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# Botanical Insights into Peptic Ulcer Disease: Therapeutic Potential of Medicinal Plants

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**ABSTRACT**: This article investigates the relationship between medicinal plants and their therapeutic effects, specifically targeting peptic ulcers in the stomach. While traditional uses of medicinal plant extracts often focus on skin conditions, superficial ailments like ulcers can also affect the gastrointestinal tract. To evaluate the impact of specific medicinal plants on peptic ulcer disease, we will extract their chemical compounds using methods such as Soxhlet extraction, TLC, and HPLC. A disease model will then be established using laboratory animals, including rats, mice, and guinea pigs, with ulcers induced through various chemical and physical techniques. After administering specific doses of the selected medicinal plants, we will assess the animals' responses to the induced ulcers and the treatments. The research will highlight several plants, including Urtica simensis, Cucumis melo, Zanthoxylum armatum (tambulin), Abrus precatorius and Jasminum sambac, ultimately providing a comprehensive analysis of their efficacy in treating induced ulcers in a laboratory context.

**KEYWORDS:(11 Bold)**Peptic ulcer, medicinal plants, H. pylori, NSAIDs, gastric mucosa, proton pump inhibitors, flavonoids, antioxidant, cytoprotective, anti-ulcer agents, bioactive compounds, alternative treatments.

## I. INTRODUCTION

Peptic ulcers are a common disorder of the stomach, primarily caused by Helicobacter pylori, but increasingly linked to stress and tension. These ulcers typically arise from an imbalance between protective and aggressive factors. While certain medications, such as NSAIDs, can induce ulcers, protective mechanisms include bicarbonate, prostaglandins, gastric mucosa, and the presence of H. pylori. Ulcers develop when aggressive factors overwhelm these defensive mechanisms. In addition to medicinal plants, synthetic medications like proton pump inhibitors, H2 receptor antagonists, cytoprotectants, demulcents, anti-cholinergics, antacids, and prostaglandin analogs are commonly used to treat ulcers. However, these synthetic options often come with various side effects, making herbal formulations a preferable alternative. **[1]**

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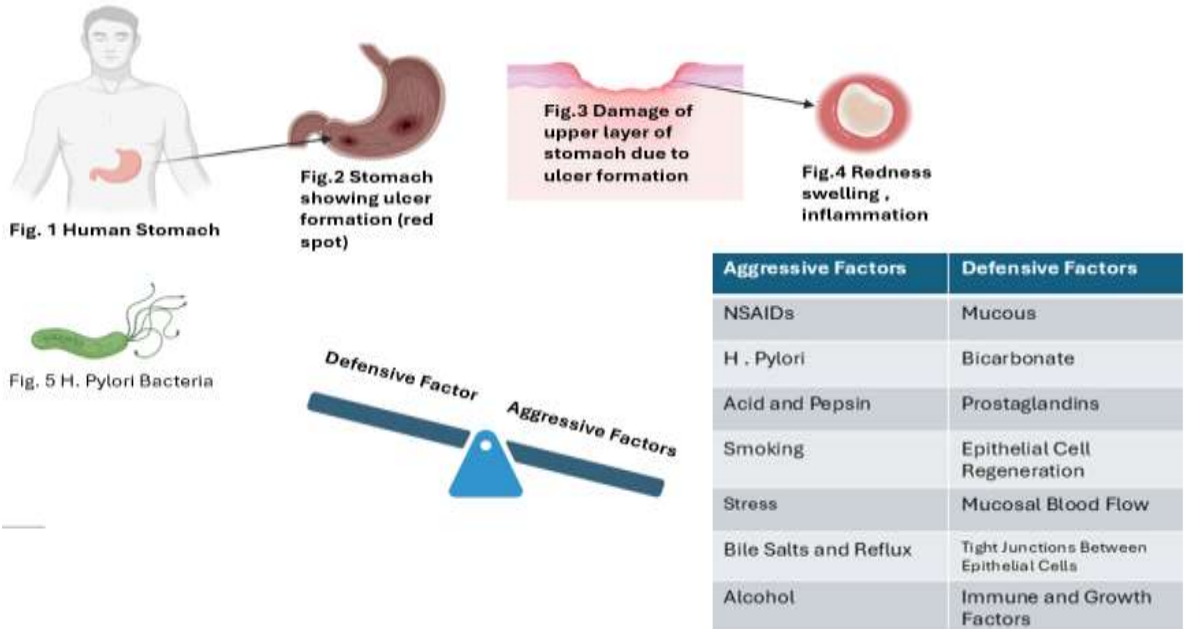


| Aggressive Factors | Defensive Factors |
|---|---|
| NSAIDs | Mucous |
| H . Pylori | Bicarbonate |
| Acid and Pepsin | Prostaglandins |
| Smoking | Epithelial Cell Regeneration |
| Stress | Mucosal Blood Flow |
| Bile Salts and Reflux | Tight Junctions Between Epithelial Cells |
| Alcohol | Immune and Growth Factors |

Fig . Showing Pathophysiology behind peptic ulcer

## II. MEDICINAL PLANTS

The aqueous and methanolic extracts Urtica simensis indicate that significantly decreases both gastric secretion volume and overall acidity in a rat model of pylorus ligation gastric ulcers, especially at doses of 200 and 400 mg/kg.. Additionally, these extracts enhance gastric wall mucus production in a manner that depends on the dosage, providing protection to the stomach lining against damage in indomethacin-induced gastric ulcers. Both extracts promote mucus secretion, with the methanolic extract demonstrating superior efficacy at higher doses, achieving up to 75.87 ± 1.52 µg alcian blue per gram of wet stomach tissue in an ethanol-induced gastric ulcer model in rats. [2]

**Cucumis melo**

In a study with 35 male Wistar rats, the subjects were categorized into seven groups: one control group, one ulcer-induced group treated with ibuprofen at 400 mg/kg, and several groups receiving misoprostol along with different concentrations of Cucumis melo, ranging from 25% to 100%. Cucumis melo demonstrated notable anti-ulcer properties, increased the synthesis of prostaglandins, and exhibited strong antioxidant activity, positioning it as a promising candidate for combating NSAID-induced gastric ulcers. [3]

**Dichrostachys cinerea (Tambulin and ombuin)**

Tambulin, a flavonoid extracted from Zanthoxylum armatum, shows significant promise in ulcer management. Both the ethyl acetate extract and ombuin exhibit dose-dependent anti-ulcer effects. At a dosage of 50 mg/kg, tambulin demonstrated the highest efficacy, resulting in an ulcer index of 2.8 ± 0.6 mm² and a 69.5% inhibition rate in the pylorus-ligated model, as well as an index of 5.2 ± 0.7 mm² with 70.2% inhibition in the ethanol-induced ulcer model. [4]

**Anogeissus pendula:**

Ranitidine (20 mg/kg body weight) and the hydroalcoholic extract of Anogeissus pendula (APHAE) were administered orally at doses of 200 and 400 mg/kg body weight, one hour prior to pylorus ligation. Treatment with APHAE at both dosages led to a significant reduction in gastric lesions ($P < 0.001$). There were notable decreases in the ulcer index and gastric volume, as well as reductions in both free and total acidity ($P < 0.001$). Additionally, APHAE administration resulted in a significant increase in the pH of gastric juice. The protein content in the gastric juice of the treated rats was also significantly lower ($P < 0.001$). Moreover, pretreatment with APHAE significantly reduced levels of superoxide dismutase (SOD), glutathione (GSH), and catalase (CAT), while also decreasing lipid peroxidation (LPO) ($P < 0.001$). [5]

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**Abrus precatorius:**

Rats received the ethyl acetate extract of Abrus precatorius seeds (EEAPS) at doses of 100 and 200 mg/kg body weight, alongside standard medications diclofenac and cimetidine (50 mg/kg body weight) over a period of 8 days. Treatment with HCl/EtOH significantly increased stomach ulceration scores and elevated the expression of COX-2, iNOS, IL-1β, NF- kB, and TNF-α mRNA compared to normal controls ($P < 0.05$). Pre-treatment with EEAPS and the standard drugs effectively reversed these changes, with the 200 mg/kg dose demonstrating the highest efficacy. [6]

**Jasminum Sambac:**

Callus extracts from Jasminum sambac demonstrate significant anti-ulcerogenic effects, positioning them as a potential source for developing new anti-ulcer treatments with reduced side effects. These extracts effectively decrease gastric volume and both free and total acidity, while also enhancing the pH of gastric fluid, indicating their anti-secretory properties. At a dosage of 200 mg/kg, the callus extract demonstrated a protection index of 65.41%, comparable to the effects of omeprazole. Furthermore, the study revealed that the extract significantly reduced pepsin content and enhanced the carbohydrate-protein ratio compared to the control groups. [7]

**Hedge Mustard Seeds:**

The extract from Hedge mustard seeds exhibited notable cytoprotective effects against aspirin-induced ulcers in rats, particularly at a dose of 400 mg/kg. In the study, rats were assigned to three groups: control, disease control, and extract-treated, receiving the extract orally prior to aspirin administration. Acute toxicity tests showed that the extract was non-toxic at a dose of 2000 mg/kg, with no significant adverse effects noted in sub-chronic studies. Aspirin treatment led to a marked increase in ulcer index and a reduction in mucosal thickness; however, pre-treatment with the Hedge mustard extract at 400 mg/kg significantly decreased the ulcer index and improved mucosal thickness. Additionally, the extract treatment enhanced alkaline phosphatase (AP) activity in gastric tissue compared to the aspirin-treated controls, suggesting improved mucosal integrity. [8]

**Acioabarteri:**

The ethanol extract of Acioabarteri leaves demonstrates significant anti-ulcer activity, comparable to standard treatments such as ranitidine and lansoprazole. Indomethacin administration led to a high ulcer index of 4.17, which was significantly lowered by the Acioa leaf extracts—reducing it to 0.61 at a dosage of 500 mg/kg and 1.83 at 250 mg/kg—compared to ranitidine, which had an ulcer index of 0.50. The extract also substantially decreased acidity levels (30.5 mEq/L at 250 mg/kg and 22.5 mEq/L at 500 mg/kg) and gastric acid volume, while increasing the pH of gastric juice to 4.00 at 250 mg/kg and 5.00 at 500 mg/kg. Treatments with Acioa extracts resulted in less gastric mucosal damage compared to the negative control, indicating their gastroprotective properties. [9]

**Cassia Tora and Butea Monospora:**

Kaempferol and Gallic Acid, derived from Cassia tora and Butea monosperma, show significant potential as anti-ulcer agents, as indicated by their strong binding affinities identified through molecular docking studies. Kaempferol demonstrated the highest binding energy at -8.7 kcal/mol, followed closely by Gallic Acid at -8.3 kcal/mol, while the standard drug ranitidine showed a lower binding energy of -5.4 kcal/mol. Both Kaempferol and Gallic Acid interacted significantly with critical amino acid residues in the active site of the enzyme; specifically, Kaempferol engaged with GLU374, ARG846, and ARG775, while Gallic Acid interacted with TYR799 and CYS813. These interactions, visualized using Biovia Discovery Studio, suggest that these compounds could effectively inhibit gastric enzyme activity, similar to the effects of ranitidine. [10]

**Lagenaria Siceraria :**

The ulcer-inhibiting effects of the methanolic extract are probably attributed to its ability to decrease gastric acid secretion and enhance mucosal protection. The extract significantly reduced the ulcer index and increased the percentage of ulcer inhibition compared to the control group in all tested models. Treatment with Lagenaria siceraria extract led to decreases in gastric volume, free acidity, and total acidity, suggesting a potential anti-secretory effect. The methanolic extract exhibited promising results in preventing gastric ulcers, comparable to the standard anti-ulcer medication ranitidine. The fruits of Lagenaria siceraria demonstrate considerable anti-ulcer activity, potentially owing to their anti-secretory, cytoprotective, and antioxidant properties. [11]

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**AsystasiaGangetica (Chinese Violet):**

Acute toxicity studies indicate that Asystasiagangetica is relatively safe for consumption at the tested doses. The anti-ulcer activity of the extract is dose-dependent, with higher doses leading to a significant reduction in lesions compared to the control group. The gastroprotective effects are likely attributed to the presence of bioactive compounds such as flavonoids and alkaloids, which align with its traditional uses in folk medicine. No significant toxic effects were noted even at high doses (up to 10 g/kg). The extract demonstrated substantial ulcer inhibition, with doses of 125 mg/kg, 250 mg/kg, and 500 mg/kg achieving 42.61%, 64.35%, and 89.56% inhibition, respectively. Key constituents identified included phenolic compounds, glycosides, saponins, and alkaloids. Thin layer chromatography confirmed the presence of various phytochemicals, supporting the extract's medicinal potential. A total of 26 compounds were detected, including notable ones like octadecenoic acid ester and beta-sitosterol, recognized for their antioxidant and anti-inflammatory properties. Spectroscopic analysis further indicated the presence of functional groups linked to different bioactive compounds. [12]

**Garcinia cambogia:**

The study highlighted the effective the gastro-protective and anti-ulcer effects of Garcinia cambogia are linked to its phytochemical composition. Ethanol-induced ulcers resulted in mucosal damage due to oxidative stress and free radicals, which the extract effectively alleviated. The findings provide insights into the underlying mechanisms, indicating that the active components in the extract contribute to its protective effects against gastric lesions. In the ethanol-induced ulcer model, the extract demonstrated dose-dependent protection, with significant reductions in ulcer index compared to the control group. The group treated with 200 mg/kg exhibited an ulcer index of 9.69, yielding a protection rate of 53.50%. In the group treated with 400 mg/kg, the ulcer index further decreased to 5.23, corresponding to the same protection rate. In the pylorus ligation model, the extract significantly reduced gastric juice volume as well as free and total acidity. The ulcer index at 200 mg/kg was 5.76, while at 400 mg/kg it dropped to 3.83, with protection rates of 36.40% and 57.70%, respectively. [13]

**Syzygiumcumini:**

The results indicate that Syzygiumcumini seeds possess significant anti-ulcer activity, likely due to their phytochemical content-especially flavonoids and tannins—recognized for their antioxidative and mucosal protective effects. The ethyl acetate fraction displayed more potent activity than the methanol extract, likely because it contained a higher concentration of active compounds. In the ethanol-induced ulcer model, both the methanol extract (ME) and the ethyl acetate fraction (EAF) significantly reduced ulcer formation. In the pylorus ligation model, both extracts led to decreased gastric secretions and significantly increased pH levels, reflecting their gastroprotective properties. Ranitidine was used as a standard comparison. In experiments involving aspirin in conjunction with pylorus ligation, the extracts significantly lowered ulcer index and free acidity compared to the control. Statistical analysis revealed significant differences ($P < 0.05$) between the treated groups and the solvent control. The study confirms the anti-ulcer effects of Syzygiumcumini seeds, demonstrating that both the methanol extract and particularly the ethyl acetate fraction provide gastroprotection comparable to standard anti-ulcer medications. [14]

**Moringa oleifera :**

The study assessed the nutrient composition and the ulcer-inhibiting effects of the methanolic extract derived from Moringa oleifera leaves. proximate assessment revealed that these leaves have relatively low moisture and protein content but are high in carbohydrates and fiber. Phytochemical screening identified several bioactive compounds, including flavonoids, alkaloids, phenols, tannins, saponins, and glycosides, all known for their health benefits. The ulcer- inhibiting effects of the extract were tested in mice using an aspirin-induced ulcer model, where it demonstrated a significant a reduction in the ulcer index that depends on the dosage, in comparison to the control group. Additionally, the extract enhanced mucosal thickness in the stomach, suggesting its potential for promoting ulcer healing. These findings indicate that Moringa oleifera leaves may possess valuable ulcer-inhibiting properties and could be beneficial in the treatment of peptic ulcers. [15]

**Psidium guajava:**

The study highlights the gastroprotective potential of Psidium guajava seeds, with specific compounds, particularly sterols, likely contributing

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to their anti-ulcer effects. LC-MS analysis detected various compounds, including sterols, phenolic acids, and flavonoids. The guava seed extract significantly reduced gastric ulcer formation in rats triggered by indomethacin, and histopathological assessments confirmed its protective impact on the gastric mucosa. Docking studies suggested that sterols such as campesterol and stigmasterol may inhibit the gastric proton pump, a crucial element in ulcer development. Additionally, some compounds indicated potential interactions with inflammatory mediators, hinting at a broader anti-ulcer mechanism.

**Pseudocedrelakotschyi and Ximenia Americana:**

This study investigated the efficacy of extracts from Pseudocedrelakotschyi and Ximenia americana in the prevention and treatment of peptic ulcers. Traditionally, these plants are used by healers in Burkina Faso for ulcer management. Both extracts significantly reduced ulcer formation induced by hydrochloric acid, ethanol, or hypothermic stress in mice. Notably, the extract from Ximenia americana demonstrated a stronger protective effect compared to that of Pseudocedrelakotschyi at equivalent doses. The Ximenia americana extract facilitated complete ulcer healing after 21 days of treatment, while Pseudocedrelakotschyi exhibited persistent inflammation. Both plant extracts are rich in polyphenols and flavonoids, known for their antioxidant and anti-inflammatory properties, which could play a role in ulcer-protective effects.

**Combretum paniculatum:**

The study indicates that the methanolic extract of Combretum paniculatum has potential as an anti-ulcer agent. The extract displayed significant anti-ulcer activity in rats with pylorus ligation-induced ulcers, with effectiveness increasing at higher doses (200 mg/kg, 400 mg/kg, and 800 mg/kg). Its activity was comparable to the standard drug omeprazole, evidenced by reductions in ulcer index and ulceration percentage, as well as increases in gastric pH and decreases in gastric volume, free acidity, and total acidity. Histopathological analysis further supported the protective effect of the extract on the gastric lining

**Peurariaphaseoloides:**

The findings suggest that the extract from Peurariaphaseoloides leaves may possess anti-ulcer properties, potentially due to its identified bioactive compounds. GC-MS analysis revealed 15 bioactive compounds in the extract, including those known for their anti-inflammatory, antioxidant, and antimicrobial activities. Compared to the control group, the extract significantly decreased ulcer index, gastric juice volume, and the number of ulcers in a dose-dependent manner, showing effectiveness similar to omeprazole, a standard anti-ulcer medication.

**Euphorbia hirta and Honey:**

The study indicates that the combination of Euphorbia hirta extract and honey has potential anti-ulcer properties in rats. The most effective dosage appeared to be 200 mg/kg of E. hirta extract. Both the extract and honey, whether alone or combined, significantly reduced ulcer formation compared to the control group. The combination of 200 mg/kg of E. hirta extract with honey resulted in the most substantial reduction in ulcers, achieving nearly complete inhibition, along with the greatest percentage reduction in ulceration. No significant changes in stomach weight were observed across treatment groups, but the combination seemed to enhance gastric mucus secretion.

**Ficus thonningii:**

The study demonstrates that the stem bark extract of Ficus thonningii exhibits potential ulcer-inhibiting activity, particularly against excess stomach acid and ethanol-induced ulcers following repeated doses. The hydro-methanol extract substantially decreased gastric volume and acidity in the pylorus ligation model, leading to reduced ulcer formation at medium and high doses. However, the effect on ethanol-induced ulcers was less pronounced, showing a trend toward reduced ulcers that was not statistically significant with a single dose. Significant reductions in ulcers were observed with repeated doses of both hydro-methanol and aqueous fractions, although the extract did not significantly affect indomethacin-induced ulcers.

## III. CONCLUSION

The article underscores the potential of medicinal plants as effective alternatives for treating peptic ulcers, showcasing their advantages over synthetic medications. Peptic ulcers often stem from H. pylori infections, stress, and NSAID use, This results in a disruption between protective and damaging factors in the stomach. Although conventional treatments like proton pump inhibitors and H2 receptor antagonists are effective, they frequently have significant side effects, making herbal remedies an appealing natural

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option. Studies have demonstrated that various plants, such as Urtica simensis, Cucumis melo, Zanthoxylum armatum (tambulin), Abrus precatorius, Jasminum sambac, Hedge mustard, and Acioabarteri, show substantial anti-ulcer effects. These plants not only help lower gastric acid production but also strengthen mucosal defenses and offer antioxidant, anti-inflammatory, and cytoprotective benefits. Many of these medicinal plants show efficacy that is equal to or greater than that of synthetic drugs, offering significant ulcer relief with fewer adverse effects. This highlights their potential role in developing safer and more effective treatment strategies for peptic ulcers

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