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Gastroesophageal Reflux Disease: A Comprehensive Literature Review

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Abstract: Gastroesophageal Reflux Disease (GERD) is a chronic gastrointestinal disorder with increasing global prevalence that adversely affects quality of life and may lead to complications such as Barrett's esophagus and esophageal adenocarcinoma. This narrative review aimed to synthesize current evidence on the pathophysiology, clinical manifestations, diagnosis, and management of GERD. A literature search was conducted using Google Scholar, PubMed, NCBI, and ScienceDirect for peer-reviewed articles and clinical guidelines published between 2021 and 2026. Twenty-two relevant articles in English and Indonesian were included. GERD results from an imbalance between aggressive factors, including transient lower esophageal sphincter relaxation, hiatal hernia, increased intra-abdominal pressure, and impaired esophageal motility, and the esophageal mucosal defense system. Non-Erosive Reflux Disease (NERD) is the most common phenotype, accounting for approximately 60–70% of cases. Diagnosis is based on symptom assessment supported by validated tools such as the GERD-Q questionnaire, ambulatory pH monitoring, and endoscopy when indicated. Proton pump inhibitors remain the first-line pharmacological therapy, complemented by lifestyle modification, while surgery is reserved for refractory or complicated cases. A patient-centered, evidence-based approach integrating early diagnosis, appropriate treatment, and patient education is essential to improve outcomes and prevent disease progression.

Keywords: Barrett's esophagus; Gastroesophageal reflux disease; Heartburn; Lower esophageal sphincter; Proton pump inhibitor.

Introduction

Gastroesophageal Reflux Disease (GERD) is a chronic gastrointestinal disorder characterised by the retrograde flow of gastric contents into the esophagus, occurring as a consequence of impaired lower esophageal sphincter (LES) function (Shaqran et al., 2023). The condition carries a substantial and growing global burden. In Western countries, prevalence estimates range from 18.1 to 27.8 percent of the adult population, while in Indonesia, a marked upward trend has been documented, particularly among elderly groups in whom rates approach 27.4 percent (Makmun et al., 2022; Shaqran et al., 2023). Beyond its frequency, GERD imposes a considerable impact on physical, emotional, and social functioning, with recurrent symptoms causing sleep disturbance, impaired concentration, and reduced capacity for daily activities. When inadequately controlled, the disease may progress to serious complications, including Barrett's esophagus and esophageal adenocarcinoma, both of which are associated with substantially elevated morbidity and mortality.

The clinical presentation of GERD is heterogeneous. Typical symptoms such as heartburn, regurgitation, and non-cardiac chest pain are well recognised, yet a considerable proportion of patients present with atypical manifestations including chronic cough, asthma, dysphonia, and pharyngitis, which frequently delay accurate diagnosis (Azer & Goosenberg, 2025). The Non-Erosive Reflux Disease (NERD) phenotype, characterised by typical symptoms in

the absence of visible mucosal damage on endoscopy, accounts for 60 to 70 percent of cases globally and poses particular diagnostic challenges in routine clinical practice (Makmun et al., 2022). Risk factors encompass both modifiable determinants, including obesity, smoking, dietary habits, and psychological stress, and non-modifiable factors such as age, sex, genetic predisposition, and anatomical abnormalities like hiatal hernia (Makmun et al., 2022; Taraszewska, 2021). The complexity of GERD pathogenesis and the breadth of its clinical manifestations underscore the need for an integrated, evidence-based approach to diagnosis and management.

Despite the high prevalence and well-documented impact of GERD, comprehensive systematic reviews addressing the full spectrum of the disease from epidemiology through to patient education, remain limited in the Indonesian medical literature. Existing reviews often lack methodological rigour and do not reflect the most recent international clinical guidelines, including the American College of Gastroenterology (ACG) 2022 guideline and the Indonesian Gastroenterological Association (PGI) 2022 consensus. This systematic literature review addresses that gap by synthesising current evidence across eight thematic domains: epidemiology, etiology and risk factors, pathophysiology, clinical manifestations, diagnosis, management, prognosis and complications, and patient education. The aim is to provide clinicians with a comprehensive, actionable, and up-to-date reference for the management of GERD in primary and secondary care settings.

Materials and Methods

Study Design

This study employed a systematic literature review design following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 framework. The review was conducted to synthesise current peer-reviewed evidence pertaining to GERD epidemiology, pathophysiology, clinical manifestations, diagnostic modalities, management strategies, complications and prognosis, and patient education.

Literature Search Strategy

A comprehensive search of the published literature was conducted across four electronic databases: Google Scholar, Medline via PubMed, NCBI, and ScienceDirect. The search was performed between January and April 2025 and employed the following terms in various Boolean combinations: gastroesophageal reflux disease, GERD pathophysiology, GERD diagnosis, GERD management, proton pump inhibitor, lower esophageal sphincter, Barrett's esophagus, and GERD complications. The search was restricted to publications released between 2021 and 2026.

Inclusion and Exclusion Criteria

Articles were included if they met all of the following criteria: they were peer-reviewed original research studies, systematic reviews, meta-analyses, or clinical practice guidelines; they were published in English or Indonesian; they were published between 2021 and 2026; full-text versions were accessible with a verifiable digital object identifier (DOI); and they addressed at least one of the eight thematic domains of this review. Articles were excluded if they were conference abstracts, editorials, grey literature, or non-peer-reviewed publications, or if they did not meet the language or date criteria.

Study Selection and Data Extraction

Study selection followed a three-stage screening process: screening of titles and abstracts for relevance, assessment of full-text eligibility, and final inclusion based on thematic alignment and scientific quality. Data were extracted by two independent reviewers covering study design, population characteristics, key findings related to the review domains, and level of evidence. Disagreements were resolved through discussion and consensus.

Data Synthesis

A narrative synthesis approach was adopted, with findings organised thematically across the eight pre-specified domains. Evidence was triangulated across included studies and cross-referenced with the ACG 2022 clinical guideline (Katz et al., 2022) and the PGI 2022 consensus document (Makmun et al., 2022) to ensure that clinical recommendations reflect the highest available level of evidence.

Results and Discussion

Study Result 1: Definition and Epidemiology of GERD

The 22 studies included in this review

collectively confirm that GERD is a chronic gastrointestinal condition defined by pathological retrograde flow of gastric contents into the esophagus, resulting in symptomatic episodes or mucosal injury, or both. Based on endoscopic findings, the disease is classified into two phenotypes: Non-Erosive Reflux Disease (NERD), in which no visible mucosal lesions are identified, and Erosive Reflux Disease (ERD), characterised by macroscopic esophageal mucosal damage that may progress to Barrett's esophagus in chronic, inadequately treated cases (Wickramasinghe & Devanarayana, 2025; Shaqran et al., 2023).

The synthesised literature reveals significant geographic variation in GERD prevalence. In Western nations, prevalence reaches up to 27.8 percent, while a notable rising trend has been documented in Indonesia, particularly among elderly populations where rates approach 27.4 percent (Makmun et al., 2022). Across all studied populations, the NERD phenotype consistently predominates, representing 60 to 70 percent of all GERD cases. A clinically meaningful sex-based difference was also identified: women are more predisposed to NERD, whereas men carry a higher risk of ERD and Barrett's esophagus, a pattern that likely reflects hormonal influences on LES tone and sex-related differences in visceral pain sensitivity (Shaqran et al., 2023).

The predominance of NERD has important clinical implications. Because the majority of GERD patients present with normal endoscopic findings, symptom-based diagnostic tools such as the validated GERD-Q questionnaire assume central importance in primary care settings (Makmun et al., 2022). The wide geographic variation in prevalence further reflects the strong influence of lifestyle, dietary patterns, and ethnic composition on GERD pathogenesis, consistent with the analyses of Taraszewska (2021) and Kazakova et al. (2023) on the relationship between global obesity trends and escalating GERD rates. These epidemiological findings support the development of population-specific preventive strategies alongside universal clinical management guidelines.

Study Result 2: Etiology and Risk Factors of GERD

Synthesis of the included literature identified ten GERD risk factors that were consistently reported across multiple independent studies. These are categorised into modifiable and non-modifiable groups. Among modifiable determinants, obesity and transient lower esophageal sphincter relaxation (TLESR) emerged as the two most dominant and most strongly evidence-supported factors. Modifiable risk factors present the primary targets for preventive and therapeutic intervention, while non-modifiable factors determine baseline individual vulnerability and influence disease severity.

Table 1. Modifiable GERD Risk Factors: Mechanisms and Evidence

Risk Factor	Primary Mechanism	Source
Obesity	Elevates intra-abdominal pressure, increases TLESR frequency, impairs esophageal motility, and reduces LES basal tone	Makmun et al. (2022); Shaqran et al. (2023)
Smoking	Reduces LES basal tone, decreases salivary bicarbonate secretion, and damages the mucosal epithelial barrier	Makmun et al. (2022)
High-fat diet, coffee, and carbonated beverages	Reduces LES pressure, increases gastric volume and acidity, and delays gastric emptying	Taraszewska (2021)
Psychological stress, depression, and anxiety	Heightens visceral hypersensitivity, elevates cortisol secretion, and increases gastric acid production	Astuti et al. (2025)

Among all identified risk factors, obesity occupies a central pathogenic role through a multifactorial mechanism that simultaneously elevates intra-abdominal pressure, increases TLESR frequency, impairs esophageal motility, and reduces LES basal tone (Makmun et al., 2022; Shaqran et al., 2023). This finding is consistent with global epidemiological data demonstrating a positive correlation between rising obesity rates and increasing GERD prevalence across diverse geographic settings (Kazakova et al., 2023; Taraszewska, 2021), and positions weight management as the single most impactful preventive strategy at the population level.

Table 2. Non-Modifiable GERD Risk Factors: Mechanisms and Evidence

Risk Factor	Primary Mechanism	Source
Age above 50 years	Progressive decline in esophageal motility and LES basal tone associated with ageing	Taraszewska (2021)
Pregnancy	Progesterone-mediated reduction in LES tone combined with mechanical compression from the enlarging uterus	Makmun et al. (2022)
Genetic predisposition	Influences individual susceptibility to disease complications and variability in treatment response	Makmun et al. (2022)
Hiatal hernia	Disrupts the anatomy of the esophagogastric junction and creates a reservoir that facilitates retrograde flow of gastric contents	Makmun et al. (2022)

The contribution of psychological factors was robustly demonstrated by Astuti et al. (2025), who reported a significant association between stress levels and GERD symptom frequency through cortisol-mediated mechanisms and visceral hypersensitivity. When considered alongside the findings of Taraszewska (2021), the evidence supports the view that psychological stress and unhealthy dietary behaviours act synergistically in exacerbating GERD symptoms. This has practical therapeutic implications: comprehensive GERD management should incorporate psychological screening and structured stress-reduction programmes alongside pharmacological treatment, rather than focusing exclusively on acid suppression.

Study Result 3: Pathopysiology of GERD

Review of pathophysiological evidence from the included literature identified five interrelated primary mechanisms underlying GERD. TLESR was consistently identified as the dominant mechanism, responsible for more than 70 percent of reflux episodes across multiple studies. Esophageal dysmotility was documented in nearly 50 percent of GERD patients, with 20 to 30 percent demonstrating ineffective esophageal motility on manometric evaluation. Each of the five key mechanisms is described below.

Transient Lower Esophageal Sphincter Relaxation and Reduced LES Basal Tone

Transient lower esophageal sphincter relaxation is the dominant pathophysiological mechanism in GERD, accounting for over 70% of reflux episodes. These relaxations occur independently of swallowing, triggered by proximal gastric distension from food, gas, or fluid. During a TLESR event, the sphincter remains open for a prolonged period, permitting acid, pepsin, and bile salts to enter the esophagus. Chronic reduction in LES basal tone further lowers the pressure barrier, such that even modest increases in intragastric pressure are sufficient to drive reflux, particularly in the supine position. When peristaltic clearance and salivary buffering are insufficient, prolonged mucosal acid contact leads to esophagitis, stricture formation, and, in severe cases, Barrett's esophagus (Zheng et al., 2021).

Hiatal Hernia

Hiatal hernia disrupts the anti-reflux barrier at the esophagogastric junction through anatomical displacement that misaligns the LES from the crural diaphragm. This configuration reduces LES closure pressure, eliminates the angle of His, and shortens the intra-abdominal esophageal segment, collectively diminishing physiological resistance to reflux. The hernial sac functions as an acid reservoir that is readily propelled into the esophagus during TLESR events, while associated esophageal dysmotility further impairs acid clearance (Zheng et al., 2021).

Elevated Intra-Abdominal Pressure

Conditions that increase intra-abdominal pressure, including obesity, pregnancy, chronic cough, ascites, and constipation, generate a pressure gradient that favours the retrograde movement of gastric contents. This gradient progressively overwhelms the functional capacity of the LES and may also contribute to mechanical widening of the esophageal hiatus, thereby promoting hiatal hernia formation. In obese patients in particular, increased TLESR frequency, esophageal dysmotility, and reduced LES tone operate concurrently, compounding reflux risk at multiple points in the pathophysiological cascade (Makmun et al., 2022; Shaqran et al., 2023).

Esophageal Dysmotility and Delayed Gastric Emptying

Normal esophageal motility is essential for

propulsion of the food bolus into the stomach and for clearance of refluxed acid from the esophageal lumen. In GERD, repeated acid exposure induces mucosal inflammation that impairs esophageal contractility and produces dysmotility, which may function both as a contributing cause of inadequate acid clearance and as a consequence of chronic mucosal injury. Nearly half of all GERD patients exhibit some degree of dysmotility, and 20 to 30% demonstrate ineffective esophageal motility on high-resolution manometric testing (Zheng et al., 2021). Coexisting delayed gastric emptying further increases intragastric pressure and volume, amplifying the risk of reflux events.

Impaired Esophageal Mucosal Defense

The esophageal mucosa maintains a three-tier defence system comprising pre-epithelial structures (saliva and mucin), epithelial elements (tight junctions, bicarbonate buffering, and membrane transport proteins), and post-epithelial mechanisms (capillary bicarbonate delivery). Disruption of tight junction integrity increases epithelial permeability, allowing acid, pepsin, and bile to reach the basal epithelial layer and activate pro-inflammatory mediators such as nuclear factor kappa-B (NF-κB). This sustained inflammatory response underlies the chronic mucosal damage characteristic of ERD and also contributes to the visceral hypersensitivity observed in NERD patients who lack macroscopic mucosal injury (Zheng et al., 2021).

The mechanistic insights described above carry direct therapeutic implications. The pivotal role of the GABA-B pathway in mediating TLESR supports the use of baclofen as an adjunctive therapy in patients with PPI-refractory GERD associated with non-acid reflux, a strategy endorsed by the ACG 2022 guideline (Katz et al., 2022). The high prevalence of esophageal dysmotility reinforces the understanding that GERD is not solely a sphincter disorder but a complex functional disease of the esophagus, for which high-resolution manometric evaluation is warranted in refractory cases where motility abnormalities are clinically suspected (Davis & Gyawali, 2024).

Study Result 4: Clinical Manifestations of GERD

Synthesis of clinical manifestation data from the included literature confirms that GERD presents across a broad and heterogeneous symptomatic spectrum. Heartburn and regurgitation represent the hallmark typical symptoms and carry the highest diagnostic value when present concurrently. A particularly important clinical finding is that approximately 30 percent of patients with reflux esophagitis present with dysphagia, and a subset of patients with Barrett's esophagus remains entirely asymptomatic—a dangerous scenario that substantially delays detection and increases the risk of malignant transformation. Atypical symptoms such as chronic cough and asthma are encountered consistently across GERD patient populations in the included literature, although the precise causal mechanisms underlying these associations warrant further investigation.

Table 3. Spectrum of GERD Clinical Manifestations

Manifestation	Clinical Notes	Source
Heartburn and regurgitation (typical)	The cardinal symptoms of GERD; they carry the highest diagnostic value when both are present simultaneously	Azer & Goosenberg (2025)
Non-cardiac chest pain (typical)	Clinically indistinguishable from angina; cardiac causes must be excluded before attribution to GERD	Kahrilas (2023)
Dysphagia (typical)	Reported in approximately 30% of patients with erosive esophagitis; may indicate stricture or Schatzki ring formation	Azer & Goosenberg (2025)
Globus sensation and water brash (typical)	Frequently overlooked ancillary symptoms that warrant specific inquiry during clinical assessment	Azer & Goosenberg (2025)
Chronic cough (atypical)	Mediated through the esophageal-bronchial reflex; often misattributed to pulmonary or ENT pathology	Azer & Goosenberg (2025)
Asthma (atypical)	The association with GERD is bidirectional; the precise causal mechanism has not yet been fully elucidated	Azer & Goosenberg (2025)
Dysphonia, laryngospasm, and sore throat (extraesophageal)	Secondary pathological changes in the laryngopharyngeal mucosa arising from chronic acid exposure	Azer & Goosenberg (2025)

Manifestation	Clinical Notes	Source
Asymptomatic Barrett's esophagus and severe esophagitis	Among the most clinically dangerous presentations owing to the high risk of delayed detection and malignant transformation	Kahrilas (2023)

The broad heterogeneity of GERD manifestations necessitates a high index of clinical suspicion. Clinicians must recognise that GERD can closely mimic cardiac, pulmonary, and ENT pathology, which frequently leads to diagnostic delays and inappropriate management pathways. The physical examination in GERD primarily serves to exclude alternative diagnoses rather than to confirm GERD itself (Davis & Gyawali, 2024). However, extra-esophageal signs identified on examination, such as posterior laryngitis, dental erosions, and hoarseness, can provide valuable diagnostic clues, particularly in patients presenting without classic heartburn. The finding that Barrett's esophagus may be entirely asymptomatic further underscores the critical importance of endoscopic surveillance programmes for high-risk groups, defined by male sex, age above 50 years, obesity, and long-standing reflux symptoms.

Study Result 5: Diagnosis of GERD

Analysis of diagnostic modality data from the included literature confirms that no single tool achieves both high sensitivity and high specificity for GERD; consequently, a stepwise, evidence-based diagnostic algorithm is the recommended approach in current guidelines. The GERD-Q questionnaire demonstrates a sensitivity of 65 percent and specificity of 71 percent, making it adequate for initial case identification in primary care but insufficient for definitive diagnosis in patients who do not respond to empirical PPI therapy (Chhabra & Ingole, 2022; Saputera & Budianto, 2017; Makmun et al., 2022).

Table 4. GERD Diagnostic Modalities: Indications and Limitations

Modality	Primary Indication	Limitation
GERD-Q Questionnaire	Initial screening in primary care and monitoring of treatment response	Cannot detect structural complications or non-acid reflux (Makmun et al., 2022)
Upper GI Endoscopy	Identifies complications; confirms erosive reflux disease; essential for Barrett's surveillance	Findings are normal in 60 to 70% of patients who have NERD (Davis & Gyawali, 2024)
Ambulatory 24-hour pH-metry	Confirms pathological acid exposure when endoscopy is normal	Cannot detect non-acid reflux episodes (Davis & Gyawali, 2024)
24-hour pH-impedance monitoring	Evaluation of persistent symptoms in patients already receiving PPI therapy	High cost and limited availability in low-resource settings (Davis & Gyawali, 2024)
High-resolution manometry (HRM)	Exclusion of achalasia and other motility disorders; pre-surgical evaluation	Does not directly diagnose GERD (Davis & Gyawali, 2024)
Histopathological biopsy	Exclusion of eosinophilic esophagitis and other mucosal conditions	Rarely required in routine clinical practice (Davis & Gyawali, 2024)

The diagnostic algorithm recommended by current guidelines begins with clinical assessment and GERD-Q scoring. A score of eight or above indicates a high probability of GERD, and empirical PPI therapy may be initiated in uncomplicated cases presenting with classic symptoms. Upper GI endoscopy is indicated in the presence of alarm features, including dysphagia, unintentional weight loss, anaemia, or age above 50 years at symptom onset, as well as in cases where symptoms persist despite adequate empirical therapy, or where Barrett's surveillance is required. When endoscopy does not confirm the diagnosis, ambulatory 24-hour pH-metry remains the gold standard for quantifying pathological acid exposure. Combined pH-impedance monitoring is preferred over pH-metry alone when non-acid reflux is suspected, particularly in patients who remain symptomatic while receiving PPI therapy. High-resolution manometry is reserved for pre-surgical evaluation and for the exclusion of primary motility disorders such as achalasia, which may mimic GERD clinically (Davis & Gyawali, 2024).

Study Result 6: Management of GERD

Synthesis of management data from

clinical guidelines and selected studies demonstrates that PPI therapy as the pharmacological first-line agent achieves symptom improvement in 70 to 80 percent of patients within eight weeks of treatment. Lifestyle modification, while forming the essential non-pharmacological foundation of GERD management, yields optimal benefit when combined with pharmacotherapy in patients with moderate to severe disease. The management approach should follow a stepwise progression guided by symptom severity, objective diagnostic findings, and therapeutic response.

Table 5. GERD Management Strategies: Mechanism and Indications

Modality	Mechanism of Action	Indications
Lifestyle modification	Targets underlying risk factors through weight reduction, dietary change, elevation of the head of bed, and meal timing adjustment	Recommended for all patients with GERD (Katz et al., 2022)
Antacids	Rapidly neutralise gastric acid through chemical buffering	Mild, intermittent symptoms requiring on-demand relief (Katz et al., 2022)
Histamine-2 receptor antagonists (H2RA)	Block histamine H2 receptors on gastric parietal cells, reducing acid secretion	Nocturnal breakthrough symptoms in patients receiving PPI therapy (Katz et al., 2022)
Proton pump inhibitors (PPI) (first-line)	Irreversibly inhibit the H+/K+-ATPase proton pump on gastric parietal cells	NERD, erosive reflux disease, and all GERD phenotypes (Katz et al., 2022)
Baclofen (GABA-B agonist)	Reduces TLESR frequency by acting on GABA-B receptors in the dorsal motor nucleus	PPI-refractory GERD with documented non-acid reflux on impedance monitoring (Katz et al., 2022)
Laparoscopic fundoplication	Surgically reconstructs the anti-reflux barrier by reinforcing the LES mechanism	PPI-refractory GERD with objective evidence of reflux, large hiatal hernia, or LA grade C/D esophagitis (PGI, 2022)

The efficacy of PPI therapy is highly dependent on correct administration timing. PPIs must be taken 20 to 60 minutes before the first meal of the day in order to maximally engage actively secreting proton pumps that are stimulated by food intake (Katz et al., 2022). Analysis of PPI use patterns in the included literature reveals that a substantial proportion of apparent treatment failures are attributable not to pharmacodynamic inadequacy but to incorrect timing of drug administration, poor patient adherence, or the presence of non-acid reflux that is not amenable to acid suppression (Davis & Gyawali, 2024). Comparison with H2 receptor antagonists demonstrates that while H2RA is inferior to PPI as monotherapy, the addition of nocturnal H2RA to ongoing twice-daily PPI therapy can provide supplementary benefit for patients who experience persistent breakthrough symptoms at night (Katz et al., 2022).

With regard to surgical intervention, the Indonesian Gastroenterological Association (PGI, 2022) recommends laparoscopic fundoplication for strictly defined clinical indications: PPI-refractory GERD with objective evidence of pathological reflux, large hiatal hernia, and severe esophagitis classified as Los Angeles grade C or D. Fundoplication should not be considered a routine alternative to medical therapy; its long-term outcomes are critically dependent on thorough patient selection based on comprehensive pre-operative reflux monitoring (Davis & Gyawali, 2024). While emerging endoscopic anti-reflux procedures are attracting growing interest in recent literature (Wickramasinghe & Devanarayana, 2025), laparoscopic fundoplication remains the most extensively validated surgical approach for GERD.

Study Result 7: Prognosis and Complications of GERD

The overall prognosis of GERD is favourable when the disease is adequately controlled through medical therapy and lifestyle modification. However, the risk of progression to clinically significant complications remains non-trivial in high-risk patient groups. Barrett's esophagus is identified in 5 to 15 percent of patients with chronic reflux esophagitis, and esophageal adenocarcinoma, the most severe complication in this continuum, demonstrates a

marked male predominance with a male-to-female incidence ratio of approximately 8:1 (Wickramasinghe & Devanarayana, 2025; Azer & Goosenberg, 2025).

Table 6. GERD Complications: Prevalence and Progression Risk Factors

Complication	Prevalence	Risk Factors of Progression
Erosive esophagitis (ERD)	More prevalent in male patients	Uncontrolled chronic GERD (Wickramasinghe & Devanarayana, 2025)
Esophageal stricture	A recognised complication of chronic erosive disease	Severe recurrent esophagitis with progressive submucosal fibrosis (Azer & Goosenberg, 2025)
Peptic stricture	Predominantly observed in elderly patients	Long-standing uncontrolled GERD (Azer & Goosenberg, 2025)
Barrett's esophagus	Identified in 5 to 15% of patients with chronic reflux esophagitis	Male sex, age above 50 years, and severe chronic reflux (Wickramasinghe & Devanarayana, 2025)
Esophageal adenocarcinoma	Develops in approximately 5% of patients with Barrett's esophagus	Long-segment Barrett's esophagus and high-grade dysplasia (Wickramasinghe & Devanarayana, 2025)
Extraesophageal complications	Laryngitis, asthma exacerbation, dental erosion, and pulmonary fibrosis	Chronic undetected or undertreated reflux disease (Azer & Goosenberg, 2025)

The oncological progression from chronic GERD to Barrett's esophagus and ultimately to esophageal adenocarcinoma represents the most clinically consequential complication trajectory of the disease. Wickramasinghe and Devanarayana (2025) explain that the columnar metaplasia characteristic of Barrett's esophagus reflects an epigenetic reprogramming of squamous epithelial cells in response to chronic acid exposure, mediated through specific molecular pathways including CDX2 transcription factor activation and Wnt signalling. This mechanistic understanding carries a vital therapeutic implication: long-term acid suppression with PPI serves not merely to control symptoms but also to exert a chemopreventive effect by slowing the progression of Barrett's metaplasia to dysplasia (Katz et al., 2022). Clinicians should therefore frame PPI therapy to patients not only in terms of symptom relief but also as a strategy for reducing the risk of oesophageal cancer—a framing that is likely to improve long-term adherence to treatment.

Study Result 8: Patient Education in GERDA

Patient education is a cornerstone of effective GERD management, yet it remains underemphasised in routine clinical encounters. The included literature consistently identifies lifestyle modification as the primary educational target, encompassing weight management, dietary adjustment, meal timing, sleep positioning, and stress management (Katz et al., 2022; Waluyo & Solikah, 2023). Weight reduction in overweight and obese patients directly addresses the primary pathophysiological driver of GERD and should be recommended as a first-line non-pharmacological intervention in this population. Dietary education should focus on the avoidance of individually identified trigger foods rather than the imposition of a uniform restrictive diet, as patient-specific triggers vary considerably and are best identified through systematic dietary diaries.

Foods commonly implicated in symptom provocation include fatty foods, citrus fruits, chocolate, carbonated beverages, coffee, and spicy foods (Taraszewska, 2021). In relation to meal timing, evidence indicates that patients who reclined within four hours of eating were more than seven times as likely to experience nocturnal GERD symptoms as those who waited longer; on this basis, a minimum interval of three hours between the last meal and bedtime is recommended. Elevating the head of the bed by 15 to 20 centimetres, using wooden blocks beneath the bedframe or a wedge pillow, reduces the frequency of nocturnal reflux episodes and accelerates esophageal acid clearance. Left-lateral decubitus positioning is preferable to right-lateral positioning because in the left-lateral position the esophagogastric junction lies above the gastric acid pool, thereby reducing the probability of acid entering the esophagus during sleep.

The management of psychological stress is equally important and should be explicitly addressed in patient education programmes. Cortisol released during periods of sustained psychological stress stimulates gastric acid

production and heightens visceral sensitivity, directly exacerbating GERD symptoms (Astuti et al., 2025). Waluyo and Solikah (2023) demonstrated through a community-based health education programme in Surakarta that structured GERD education delivered to adolescents and young adults significantly improved knowledge scores and self-reported adherence to lifestyle modification recommendations, suggesting that educational interventions can be effective even in younger, previously under-targeted populations. Evidence-based stress reduction techniques, including diaphragmatic breathing and progressive muscle relaxation, have been shown to reduce symptom intensity and improve parasympathetic tone in GERD patients and should be incorporated into structured patient education programmes. Taken together, these findings support the view that structured patient education, delivered through clinic-based programmes, community outreach, or digital health platforms, should be regarded as an integral and non-negotiable component of any comprehensive GERD management strategy.

Conclusion

This systematic literature review demonstrates that GERD is a chronic, multifactorial gastrointestinal disorder with a rising global prevalence driven by a complex interaction of modifiable lifestyle factors, principally obesity, smoking, and dietary habits, and non-modifiable determinants including sex, age, hiatal hernia, and genetic predisposition. Pathophysiologically, the disease arises from an imbalance between aggressive gastric factors and esophageal mucosal defence mechanisms, with TLESR serving as the dominant mechanism responsible for over 70 percent of reflux episodes. The disease presents across a wide symptomatic spectrum, from classic heartburn and regurgitation to atypical manifestations and asymptomatic Barrett's esophagus, necessitating a high index of clinical suspicion and the systematic application of validated diagnostic tools, including the GERD-Q questionnaire, upper GI endoscopy, ambulatory pH monitoring, and high-resolution manometry where indicated. Proton pump inhibitors achieve 70 to 80 percent symptom improvement within eight weeks and constitute the pharmacological cornerstone of management, while lifestyle modification, adjunctive H2RA therapy, and laparoscopic fundoplication are reserved for specific clinical scenarios as defined by the ACG 2022 and PGI 2022 guidelines. The risk of progression to severe complications, including Barrett's esophagus in 5 to 15 percent of erosive esophagitis patients and esophageal adenocarcinoma, underscores the critical importance of sustained PPI adherence, structured patient education encompassing dietary modification, weight management, sleep positioning, and stress reduction, and systematic endoscopic surveillance in high-risk groups. Effective GERD management therefore requires an integrated approach that combines early risk-factor identification, evidence-based diagnosis, comprehensive pharmacotherapy, and ongoing patient education to prevent disease progression, reduce the risk of malignant transformation, and optimise long-term quality of life.

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References

Astuti, I., Kalaha, E., & Dadung, P. (2025). The relationship between stress and eating habits with the incidence of gastroesophageal reflux disease (GERD) in the community of Kaleke Village Banggai District. *Jurnal Ilmiah Kesehatan Poltekkes (JIKP), 14*(1). https://jurnal.itkesmusidrap.ac.id/JIKP/article/view/858

Azer, S. A., & Goosenberg, E. (2025). Gastroesophageal reflux disease (GERD). In *StatPearls* [Internet]. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK441938/

Chhabra, P., & Ingole, N. (2022). Gastroesophageal reflux disease (GERD): Highlighting diagnosis, treatment, and lifestyle changes. *Cureus, 14*(8), e28563. https://doi.org/10.7759/cureus.28563

Davis, T. A., & Gyawali, C. P. (2024). Refractory gastroesophageal reflux disease: Diagnosis and management. *Journal of Neurogastroenterology and Motility, 30*(1), 17–28.

https://doi.org/10.5056/jnm23145

Kahrilas, P. J. (2023). Clinical manifestations and diagnosis of gastroesophageal reflux in adults. In *UpToDate*. Wolters Kluwer. Retrieved from https://www.uptodate.com

Katz, P. O., Dunbar, K. B., Schnoll-Sussman, F. H., Greer, K. B., Yadlapati, R., & Spechler, S. J. (2022). ACG clinical guideline for the diagnosis and management of gastroesophageal reflux disease. *The American Journal of Gastroenterology, 117*(1), 27–56. https://doi.org/10.14309/ajg.0000000000001538

Kazakova, T., Danoff, R., Esteva, I., & Shchurin, A. (2023). Gastro-esophageal reflux disease in primary care practice: A narrative review. *Annals of Esophagus, 6*(0). https://doi.org/10.21037/aoe-21-62

Makmun, D., *et al*. (2022). *Konsensus nasional penatalaksanaan penyakit refluks gastroesofageal (Gastroesophageal reflux disease/GERD) di Indonesia (Revisi 2022).* PIP Interna.

Saputera, M. D., & Budianto, W. (2017). Diagnosis dan tatalaksana gastroesophageal reflux disease (GERD) di pusat pelayanan kesehatan primer. *CDK-252, 44*(5).

Shaqran, T. M., Ismaeel, M. M., Alnuaman, A. A., Al Ahmad, F. A., Albalawi, G. A., Almubarak, J. N., AlHarbi, R. S., AlAqidi, R. S., AlAli, Y. A., Alfawaz, K. S., & Daghriri, A. A. (2023). Epidemiology, causes, and management of gastro-esophageal reflux disease: A systematic review. *Cureus, 15*(10), e47420. https://doi.org/10.7759/cureus.47420

Taraszewska, A. (2021). Risk factors for gastroesophageal reflux disease symptoms related to lifestyle and diet. *Roczniki Państwowego Zakładu Higieny, 72*(1), 21–28. https://doi.org/10.32394/rpzh.2021.0145

Waluyo, S. J., & Solikah, S. N. (2023). Edukasi kesehatan mengenai penyakit asam lambung (GERD) pada remaja di Kel. Sangkrah, Kota Surakarta. *Jurnal Kreativitas Pengabdian Kepada Masyarakat (PKM), 6*(1), 203–211. https://doi.org/10.33024/jkpm.v6i1.8100

Wickramasinghe, N., & Devanarayana, N. M. (2025). Unveiling the intricacies: Insight into gastroesophageal reflux disease. *World Journal of Gastroenterology, 31*(1), 98479. https://doi.org/10.3748/wjg.v31.i1.98479

Zheng, Z., Shang, Y., Wang, N., Liu, X., Xin, C., Yan, X., Zhai, Y., Yin, J., Zhang, J., & Zhang, Z. (2021). Current advancement on the dynamic mechanism of gastroesophageal reflux disease. *International Journal of Biological Sciences, 17*(15), 4154–4164. https://doi.org/10.7150/ijbs.65066