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Dietary interventions as a therapeutic strategy: Insights into peptic ulcer

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Abstract
Peptic ulcer disease (PUD) remains a significant global health concern, characterized by mucosal erosion in the stomach or duodenum. While pharmacological therapies such as proton pump inhibitors (PPIs), H2 receptor antagonists, and antibiotics for *Helicobacter pylori* eradication have revolutionized management, recurrence and drug resistance remain persistent challenges. Increasing evidence highlights the therapeutic role of diet and functional foods in ulcer prevention and management. This review explores dietary interventions, emphasizing nutrients, bioactive compounds, and food-based strategies with anti-inflammatory, antioxidant, antimicrobial, and mucosal-protective properties. Traditional dietary practices, functional foods, and nutraceuticals are also discussed, offering insights into integrative approaches for peptic ulcer therapy.

Keywords: Peptic ulcer, functional foods, human health, antioxidant, nutraceuticals

Introduction

Peptic ulcer disease (PUD) is a multifactorial gastrointestinal disorder with substantial morbidity worldwide. Its etiology involves *H. pylori* infection, non-steroidal anti-inflammatory drug (NSAID) usage, oxidative stress, smoking, alcohol intake, and dietary factors (Sung *et al*., 2020) [16]. Standard pharmacological treatment has limitations such as antibiotic resistance, relapse, and long-term adverse effects (Savoldi *et al*., 2018) [14]. Hence, dietary interventions have emerged as complementary or alternative strategies in managing peptic ulcers.

Diet plays a dual role—certain foods (spices, alcohol, excessive caffeine) aggravate mucosal injury, while others (probiotics, flavonoid-rich fruits, polyphenols, and fibres) enhance mucosal defense. Nutrients such as vitamin C, vitamin E, zinc, and omega-3 fatty acids demonstrate ulcer-healing potential through antioxidant and anti-inflammatory mechanisms. Moreover, functional foods like honey, licorice, turmeric, and fermented dairy products have shown promising gastroprotective properties. This review synthesizes current evidence on dietary interventions for peptic ulcer management, highlighting potential clinical applications.

Pathophysiology of Peptic Ulcer and the Role of Diet

Peptic ulcers result from an imbalance between aggressive factors (acid, pepsin, *H. pylori*, NSAIDs, ROS) and defensive mechanisms (mucus, bicarbonate, blood flow, prostaglandins). Diet modulates both sides of this balance. Irritant foods can increase gastric acid secretion or impair mucosal protection, while protective foods enhance mucus secretion, neutralize free radicals, and promote healing (Malfertheiner *et al*., 2017) [8].

Table 1: Dietary Risk Factors and Their Aggravating Effects on Peptic Ulcer Development and Healing (Mustafa *et al*., 2015 [10]; Kulshreshtha*et al*., 2017) [7]

Dietary Factor	Mechanism of Action	Evidence/Findings	Impact on Peptic Ulcer
Spicy foods and chili peppers (Capsaicin)	Stimulates gastric secretions; excessive intake irritates mucosa; moderate intake may increase mucus secretion	Evidence is mixed—some studies show protective mucus stimulation; others show mucosal irritation	Excessive intake may aggravate symptoms; moderate intake may not be harmful
Caffeine and coffee	Stimulate gastric acid and pepsin secretion	Clinical studies show worsening of ulcer symptoms with high consumption	Increases ulcer symptoms and delays healing
Alcohol	Direct mucosal injury; disrupts gastric barrier; increases oxidative stress and inflammation	Strong evidence links alcohol to ulcer relapse and impaired healing	Aggravates ulcers and increases recurrence risk
High-salt diets	Enhances *H. pylori* colonization; damages mucosal defense	Experimental and epidemiological studies show higher risk of *H. pylori* infection and delayed ulcer healing	Promotes persistence and progression of ulcers
Processed and fried foods	High in oxidized fats and additives; induce oxidative stress and inflammation	Associated with impaired gastric mucosal repair and inflammation	Slows healing and increases ulcer risk

Protective Nutrients and Food Components

1. Antioxidants

- **Vitamin C:** Enhances collagen synthesis, reduces oxidative stress, and may inhibit *H. pylori* colonization (Gonciarz *et al*., 2019) [6].
- **Vitamin E:** Protects gastric mucosa by neutralizing lipid peroxidation (Ohta *et al*., 2010) [11].
- **Polyphenols:** Found in green tea, berries, grapes, and apples, they exert anti-inflammatory and anti-*H. pylori* activity (da Silva, 2020) [4].

2. Minerals

- **Zinc:** Promotes epithelial regeneration and protects against gastric lesions (Mei *et al*., 2012) [9].
- **Selenium:** Supports antioxidant defense through glutathione peroxidase activity (Battin & Brumaghim, 2009) [3].

Functional Foods and Bioactive Compounds

Several functional foods have shown significant promise in the dietary management of peptic ulcers. Honey possesses strong antibacterial, antioxidant, and wound-healing properties, which aid in protecting the gastric mucosa and promoting ulcer healing (Pol *et al*., 2024) [12]. Licorice (*Glycyrrhiza glabra*) enhances mucus secretion, thereby strengthening the gastric barrier, while also inhibiting the growth of *Helicobacter pylori*. Similarly, turmeric (curcumin) demonstrates potent anti-inflammatory, antioxidant, and anti-*H. pylori* activities, contributing to both symptom relief and mucosal protection (Zahid *et al*., 2020) [17]. The use of probiotics, particularly *Lactobacillus* and *Bifidobacterium* strains, has been shown to improve *H. pylori* eradication when administered alongside antibiotics, while also reducing treatment-related side effects and maintaining gut microbial balance (Bai *et al*., 2022) [2]. In addition, cabbage juice, rich in glutamine, has been historically recognized for its mucosal protective effects and its ability to accelerate ulcer healing. Together, these natural interventions highlight the therapeutic potential of functional foods in complementing conventional pharmacological treatments for peptic ulcer disease.

Omega-3 and Omega-6 Fatty Acids

Polyunsaturated fatty acids exhibit anti-inflammatory effects and promote gastric mucosal defense, reducing ulcer risk.

Clinical and Experimental Evidence

- **Probiotic supplementation:** Clinical studies demonstrate improved *H. pylori* eradication rates and reduced side effects of triple therapy (Zhang *et al*., 2015) [18].
- **Curcumin:** Randomized controlled trials report symptomatic improvement and partial eradication of *H. pylori* infection (Shahani *et al*., 2019) [15].
- **Honey:** Animal studies show accelerated ulcer healing and reduced gastric lesions (Almasaudi *et al*., 2017) [1].
- **Cabbage juice:** Early clinical reports demonstrated rapid healing of peptic ulcers within 7–10 days due to its glutamine content.

Integrative Dietary Approaches

Mediterranean Diet

Rich in fruits, vegetables, legumes, whole grains, olive oil, and fish, the Mediterranean diet offers antioxidants, polyphenols, and healthy fats that promote gastric mucosal health (Del Chierico *et al*., 2014) [5].

Functional Food Formulations

Development of nutraceuticals and fortified foods (probiotic yogurts, flavonoid supplements, herbal teas) can support conventional therapy and reduce recurrence (Puri *et al*., 2022) [13].

Personalized Nutrition

Genetic, microbiome, and lifestyle factors may influence individual responses to dietary therapy, making precision nutrition approaches crucial in ulcer management.

Table: 1 Summary of Dietary Interventions and Their Therapeutic Effects in Peptic Ulcer Management from Published Studies

Dietary Component	Mechanism of Action	Study Type	Key Findings	Reference
Vitamin C	Antioxidant, collagen synthesis, inhibits *H. pylori*	Clinical and experimental studies	Improved ulcer healing; reduced *H. pylori* colonization	Sung *et al*., 2020
Vitamin E	Antioxidant, prevents lipid peroxidation	Animal studies	Reduced gastric lesions and accelerated mucosal repair	Malfertheiner *et al*., 2017 [8]
Zinc	Enhances epithelial regeneration, mucosal protection	Experimental study	Accelerated healing of gastric ulcers in rats	Savoldi *et al*., 2018 [14]
Selenium	Boosts glutathione peroxidase activity, antioxidant	Animal studies	Protected gastric mucosa from oxidative damage	Zhang *et al*., 2015 [18]
Polyphenols (Green tea, berries, grapes)	Anti-inflammatory, anti-*H. pylori*, antioxidant	Epidemiological and clinical studies	Lower ulcer prevalence, improved healing	Malfertheiner *et al*., 2017 [8]
Honey	Antibacterial, antioxidant, enhances tissue repair	Animal studies and small clinical studies	Accelerated gastric ulcer healing; reduced oxidative stress	Almasaudi *et al*., 2017 [1]
Licorice (Glycyrrhiza glabra)	Increases mucus secretion, inhibits *H. pylori*	Clinical and experimental studies	Decreased gastric lesion size, protective effect against ulcers	

Conclusion

Dietary interventions hold considerable potential as a therapeutic strategy for peptic ulcer disease. Antioxidant-rich foods, probiotics, flavonoids, honey, licorice, and turmeric demonstrate protective and healing properties, complementing pharmacological therapy. Integrating dietary approaches with standard care can improve outcomes, reduce recurrence, and enhance quality of life in peptic ulcer patients. Well-designed clinical trials and personalized nutrition strategies will be pivotal in translating these insights into practice.

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