Medical nutrition therapy in gastroesophageal reflux disease (GERD)

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The Critical Role of Nutrition in GERD: A Clinical Imperative

- Nutrition plays a pivotal role in both the etiology and management of GERD, as poor dietary habits exacerbate lower esophageal sphincter (LES) dysfunction and esophageal inflammation, while targeted interventions can reduce acid exposure by up to 50% and improve quality of life.

The Critical Role of Nutrition in GERD: A Clinical Imperative

- **Superior Efficacy of Diet:** A systematic review and meta-analysis of intervention studies (2024) concluded that **dietary management leads to a significant reduction in GERD symptoms.**

- A specific randomized clinical trial (2024) demonstrated that an **8-week dietary weight loss intervention resulted in a 40% reduction in GERD symptom scores compared to the control group**.

Dietary Risk Factors & Aggravating Habits

➢ **High-Fat Meals (>20g per meal):** Cause transient LES relaxation and delay gastric emptying. A study using 24-hour pH monitoring found that high-fat meals **significantly increased total esophageal acid exposure time by 25% compared to low-fat meals**.

➢ **Refined Carbohydrates & Simple Sugars:** Diets high in sugary foods, sugary drinks, and refined grains (white bread, white rice) can exacerbate GERD.

- A cross-sectional study found that **high intake of simple sugars was independently associated with a 1.5-fold increased odds of troublesome GERD symptoms.**

- Proposed mechanisms include increased gas production from fermentation and potential effects on visceral sensitivity.

- Yuan et al., Therap Adv Gastroenterol 2019
- Quach et al., Front Nutr 2023
- Fox & Gyawali, Gastroenterol 2023

Dietary Risk Factors & Aggravating Habits

➢ **Large Volume Meals:** Increase intragastric pressure. Consuming >500 kcal in a single sitting is a common trigger.

➢ **Obesity (BMI >30):** A primary risk factor. A prospective study found that a **5-unit increase in BMI was associated with a 1.5-fold increased risk of weekly GERD symptoms.**

➢ **Direct Mucosal Irritants & Acid Stimulants:**

- **High-Acidity Foods:** Citrus fruits/juices, tomatoes/tomato sauce, vinegar.
- **Spicy Foods:** Chili peppers, black pepper, raw onions, garlic (via capsaicin and other irritants).

- Gu et al., Therap Adv Gastroenterol 2022
- Yuan et al., Therap Adv Gastroenterol 2019
- Quach et al., Front Nutr 2023
- Fox & Gyawali. Gastroenterol 2023

Dietary Risk Factors & Aggravating Habits

➢ **Foods that Induce LES Relaxation:**

- **Methylxanthine-containing:** Chocolate, coffee, black tea, cola/soft drinks.
- **Direct Smooth Muscle Relaxants:** Peppermint, spearmint.
- **Fat-Stimulated:** High-fat meals (especially saturated fats) trigger cholecystokinin (CCK) release.
- **Nicotine:** A primary component of tobacco smoke; significantly reduces LES pressure.

Dietary Risk Factors & Aggravating Habits

➢ **Gas & Pressure-Inducing Foods:**

- **Carbonated Beverages:** All sodas and sparkling waters increase intragastric pressure.
- **Gas-Producing (High-FODMAP) Foods:** Onions, garlic, beans, lentils, cabbage, cauliflower. These can cause bloating and increase intra-abdominal pressure.

➢ **Other Recognized Triggers:**

- **Alcohol:** Reduces LES pressure and directly irritates the esophagus.
- **Full-Fat Dairy:** High saturated fat content can provoke symptoms.

The Shift to Personalized & Empirical Elimination Diets

➢ **Modern Approach:** Shift from generic advice to **systematic elimination & rechallenge** guided by patient symptom tracking.

➢ **Core Methodology:** This involves a structured process of:

- **Eliminating** common dietary triggers (e.g., coffee, chocolate, spicy foods, high-fat meals) based on patient history.
- **Systematically reintroducing** foods one at a time.
- **Using a detailed food and symptom diary** to objectively identify individual-specific triggers.

Fox M, Gyawali CP. Dietary factors involved in GERD management. *Gastroenterol*. 2023. doi:10.1016/j.gastro.2023.04.002

The Shift to Personalized & Empirical Elimination Diets

- **Clinical Rationale:** This personalized approach is crucial because dietary triggers are highly individual.

- A 2023 study on dietary factors concluded that **trigger foods vary significantly between patients, and a personalized identification strategy is more effective than blanket restrictions**.

➢ **Clinical Impact:** Creates a **sustainable, individualized diet** that minimizes unnecessary food avoidance while controlling symptoms.

- Fox M, Gyawali CP. Dietary factors involved in GERD management. *Gastroenterol*. 2023. doi:10.1016/j.gastro.2023.04.002

Macronutrient Management: Energy & Meal Patterns

➢ **Caloric Recommendation:**

- **For Weight Loss (BMI ≥25):** Create a 500-750 kcal/day deficit to achieve 0.5-1 kg/week weight loss. A 2024 randomized trial showed **a 5-10% weight loss led to a 35-40% improvement in GERD symptom scores**.

- **For Normal/Underweight:** Ensure energy intake meets requirements (e.g., 25-30 kcal/kg/day) to prevent malnutrition, focusing on nutrient-dense, small, frequent meals.

- Valentini Jr et al., Clin Obes 2024;
- Fox & Gyawali, Gastroenterol 2023

Macronutrient Management: Energy & Meal Patterns

➢ **Meal Volume & Frequency:**

- **Mechanism:** Large meals cause gastric distension, promoting transient LES relaxations (TLESRs).
- **Recommendation:** Consume **4-6 small meals per day**, each <500 kcal. Avoid meals within **2-3 hours of bedtime**.

➢ **Fluid Intake:**

- **Mechanism:** Large fluid volumes with meals exacerbate gastric distension.
- **Recommendation: Separate fluid intake from meals** by 30 minutes. Prioritize water; avoid carbonated and acidic beverages and caffeine.

- Valentini Jr et al., Clin Obes 2024;
- Fox & Gyawali, Gastroenterol 2023

Macronutrient Management: Protein

➢ **Recommended Intake: 1.2 - 1.5 g/kg/day** to support mucosal repair and LES function.

➢ **Mechanism of Action:** Dietary protein stimulates gastrin secretion, which increases LES resting pressure.

➢ **Food Sources (Recommended):** Lean poultry (skinless chicken, turkey), fish (salmon, cod), eggs, tofu, lentils.

➢ **Food Sources (Limit):** High-fat meats (prime rib, bacon, sausages), heavily fried proteins.

- Bradley & Gilbert, Gavin Publishers 2023;
- Fox & Gyawali, Gastroenterol 2023

- A 2023 dietary regime study ("Akram's Regime") incorporating adequate protein reported **>70% of participants achieved significant symptomatic relief within 2-3 weeks**.

Dietary Pattern 6: "Akram's Lifestyle" Regime

➢ **Akram's Lifestyle** is a structured 4-week protocol featuring strict meal timing (4-hour intervals, 4-hour pre-bed fasting), food sequencing (protein-first), and complete separation of fluids from meals.

➢ **Mechanism:** Creates optimal conditions for gastric emptying, minimizes intra-gastric pressure, and prevents fluid from diluting digestive enzymes. The protein-first approach may stimulate gastrin release for better LES tone.

➢ **Duration:** Minimum 4 weeks of strict adherence required for significant results.

- **Clinical Evidence:** A 2023 clinical study (n=105) implementing this protocol reported **complete resolution of major GERD symptoms in 91.4% of participants and 92.5% reduction in GERD-HRQL scores after 4 weeks**.

Macronutrient Management: Carbohydrates

➢ **Recommended Intake: 45-50% of total energy intake**, focusing on complex, high-fiber sources (>25-30g fiber/day). Limit simple sugars to <10% of total energy (<50g/day).

➢ **Mechanism of Action:** Fiber accelerates gastric emptying, reduces intra-gastric pressure, and is fermented to SCFAs which have systemic anti-inflammatory effects, and improves microbiome.

- Nobel et al., Clin Transl Gastroenterol 2018;
- Moradi et al., BMC Gastroenterol 2022.

Macronutrient Management: Carbohydrates

➢ A 2022 prospective study found that **the highest quartile of dietary fiber intake was associated with a 20% reduction in the risk of frequent GERD symptoms.**

➢ **Food Sources (Recommended):** Oats, barley, whole-grain bread, brown rice, legumes (lentils, chickpeas), non-citrus fruits, and vegetables.

- Highly Recommended fruits (Low Acidity) Bananas, Melons (cantaloupe, honeydew), Avocado, Papaya, Mango (ripe)
- Moderately Recommended fruits (Consume with Care) Apples (sweet varieties), Pears, Blueberries, Strawberries, Peaches, Nectarines, Cherries

➢ **Food Sources (Limit):** Refined sugars, white bread, pastries, sugary cereals, and candies.

- Nobel et al., Clin Transl Gastroenterol 2018;
- Moradi et al., BMC Gastroenterol 2022.

Macronutrient Management: Fats

➢ **Recommended Intake: 25-30% of total energy intake**. Limit saturated fats to <7% of total energy. Increase MUFA and PUFA.

• **Fat Quality Matters:** While total fat should be 25-30% of energy, the type is crucial. **Saturated/trans fats** (fried foods, fatty meats) potently trigger reflux by relaxing the LES, whereas **unsaturated fats** (olive oil, nuts, fish) are neutral or protective due to anti-inflammatory effects.

➢ **Mechanism of Action:** High-fat meals, particularly saturated fats, stimulate cholecystokinin (CCK), which promotes TLESRs and delays gastric emptying.

TLESRs : Transient Lower Esophageal Sphincter Relaxations

- Gu et al., Therap Adv Gastroenterol 2022; [9]
- Fox & Gyawali, Gastroenterol 2023

Macronutrient Management: Fats

➢ **Clinical Evidence:** A 2022 intervention study using pH monitoring found that **meals high in saturated fat significantly increased esophageal acid exposure time by 35% compared to isocaloric meals high in unsaturated fats**.

➢ **Food Sources (Recommended):** Avocado, olive oil, nuts (almonds, walnuts), seeds (flax, chia), fatty fish (salmon, mackerel).

➢ **Food Sources (Limit):** Fried foods, fatty red meats, butter, cream, full-fat cheese, processed snacks.

- Gu et al., Therap Adv Gastroenterol 2022; [9]
- Fox & Gyawali, Gastroenterol 2023

Micronutrient Focus: Magnesium

➢ **Risk of Deficiency:** Increased with long-term PPI use (>1 year). Prevalence of **hypomagnesemia** can be up to 40% in chronic users.

➢ **Mechanism:** PPI-induced hypochlorhydria impairs magnesium absorption.

➢ **Indication for Supplementation:** Serum magnesium <1.8 mg/dL or presence of symptoms (e.g., muscle cramps) in a chronic PPI user.

- de Man et al., JPEN 2024;
- Ahuja, Gastroenterol Clin North Am 2023.

Micronutrient Focus: Magnesium

➢ **Recommendation:**

- **Dose & Form: 300-400 mg/day** of Magnesium Glycinate or Citrate.
- **Duration:** Long-term for patients on chronic PPI therapy.

➢ **Clinical Evidence:** A 2024 review on micronutrients in critically ill (a high-risk model) highlighted that **PPI use is a major independent risk factor for clinically significant hypomagnesemia**.

- de Man et al., JPEN 2024;
- Ahuja, Gastroenterol Clin North Am 2023.

Micronutrient Focus: Vitamin B12

➢ **Risk of Deficiency:** High in long-term PPI users (>2-3 years).

➢ A 2023 review indicated a **pooled prevalence of B12 deficiency of 12% in chronic PPI users vs. 4% in non-users**.

➢ **Mechanism:** Impaired acid-dependent cleavage of food-bound B12.

➢ **Indication for Supplementation:** Serum B12 <300 pg/mL, especially with associated symptoms or concomitant atrophic gastritis.

- Ahuja, Gastroenterol Clin North Am 2023;
- de Man et al., JPEN 2024.

Micronutrient Focus: Vitamin B12

➢ **Recommendation:**

- **Supplementayion** of sublingual Methylcobalamin or Cyanocobalamin.
- **Duration:** Long-term maintenance.

➢ **Clinical Evidence:** A meta-analysis found that **long-term PPI use (>2 years) was associated with a significant increase in risk of vitamin B12 deficiency.**

- Ahuja, Gastroenterol Clin North Am 2023;
- de Man et al., JPEN 2024.

Micronutrient Focus: Calcium

➢ **Risk of Deficiency :** PPIs may reduce absorption of calcium carbonate.

➢ **Recommendation:** 1000-1200 mg/day. Use **calcium citrate**, which is acid-independent, for better absorption in PPI users.

➢ **Evidence:** Cohort studies suggest a **modestly increased fracture risk with long-term, high-dose PPI use**, highlighting the importance of adequate calcium.

- de Man et al., JPEN 2024; [14] Ahuja, Gastroenterol Clin North Am 2023

Micronutrient Focus: Iron

➢ **Risk of Deficiency:** Increased with long-term PPI use and chronic inflammation. PPI use can **decrease non-heme iron absorption by up to 65%**.

➢ **Mechanism:** Acid suppression converts ferric iron (Fe^{3+}) to the less absorbable ferrous form (Fe^{2+}).

➢ **Indication for Supplementation:** Ferritin <30 ng/mL, with or without anemia.

- de Man et al., JPEN 2024.
- Ahuja, Gastroenterol Clin North Am 2023.

Micronutrient Focus: Iron

➢ **Recommendation:**

- **Dose & Form: 65 mg of elemental iron** once or twice daily as Ferrous Bisglycinate (for better tolerability). Administer **2-4 hours apart from PPIs** and with Vitamin C.
- **Duration:** 3-6 months to replete stores, then recheck.

➢ **Clinical Evidence:** Observational studies show that **chronic PPI users have a 1.5 to 2-fold higher risk of iron deficiency anemia compared to non-users.**

- de Man et al., JPEN 2024.
- Ahuja, Gastroenterol Clin North Am 2023.

Micronutrient Focus: Zinc-Carnosine

➢ **Description:** A complex composed of zinc and L-carnosine that exhibits synergistic effects in protecting the gastrointestinal mucosa.

➢ **Mechanism:** Binds directly to mucosal sites, forming a protective barrier on the stomach and esophageal lining. Possesses strong antioxidant properties and promotes cellular repair.

➢ **Indication:** As an adjunct therapy for reducing esophageal inflammation (esophagitis) and accelerating mucosal healing alongside standard

- Kato et al., J Clin Biochem Nutr 2023.

Micronutrient Focus: Zinc-Carnosine

➢ **Recommendation:**

- **Dose & Form: 75-150 mg per day** of zinc-carnosine complex, preferably on an empty stomach.
- **Duration:** 8 to 12 weeks.

➢ **Clinical Evidence:** A clinical trial (2023) on patients with mild to moderate esophagitis demonstrated that **supplementation with 150 mg of zinc-carnosine for 8 weeks led to a 50% greater improvement in endoscopic mucosal grades compared to the placebo group**.

- Kato et al., J Clin Biochem Nutr 2023.

Mucosal Healing Support: L-Glutamine

➢ **Description:** A conditionally essential amino acid critical for cellular proliferation and repair of the gastrointestinal epithelium.

➢ **Mechanism:**

- Primary metabolic fuel for enterocytes and esophageal epithelial cells.
- Strengthens epithelial barrier integrity by **supporting tight junction proteins** and **increasing mucin production**.
- Modulates the inflammatory response, reducing cytokine-mediated damage.

- Benjamin et al., Nutrients 2022.

Mucosal Healing Support: L-Glutamine

➢ **Indication:** Support for healing in refractory esophagitis and repair of damaged esophageal tissue.

➢ **Recommendation:**

- **Dose & Form: 5-15 grams of L-Glutamine powder daily**, mixed with water or a cool beverage.
- **Duration:** 4-8 weeks.

➢ **Clinical Evidence:** A 2022 study by Benjamin et al. found that **supplementation with 10 grams of L-Glutamine daily for 4 weeks resulted in significant improvement in histopathological scores of esophageal mucosal repair compared to baseline.**

Mucosal Healing Support:

- **Zinc-Carnosine (75-150 mg/day), Deglycyrrhizinated Licorice - DGL (400 mg chewed before meals), and Alginate formulations (10-20 mL after meals) have demonstrated significant efficacy in promoting esophageal mucosal healing and reducing inflammation in clinical studies.**

- Kato et al., J Clin Biochem Nutr 2023
- Benjamin et al., Nutrients 2022
- Ravenshaw et al., J Aromatic Integr Med 2020
- Guerra et al., World J Gastroenterol 2021

Body Composition & GERD: Key Connections

➢ **Visceral Fat (VF): Primary Risk Driver**

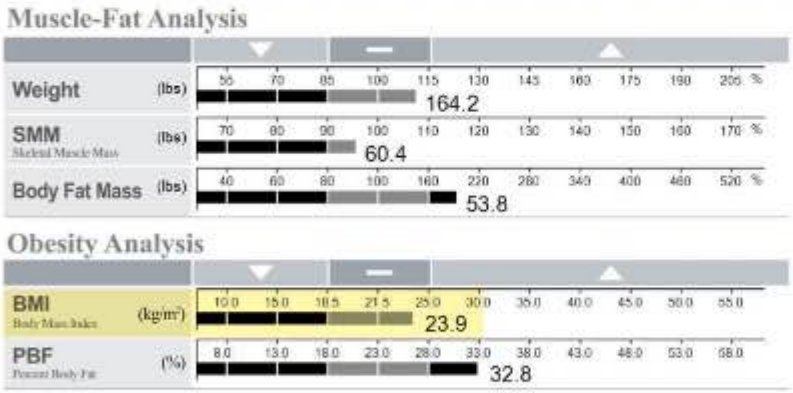
- **Mechanism:** Increases intra-abdominal pressure and secretes pro-inflammatory cytokines (IL-6, TNF-α), directly impairing the esophageal barrier.
- **Evidence:** A 2024 study found that a high **Visceral-to-Subcutaneous fat ratio** is associated with a **2.1-fold increased GERD risk ,**even in **non-obese individuals**.

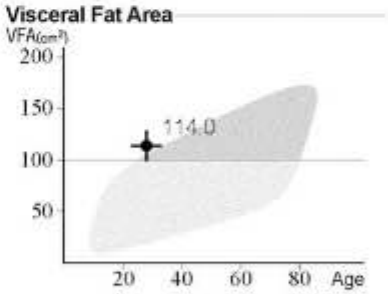
➢ **Subcutaneous Fat (SCF): Potential Protective Role**

- Higher SCF mass may indicate better metabolic health and buffer against VF-driven inflammation.

- Paula S, et al. In Obesity, Esophagogastric Junction Fat Impairs Esophageal Barrier Function. *Gastroenterology*. 2024.
- Koo JE, et al. High Visceral-To-Subcutaneous Fat Ratio Is Associated with an Increased Risk of GERD. *Dig Dis*. 2024.
- Liu X, et al. Sex-specific association of visceral and abdominal subcutaneous adipose tissue with GERD. *Sci Rep*. 2024.
- Caterati A, et al. The use of phase angle in patients with diverticular and liver diseases. *Rev Endocr Metab Disord*. 2024.

Visceral Fat in InBody result





Body Composition & GERD: Key Connections

➢ Phase Angle (PhA): A Marker of Cellular Health & Nutritional Status

- **Definition:** PhA, measured by Bioelectrical Impedance Analysis (BIA), reflects **cell membrane integrity and body cell mass**. A low PhA indicates cellular dysfunction and malnutrition.

- **Link to GERD:** Patients with GERD, particularly those with sarcopenia or poor nutritional status, often exhibit a reduced PhA.
- This signifies poor cellular health, which can impair muscle function (including the diaphragm) and tissue repair in the esophagus.

- Paris S, et al. In Obesity, Esophagogastric Junction Fat Impairs Esophageal Barrier Function. *Gastroenterology*. 2024.
- Koo JE, et al. High Visceral-To-Subcutaneous Fat Ratio Is Associated with an Increased Risk of GERD. *Dig Dis*. 2024.
- Liu X, et al. Sex-specific association of visceral and abdominal subcutaneous adipose tissue with GERD. *Sci Rep*. 2024.
- Castaño A, et al. The use of phase angle in patients with digestive and liver diseases. *Rev Endocr Metab Disord*. 2024.

Body Composition & GERD: Key Connections

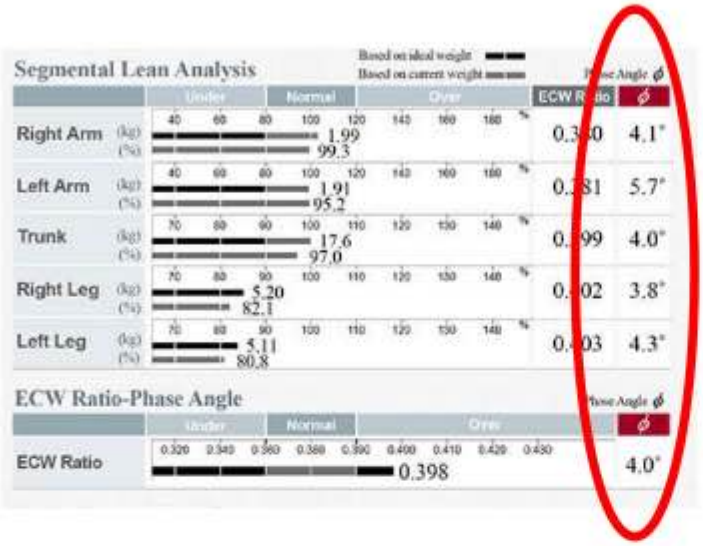
- A 2024 review found that **GERD patients with poor nutritional status showed significantly lower PhA values (≈ 4.5°) compared to healthy controls (≈ 6.0°), indicating compromised cell integrity and muscle quality**.

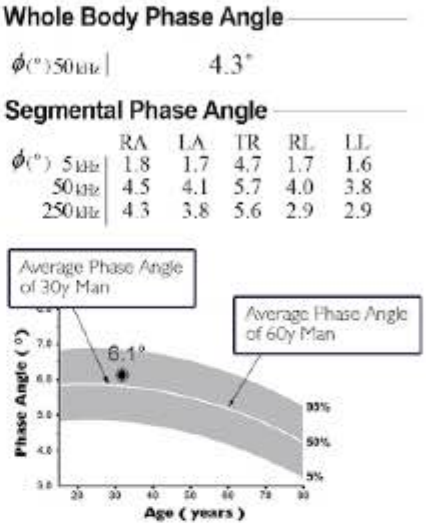
- PhA is a useful tool for assessing overall nutritional status and guiding therapy in complex GERD cases.

➢ **Clinical Implication:** Assessment of body composition (VF/SCF ratio) and cellular health (PhA) provides a deeper understanding of GERD pathophysiology beyond BMI, enabling more precise, personalized nutritional and lifestyle interventions.

- Paris S, et al. In Obesity, Esophagogastric Junction Fat Impairs Esophageal Barrier Function. *Gastroenterology*. 2024.
- Koo JE, et al. High Visceral-To-Subcutaneous Fat Ratio Is Associated with an Increased Risk of GERD. *Dig Dis*. 2024.
- Liu X, et al. Sex-specific association of visceral and abdominal subcutaneous adipose tissue with GERD. *Sci Rep*. 2024.
- Castaño A, et al. The use of phase angle in patients with digestive and liver diseases. *Rev Endocr Metab Disord*. 2024.

Phase Angle in InBody result





The Diaphragm's Crucial Role in GERD Pathogenesis

➢ **Mechanism 1: Anatomic Barrier.** The crural fibers of the diaphragm wrap around the esophagus, forming a **physical sphincter that reinforces the Lower Esophageal Sphincter (LES)**.

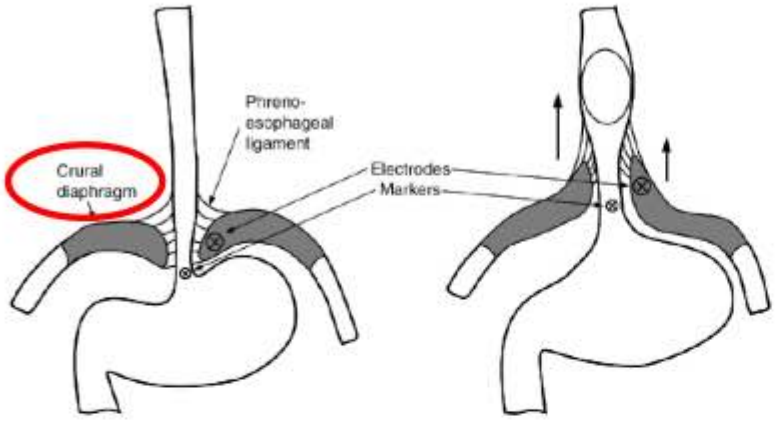
➢ Weakening of these muscles compromises this external squeeze, making it easier for gastric contents to reflux.

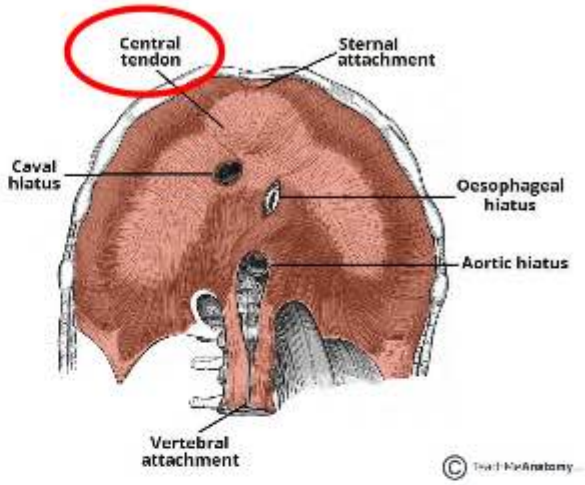
➢ **Mechanism 2: Pressure Gradient.** The diaphragm creates a **high-pressure zone in the abdomen compared to the chest**.

➢ A weak diaphragm fails to maintain this pressure gradient effectively, reducing the overall anti-reflux barrier pressure.

- Letter to the Editor—Post Sleeve Gastrectomy GERD: Role of Loss of Crural Muscle Volume. *Surg Obes Relat Dis*. 2023.
- Rosen RD, Winters R. Physiology, Lower Esophageal Sphincter. In: StatPearls [Internet]. 2024.

Crual diaphragm muscle





Muscle Health's Impact on GERD (Sarcopenia → GERD)

- **Weakened Skeletal Muscle:** Low muscular strength, especially in the core and lower body, is associated with a **1.5 to 2-fold increased risk of developing GERD**.
- Weak muscles impair posture and abdominal support, reducing the anti-reflux barrier.
- **Critically, Weakened Diaphragm:** Sarcopenia affects the crural diaphragm muscles. A 2023 analysis demonstrated that **loss of crural muscle volume directly contributes to LES incompetence and GERD development post-surgery.**

Muscle Health's Impact on GERD (Sarcopenia → GERD)

- ➢ **Frailty Link:** Pre-frailty, a state of declining physiological reserve, is significantly associated with a higher incidence of GERD, highlighting the role of overall musculoskeletal decline.

- ➢ **Clinical Implication:** Assessment and management of GERD must now include evaluation of muscle strength (e.g., grip strength) and nutritional status to break this vicious cycle. Resistance training and adequate protein intake (1.2-1.5 g/kg/day) are essential components of comprehensive GERD care.

GERD's Impact on Muscle Health (GERD → Sarcopenia)

- ➢ **Chronic Systemic Inflammation:** GERD-driven inflammation elevates pro-inflammatory cytokines (e.g., IL-6, TNF-α), which promote muscle protein breakdown and inhibit synthesis.

- ➢ **Physical Deconditioning:** A 2024 study by Hong et al. demonstrated that **patients with GERD showed a 25% faster development of muscle fatigue during physical tasks compared to healthy controls, directly linking GERD to impaired muscle function**.

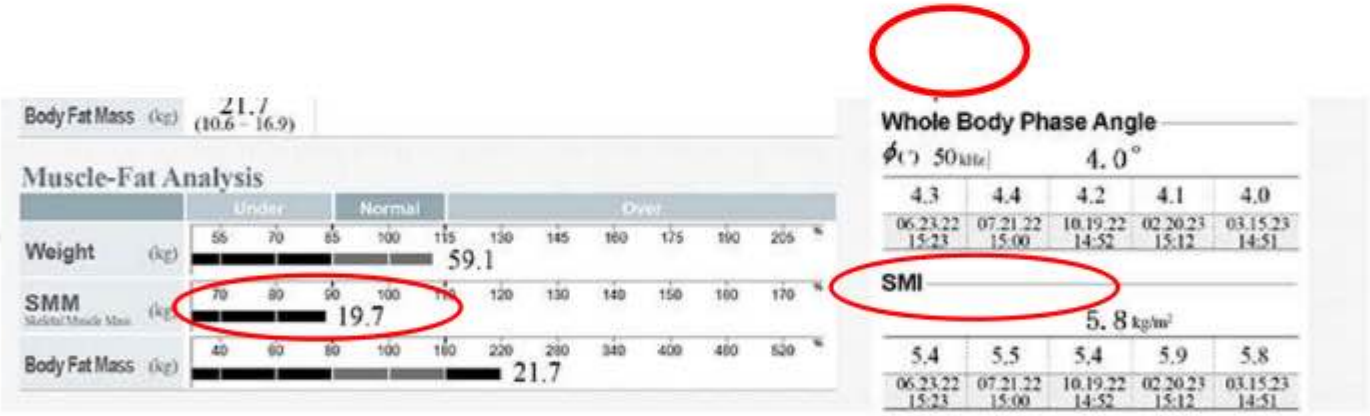
GERD's Impact on Muscle Health (GERD → Sarcopenia)

➢ **Nutrient Malabsorption & Avoidance:** Chronic reflux can lead to fear of eating and potential malabsorption of protein and micronutrients crucial for muscle maintenance.

➢ **Direct Muscle Loss:** A 2024 prospective cohort study by Dan et al. revealed that **patients with GERD had a 32% higher risk of developing sarcopenia over a 3-year follow-up period compared to those without GERD.**

- Dan L, et al. Risk of subsequent gastrointestinal disease assessed by skeletal muscle strength and mass. Science. 2024;27(5):109-55.
- Hong W. Evaluation of the impact of nonerosive reflux disease on muscle fatigue. J Gastroenterol Hepatol. 2024;39(3):450-462.
- Gold SL, Rasouli M, Sands BE. Aliment Pharmacol Ther. 2023;57(9):999-412. doi:10.1111/apt.17498.
- Letter to the Editor—Post Sleeve Gastrectomy GERD. Surg Obes Relat Dis. 2025;19(11):1259-1259.

SMM and SMI in InBody result



Adiponectin, Insulin Resistance & GERD Pathogenesis

➢ **Adiponectin: Protective Hormone**

- **Role:** An anti-inflammatory and insulin-sensitizing adipokine secreted by adipose tissue.
- **Association: Low serum adiponectin levels** are independently associated with an increased risk of GERD and erosive esophagitis. A case-control study found that **patients with GERD had 25% lower adiponectin levels compared to healthy controls**.
- **Mechanism:** Low adiponectin fails to counterbalance the pro-inflammatory state driven by visceral fat, exacerbating esophageal mucosal injury.

- Almers LM, et al. Adiponectin May Modify the Risk of Barrett's Esophagus in Patients With GERD. *Clin Gastroenterol Hepatol*. 2015.
- Budiyani L, et al. Insulin Resistance in Gastroesophageal Reflux Disease. *Acta Med Indones*. 2021.

Adiponectin, Insulin Resistance & GERD Pathogenesis

➢ **Insulin Resistance (IR): Key Metabolic Driver**

- **Role:** A state of reduced cellular response to insulin, highly correlated with visceral obesity.
- **Association: IR is a significant independent risk factor for GERD**. A cross-sectional study reported that **individuals in the highest quartile of HOMA-IR had a 2.3-fold increased odds of having GERD.**
- **Mechanism:** IR promotes LES relaxation via neural dysfunction and contributes to systemic inflammation, creating a favorable environment for reflux and tissue damage.

- Almers LM, et al. Adiponectin May Modify the Risk of Barrett's Esophagus in Patients With GERD. *Clin Gastroenterol Hepatol*. 2015.
- Budiyani L, et al. Insulin Resistance in Gastroesophageal Reflux Disease. *Acta Med Indones*. 2021.

➢ **Clinical Implication:** Assessment of adiponectin and HOMA-IR can identify the

Dietary Pattern 1: Mediterranean Diet

➢ **Definition:** A pattern rich in fruits, vegetables, whole grains, legumes, nuts, olive oil, and fish, with moderate poultry and low red meat.

➢ **Mechanism:** High fiber content improves motility; anti-inflammatory compounds (polyphenols, omega-3) reduce mucosal inflammation; healthy fats do not trigger TLESRs as strongly as saturated fats.

➢ **Duration:** Long-term adherence recommended.

- Beigrezaei et al., BMC Public Health 2023; [2] Katz et al., Am J Gastroenterol 2022.
- Spechler & Sharma, Gastroenterol Clin North Am 2015;

Dietary Pattern 1: Mediterranean Diet

➢ **Clinical Evidence:** A 2023 cross-sectional study in adolescents found that **high adherence to a Mediterranean-like diet was associated with a 30% lower odds of GERD .**

➢ A large cohort study linked this pattern to a reduced risk of **Barrett's Esophagus** (BE).

- Beigrezaei et al., BMC Public Health 2023; [2] Katz et al., Am J Gastroenterol 2022.
- Spechler & Sharma, Gastroenterol Clin North Am 2015;

Mediterranean Diet pyramid

Dietary Pattern 2: Low-FODMAP Diet

➢ **Definition:** A short-term diet limiting Fermentable Oligo-, Di-, Mono-saccharides, and Polyols (e.g., onions, garlic, wheat, beans, lactose).

➢ **Mechanism:** Reduces gas production and visceral distension, lowering intra-abdominal pressure.

➢ **Indication:** Primarily for patients with significant GERD-Irritable Bowel Syndrome (IBS) overlap.

- Kuźmin et al., Nutrients 2025.

Dietary Pattern 2: Low-FODMAP Diet

➢ **Duration:** Strict elimination for **4-8 weeks**, followed by structured reintroduction.

➢ **Clinical Evidence:** A 2025 systematic review of RCTs concluded that a **Low-FODMAP diet significantly reduces the severity of heartburn and regurgitation (Mean Difference in symptom scores: -1.05, 95% CI: -1.56 to -0.54) in patients with functional gut disorders**.

- Kuźmin et al., Nutrients 2025.

Dietary Pattern 3: Low-Carbohydrate / Ketogenic Diet

➢ **Definition:** A dietary pattern that severely restricts carbohydrate intake (typically to <50g per day) while increasing fat consumption.

➢ **Mechanism:** Significant carbohydrate reduction may work by decreasing intra-gastric pressure from bacterial fermentation and stabilizing blood sugar, which can influence LES tone.

➢ **Indication:** For patients with treatment-resistant GERD, particularly those with overlapping metabolic disorders. **Use with extreme caution and supervision.**

- Latorre-Rodriguez et al., JGH Open 2024.

Dietary Pattern 3: Low-Carbohydrate / Ketogenic Diet

➢ **Duration:** A supervised 4 to 8-week trial period.

➢ **Clinical Evidence:** An exploratory study (2024) on GERD patients following a ketogenic diet reported that **58% of participants experienced significant improvement in heartburn and regurgitation symptoms after 6 weeks**. However, this diet can exacerbate symptoms in some individuals.

➢ The evidence remains unclear. While some studies show symptom improvement, it is **indistinguishable whether benefits derive from the diet itself or from the associated weight loss**. Use with caution as high fat content may trigger reflux in some individuals.

- Latorre-Rodriguez et al., JGH Open 2024.

Dietary Pattern 4: Soft or "Baby Food" Inspired Diet

➢ **Definition:** A short-term diet consisting of soft, pureed, low-spice, and low-fiber foods that are easy to digest.

➢ Trigger foods like tomatoes, citrus, and caffeine are avoided.

➢ **Mechanism:** Reduces the mechanical and chemical workload on the stomach and esophagus, minimizing mucosal irritation and acid production.

➢ **Indication:** For short-term use during acute GERD symptom flare-ups or for patients with severe esophagitis/esophageal erosions.

- Li et al., Clinical Nutrition Open Science 2025.

Dietary Pattern 4: Soft or "Baby Food" Inspired Diet

➢ **Duration:** 2 to 4 weeks, followed by a gradual transition to a full, healthy diet.

➢ **Clinical Evidence:** A clinical trial (2025) evaluating a comprehensive baby food-inspired dietary approach for superficial gastritis found that **this diet led to a 65% reduction in heartburn scores after 2 weeks compared to a 30% reduction in the control group.**

- Li et al., Clinical Nutrition Open Science 2025.

Dietary Pattern 5: High-Fiber, Plant-Forward Diet

➢ **Definition:** An eating pattern emphasizing whole plant foods like fruits, vegetables, legumes, and whole grains, often associated with vegetarian or vegan diets.

➢ **Mechanism:** Dietary fiber accelerates gastric emptying, reduces intra-gastric pressure, and is fermented to SCFAs which have systemic anti-inflammatory effects. It also promotes a healthy gut microbiome.

➢ **Indication:** First-line strategy for long-term GERD management and prevention for most patients.

- Lu et al., Nutrients 2024.
- Nobel et al., Clin Transl Gastroenterol 2018.

Dietary Pattern 5: High-Fiber, Plant-Forward Diet

➢ **Duration:** Long-term adherence.

➢ **Clinical Evidence:** A nationwide longitudinal survey in Taiwan (2024) found that **adhering to a vegetarian diet was associated with a 28% reduced risk of GERD .**Another study showed high fiber intake alters the esophageal microbiome towards a healthier profile.

- Lu et al., Nutrients 2024.
- Nobel et al., Clin Transl Gastroenterol 2018.

Soluble vs Insoluble Fibre — Effects on GERD

Fibre Type	Mechanism of Action (GERD context)	Food Sources / Examples	Key Findings / Numerical Results	References
Soluble fibre	• Forms viscous • Reduces post-prandial gastric distension • May increase lower esophageal sphincter resting pressure • Reduces reflux events and acid exposure • Improve Gut microbiota and reduce inflammation	Oats, barley, psyllium husk, beans, lentils, apples, citrus, carrots	• Supplement ~15 g/day psyllium: heartburn frequency ↓ 93% → 40%, GER events ↓ 67.9 ± 17.7 → 42.4 ± 13.5 (P<0.001) • Observational: higher soluble fibre intake associated with reduced risk of weekly GERD symptoms	Samathpongtom 2024; Morozov 2018
Insoluble fibre	• Adds stool bulk → improves bowel regularity • Accelerates transit through large intestine → reduces intra-abdominal pressure • Reduces bloating/distension that can trigger reflux • Less effect on gastric emptying compared to soluble fibre	Whole wheat, wheat bran, brown rice, nuts, seeds, cauliflower, green beans	• Observational: cereals (mostly insoluble fibre) show weaker association with reflux symptom reduction • Supports gut motility and indirectly reduces reflux triggers	Samathpongtom 2024; Longdom review

Soluble vs Insoluble Fibre — Effects on GERD

➢ Both soluble and insoluble fibre have roles in managing GERD – **soluble fibre** is likely more directly beneficial for reducing reflux events and symptoms by improving gastric and oesophageal motility.

➢ **Insoluble fibre** contributes more indirectly via improving bowel regularity and reducing intra-abdominal pressure, which may help reduce reflux triggers.

➢ Given current evidence, **emphasis on increasing soluble fibre** sources may yield greater symptom benefit in GERD, but a mix of both fibre types is advisable for overall gut health and reflux prevention.

Gluten's Role in GERD: A Targeted Approach

➢ **Does Gluten Cause Reflux? Not Universally.** A 2024 meta-analysis of 16 studies concluded that **a gluten-free diet (GFD) is protective against GERD**, indicating gluten intake is a significant risk factor on a population level, but not the sole cause for every individual.

➢ **Is a GFD Recommended for All GERD Patients? No.** The diet is **not a first-line treatment for typical GERD**

- Jeans MZ, et al. Coeliac disease is a strong risk factor for Gastro-oesophageal reflux disease while a gluten free diet is protective: a systematic review and meta-analysis. *eClinicalMedicine*. 2024;72:102615.
- Manzini F, et al. Non-Celiac Gluten/Wheat Sensitivity—State of the Art. *Nutrients*. 2025;17(2):220.
- Balouch B, et al. Gluten Sensitivity Underlying Resistant "Laryngopharyngeal Reflux" Symptoms and Signs. *J Voice*. 2025. [Epub ahead of print]

Gluten's Role in GERD: A Targeted Approach

➢ **GFD** is specifically indicated for:

- **Confirmed Celiac Disease (CD):** CD is a **3.12-fold stronger risk factor for GERD**. A strict GFD is essential and treats the root cause.

- **Non-Celiac Gluten/Wheat Sensitivity (NCGS):** Gluten can trigger functional GI symptoms, including reflux, in this subset.

- **Refractory GERD:** In unresponsive cases, gluten may be an overlooked trigger. The mechanism involves **immune-mediated low-grade inflammation and dysmotility** triggered by gluten, even in the absence of full-blown celiac disease.

- Irani MZ, et al. Coeliac disease is a strong risk factor for Gastro-oesophageal reflux disease while a gluten free diet is protective: a systematic review and meta-analysis. *eClinicalMedicine*. 2024;72:102615.
- Manzin F, et al. Non-Celiac Gluten/Wheat Sensitivity—State of the Art. *Nutrients*. 2025;17(2):220.
- Baltouch B, et al. Gluten Sensitivity Underlying Resistant "Laryngopharyngeal Reflux" Symptoms and Signs. *J Voice*. 2023. [Epub ahead of print]

Gluten's Role in GERD: A Targeted Approach

➢ **Evidence & Duration:**

1. Celiac Disease: A strict, lifelong GFD is required. Symptom improvement, including reflux reduction, is typically observed **within weeks to months**.

2. NCGS/Refractory GERD: A **6-8 week therapeutic trial** of a strict GFD is recommended to assess symptom response. If no improvement occurs, gluten is unlikely the primary trigger.

- **If Symptoms Improve:** This suggests gluten sensitivity. The patient should **continue a strict GFD long-term**. Formal evaluation for Celiac Disease (via serology and biopsy) should be considered *before* reintroducing gluten, as the GFD can normalize test results.

- Irani MZ, et al. Coeliac disease is a strong risk factor for Gastro-oesophageal reflux disease while a gluten free diet is protective: a systematic review and meta-analysis. *eClinicalMedicine*. 2024;72:102615.
- Manzin F, et al. Non-Celiac Gluten/Wheat Sensitivity—State of the Art. *Nutrients*. 2025;17(2):220.
- Baltouch B, et al. Gluten Sensitivity Underlying Resistant "Laryngopharyngeal Reflux" Symptoms and Signs. *J Voice*. 2023. [Epub ahead of print]

Intermittent Fasting in GERD: Not Recommended as Therapy

➢ **Mechanism of Harm:** Prolonged fasting leads to an absence of food in the stomach to buffer continuously secreted gastric acid.

➢ This results in a highly acidic gastric environment, and any transient Lower Esophageal Sphincter Relaxation (TLESR) causes reflux of this unbuffered, concentrated acid, leading to significant esophageal irritation.

➢ **Clinical Evidence for Symptom Worsening:** A 2023 study by Jiang et al. on patients with suspected GERD found that **intermittent fasting was associated with a 1.7-fold increased risk of exacerbating reflux symptoms (Risk Ratio: 1.7)**.

- Jiang Y, Soffer L, et al. The Impact of Intermittent Fasting on Patients With Suspected Gastroesophageal Reflux Disease. *J Clin Gastroenterol*. 2023;57(9):e345-e351. doi:10.1097/MCG.0000000000001815
- Valentini Jr DF, et al. Dietary weight loss intervention provides improvement of gastroesophageal reflux disease symptoms—A randomized clinical trial. *Clin Obes*. 2024;14(2):e12656. doi:10.1111/cob.12656

Intermittent Fasting in GERD: Not Recommended as Therapy

➢ **Benefit is from Weight Loss, Not Fasting:** A 2024 randomized trial confirmed that **dietary weight loss led to a 40% improvement in GERD symptom scores**.

➢ However, this benefit is attributed to the weight loss itself, not the fasting pattern used to achieve it.

➢ Fasting is an inefficient and potentially harmful strategy for this purpose in GERD patients.

➢ **Clinical Recommendation:** Intermittent fasting is **not recommended as a therapeutic strategy for GERD**.

➢ The **consistency of small, frequent meals** is a safer and more effective dietary approach to manage symptoms by preventing excessive gastric acid accumulation

Coffee, Caffeine & GERD

➢ **Mechanism:** Reduces LES pressure and may irritate esophageal mucosa.

➢ **Epidemiological Evidence:** Meta-analysis shows **coffee increases GERD risk by 26%**.

➢ **Individual Response:** Effects vary significantly between individuals.

➢ **Recommended Limit: <200 mg caffeine/day** (≈ 1-2 small cups). Consume with food.

- Boom BD, Winters R. Physiology, Lower Esophageal Sphincter. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024. Available from: https://www.ncbi.nlm.nih.gov/books/NBK557432/
- Kim J, Oh SW, Myung SK. Association between coffee intake and gastroesophageal reflux disease: a meta-analysis. Dis Esophagus. 2014;27(4):311–7. (c)
- Kouchakpour G, et al. Association between coffee and caffeine intake and functional dyspepsia. Sci Rep. 2024;14(1):1068.

Milk, Lactose & GERD: A Trigger, Not a Universal Cause

➢ **Does it Cause Reflux?**

- Lactose itself does not directly cause GERD. However, in individuals with **Lactose Intolerance**, it can significantly exacerbate symptoms. The mechanism involves bacterial fermentation of undigested lactose, leading to gas, bloating, and increased intra-abdominal pressure, which promotes reflux.

➢ **Effect in Tolerant Individuals:** For those **without** lactose intolerance, the evidence is mixed and likely depends on the fat content.

➢ **Recommendation:** A **2-4 week trial of lactose elimination** is recommended for GERD patients with overlapping symptoms of bloating, gas, and diarrhea. If symptoms improve, lactose restriction should be maintained

- Schiavdi WJ, et al. Refractory symptoms of gastroesophageal reflux disease after fundoplication may be associated with food intolerance/malabsorption. *Sci Rep*. 2025.
- Fernandes I, et al. The impact of low-fat and full-fat dairy foods on symptoms of gastroesophageal reflux disease. *Eur J Clin Nutr*. 2022. (c)
- Usman M, et al. Ramadan intermittent fasting for patients with gastrointestinal and hepatobiliary diseases. *Lancet Gastroenterol Hepatol*. 2024.

Other Dairy Products & GERD

➢ **High-Fat Dairy:** A 2022 randomized controlled trial found that **full-fat dairy products increased GERD symptoms compared to low-fat alternatives**.

- The mechanism involves high saturated fat content **stimulating** cholecystokinin (CCK), which promotes transient LES relaxations.

➢ **Fermented Dairy (e.g., Yogurt, Kefir):**

➢ These products may be better tolerated due to lower lactose content. Furthermore, specific probiotic strains found in fermented dairy, such as ***Bifidobacterium animalis*** **subsp.** ***lactis*** **MH-02**, have shown efficacy as an adjunctive treatment for reflux esophagitis in clinical trials.

- Fernando I, et al. The impact of low-fat and full-fat dairy foods on symptoms of gastroesophageal reflux disease. *Eur J Clin Nutr*. 2022.
- Gan L, et al. Therapeutic Evaluation of Bifidobacterium animalis subsp. lactis MH-02 as an Adjunctive Treatment in Patients with Reflux Esophagitis. *Nutrients*. 2024.

Other Dairy Products & GERD

➢ **Clinical Guidance:** Patients should be advised to **choose low-fat or fat-free dairy options** and consider **fermented dairy products** as potentially better alternatives.

➢ Individual tolerance should guide consumption.

- Fernando I, et al. The impact of low-fat and full-fat dairy foods on symptoms of gastroesophageal reflux disease. *Eur J Clin Nutr*. 2022.
- Gan L, et al. Therapeutic Evaluation of Bifidobacterium animalis subsp. lactis MH-02 as an Adjunctive Treatment in Patients with Reflux Esophagitis. *Nutrients*. 2024.

The Esophageal Microbiome: A Key Player in GERD Pathogenesis

➢ **Paradigm Shift:** GERD is no longer viewed solely as a chemical injury but as a disorder involving **esophageal dysbiosis**.

➢ **Mechanism of Dysbiosis:** A shift from a healthy, Gram-positive dominated microbiome (e.g., *Streptococcus*) to a pathogenic, Gram-negative dominated one (e.g., *Prevotella*, *Veillonella*) triggers inflammation via:

- **TLR/NF-κB pathway activation** by bacterial LPS, impairing the esophageal barrier and increasing pro-inflammatory cytokines (IL-6, IL-8).

➢ **Therapeutic Goal:** Modulate the microbiome to restore a healthy balance and address root-cause inflammation.

TLR: Toll-Like Receptor
LPS: Lipopolysaccharide

- Guan Y, et al. The role of the esophageal and intestinal microbiome in GERD. *Front Immunol*. 2025.
- Tarsi F, et al. Efficacy of a food supplement containing *L. acidophilus* LA14... *Nutrients*. 2024.
- Gan L, et al. Therapeutic evaluation of *Bifidobacterium animalis*... MH-02... *Nutrients*. 2024.

Evidence-Based Probiotic Strains, Dosage & Clinical Outcomes

➢ **Mechanism:** Modulate gut and esophageal microbiota, enhance mucosal barrier function, reduce inflammation.

➢ **Strain, Dose & Duration:**

- ***Lactobacillus acidophilus* LA14**
- **Dose & Duration: 2.5 billion CFU/day for 8 weeks**.
- **Outcome:** In a 2024 RCT, this strain in a multi-nutrient supplement **improved GERD-related outcomes and QoL scores by 45% vs. 15% in placebo (p<0.01)**.

- Tarsi F, et al. Efficacy of a food supplement containing *L. acidophilus* LA14... *Nutrients*. 2024.
- Gan L, et al. Therapeutic evaluation of *Bifidobacterium animalis*... MH-02... *Nutrients*. 2024.
- Komatsu Y, et al. Beneficial effect of heat-killed *L. johnsonii*... *Nutrients*. 2024.

Evidence-Based Probiotic Strains, Dosage & Clinical Outcomes

- ***Bifidobacterium animalis* subsp. *lactis* MH-02**
- **Dose & Duration: 5 billion CFU/day for 8 weeks** (with PPI).
- **Outcome:** A 2024 trial showed **earlier symptom relief and a longer mean time to relapse (98 days vs. 65 days, $p<0.05$)**.

- ***Lactobacillus johnsonii* No. 1088** (Heat-Killed)
- **Dose & Duration: 10 billion cells/day for 8 weeks**.
- **Outcome:** A 2024 study demonstrated a **significant reduction in temporal GERD-related symptoms in healthy volunteers**.

- Tarsi F, et al. Efficacy of a food supplement containing *L. acidophilus* LA14... *Nutrients*. 2024.
- Gan L, et al. Therapeutic evaluation of *Bifidobacterium animalis*... MH-02... *Nutrients*. 2024.
- Komatsu Y, et al. Beneficial effect of heat-killed *L. johnsonii*... *Nutrients*. 2024.

Prebiotics and Synbiotics in GERD

➢ Prebiotics (e.g., Inulin, GOS, FOS):

- **Mechanism:** Fermented by colonic bacteria to produce SCFAs (butyrate), which strengthen the intestinal barrier and have systemic anti-inflammatory effects.
- **Dose & Food Sources: 5-10g/day**. Found in chicory root, garlic, onions, asparagus, bananas, oats. *Note: Introduce slowly to avoid gas/bloating.*

➢ Synbiotics:

- **Definition:** Combinations of probiotics and prebiotics.
- **Evidence:** A 2024 review on gut health highlighted that synbiotics can be more effective than either component alone for stabilizing the gut ecosystem, though GERD-specific RCTs are needed.

- Guan et al., Front Immunol 2025.
- Pulvirenti et al., Ital J Pediatr 2023

Functional Food 1: Ginger

➢ **Description:** A rhizome with potent anti-inflammatory and gastroprotective properties.

➢ **Mechanism:** Inhibits cyclooxygenase and lipoxygenase pathways, reduces nausea, and may accelerate gastric emptying.

➢ **Dose & Form: 1g of ginger powder or 1-2g of fresh ginger root per day**.

➢ **Duration:** Can be used chronically.

➢ **Clinical Evidence:** An RCT (2024) on peptic ulcers found that **1g/day of ginger powder for 4 weeks significantly reduced dyspepsia severity scores by 25% more than placebo**

Functional Food 2: Deglycyrrhizinated Licorice (DGL)

➢ **Description:** Licorice root with the glycyrrhizin removed to avoid hypertensive side effects.

➢ **Mechanism:** Stimulates mucus secretion, improves blood flow to the gastric mucosa, and has anti-inflammatory effects.

➢ **Dose & Form: 400 mg chewable tablets, 20 minutes before meals**.

- Kuna & Jakab, J Clin Med 2019.

Functional Food 2: Deglycyrrhizinated Licorice (DGL)

➢ **Duration:** 4-8 weeks for symptomatic relief.

➢ **Clinical Evidence:** While direct GERD RCTs are limited, clinical practice guidelines and reviews on herbal therapy note its efficacy for soothing esophageal and gastric mucosa, with studies showing **symptomatic improvement in 70-70% of patients with functional dyspepsia within 2-4 weeks**.

- Kuna & Jakab, J Clin Med 2019.

Functional Food 3: Manuka Honey

Manuka Honey (MGO 400+):

- **Mechanism: Anti-inflammatory and antimicrobial activity**; soothes the esophageal mucosa.
- **Dose: One teaspoon (approx. 10g) 3 times a day**, away from meals.
- **Evidence:** A 2024 literature review concluded **Manuka honey is an efficacious treatment for reducing heartburn and regurgitation in GERD patients**.

- Gośliński & Nowak, Food Sci Nutr 2024.
- Yuspar et al., Sciena 2023.

Functional Food 4: Alginates

- **Alginate Formulations (e.g., Gaviscon):**
- **Description : Alginate** is a natural polysaccharide derived from brown seaweed that forms a protective gel barrier in the stomach to prevent acid reflux.

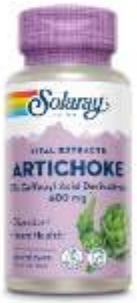
- **Mechanism:** Forms a physical "raft" on top of gastric contents, acting as a mechanical barrier to reflux.
- **Dose: 10-20 mL after meals and at bedtime**.

- Gośliński & Nowak, Food Sci Nutr 2024.
- Yuspar et al., Sciena 2023.

Functional Food 4: Artichoke Leaf Extra

➢ **Description:** Standardized extract from the leaves of the *Cynara scolymus* plant.

➢ **Mechanism:** Enhances gastric emptying by stimulating bile secretion and reducing smooth muscle spasms in the GI tract. Also possesses hepatoprotective and antioxidant properties.



➢ **Dose & Form: 320-640 mg of standardized extract, daily before meals**.

- **Duration:** 6 weeks.

➢ **Clinical Evidence:** A RCT by Marakis et al. (2021) on patients with functional dyspepsia (which often overlaps with GERD)

- Marakis et al., Journal of Ethnopharmacology, 2021.

Essential Non-Dietary Lifestyle Modifications in GERD

➢ **Sleep Modifications:**

- **Head-of-Bed Elevation (HBE):** Elevating the head of the bed by **6-8 inches** is a core recommendation to utilize gravity in reducing nocturnal reflux.

- **Meal-to-Bed Interval:** A large population-based study identified **shorter meal-to-bed time as a significant risk factor**. Maintaining a **≥3-hour gap** between the last meal and bedtime is strongly advised.

- Kelsay PT, et al. The Medical Management of Gastroesophageal Reflux Disease: A Narrative Review. J Prim Care Community Health. 2025.
- Sadeli S, et al. Risk factors for gastroesophageal reflux disease: a population-based study. BMC Gastroenterol. 2024.
- Fox M, Oyesiji CP. Dietary factors involved in GERD management. Gastroenterol. 2025.
- Choudury H, Villiwock I. Patient Perspectives on Adherence to Reflux Lifestyle Modifications: A Qualitative Study. J Prim Care Community Health. 2025.

Essential Non-Dietary Lifestyle Modifications in GERD

➢ **Tobacco & Alcohol Cessation:**

- **Smoking:** A population-based study confirmed **smoking as a significant modifiable risk factor for GERD**. Smoking reduces LES pressure and impairs mucosal defense.

- **Alcohol:** Alcohol consumption is a recognized trigger that can reduce LES pressure and directly irritate the esophageal mucosa.

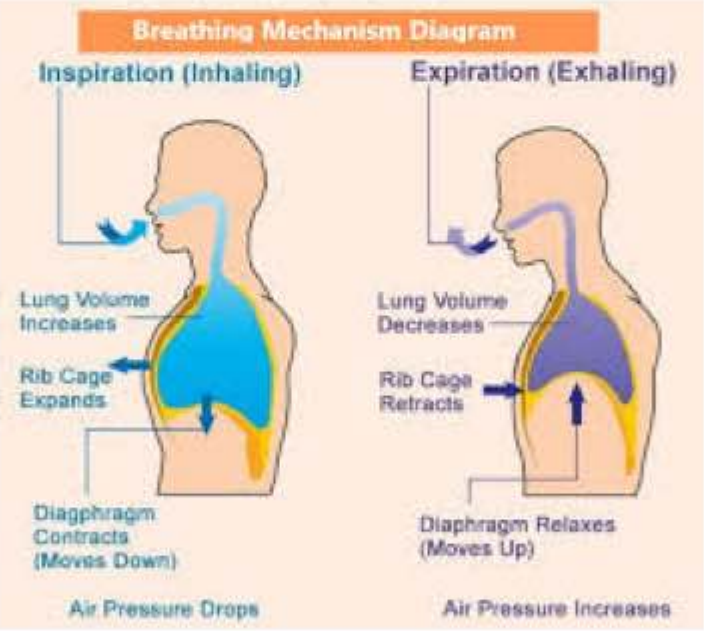
- Kelsay PT, et al. The Medical Management of Gastroesophageal Reflux Disease: A Narrative Review. J Prim Care Community Health. 2025.
- Sadeli S, et al. Risk factors for gastroesophageal reflux disease: a population-based study. BMC Gastroenterol. 2024.
- Fox M, Oyesiji CP. Dietary factors involved in GERD management. Gastroenterol. 2025.
- Choudury H, Villiwock I. Patient Perspectives on Adherence to Reflux Lifestyle Modifications: A Qualitative Study. J Prim Care Community Health. 2025.

Stress Reduction & Sleep Hygiene for GERD Management

➢ Stress Reduction Techniques:

- **Structured Breathing Exercises:** A systematic review confirmed that **diaphragmatic breathing and paced respiration improve antireflux barrier function and reduce GERD symptoms**. Practice for 5-10 minutes, twice daily.
- **Inspiratory Muscle Training:** Strengthening the diaphragm via specific inspiratory exercises can directly support the LES. Use a device or resisted breathing for **30 breaths, twice daily**.
- **Mindfulness & Behavioral Modification:** A qualitative study identified stress as a major exacerbating factor. Incorporating **mindfulness meditation or cognitive-behavioral strategies** can help manage stress-related symptom flares.

- Zdilova L., et al. Breathing Exercises in Gastroesophageal Reflux Disease: A Systematic Review. *J Clin Med*. 2023.
- Choudary H, Vilbrock J. Patient Perspective on Adherence to Reflux Lifestyle Modifications: A Qualitative Study. *J Prim Care Community Health*. 2023.
- Sadafi S, et al. Risk factors for gastroesophageal reflux disease: a population-based study. *BMC Gastroenterol*. 2024.
- Person E, et al. The effect of nutrition on antiesophageal reflux. *Dis Dis Sci*. 2015.



Stress Reduction & Sleep Hygiene for GERD Management

➢ **Sleep Duration & Timing:**

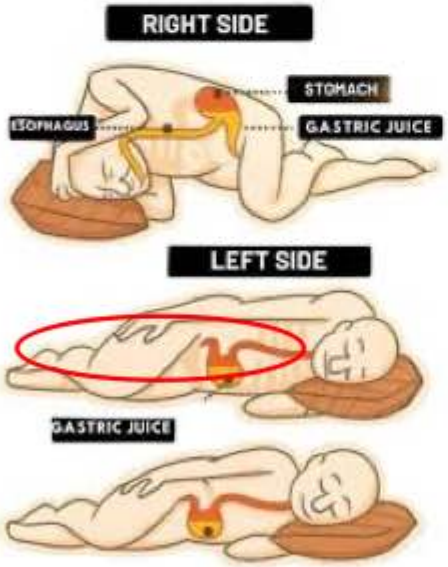
- **Consistent Sleep Schedule:** A large population-based study linked poor sleep habits to GERD risk. Maintain a **consistent bedtime and wake-up time**, even on weekends.

- **Adequate Duration:** While not explicitly quantified in GERD studies, general health guidelines recommend **7-9 hours of quality sleep per night** to support overall physiological regulation, including GI function.

- **Optimal Positioning:** Sleep in the **left lateral decubitus position** to position the gastroesophageal junction above the gastric contents, utilizing gravity to reduce nocturnal reflux episodes.

- Zdilova L., et al. Breathing Exercises in Gastroesophageal Reflux Disease: A Systematic Review. *J Clin Med*. 2023.
- Choudoky H, Vilbrock J. Patient Perspective on Adherence to Reflux Lifestyle Modifications: A Qualitative Study. *J Prim Care Community Health*. 2023.
- Sadafi S, et al. Risk factors for gastroesophageal reflux disease: a population-based study. *BMC Gastroenterol*. 2024.
- Person E. et al. The effect of nutrition on gastroesophageal reflux. *Dis Dis Sci*. 2015.

left lateral decubitus position



Exercise in GERD Management: A Double-Edged Sword

➢ **Moderate-Intensity Aerobic Exercise (Protective):**

- **Mechanism:** Promotes healthy weight and improves gastrointestinal motility.
- **Evidence:** A population-based study found that **regular physical activity was a protective factor, reducing GERD risk by approximately 25%.**

- Sadafi S, et al. Risk factors for gastroesophageal reflux disease: a population-based study. *BMC Gastroenterol*. 2024.
- Hong W. Evaluation of the impact of oesophageal reflux disease on muscle fatigue. *J Gastroenterol Hepatol*. 2024.
- Zdrhova L, et al. Breathing Exercises in Gastroesophageal Reflux Disease: A Systematic Review. *J Clin Med*. 2023.

Exercise in GERD Management: A Double-Edged Sword

➢ **High-Intensity & Resistance Exercise (Risky):**

- **Mechanism:** Activities like heavy weightlifting and high-intensity interval training can increase intra-abdominal pressure, forcing gastric contents into the esophagus.
- **Evidence:** A 2024 study showed that **GERD patients developed muscle fatigue 25% faster during physical tasks**, and certain exercises can directly provoke symptoms.

- Sadafi S, et al. Risk factors for gastroesophageal reflux disease: a population-based study. *BMC Gastroenterol*. 2024.
- Hong W. Evaluation of the impact of oesophageal reflux disease on muscle fatigue. *J Gastroenterol Hepatol*. 2024.
- Zdrhova L, et al. Breathing Exercises in Gastroesophageal Reflux Disease: A Systematic Review. *J Clin Med*. 2023.

Exercise in GERD Management: A Double-Edged Sword

➢ **Targeted Muscle Training (Therapeutic):**

- **Mechanism:** Inspiratory muscle training strengthens the diaphragm, including the crural fibers that contribute to the anti-reflux barrier.
- **Evidence:** A systematic review found that specific exercises, including breathing techniques, can improve antireflux barrier function and reduce symptoms.

➢ **Recommendation:** Encourage **regular, moderate-intensity aerobic exercise** (e.g., brisk walking). **Avoid high-intensity exercises** soon after meals. Consider **inspiratory muscle training** for refractory cases.

- Sadafi S, et al. Risk factors for gastroesophageal reflux disease: a population-based study. *BMC Gastroenterol*. 2024.
- Hong W. Evaluation of the impact of oesophageal reflux disease on muscle fatigue. *J Gastroenterol Hepatol*. 2024.
- Zdrhova L, et al. Breathing Exercises in Gastroesophageal Reflux Disease: A Systematic Review. *J Clin Med*. 2023.

Clinical Application: A Stepwise & Actionable Plan

1. **Assessment:** Check BMI, dietary habits, PPI use duration, and screen for micronutrient deficiencies (Mg, B12, Ferritin).

2. **Stage 1 (Weeks 1-4): Foundation**
   - **Energy & Meal Pattern:** Prescribe a 500 kcal deficit if BMI>25. Recommend **4-6 small meals/day** with a **3-hour meal-to-bed gap**.
   - **Macros: Protein: 1.2-1.5 g/kg/day. Carbs: >30g fiber/day. Fats: <30% energy, <7% saturated.**
   - **Habits:** Head-of-bed elevation.

Clinical Application: A Stepwise & Actionable Plan

3.Stage 2 (Weeks 5-12): Advanced Targeting

- **Dietary Pattern:** Initiate a **Mediterranean Diet**.
- **Microbiome:** Add a **probiotic (e.g., L. acidophilus LA14, 2.5B CFU/day or B. lactis MH-02, 5B CFU/day)**.
- **Functional Foods:** Consider **1g/day ginger** or **alginate** post-meals for persistent symptoms.
- **Micronutrients:** Supplement as needed: **Mg Glycinate 300mg, B12 500mcg sublingual, Iron Bisglycinate 65mg**.

4.Monitoring: Re-evaluate symptom scores (e.g., GERD-Q) at 4, 8, and 12 weeks.

Thanks for your attenetion