



"Guardians of the Gut: Understanding and Managing Peptic Ulcers - From Symptoms to Herbal Remedies"

Mr. Shivshankar M. Nagrik^a, Miss. Akanksha D. Thigale^b, Miss. Vaishnavi R Ghait^c, Miss. Shivani G. Ambhore^d, Miss. Bhavika A. wargat^e, Miss. Samruddhi P. Sable^f, Miss. Shraddha S. Pathrikar^g

^a Student, M. Pharm, Department of Pharmaceutics, RSCP, Buldhana, 443001, India

^b Student, B. Pharm Final Year, GCP, Sakharkherda, Buldhana, 443202, India.

^{c,d,e,f,g} Student, B. Pharm Third Year, GCP, Sakharkherda, Buldhana, 443202, India

ABSTRACT :

Peptic ulcers, painful sores in the lining of the stomach or duodenum, are primarily caused by *Helicobacter pylori* infection and the prolonged use of nonsteroidal anti-inflammatory drugs (NSAIDs). Contributing factors include excessive alcohol consumption, smoking, and stress. Symptoms range from burning abdominal pain, particularly between meals or at night, to nausea, vomiting, and unexplained weight loss. Serious complications, such as bleeding, perforation, and gastric outlet obstruction, can arise if untreated. Diagnosis involves a combination of medical history review, physical examination, and specialized tests like endoscopy, breath tests, blood tests, and stool tests to detect *H. pylori*. Treatment strategies aim to alleviate symptoms, heal ulcers, and prevent complications, employing lifestyle modifications, acid-reducing medications, antibiotics to eliminate *H. pylori*, and cytoprotective agents. Emerging interest in herbal remedies presents potential alternative treatments for peptic ulcers. Specific herbs exhibit pharmacological actions that may support traditional treatments. Licorice root (*Glycyrrhiza glabra*) possesses anti-inflammatory, anti-ulcer, anti-*H. pylori*, antioxidant, and immune-modulating properties. Slippery elm (*Ulmus rubra*) acts as a demulcent, anti-inflammatory, and mucosal protector, alleviating pain and aiding ulcer healing. Aloe vera offers anti-inflammatory, mucosal protection, wound healing, and antibacterial effects. Turmeric (*Curcuma longa*) provides anti-inflammatory, antioxidant, antimicrobial, and cytoprotective benefits. Marshmallow root (*Althaea officinalis*) delivers mucilage for protection and anti-inflammatory relief. Chamomile (*Matricaria chamomilla*) contributes anti-inflammatory, antispasmodic, ulcer-healing, antimicrobial, and antioxidant effects. The integration of these herbal remedies into peptic ulcer management could enhance healing, reduce inflammation, and offer a complementary approach to conventional treatments. This project explores the pharmacological potential of these herbs, aiming to substantiate their efficacy and support their incorporation into comprehensive peptic ulcer treatment protocols.

Keywords: Peptic ulcers, *Helicobacter pylori* (*H. pylori*), Cytoprotective agents, Upper abdominal pain, Complications of peptic ulcers, Herbal remedies.

1. Introduction :

A disorder where the lining of the stomach or the duodenum, the first segment of the small intestine, develops painful sores called ulcers. Peptic ulcers is a common term used to describe these ulcers. When the duodenum's or stomach's protective lining weakens or is destroyed, peptic ulcers may result. Ulcers arise as a result of the lining becoming irritated and eroded by stomach acids and enzymes. *Helicobacter pylori* (*H. pylori*) is a bacterial infection that is the most prevalent cause of peptic ulcers. Long-term use of some medications, such as nonsteroidal anti-inflammatory drugs (NSAIDs), excessive alcohol use, smoking, and stress are other factors that might lead to the formation of peptic ulcers. A burning or gnawing sensation in the abdomen, especially in the early morning or in between meals, is one of the many signs of peptic ulcers [1]. Belching, bloating, nausea, vomiting, and an appetite loss are some more typical symptoms. Serious side effects from peptic ulcers include bleeding, perforation (a hole in the stomach or duodenal wall), and obstruction of the gastric outlet (the blockage of the entrance between the stomach and intestines). A combination of the patient's medical history, physical examination, and specialist testing is usually used to diagnose peptic ulcers. A thin, flexible tube with a camera is placed through the mouth during an endoscopy to inspect the stomach and duodenum. Other tests that may be performed to check for the presence of *H. pylori* include blood, stool, and breath tests [2].

The goals of peptic ulcer treatment are to reduce symptoms, encourage ulcer healing, and avoid complications. A combination of lifestyle modifications, including avoiding triggers like caffeine, alcohol, and spicy foods, as well as taking antibiotics to treat the *H. pylori* infection, medications to lower stomach acid production, and potentially cytoprotective agents to shield the stomach and duodenum lining, may be necessary to achieve this. A rupture in the inner lining of the stomach, first segment of the small intestine, or occasionally the lower esophagus is known as peptic ulcer disease (PUD). A duodenal ulcer is one that occurs in the first section of the intestines, while a gastric ulcer occurs in the stomach. The most typical signs of a duodenal ulcer are upper abdominal discomfort when you wake up in the middle of the night or upper abdominal pain that gets better when you eat [3]. In the case of a gastric ulcer, the pain may also get worse when you eat. People frequently describe the pain as a scorching or foolish agony. Additional symptoms include weight loss, vomiting, belching, and reduced appetite. One-third of elderly people do not exhibit any symptoms at all. Bleeding, gastrointestinal

obstruction, and perforation are possible complications. Fever occurs in up to 15% of individuals. Non-steroidal anti-inflammatory medications (NSAIDs) and the bacteria *Helicobacter pylori* are common causes of stomach ulcers. Tobacco, smoking, pressure from severe illness, Behcet disorder, Zollinger-Ellison syndrome, Crohn's disease, liver cirrhosis, and other, less uncommon causes are also present. Older adults are more susceptible to NSAIDs' ulcer-causing effects. Usually, the diagnosis is suspected based on the indications that are confirmed by endoscopy or barium swallow. The diagnosis of *H. Pylori* can be made by urea breath test, blood test for antibodies, stool test for signs of the bacteria, or stomach biopsy. Other conditions that cause comparable symptoms and signs include stomach malignancies, coronary heart disease, and gallbladder or stomach lining inflammation. Dietary factors are no longer significant in the development or prevention of ulcers [4].

2. Peptic ulcer: signs and symptoms

While a peptic ulcer might leave you sighing in discomfort, the good news is there are often telltale signs and symptoms. Here's a detailed look:

2.1. Common Symptoms

2.1.1 Upper abdominal pain

This is the hallmark symptom, often described as a burning or gnawing sensation in the upper middle of your abdomen, between your breastbone and belly button. The pain typically:

- Occurs on an empty stomach or between meals (when stomach acid is highest)
- May be eased by eating certain foods (like antacids) or drinking milk, but the relief is temporary
- May improve with lying down or assuming a fetal position
- May worsen with certain foods (spicy, greasy), stress, or alcohol [6-7].

2.1.2 Indigestion (dyspepsia)

- This term encompasses a combination of uncomfortable upper abdominal symptoms, often along with the peptic ulcer pain. It can include:
- Feeling full or bloated, especially after eating
- Belching
- Nausea

2.2. Less Common Symptoms

2.2.1 Unexplained weight loss

- This can occur due to difficulty eating or reduced appetite caused by the ulcer pain.
- **Vomiting:** This may contain blood or appear dark and gritty, resembling coffee grounds (hematemesis)[8].
- **Black, tarry stools (melena):** This indicates bleeding in the digestive tract.
- Not everyone with a peptic ulcer experiences symptoms. In fact, some ulcers are "silent" and only detected during investigations for other conditions.

When to Sigh With Worry and See a Doctor:

- If you experience any of the above symptoms, especially persistent or severe pain, vomiting blood, or black stools.
- If you have symptoms that worsen despite over-the-counter medications like antacids[9].

3. peptic ulcer complications

Peptic ulcers, while often manageable, can develop serious complications if left untreated. Here's a detailed breakdown of the four main complications:

3.1. Bleeding

Types of Bleeding

Peptic ulcer bleeding can be:

- **Acute:** Sudden and severe, causing vomiting of blood (hematemesis) or black, tarry stools (melena). This is a medical emergency.
- **Chronic:** Slower, long-term blood loss leading to iron deficiency anemia. Symptoms include fatigue, pale skin, and shortness of breath.
- **Causes:** An ulcer erodes a blood vessel in the stomach or duodenum. Factors like *H. pylori* infection and NSAID use increase risk.
- **Severity:** Bleeding can range from mild (going unnoticed) to life-threatening. Blood loss severity depends on the size and location of the eroded vessel.
- **Diagnosis:** Endoscopy (EGD) allows doctors to visualize the ulcer and bleeding source. Blood tests assess anemia[10].

3.1.1 Treatment

- **Medications:** Antacids, proton pump inhibitors (PPIs) to reduce stomach acid and promote healing.
- **Endoscopy:** Techniques like injection or clips can stop bleeding during the procedure.
- **Surgery:** In severe cases, surgery might be necessary to repair the ulcer or remove part of the stomach[11].

3.2. Perforation

- A perforation is a hole that forms through the entire stomach or duodenum wall due to a deep ulcer. This creates a medical emergency.
- **Symptoms:** Sudden, severe abdominal pain that worsens with movement, nausea, vomiting, and sweating.
- **Risks:** Increased with smoking, steroid use, and previous perforation.
- **Diagnosis:** X-rays or CT scans can reveal free air in the abdomen, a sign of perforation.
- **Treatment:** Immediate surgery is required to close the perforation, clean the abdominal cavity (due to potential infection), and sometimes remove part of the stomach[12].

3.3. Penetration:

- **Description:** Less common than perforation. An ulcer extends beyond the stomach or duodenum wall but doesn't create a full perforation. It can involve nearby organs like the pancreas or liver.
- **Symptoms:** Pain can be localized depending on the penetrated organ. Additional symptoms like nausea, vomiting, and back pain might occur.
- **Diagnosis:** Endoscopy (EGD) or CT scan can reveal penetration.
- **Treatment:** Depends on the severity and affected organ. Treatment might involve medications like PPIs to promote ulcer healing and pain management. Surgery might be necessary in some cases[13].



Fig 1. Peptic ulcer penetration

4.4. Gastric Outlet Obstruction

- **Description:** Peptic ulcers in the duodenum can cause scar tissue to form. This scarring can narrow the opening from the stomach to the duodenum, hindering food passage.
- **Symptoms:** Nausea, frequent vomiting, bloating after meals, and weight loss due to difficulty eating and absorbing nutrients.
- **Diagnosis:** Endoscopy (EGD) allows visualization of the narrowed passage. Barium X-ray may also be used.
- **Treatment:** Treatment aims to relieve the blockage and allow food passage. Options include:
 - Endoscopic balloon dilation: A balloon is inflated during endoscopy to widen the narrowed passage.
 - Surgery: In severe cases, surgery might be needed to remove scar tissue or create a new passage for food (gastrojejunostomy)[14].

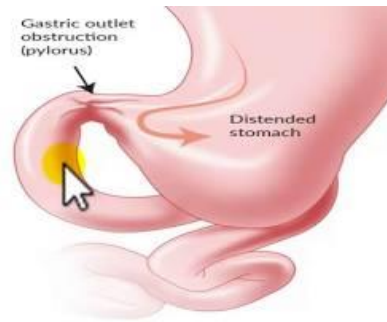


Fig 2. Peptic ulcer gastric outlet obstruction

4. Causes of peptic ulceration

Infection: *Helicobacter pylori*

Drugs: Non-steroidal anti-inflammatory drugs (including aspirin), Steroids, Bisphosphonates, Immunosuppressant's, Cocaine.

Stress: Psychological, Physical e burns (Curling's ulcer), Head injury (Cushing's ulcer. Tobacco smoking, Alcohol intake, Zollingere Ellison syndrome (Gastrinomas), Age related decline in prostaglandin levels[15].

5. Epidemiology

Epidemiological shows that PUD stays a moderately common condition worldwide, with yearly rate running from 0.10% to 0.19% for physician-diagnosed PUD and from 0.03% to 0.17% for PUD diagnosed during hospitalization. The 1-year predominance of physician diagnosed PUD was 0.12–1.5%, and the 1-year prevalence of PUD diagnosed during hospitalizations was 0.10–0.19%. The data show that the incidence of PUD has decreased over recent decades in many nations, in all likelihood because of the abatement in *H. pylori* infection, especially in Western populations. However, it is possible that the circumstance might be distinctive in Asian nations; an ongoing study in Korea revealed that the prevalence of *H. pylori* infection in relationship with GU was expanding with time, whereas *H. pylori* infection in DU was decreasing. The most dependable investigation of physician-diagnosed predominance was from Sweden, reporting cross-sectional data illustrative of the general population; the examination in this manner included both symptomatic and asymptomatic PUD. The overall predominance of PUD saw in this study was 4.1%; 19.5% of all PUD cases recognized were asymptomatic[16-17].

6. Etiology

Till the last decade it has been evaluated that 95% of duodenal ulcer and 70% of gastric ulcer is credited because of *H. pylori*. About 14%–25% of gastric and duodenal ulcers are seen as related with NSAID use. Interaction data and randomized trial with NSAIDs and *H. pylori* annihilation therapy uncovered that the ulcer-inducing effects of both hazard factors are cumulative. However, their potential interaction in the producing of ulcer disease remains unidentified. Eradication of *H. pylori* didn't reduces the rate of ulcer relapse in existing long term NSAID users. PUDs posse a multifactorial disease pathway significantly represented by acid disbalance and low mucosal defense prompting inflammation[18]. This is represented by hyper section of hydrochloric acid and pepsin. This causes an imbalance between gastric luminal element and degradation in the protective capacity of the gastric mucosal barrier for example mucus, secretion of bicarbonate, mucosal blood flow, and epithelial cell defense. On attack of acid and pepsin through a weakened area of the mucosal barrier prompts the release of histamine. Histamine stimulates parietal cells to secrete more acid. With the continuation of this endless loop resulting in disintegration to form the ulcer[19].

6.1. Role of *H. Pylori* infection

H. pylori prompted ulcer development is impacted by a variety of host and bacterial factors. Ulcers mostly occur at sites of most serious mucosal inflammation. Decreased acid output, usually is the gastric transitional zone between corpus and antrum, offer ascent to gastric ulcer disease. If acid production is normal to high, the most serious inflammation normally is found in the distal stomach and proximal duodenum, offering ascend to juxta-pyloric and duodenal ulcer disease. Anperson's definitive clinical outcome is dependent on the cytokine response and on the gastric acid secretion. An increase in stimulated acid production predisposes to duodenal ulceration and decreased acid formation predisposes to corpus gastritis or pangastritis which in turn predisposes to gastric ulceration, atrophic gastritis, and gastric carcinoma. The intragastric distribution of gastritis is thought to be dependent on host genetic factors, bacterial harmfulness factors and environmental factors including age at beginning of infection[20].

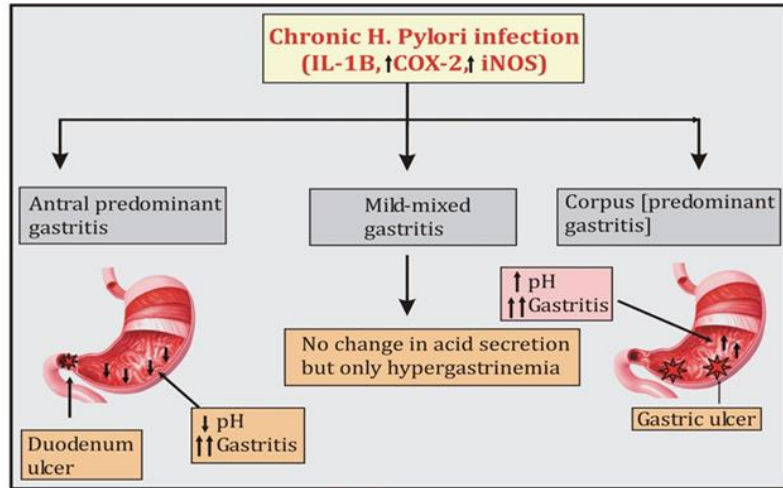


Fig 3: Depicting colonization of H. pylori in different regions of the stomach leading to various gastroduodenal diseases.

Duodenal ulcers are related with H. pylori–induced antrum predominant gastritis, diminished somatostatin levels and enlarged gastrin and acid secretion. Development of gastric metaplasia in the duodenum further permits bacterial colonization, in this manner prompting to duodenitis and epithelial damage. Gastric ulcers are associated with corpus gastritis, which is accepted to damage the epithelium. Eradication of the infection recuperates peptic ulcer disease, restablidhes ordinary acid secretion and prevents ulcer relapse. Host response plays a critical role in H. pylori induced ulceration. The humoral immune system has only marginal pertinence for defensive immunity in H. pylori infection. H. pylori induce a Th1- polarized response that unfortunately doesn’t result in clearance of the infection. H. pylori is thought to control the host immune response and inflammation. The key activator of the innate immune response is presumably intracellular peptidoglycan[21-22].

6.2. Role of NSAIDs

Severe ulcer complications and gastrointestinal damages have been associated with NSAIDs, since last two decades. The risk of these complications have been found to increase with geriatric population, previous history of peptic ulceration, and presumably the initial three months of NSAID treatment.. Endoscopic examination reported more gastric than duodenal ulcers related with NSAID use, however, patients shows the result with gastrointestinal bleeding on NSAIDs may have a comparative frequency of gastric and duodenal ulceration. NSAIDs will in general impact the Cyclo-Oxygenase (COX) pathways which lead to generate of prostanoids (prostaglandins, prostacycline, and thromboxane). This effect the mucosal protection by diminishing the effectiveness of the mucus-bicarbonate obstruction; gastric acid, and possibly also pepsin, plausibly causing damage. As most NSAIDs are also weak acids may also be a contributory factor responsible ulceration[23].

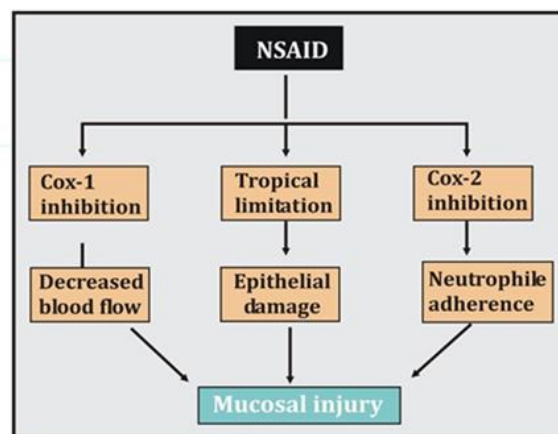


Fig 4: Pathogenesis of NSAIDs induced GI injury.

6.3. Stress

Stress due to serious health problems for example, those requiring treatment in an emergency care unit is well described as a reason for peptic ulcers, which are also called as stress ulcers. While chronic life stress was once accepted to be the main cause of ulcers, this is no longer the case. It is, however,

even now occasionally accepted to play a role. This may be due to the well documented impact of stress on gastric physiology, expanding the risk in those with other causes for example *H. pylori* or NSAID use.

6.4. Diet

Dietary factors, like as, spice consumption, were hypothesized to cause ulcers until late in the 20th century, however have been demonstrated to be of relatively minor importance. Caffeine and coffee, also commonly thought to cause or exacerbate ulcers, seem to have little effect. Similarly, while studies have discovered that alcohol consumption expands risk when associated with *H. pylori* infection, it does not appear to independently increase risk. Even when coupled with *H. pylori* infection, the increase is modest in comparison with the essential primary risk factor[24].

6.5. Other

Other reasons for peptic ulcer disease includes: gastric ischemia, drugs, metabolic disturbances, cytomegalovirus (CMV), upper abdominal radiotherapy, Crohn's disease, and vasculitis. Gastrinomas (Zollinger Ellisonsyndrome), rare gastrin-secreting tumors, also cause multiple and difficult-to-heal ulcers. It is still unclear if smoking increases the danger of getting peptic ulcers[25].

7. Diagnosis of peptic ulcer disease

Peptic ulceration is a diagnosis usually confirmed by flexible upper GI endoscopy. An ulcer is defined as a mucosal break with a diameter greater than 5 mm. Ulcers may be single or multiple and most commonly affect the lesser curve of the stomach and the first part of the duodenum. Gastric ulcers should be biopsied in every instance to exclude malignancy. All patients with a gastric ulcer should undergo a repeat endoscopy in 6 to 8 weeks following treatment to ensure ulcer healing, and further biopsies should be taken if there is any evidence of ongoing ulceration. This should be repeated until the ulcer has fully healed. During endoscopy for suspected peptic ulceration it is also possible to test for *H. pylori* by biopsying the gastric mucosa for histological identification, microbiological culture or rapid urease test. The rapid urease test (CLO test_) is widely available and the most commonly used method of detecting *H. pylori* during endoscopy. It has the advantage of being quick, cost effective, with a high sensitivity (97%) and specificity (100%) when multiple biopsies are taken[26-27].

8. Specific herbs with potential

Peptic ulcers are open sores that develop on the inside lining of the stomach, upper small intestine, or esophagus. While conventional treatments for peptic ulcers include proton pump inhibitors (PPIs), H2 receptor blockers, and antibiotics (for *H. pylori* infection), several herbs have shown potential in managing and healing peptic ulcers. Here are specific herbs that are known for their beneficial effects on peptic ulcers:

8.1. Licorice root (*glycyrrhiza glabra*)

Licorice root, derived from the plant *Glycyrrhiza glabra*, is a perennial herb that belongs to the legume family Fabaceae. Known for its sweet flavor, licorice root has been used for thousands of years in various cultures for its medicinal, culinary, and cosmetic properties. Native to southern Europe, parts of Asia, and the Mediterranean, this plant thrives in well-drained soils and can grow up to five feet tall, characterized by its blue or violet flowers and feathery leaves[28].

Botanical Description

Family: Fabaceae (Leguminosae)

Common Names: Licorice, Sweet Root, Liquorice

Plant Description:

Roots: Licorice root is a perennial plant with a long, branched, cylindrical, woody root system. The roots are brown externally and yellow internally.

Stems: The stems are erect and branched.

Leaves: Compound leaves with 9-17 leaflets, oblong to ovate in shape.

Flowers: Small, pale blue to violet, arranged in axillary racemes.

Fruits: Small, oblong pods containing several seeds[29].



Fig 5. Licorice Root (*Glycyrrhiza glabra*)

Macroscopic Characteristics

Color: Brown on the outside, yellow on the inside.

Texture: Woody, fibrous texture.

Taste: Sweet, slightly bitter, and astringent.

Odor: Characteristic, faint.

Chemical Constituents

Glycyrrhizin (Glycyrrhizic Acid): The main active compound, a triterpenoid saponin, which is responsible for the sweet taste and has anti-inflammatory properties.

Flavonoids: Including liquiritin, isoliquiritin, and liquiritigenin, which have antioxidant and anti-inflammatory effects.

Coumarins: Including herniarin and umbelliferone.

Polysaccharides: Which contribute to mucosal protection.

Volatile Oils: Such as anethole, contributing to its flavor and potential therapeutic effects[30].

Pharmacological Actions Relevant to Peptic Ulcers

Anti-inflammatory: Glycyrrhizin inhibits the enzyme 11 β -hydroxysteroid dehydrogenase, leading to increased levels of endogenous corticosteroids, which reduce inflammation.

Anti-ulcer Activity: Licorice root extract has been shown to increase mucus secretion in the stomach, providing a protective barrier against stomach acid and promoting healing of ulcers.

Anti-*H. pylori* Activity: Glycyrrhizin and flavonoids exhibit antibacterial properties that help inhibit the growth of *H. pylori*, a bacterium associated with peptic ulcers.

Antioxidant Properties: Flavonoids and other compounds scavenge free radicals, reducing oxidative stress and promoting healing of the gastric mucosa.

Immune Modulation: Licorice root modulates immune responses, which can help reduce inflammation and promote healing[31].

Dosage Forms and Usage

DGL (Deglycyrrhizinated Licorice): Preferred for treating peptic ulcers due to the removal of glycyrrhizin, which can cause side effects like hypertension and edema. Typically available as chewable tablets or powder.

Extracts and Tinctures: Standardized extracts that contain specific amounts of glycyrrhizin and other active compounds.

Teas and Decoctions: Prepared by boiling the dried root in water.

Safety and Toxicity

Side Effects: Excessive consumption of glycyrrhizin can lead to pseudoaldosteronism, characterized by sodium retention, potassium loss, hypertension, and edema.

Contraindications: Should be used with caution in individuals with hypertension, renal disease, liver disorders, or those on corticosteroid therapy.

Pregnancy and Lactation: Use with caution; consult a healthcare provider before use.

Quality Control

Identification Tests: Thin-layer chromatography (TLC), high-performance liquid chromatography (HPLC), and spectrophotometric methods are used for identifying and quantifying glycyrrhizin and other active constituents.

Purity Tests: Assessments for contaminants such as heavy metals, pesticides, and microbial contamination.

Standardization: Ensuring consistent levels of active compounds, particularly glycyrrhizin[32].

8.2. Slippery elm (*Ulmus rubra*)

Slippery Elm (*Ulmus rubra*), also known as Red Elm, is a deciduous tree native to North America, widely recognized for its distinctive reddish-brown to dark brown bark, which becomes rough and fissured with age. It belongs to the Ulmaceae family and is typically found in moist, nutrient-rich soils in forests, along streams, and in floodplains from the eastern to the central United States and southeastern Canada.

Botanical Characteristics-Slippery Elm can reach heights of 60 to 80 feet, with a broad, vase-shaped crown. Its leaves are ovate, measuring 4 to 8 inches in length, with serrated margins and an asymmetrical base, typical of elm species. The upper surface of the leaves is rough to the touch, while the underside is covered in soft, velvety hairs. In early spring, before the leaves emerge, the tree produces small, inconspicuous, greenish-red flowers that are wind-pollinated. These flowers give way to samaras—flat, winged seeds that are dispersed by the wind[33].

Medicinal and Traditional Uses- One of the most notable features of Slippery Elm is its inner bark, which contains a mucilaginous substance that becomes slippery when mixed with water. This mucilage has been utilized for centuries in traditional medicine by Native American tribes and later by European settlers. It was commonly used to treat digestive issues, sore throats, and respiratory ailments due to its soothing, anti-inflammatory properties. The inner bark can be dried and powdered to create teas, lozenges, and poultices.



Fig 6. Slippery Elm (*Ulmus rubra*)

Cultivation and Care-For those interested in cultivating Slippery Elm, it is essential to provide a site with well-drained, loamy soil and ample sunlight, although it can tolerate partial shade. The tree is relatively hardy and can withstand a range of environmental conditions once established. Regular monitoring for signs of disease and pests, along with appropriate preventative measures, is crucial for maintaining healthy specimens[34].

Morphological Characteristics:

Tree Description: *Ulmus rubra*, commonly known as Slippery Elm, is a medium-sized deciduous tree native to North America. It belongs to the Ulmaceae family.

Leaves: The leaves are alternate, oval to elliptical in shape, with serrated edges. They have a rough texture on top and a soft, downy texture underneath.

Bark: The inner bark is the part used for medicinal purposes. It is reddish-brown and has a slippery, mucilaginous texture when chewed or mixed with water.

Flowers and Fruits: Slippery Elm produces small, inconspicuous flowers and winged fruits called samaras[35].

Chemical Composition:

Mucilage: The inner bark of Slippery Elm contains a high concentration of mucilage, a complex mixture of polysaccharides (mainly consisting of arabinogalactans and galacturonic acid). Mucilage is responsible for the plant's slippery and gel-like consistency when mixed with water.

Tannins: Tannins are also present in Slippery Elm bark, albeit in lower amounts compared to the mucilage. Tannins have astringent properties and can help reduce inflammation and tighten mucous membranes.

Pharmacological Actions Relevant to Peptic Ulcers:

Demulcent: The mucilage content in Slippery Elm has demulcent properties, forming a protective coating over irritated or inflamed mucous membranes in the gastrointestinal tract. This soothing effect can help alleviate pain and discomfort associated with peptic ulcers.

Anti-inflammatory: Tannins and other compounds in Slippery Elm bark have mild anti-inflammatory effects, which can contribute to reducing inflammation in the stomach lining, thereby aiding in the healing of ulcers.

Mucosal Protection: The mucilage also acts as a barrier that protects the stomach lining from the corrosive effects of gastric acid, promoting the healing of ulcers and preventing further damage.

Recommendations may vary based on the manufacturer's instructions and individual needs[36].

8.3. Aloe vera

Aloe vera is a perennial, drought-resisting, succulent plant belonging to the Asphodelaceae family. The name, aloe, is derived from the Arabic "aloe" or Hebrew "halal" meaning bitter shiny substance. It has a vast traditional role in indigenous system of medicine like ayurveda, siddha, Unani and homoeopathy. Aloe barbadensis miller or Aloe vera, a semi tropical plant is one of the 250 species of Aloe. Most commonly used for its medicinal properties, Aloe Vera or the Sanskrit name "Ghee kunwar" is a member of Lilly family. The plant has lance-shaped, sharp pointed, and jagged & edged leaves. Aloe vera is found as the wild herb along the coast of south India. It is under cultivation in fairly large areas in many parts of India viz; Tamil Nadu, Gujarat, Maharashtra etc. Aloes are often thought to only grow in hot and dry climates but they actually grow in a variety of climates including desert, grassland, and coastal or even alpine locations. There are more than 200 compounds found in Aloe barbadensis, about 75 of which have biological activity, Aloe vera leaves contain a diverse array of compounds, including anthraquinones (e.g. aloe-emodin), anthrones and their glycosides (e.g. 10-(1, 5' anhydroglucosyl)-aloeemodin- 9-anthrone, also known as aloin A and B), chromones, carbohydrates, proteins, glycoproteins, amino acids, organic acids, lipids, sugars, vitamins and minerals. Aloe vera has number of uses and mainly they are used as a food preservative and medicine. Commercially, aloe can be found in pills, sprays, ointments, lotions, liquids, drinks, jellies, and creams. Numerous aloe species around the world are used for conditions ranging from dermatitis to cancer. Various studies have revealed that Aloe vera leaf possesses many pharmaceutical activities, including antimicrobial, anticancer, antioxidant, antidiabetic, antiulcer, hepatoprotective, immunomodulatory and many more activities. Many of the health benefits associated with Aloe vera have been attributed to the polysaccharides contained in the gel of the leaves[37].

Botanical Features: Aloe Vera is characterized by its thick, fleshy leaves that store water, making it well-adapted to survive in dry conditions. The leaves are serrated along the edges and contain a gel-like substance that is the source of its medicinal and cosmetic benefits.



Fig 7. Aloe vera Plant

Morphological Characteristics:

Plant Description: Aloe vera is a succulent plant with thick, fleshy leaves arranged in rosettes. The leaves are green to gray-green, with serrated edges and a gel-filled interior.

Roots: Aloe vera has a fibrous root system that aids in anchoring the plant and absorbing water and nutrients from the soil.

Stem: The stem of Aloe vera is short and thick, mainly serving as a support structure for the leaves.

Leaves: The leaves of Aloe vera are the most pharmacologically active part of the plant. They are lanceolate (long and narrow) and contain the gel and latex components[38].

Chemical Constituents:

Polysaccharides: Aloe vera gel is primarily composed of complex polysaccharides, including acemannan (or aloverose), glucomannans, and other mucopolysaccharides. These polysaccharides contribute to the gel's soothing and healing properties.

Anthraquinones: The latex portion of Aloe vera contains anthraquinone derivatives, including aloin, aloe-emodin, and others. Aloin has laxative effects but is typically removed or reduced in commercial preparations intended for internal use due to its potential irritation to the digestive tract.

Flavonoids: Aloe vera also contains flavonoids with antioxidant and anti-inflammatory properties, such as quercetin, kaempferol, and rutin.

Enzymes: Enzymes like amylase, lipase, and catalase are present in Aloe vera gel and may contribute to its digestive and healing effects[39].

Medicinal Uses

Medicinal properties of Aloe vera range from external burn treatments to helping relieve constipation by consumption. Aloe vera is the most efficacious natural plant used both externally and internally and there are numerous benefits that are derived from this wonderful plant. The health benefits of Aloe vera have been propagated throughout the world. There are two parts of Aloe vera that are commonly used. The bitter exudate is used as a natural drug for its cathartic effect and is widely employed as a bittering agent in alcoholic beverages and as a laxative. The dried latex, with a high barbaloin content, is a strong laxative, but its use should be limited to no more than one week, and it should not be used during menstruation, pregnancy and nursing. The suggested medicinal use of Aloe vera is based on its historic and traditional use, and an analysis of modern pharmacological and toxicological research.

The inner gel, or “pure gel”, is the more readily known part of the Aloe vera plant. This is the section of the plant that is most commonly known to be used for treatments of sun burns. But if prepared properly, the inner gel can be consumed to help treat certain internal ailments[40].

Pharmacological Actions Relevant to Peptic Ulcers:

Anti-inflammatory: Aloe vera gel has potent anti-inflammatory effects, which can help reduce inflammation and irritation in the stomach lining associated with peptic ulcers.

Mucosal Protection: The mucopolysaccharides in Aloe vera gel form a protective layer over the gastric mucosa, promoting healing and reducing the risk of ulceration.

Wound Healing: Aloe vera stimulates the production of collagen and promotes wound healing, which is beneficial for ulcer repair.

Antibacterial: Some components of Aloe vera, particularly anthraquinones, exhibit antibacterial activity, which may help in inhibiting the growth of *H. pylori* bacteria, a common cause of peptic ulcers[41].

8.4. Turmeric (*curcuma longa*)

Turmeric, scientifically known as *Curcuma longa*, is a flowering plant in the ginger family, Zingiberaceae. It is native to the Indian subcontinent and Southeast Asia, where it thrives in tropical and subtropical climates. Turmeric requires warm temperatures between 20°C to 35°C and substantial annual rainfall to grow optimally.

Taxonomical Classification

Kingdom: Plantae

Subkingdom: Tracheobionta

Superdivision: Spermatophyta

Division: Magnoliophyta

Subclass: Zingiberidae

Order: Zingiberales

Family: Zingiberaceae

Genus: *Curcuma*

Species: *longa*

Scientific name: *Curcuma longa*.

Botanical Characteristics-Turmeric is a perennial, rhizomatous herbaceous plant. It has a robust underground stem system (rhizomes) which are harvested annually. These rhizomes are the primary source of turmeric powder, known for its vibrant orange-yellow color and warm, bitter taste (Wikipedia). The rhizomes are either used fresh or boiled and dried before being ground into powder[42].

Cultivation and Soil Requirements-Turmeric grows best in well-drained, sandy, or clay loam soils rich in organic matter, with a pH range of 4.5 to 7.5. It can be cultivated under both irrigated and rain-fed conditions, often at altitudes up to 1500 meters above sea level. The plant is typically propagated from rhizomes, with both mother and finger rhizomes being used. Proper soil preparation and manuring are crucial for a healthy crop, with recommendations for decomposed farmyard manure and specific N:P:K ratios[43].



Fig 8. Turmeric Plant

Chemical Constituents

Curcuminoids:

Curcumin: The principal active component, responsible for the yellow color and therapeutic effects.

Demethoxycurcumin: A variant of curcumin with similar properties.

Bisdemethoxycurcumin: Another curcumin derivative.

Volatile Oils:

Turmerone: Contributes to anti-inflammatory and antimicrobial activities.

Atlantone: Exhibits anti-inflammatory properties.

Zingiberene: Adds to the aromatic profile and therapeutic effects.

Pharmacological Activities Relevant to Peptic Ulcer

Anti-inflammatory Properties:

Curcumin has potent anti-inflammatory effects, reducing inflammation of the gastric mucosa which is crucial in the healing of peptic ulcers.

Antioxidant Activity:

Curcumin scavenges free radicals, protecting the gastric mucosa from oxidative damage.

Antimicrobial Activity:

Curcumin exhibits antibacterial effects, particularly against *Helicobacter pylori*, a common cause of peptic ulcers.

Cytoprotective Effects:

Curcumin enhances the production of gastric mucus, providing a protective barrier against stomach acid.

Inhibition of Acid Secretion:

Curcumin has been shown to inhibit gastric acid secretion, reducing irritation of the ulcerated area[44].

8.5. Marshmallow root (*Althaea officinalis*)

Marshmallow root (*Althaea officinalis*) is a perennial herb indigenous to Europe, Western Asia, and North Africa, renowned for its medicinal and culinary uses. This plant, which thrives in damp environments such as marshes (hence its name), has been utilized for centuries due to its numerous health benefits.

Botanical Description

Family: Malvaceae

Common Names: Marshmallow, White Mallow

Plant Description:

Roots: Thick, white, fibrous, and fleshy roots.

Leaves: Soft, velvety, ovate to heart-shaped, with irregularly toothed margins.

Flowers: Pale pink or white, five-petaled, and arranged in axillary clusters.



Fig 9. Marshmallow root (*Althaea officinalis*)

Macroscopic Characteristics

Root Characteristics:

Color: White or pale yellow.

Shape: Cylindrical, tapering, and somewhat branched.

Size: Usually around 1-2 cm in diameter and 10-15 cm in length.

Texture: Tough and fibrous externally, with a smooth, starchy interior.

Microscopic Characteristics

Root Powder Characteristics:

Parenchyma Cells: Large, thin-walled, filled with starch granules.

Mucilage Cells: Contain mucilage, appearing as swollen cells.

Fibers: Scattered, elongated, and lignified.

Vascular Bundles: Small, scattered with xylem vessels.

Chemical Constituents

Primary Constituents:

Mucilage Polysaccharides: Comprising up to 35% of the root, including arabinogalactans, rhamnogalacturonans, and glucans.

Flavonoids: Such as quercetin, kaempferol, and their glycosides.

Phenolic Acids: Including ferulic acid and caffeic acid.

Starch: Contributing to the root's carbohydrate content.

Pectins: Gel-forming polysaccharides[45].

Pharmacological Actions Related to Peptic Ulcers

Mucilage Content:

Protective Effect: Forms a protective layer on the mucous membranes of the stomach and intestines, reducing irritation and aiding in the healing process.

Barrier Function: Mucilage can act as a barrier against the harsh effects of stomach acid, thereby preventing further damage to the ulcerated tissues.

Anti-inflammatory Properties:

Reduction of Inflammation: The flavonoids and phenolic acids present in marshmallow root contribute to its anti-inflammatory effects, helping reduce gastric inflammation associated with peptic ulcers.

Demulcent Action:

Soothing Effect: The mucilage provides a soothing effect on the gastrointestinal tract, relieving pain and discomfort associated with ulcers.

Moistening Effect: Helps in maintaining hydration of the mucosal membranes, promoting repair and regeneration of ulcerated tissues[46].

8.6. Chamomile (*matricaria chamomilla*)

Chamomile (*Matricaria chamomilla* L.) is one of the important medicinal herb native to southern and eastern Europe. It is also grown in Germany, Hungary, France, Russia, Yugoslavia, and Brazil[47]. It was introduced to India during the Mughal period, now it is grown in Punjab, Uttar Pradesh, Maharashtra, and Jammu and Kashmir. The plants can be found in North Africa, Asia, North and South America, Australia, and New Zealand. Hungary is the main producer of the plant biomass. In Hungary, it also grows abundantly in poor soils and it is a source of income to poor inhabitants of these areas. Flowers are exported to Germany in bulk for distillation of the oil[48]. In India, the plant had been cultivated in Lucknow for about 200 years, and the plant was introduced in Punjab about 300 years ago during the Mughal period. It was introduced in Jammu in 1957 by Handa et al. The plant was first introduced in alkaline soils of Lucknow in 1964–1965 by Chandra et al. There is no demand for blue oil as such at present in India. However, flowers of chamomile are in great demand. Presently, 2 firms, namely, M/s Ranbaxy Labs Limited, New Delhi and M/s German Remedies are the main growers of chamomile for its flowers. Chamomile has been used in herbal remedies for thousands of years, known in ancient Egypt, Greece, and Rome. This herb has been believed by Anglo-Saxons as 1 of 9 sacred herbs given to humans by the lord. The chamomile drug is included in the pharmacopoeia of 26 countries. It is an ingredient of several traditional, unani, and homeopathy medicinal preparations. As a drug, it finds use in flatulence, colic, hysteria, and intermittent fever[49].



Fig 10. Chamomile (*Matricaria chamomilla* L.)

Botanical Description

Family: Asteraceae (Compositae)

Common Names: German chamomile, Hungarian chamomile, true chamomile

Description:

Appearance: Chamomile is an annual herb that grows up to 60 cm tall. It has a branched, erect, and smooth stem.

Leaves: The leaves are alternate, sessile, and finely divided, with a feathery appearance[50].

Flowers: The flowers are daisy-like with a yellow conical center (composed of tubular disc florets) and white ray florets surrounding it. The inflorescence is a capitulum.

Roots: The plant has a thin, branching root system.

Phytochemical Constituents

Chamomile contains a variety of bioactive compounds, which contribute to its medicinal properties, especially in treating peptic ulcers.

Key Constituents:

Essential Oils: Chamazulene, α -bisabolol, bisabolol oxides, and bisabolene.

Flavonoids: Apigenin, luteolin, quercetin, and patuletin.

Other Compounds: Coumarins (herniarin and umbelliferone), polyacetylenes, and phenolic acids.

Pharmacological Actions Related to Peptic Ulcers

The therapeutic efficacy of chamomile in peptic ulcer treatment is attributed to its diverse pharmacological actions:

Anti-inflammatory Effects: Chamomile's anti-inflammatory properties are largely due to α -bisabolol and chamazulene. These compounds inhibit the synthesis of pro-inflammatory mediators, reducing gastric inflammation.

Antispasmodic Action: Apigenin and other flavonoids present in chamomile exhibit antispasmodic effects, which help relax the smooth muscles of the gastrointestinal tract, alleviating cramps and discomfort associated with peptic ulcers[51].

Ulcer Healing: Chamomile promotes the healing of ulcers by enhancing mucosal regeneration and increasing mucus production, which protects the gastric lining from acidic damage.

Antimicrobial Activity: Chamomile exhibits antimicrobial properties against *Helicobacter pylori*, a bacterium implicated in the development of peptic ulcers. This activity is primarily due to the essential oils and flavonoids in the plant.

Antioxidant Properties: The flavonoids and other polyphenolic compounds in chamomile have strong antioxidant effects, which protect the gastric mucosa from oxidative stress-induced damage[52].

Acknowledgements

Authors (Shivshankar M. Nagrik) are grateful to, Akanksha D. Thigale, Vaishnavi R Ghait, Shivani G. Ambhore, Bhavika A. Wargat, Samruddhi P. Sable, Shraddha S. Pathrikar.

Conclusion

In conclusion, peptic ulcers present a significant medical concern, with millions affected globally each year. These ulcers, often caused by factors like *H. pylori* infection or NSAID use, can lead to severe complications if left untreated, such as bleeding or gastric outlet obstruction. However, timely diagnosis through methods like endoscopy and effective management strategies involving lifestyle changes, medication, and potential herbal remedies offer hope in alleviating symptoms, promoting healing, and preventing complications. Incorporating herbs like licorice root, slippery elm, aloe vera, turmeric, marshmallow root, and chamomile, with their diverse pharmacological actions, can contribute positively to peptic ulcer management, providing relief and supporting ulcer recovery. Through ongoing research and advancements in medical care, the outlook for individuals with peptic ulcers continues to improve, emphasizing the importance of comprehensive healthcare approaches in addressing this prevalent gastrointestinal condition.

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