageal strictures, or esophageal adenocarcinoma) or extra-esophageal (asthma exacerbations, chronic laryngitis, hypersalivation). The prevalence of GERD associated complications is 18% to 25% for esophagitis, 7% to 23% for esophageal strictures, and 7.2% for Barrett’s esophagus.⁶

GERD has been reported to be alleviated, or even cured, with a combination of lifestyle interventions and medication. Effective treatments include lifestyle modification, proton pump inhibitors (PPIs) and surgery.⁷⁻⁸ With the recognition of the side effects of the long-term use of PPIs, as nondrug methods and first-line treatments, diet and lifestyle modifications are receiving increasing attention due to their importance in the prevention and treatment of GERD. Moreover, poor lifestyle habits can worsen GERD and reduce treatment efficacy.⁷⁻⁹ Therefore, we reviewed and analyzed the current literature to elucidate which dietary and lifestyle factors are associated with GERD, provide specific and

informative dietary and lifestyle recommendations for patients, and provide information for follow-up studies.

RESEARCH DESIGN AND METHODS

Study Design

This research conducted by following guidelines from the PRISMA 2020 (Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols).¹⁰ The related articles were found using some databases and sources including PubMed, PMC, Science Direct, Cochrane Library and Taylor and Francis written in English from 2010-2021. The keywords searched through the following basic and MeSH (medical subject headings) terms: “Lifestyle Intervention” or “Lifestyle Management” or “Lifestyle Changes” or “Lifestyle Modification” or “Lifestyle Therapy and “Gastroesophageal Reflux” or “Gastroesophageal Reflux Disease” or “Gastric Acid Reflux” or “Gastric Acid Reflux Disease. At first screening, all of the potentially relevant articles were listed and evaluated. This process was performed independently by two independent investigators (PIDA and SM) (Figure 1).

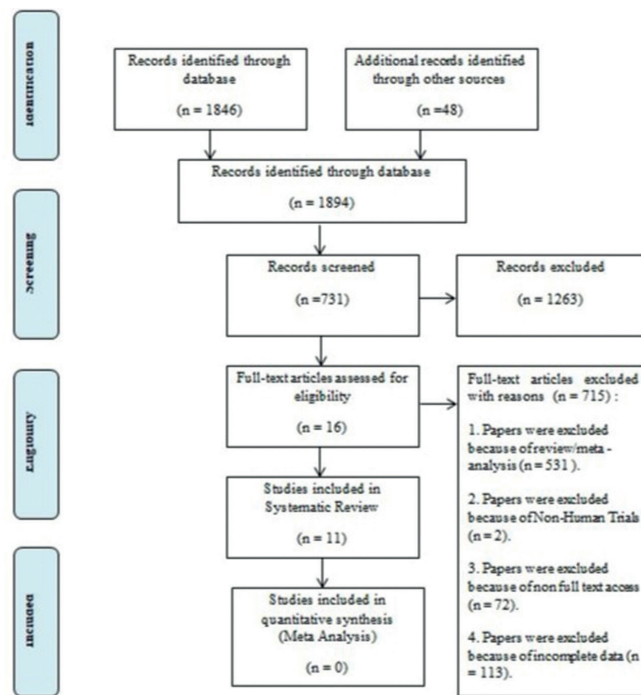


Figure 1. A flowchart of paper selection in our study

Eligibility Criteria

Inclusion and exclusion criteria were compiled to ensure methodological consistency across all studies being included in the meta-analysis and to address potential study-level bias.

The eligibility criteria for inclusion were as follows:

1. Presence of English abstract and/or summary and/or manuscript or presence of one of the above in a language known to one of the authors.
2. Full-text observational study or randomized control trial study.
3. Subjects in study were diagnosed with GERD based on:
 - Symptoms of heartburn of greater than 6 months' duration, with an average of ≥ 2 episodes of night-time heartburn per week, with an associated GERD-related sleep disturbance of ≥ 1 month's duration
 - Previous response to acid suppressive therapy (either PPIs or H2-histamine receptor blockers)
 - Abnormal 24 h esophageal pH test. Patients who had supine reflux (nocturnal) during 24 h esophageal pH test
 - GERD-Q questionnaire (Symptom score of 8 points or higher)
4. Subjects with more than 18 years old.

Thus, the exclusion criteria were mentioned below:

- 1) Articles which were not written in English
- 2) Articles which were written before 2010

Data Extraction

Data extraction is performed independently by the two independent investigators (PIDA and SM) with equal amounts. All discrepancies are decided jointly to reach agreement. All the studies collected will be unified by all two independent investigators. Simultaneously all two independent investigators eliminate studies for duplication. The collected studies will be searched for full text version of it. Independent investigators also assessed risk-of-bias using an assessment tool based on the Cochrane Handbook for Systematic Reviews of Interventions (version 6.3).

RESULTS

Characteristics of Studies

A total of 1,894 studies were identified from research database (Figure 1). After removing the duplicate records, 731 records were screened, and 16 were

assessed for eligibility. Eleven studies were included in the review, after excluding 5 studies due to out of scope and insufficient detail. There are 11 studies published between 2010 and 2021 (Table 1).⁹⁻¹⁵ The studies found were randomized controlled trials and non randomized controlled trials. There are 4 studies examined the effect of weight loss intervention, 2 studies examine the effect of smoking cessation, 2 studies examined the bed elevation intervention, and 3 studies examined the dietary intervention.

Weight Loss

The reflux of gastroduodenal contents from the stomach into the esophagus due to any anatomical defect at the gastroesophageal junction (GEJ) is defined as gastroesophageal reflux disease.¹⁰⁻¹² Over the last few decades there has been steady increase in the prevalence of GERD^{13-15,26-27} and several recent studies have suggested a significant association between obesity and GERD.^{26,28-34} The prevalence of GERD has been shown to increase with increasing BMI^{26,33,35} and ranges from 59 to 79% among extremely obese subjects.^{27,36-37} Individuals can use different strategies to lose weight, including physical activity, dietary modifications, and behavioral changes as summarized in Table 1. Bortoli et al. comparative study showed that GERD symptoms were prevalent in 37% of overweight and/or obese individuals enrolled in a weight loss program.¹⁶ Furthermore, results of the prospective study showed that weight loss led to a significant improvement in GERD symptoms ($P < 0.05$). In Singh et al. study cohort, weight loss over a 6-month period, the majority of subjects (81%) experienced a reduction in GERD symptoms and 65% of the study subjects with complete resolution of reflux symptoms. There was a significant correlation between % body weight loss and reduction in GERD symptom scores ($r = 0.17$, $P < 0.05$).¹² Anderson and Jhaveri study, showed substantial weight loss is associated with large reductions in medication costs (Group A, total, \$249 \pm 25 and \$153 \pm 19; Group B: total, \$237 \pm 27 and \$65 \pm 12). Moreover, numbers of medications also decreased significantly for all co-morbidities. Mean numbers of daily medications, initial and final, respectively were: Group A, total, 3.0 \pm 0.2 (mean \pm SEM) and 1.7 \pm 0.2; Group B, total, 2.5 \pm 0.2 and 0.7 \pm 0.1.¹⁷ In Ness-Jensen et al. study, Weight loss was dose-dependently associated with a reduction of GERS and an increased treatment success with antireflux medication. Among individuals with >

Table 1. Baseline characteristics of studies included in our analysis

Category	Author Year	Title	Lifestyle Intervention	Study Design, Duration, Number of participants	Outcomes	Adverse Effect
Weight Loss	Bortoli et al. ¹⁶	Voluntary and controlled weight loss can reduce symptoms and proton pump inhibitor use and dosage in patients with gastroesophageal reflux disease: a comparative study	Group A (PPI & a personalized hypocaloric diet and aerobic exercise) vs Group B (PPI and a 'standard of care diet').	Nonrandomized prospective study	In group A, mean body mass index (BMI) decreased from 30.3 ± 4.1 to 25.7 ± 3.1 ($P < 0.05$), and mean weight decreased from 82.1 ± 16.9 kg to 69.9 ± 14.4 kg ($P < 0.05$). In group B, there was no change in BMI and weight. Symptom perception decreased ($P < 0.05$) in both groups during PPI therapy, but a higher improvement was recorded in group A. In group A, PPI therapy was completely discontinued in 27/50 of the patients, and halved in 16/50. Only 7/50 continued the same PPI dosage. In group B, 22/51 halved the therapy and 29/51 maintained full dosage of therapy, but none was able to discontinue PPI due to a symptom recurrence.	Not Reported
	Singh et al. ¹²	Weight Loss Can Lead to Resolution of Gastroesophageal Reflux Disease Symptoms: A Prospective Intervention Trial	Phone based vs. traditional face-to-face clinic program for weight loss and weight maintenance.	RCT	At baseline, the mean body weight, BMI, and waist circumference were 101 (618) kg, 35 (65) kg/m ² and 103 (613) cm. At 6 months, majority of the subjects (97%) lost weight (average weight loss: 13.6 7.7 kg) and as compared with baseline, there was a significant decrease in the overall prevalence of GERD (15 vs. 37%; $P < 0.01$) and the mean GERD symptom score (1.8 vs. 5.5; $P < 0.01$). Overall, 81% of the subjects had reduction in GERD symptom scores; 65% had complete resolution and 15% had partial resolution of reflux symptoms. There was a significant correlation between % body weight loss and reduction in GERD symptom scores ($r = 0.17$, $P < 0.05$).	Not Reported
	Anderson & Jhaveri ¹⁷	Reductions in Medications with Substantial Weight Loss with Behavioral Intervention	Behavioral weight loss program employing low-energy diets (LED)	Nonrandomized prospective study	Group A, 83 obese patients on medications completed 8 weeks of classes, lost 19 kg in 20 weeks. Group B, 100 severely obese patients, lost 59 kg in 45 weeks. Medications were discontinued: Group A, 18%; Group B, 64%. Mean numbers of medications decreased significantly for all co-morbidities. Mean numbers of daily medications, initial and final, respectively were: Group A, total, 3.0 ± 0.2 (mean ± SEM) and 1.7 ± 0.2; Group B, total, 2.5 ± 0.2 and 0.7 ± 0.1. Monthly costs for all medications decreased significantly for all co-morbidities and were as follows: Group A, total, \$249 ± 25 and \$153 ± 19; Group B: total, \$237 ± 27 and \$65 ± 12.	Not Reported
	Ness-Jensen et al. ¹⁵	Weight Loss and Reduction in Gastroesophageal Reflux. A Prospective Population-Based Cohort Study: The HUNT Study	Weight loss intervention	Prospective population based cohort study	Among individuals with > 3.5 units decrease in BMI, the adjusted odds ratio (OR) of loss of any (minor or severe) GERS was 1.98 (95 % confidence interval (CI) 1.45 – 2.72) when using no or less than weekly antireflux medication, and 3.95 (95 % CI 2.03 – 7.65) when using at least weekly antireflux medication. The corresponding ORs of loss of severe GERS was 0.90 (95 % CI 0.32 – 2.55) and 3.11 (95 % CI 1.13 – 8.58).	Not Reported
Tobacco Smoking Cessation	Kohata et al. ¹⁹	Long-Term Benefits of Smoking Cessation on Gastroesophageal Reflux Disease and Health-Related Quality of Life	Varencline Treatment	Prospective population based cohort study	A total of 141 patients achieved smoking cessation (success group) and 50 did not (failure group) at 1 year after the treatment. The GERD improvement in the success group (43.9%) was significantly higher than that in the failure group (18.2%). The frequency of reflux symptoms significantly decreased only in the success group. HR-QoL significantly improved only in the success group.	Not Reported
	Ness-Jensen et al. ²⁰	Tobacco Smoking Cessation and Improved Gastroesophageal Reflux: A Prospective Population-Based Cohort Study: The HUNT Study	Tobacco Smoking Cessation	Prospective population based Cohort study	Among individuals using antireflux medication at least weekly, cessation of daily tobacco smoking was associated with improvement in GERS from severe to no or minor complaints (adjusted OR 1.78; 95 % CI: 1.07 – 2.97), compared with persistent daily smoking. This association was present among individuals within the normal range of BMI (OR 5.67; 95 % CI: 1.36 – 23.64), but not among overweight individuals.	Not Reported
Dietary Intervention	Morozov et al. ²¹	Fiber-enriched diet helps to control symptoms and improves esophageal motility in patients with non-erosive gastroesophageal reflux disease	Fiber Enriched Diet only	Nonrandomized prospective study	The number of patients experiencing heartburn was less (93.3% at baseline vs 40% at the end of the study, $P < 0.001$) and the GERD-Q score decreased (mean ± SD: 10.9 ± 1.7 vs 6.0 ± 2.3, $P < 0.001$) after the treatment period. Minimal resting lower esophageal sphincter (LES) pressure increased from 5.41 ± 10.1 to 11.3 ± 9.4 mmHg ($P = 0.023$). Total number of gastroesophageal refluxes (GER) decreased from 67.9 ± 17.7 to 42.4 ± 13.5 ($P < 0.001$) predominantly by acid and weak acid types of GERs. Maximal reflux time decreased from 10.6 ± 12.0 min to 5.3 ± 3.7 min ($P < 0.05$).	Severe diarrhea (stool frequency per week, mean ± SD 7 ± 2 at baseline vs 8 ± 3 at the end of the treatment period, $P = 0.00002$).
	Rivière et al. ²²	Low FODMAPs diet or usual dietary advice for the treatment of refractory gastroesophageal reflux disease: An open-labeled randomized trial	The low FODMAPs (fermentable oligo-, di-, monosaccharides, and polyols) diet vs the usual dietary advice	RCT	No difference in response rates (RDQ score ≤ 3) between the low FODMAPs diet (6/16, 37.5%) and usual dietary advice (3/15, 20%) groups ($p = 0.43$). Total RDQ score and dyspepsia subscore decreased significantly over time in both groups ($p = 0.002$), with no difference according to the assigned diet group ($p = 0.85$).	Not Reported
	Tosseti et al. ²³	Elimination of Dietary Triggers Is Successful in Treating Symptoms of Gastroesophageal Reflux Disease	Elimination of Dietary Triggers and to come back for follow-up visit after 2 weeks	Nonrandomized prospective study	Eighty five patients reported at least one triggering food, mostly spicy foods (62%), chocolate (55%), pizza (55%), tomato (52%), and fried foods (52%). At follow-up visit, the diagnosis of GERD was confirmed in only 55 patients, and the mean GERD-Q score decreased to 8.9. Heartburn reporting decreased from 93 to 44% of patients, while regurgitation decreased from 72 to 28%. About half of the patients agreed to continue with only dietary recommendations.	Not Reported

Head of the Bed Elevation	Study	Intervention	Design	Results	Adverse Events	
Head of the Bed Elevation	Morales et al. ²⁴	Impact of head of bed elevation in symptoms of patients with gastroesophageal reflux disease: A randomized single-blind study (IBELGA)	Head-of-bed-elevation of 20 cm for 6 weeks and then to sleep without inclination for 6 additional weeks with a wash-out of 2 weeks between periods vs control group	RCT	27 (69.2%) patients who used the intervention reached the primary outcome vs 13 (33.3%) patients in the control group (RR: 2.08; 95% CI: 1.19---3.61). No effect was found in SF-36 score (RR: 1.11; 95% CI: 0.47---2.60). Preference favoring the intervention was 77.1% and adverse event proportion was 54.0%.	<i>Mild adverse events, n (%)</i> Patient Sliding down the bed 16 (25.4). Venous insufficiency symptoms in lower limbs 6 (9.5) Neck pain or low-back pain 2 (3.2) Headache 1 (1.6) Osteoarthritis of the knee 1 (1.6) Bed instability 1 (1.6) Sexual problems associated with the tilting of the bed 1 (1.6)
	Khan et al. ²⁵	Effect of bed head elevation during sleep in symptomatic patients of nocturnal gastroesophageal reflux	Day 1 (without bed head elevation) and Day 7 (with bed head elevation)	Nonrandomized prospective study	The mean (\pm SD) supine reflux time %, acid clearance time, number of refluxes 5 min longer and symptom score on day 1 and day 7 were 15.0 ± 8.4 and 13.7 ± 7.2 ; $P = 0.001$, 3.8 ± 2.0 and 3.0 ± 1.6 ; $P = 0.001$, 3.3 ± 2.2 and 1.0 ± 1.2 ; $P = 0.001$, and 2.3 ± 0.6 and 1.5 ± 0.6 ; $P = 0.04$, respectively. The sleep disturbances improved in 13 (65%) patients.	<i>Serious adverse events, n (%)</i> Patient Sliding down the bed 4 (6.3) Insufficiency symptoms in lower limbs 4 (6.3). Neck pain or low-back pain 4 (6.3) Problems related to the bed (instability or breakage) 3 (4.8)

3.5 units decrease in BMI, the adjusted odds ratio (OR) of loss of any (minor or severe) GERS was 1.98 (95 % confidence interval (CI) 1.45 – 2.72) when using no or less than weekly antireflux medication, and 3.95 (95 % CI 2.03 – 7.65) when using at least weekly antireflux medication.¹⁸

Tobacco and Smoking Cessation

Most studies have shown a positive association between smoking and GERD symptoms. In a recent systematic review conducted by Ness-Jensen et al. It was revealed that smoking reduces the LOS pressure facilitating reflux.²⁰ The study found that tobacco smoking cessation was associated with an improvement in severe GERS among normal weight individuals using antireflux medication at least weekly (adjusted OR 1.78; 95 % CI: 1.07 – 2.97). There was, however, no such pattern in individuals with minor GERS, overweight, or those using antireflux medication less than weekly.²⁰ Kohata et al. study showed that successful smoking cessation by varenicline associated with decreased prevalence of GERD, reduced frequency of reflux symptoms (43.9%), and improved HR-QOL.¹⁹

Dietary Intervention

Although dietary manipulation is commonly employed in clinical practice, data is conflicting on definitive recommendations.³⁸ Earlier dietary studies focused on analyzing types of foods or beverages in terms of their

effect on GERD pathophysiology and symptoms. More recently, dietary patterns including macronutrient composition and eating behavior have been assessed, which may be a more practical approach for patients.³⁹ In Morozov et al open-label prospective study, we demonstrated for the first time that intake of dietary fibers increases LES minimal resting pressure and decreases the number of acid, weakly-acid, and total refluxes. It was associated also with twice as low frequency of heartburn in patients with NERD (93.3% at baseline vs 40% at the end of the study, $P < 0.001$) and GERD-Q score (mean \pm SD: 10.9 ± 1.7 vs 6.0 ± 2.3 , $P < 0.001$).⁴⁰ In Rivière et al. multicenter preliminary randomized study, we found no benefit of a 4-week low FODMAPs diet (6/16, 37.5%) over usual dietary advice (3/15, 20%) in patients with PPI refractory GERD symptoms ($p = 0.43$). Both dietary interventions improved moderately GERD and dyspepsia symptoms in a subset of patients ($p = 0.002$).²² Tosseti et al. showed that patients are able to identify at least one food which is considered to cause their symptoms, with an increased detection by using a precompiled list of potential triggering foods. Moreover, after 2 weeks of specific food elimination diet according to the results of the questionnaire, the diagnosis of GERD was confirmed in only 55 patients, and the mean GERD-Q score decreased to 8.9. Heartburn reporting decreased from 93 to 44% of patients, while regurgitation decreased from 72 to 28%. About half of the patients agreed to continue with

only dietary recommendations and not require the start of a pharmacological therapy or to undergo further investigations.²³

Head of the Bed Elevation

One promising, easy-to-adopt, non-drug intervention is elevating the head of the bed, which may also be used to avoid, or to lower the dose required of PPIs.⁴⁰ A potential mechanism of action is by reducing the esophageal exposure to stomach acid and increasing the clearance of acid from the oesophagus.⁴¹ In Morales et al. study found that the use of HBE for six weeks significantly reduced reflux symptoms in patients with GORD and night-time symptoms treated on an outpatient basis with PPI compared to sleeping without that elevation (RR: 2.08; 95% CI: 1.19---3.61).²⁴ The Khan et al. study showed that bed head elevation significantly reduced esophageal acid exposure and acid clearance time during the supine period besides reduction in symptom grade. The mean (± SD) supine reflux time %, acid clearance time, number of refluxes 5 min longer and symptom score on day 1 and day 7 were 15.0 ± 8.4 and 13.7 ± 7.2; *P* = 0.001, 3.8 ± 2.0 and 3.0 ± 1.6; *P* = 0.001, 3.3 ± 2.2 and 1.0 ± 1.2; *P* = 0.001, and 2.3 ± 0.6 and 1.5 ± 0.6; *P* = 0.04, respectively, although total resolution of heartburn and sleep disturbance was not seen.²⁵

Adverse Event

Only 2 studies reported adverse event but none of them were serious and need further treatment. A study by Morales et al.²⁴ showed thirty-four of these 63 participants reported some adverse effect during the use of HBE (proportion: 54.0%; 95% CI: 41.7---66.3) and 15 of these 34 patients had to discontinue HBE due to a related adverse effect (proportion: 23.8%; 95% CI: 15.0---35.6). However, none of the participants had to seek medical help to resolve the adverse effect (Table 1). Morozov et al. reported that no serious adverse event was registered during the study. Because of the primary indication of psyllium (laxative), significant increase in bowel movements was expected, but it was not necessary to withdraw treatment due to severe diarrhea (stool frequency per week, mean ± SD 7 ± 2 at baseline *vs* 8 ± 3 at the end of the treatment period, *P* = 0.00002).²¹

Risk of Bias

Bias assessment included selection bias, performance bias, detection bias, attrition bias, reporting bias and other bias (Figure 2). Most of all studies had low risk of bias.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Anderson & Jhaveri, 2010	+	+	+	+	+	+	+
Bortoli et.al, 2016	+	+	+	+	+	+	+
Khan et.al, 2011	+	-	+	+	+	+	+
Kohata et.al, 2016	+	+	+	+	+	+	+
Morales et.al, 2020	+	+	+	+	+	+	+
Morozov et.al, 2018	+	+	+	+	+	+	+
Ness-Jensen et al, 2013	+	+	+	+	+	+	+
Ness-Jensen et al, 2014	+	+	+	+	+	+	+
Rivière et.al, 2021	+	+	+	+	+	+	+
Singh et al, 2013	+	+	+	+	+	+	+
Tosseti et.al, 2020	-	+	+	+	+	+	+

Figure 2. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.

DISCUSSION

Lifestyle management for GERD is increasingly sought by families and healthcare providers to treat GERD symptoms. The non-invasive nature and minimally likely side effects of these non-drug, non-addictive therapies may benefit GERD patients, especially those who have failed pharmacological interventions medicine. We believe that patients suffering from GERD should be recommended to lose weight if they are obese, that tobacco smoking cessation and increased dietary fiber should be encouraged and that late evening

meals should be avoided and head of the bed elevation recommended for patients with supine reflux (1 discussion). Fiber-enriched diet led to a significant increase of minimal lower esophageal sphincter resting pressure, a decrease of number of gastroesophageal refluxes, and a decrease of heartburn frequency per week in NERD.²¹ It is speculated that dietary fiber expand with water to form a barrier to the acid rising into the esophagus.⁴² The low FODMAPs diet could be beneficial in GERD management was based on the known effect of short-chain carbohydrate fermentation products on LES transient relaxation facilitating reflux events.⁴³⁻⁴⁵ However, in our review, A low FODMAPs diet did not seem more effective for patients with PPI refractory GERD symptoms than usual dietary advice.²²

Identify at least one food triggering their symptoms and that an initial therapeutic approach based on abstinence from identified food may be effective in the short term.²³ High-fat meals increase the esophageal acid exposure as assessed by reflux monitoring in reflux patients with and without esophagitis,⁴⁶ reduce the resting pressure of the lower esophageal sphincter and prolong the time of gastric emptying.⁴⁷ Animal fats and proteins seem to increase acid secretion and gastrin levels,⁴⁸ whereas chocolate is considered a food capable of reducing the tone of the lower esophageal sphincter.⁴⁹⁻⁵⁰ A study carried out in 15 patients by means of pH impedance monitoring and comparing in the same patient the effects of a meal with a high rate of animal proteins and those of a meal with a high rate of vegetable proteins showed that the meal rich in animal proteins was followed by a greater number of total and acid refluxes.⁵¹ Finally, it has been shown that the frequency of GERD is lower in individuals following predominantly a Mediterranean diet (frequent consumption of composite/traditional dishes, fresh fruit and vegetables, olive oil, and fish) compared to those following largely non-Mediterranean diet (frequent consumption of red meat, fried food, sweets, and junk/ fast food).⁵²⁻⁵⁵

Smoking cessation reduced the prevalence of GERD, reduced the severity of reflux symptoms, and improved HR-QOL. Smoking cessation will normalize the lower esophageal sphincter pressure and salivary bicarbonate production.⁵⁶⁻⁵⁸ Kahrilas and Gupta showed that smokers exhibited lower LES pressures compared with nonsmokers, and smoking increased acid reflux events through an abrupt increase in intra-abdominal pressure during coughing or deep inspiration.⁵⁹ HBE as a non-pharmacological adjuvant therapy in

the treatment of patients with GORD and night-time symptoms treated with PPI demonstrated a therapeutic effect in reducing reflux symptoms, the magnitude of which was clinically and statistically significant. Additionally, PPI-based triple therapy, often combined with antibiotics such as amoxicillin, clarithromycin, or metronidazole for 10–14 days, has shown beneficial effects beyond symptom control, including improvements in hematological parameters such as Hb, HCT, MCV, iron, and ferritin three months after treatment initiation.⁶⁰ Patients who obtained weight loss recorded a great improvement in typical GERD-related symptoms and were able to reduce or discontinue drug intake without observing recurrence of symptoms.²⁴

Lifestyle interventions, especially weight loss and tobacco smoking cessation, are also beneficial from other perspectives, including low economic costs, no harmful side-effects and overall health benefits. In addition, observational studies have shown that weight loss and tobacco smoking cessation are associated with improved success with medical treatment.^{18,20}

Current evidence supporting the routine use of non-pharmacological therapies in the treatment of patients with GERD is still limited, although some GERD patients respond well to non-pharmacological treatment. When to incorporate non-pharmacological therapy into drug therapy and its place in the current treatment regimen for patients with GERD remains to be determined. Just as gastric NETs (neuroendocrine tumors) require accurate diagnosis due to their distinct pathogenesis and management; a precise evaluation of GERD is essential to determine the most appropriate treatment strategy for each patient.⁶¹ It remains unclear whether it should be used in patients with refractory GERD or whether it should be used as an adjunct to pharmacological treatment. Future, large-scale, well-conducted clinical trials are needed to confirm their effectiveness and identify possible side effects of GERD treatment.

The study had a number of limitations. First, several confounding factors that might affect the final findings such as age, gender, ethnicity, nutritional status, underlying disease, family history, and environmental factors were not included in the study. Second, since some of the design of included studies in our analysis was non-RCT, it might yield low-evidence. Third, false positive finding could be occurred because of small sample size even when combined. Thus, further studies with larger sample size are required to investigate the association.

CONCLUSION

Lifestyle management for GERD, including weight loss, smoking cessation, dietary interventions, and bedside elevation, may be useful options for the treatment of GERD (Table 1).

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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