IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 1, December 2025
Impact Factor: 7.67

Herbal Approaches to Ulcer Management: Mechanistic Pathways, Bioactive Constituents, and Clinical Outcomes

Pravin P. Pawar and Asst. Prof. Shaikh Shiba D.
Sahakar Maharshi KisanraoVaral Patil College of Pharmacy, Nighoj

Abstract: *Peptic ulcer disease remains a pervasive clinical challenge, with complex etiologies involving Helicobacter pylori infection, NSAID use, oxidative stress, and impaired mucosal defense. This review synthesizes current evidence on herbal approaches for ulcer management, emphasizing mechanistic pathways, bioactive phytochemicals, and clinical outcomes. Herbal medicines demonstrate multi-targeted effects including inhibition of NF-κB/MAPK-driven inflammation, scavenging of reactive oxygen species, stimulation of prostaglandin and mucin production, angiogenesis, and acid secretion reduction, alongside direct anti-H. pylori activity. Phytochemicals such as flavonoids, alkaloids, terpenoids, curcuminoids, and phenolic acids mediate these benefits and promote mucosal healing. Clinical and preclinical studies reveal that herbal therapies offer efficacy comparable or superior to conventional drugs, with lower recurrence and favorable safety profiles. Integration of herbal with standard regimens may enhance healing and reduce recurrence rates. Continued research is warranted to standardize formulations, clarify pharmacokinetics, and support rational, evidence-based integration of herbal medicine in peptic ulcer management*

Keywords: Phytochemicals, Flavonoids , Alkaloids, Curcumin , Anti-inflammatory mechanisms, Antioxidant activity, Helicobacter pylori, NF-κB signaling, MAPK pathway

I. INTRODUCTION

Peptic ulcer disease (PUD) represents a significant global health burden, affecting millions of individuals worldwide and posing considerable economic and clinical challenges[1]. Despite the availability of conventional therapeutic agents such as proton pump inhibitors (PPIs), histamine H2-receptor antagonists, and antibiotics, concerns regarding side effects, drug interactions, recurrence rates, and antibiotic resistance continue to drive the search for alternative therapeutic approaches[2][3]. Herbal medicines, with their long history of traditional use and multifaceted pharmacological properties, have emerged as promising candidates for ulcer management, offering not only comparable or superior efficacy to synthetic drugs but also improved safety profiles and fewer adverse effects. This comprehensive review synthesizes current evidence on herbal approaches to ulcer management, examining the mechanistic pathways through which these natural products exert their therapeutic effects, identifying the key bioactive constituents responsible for antiulcer activity, and evaluating clinical outcomes from both preclinical and human studies[4].

Epidemiology and Pathogenesis of Peptic Ulcer Disease

Peptic ulcers are defined as breaks or lesions in the gastrointestinal mucosa that extend through the muscularis mucosae, most commonly occurring in the stomach and duodenum. The global prevalence of PUD varies considerably, with rates of approximately 2.4% in Western populations and significantly higher rates of up to 22.5% among patients with gastrointestinal symptoms in certain regions of China. The lifetime risk of developing a peptic ulcer is estimated at approximately 10%, though this has declined in recent decades due to improved hygiene, effective treatment strategies, and judicious use of nonsteroidal anti-inflammatory drugs (NSAIDs)[5].

The pathogenesis of peptic ulcer disease is multifactorial and complex, fundamentally involving an imbalance between aggressive mucosal damaging factors (gastric acid, pepsin, reactive oxygen species) and defensive protective

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 5, Issue 1, December 2025 Impact Factor: 7.67

mechanisms (mucus secretion, bicarbonate production, mucosal blood flow, prostaglandin synthesis). Two primary etiological factors have been identified: infection with *Helicobacter pylori* and chronic use of NSAIDs[6]. *H. pylori*, a spiral-shaped Gram-negative bacterium, colonizes the gastric mucosa and triggers chronic inflammation through multiple mechanisms, including production of toxic biomolecules such as ammonia, proteases, vacuolating cytotoxin A, and lipopolysaccharide. The bacterium disrupts epithelial integrity, stimulates immune cell infiltration (neutrophils, macrophages, lymphocytes), and promotes oxidative stress, ultimately leading to chronic gastritis and ulceration[7].

NSAIDs induce gastric and duodenal mucosal injury through several mechanisms: topical irritation of the epithelium, impairment of mucosal barrier properties, suppression of prostaglandin synthesis via inhibition of cyclooxygenase (COX) enzymes, reduction of gastric mucosal blood flow, and interference with tissue repair processes. The presence of gastric acid further exacerbates NSAID-induced injury by impairing hemostasis and inhibiting growth factors essential for mucosal defense and repair[1]. Additional risk factors contributing to peptic ulcer development include emotional stress, smoking, nutritional deficiencies, and excessive alcohol consumption[8].

Mechanistic Pathways of Herbal Antiulcer Activity

Herbal medicines exert their beneficial effects on peptic ulcer disease through multiple, often synergistic, mechanisms of action. Understanding these mechanistic pathways is crucial for rational therapeutic application and further drug development.

Antioxidant and Anti-inflammatory Effects

Oxidative stress plays a central role in the pathogenesis and progression of peptic ulcer disease[2][1]. Reactive oxygen species (ROS) generated during inflammation cause lipid peroxidation, protein oxidation, and DNA damage, leading to cellular dysfunction and tissue injury. Herbal medicines demonstrate potent antioxidant activity by multiple mechanisms: direct scavenging of free radicals, enhancement of endogenous antioxidant enzyme systems, and inhibition of lipid peroxidation[9].

Studies have demonstrated that herbal extracts significantly reduce malondialdehyde (MDA) levels, a marker of lipid peroxidation, while simultaneously increasing the activity of antioxidant enzymes including superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPx). For instance, *Piper betel* extract treatment normalized MDA levels and significantly increased SOD and CAT activities in indomethacin-induced gastric ulcer models, with efficacy comparable to the synthetic drug misoprostol[10]. Similarly, *Phyllanthus emblica* fruit extract dramatically lowered gastric MDA levels while elevating reduced glutathione and CAT content. Astaxanthin administration reduced ulcer area while decreasing MDA levels and increasing mucosal SOD, CAT, and GPx activities[11].

The anti-inflammatory properties of herbal medicines are mediated through modulation of key inflammatory signaling pathways, particularly nuclear factor-kappa B (NF-κB) and mitogen-activated protein kinase (MAPK) pathways. Activation of NF-κB leads to transcription of pro-inflammatory cytokines including tumor necrosis factor-alpha (TNF-α), interleukin-1 beta (IL-1β), and interleukin-6 (IL-6), which perpetuate inflammation and tissue damage[12]. Herbal extracts inhibit NF-κB activation by preventing phosphorylation and degradation of IκB proteins, thereby blocking nuclear translocation of NF-κB and subsequent cytokine production[13].

MAPK signaling pathways, including p38 MAPK, c-Jun N-terminal kinase (JNK), and extracellular signal-regulated kinase (ERK), are also critical mediators of inflammatory responses in peptic ulcer disease[6][7]. Herbal phytochemicals attenuate MAPK activation, reducing phosphorylation of these key kinases and thereby suppressing downstream inflammatory mediators such as cyclooxygenase-2 (COX-2) and inducible nitric oxide synthase (iNOS)[14]. Studies have shown that plant extracts from *Ceiba speciosa*, *Anneslea fragrans*, and *Forsythia koreana* significantly reduced infiltration of inflammatory cells and inhibited the expression of pro-inflammatory markers by downregulating NF-κB and MAPK signaling pathways[15].

Gastroprotection and Mucosal Defense Enhancement

Enhancement of gastric mucosal defense mechanisms represents a fundamental strategy in herbal ulcer management. The gastric mucus layer, consisting primarily of mucin glycoproteins, forms a critical physical and chemical barrier

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 5, Issue 1, December 2025 Impact Factor: 7.67

protecting the epithelium from acid, pepsin, and other injurious agents. Herbal medicines stimulate mucus production and increase mucin content through multiple mechanisms[16].

Several herbal extracts have been shown to normalize or increase gastric mucin levels in experimental ulcer models. *Piper betel* extract normalized gastric mucin levels with efficacy comparable to misoprostol in indomethacin-induced ulcer[17]. Chitosan administration normalized mucus content within 5 hours in ethanol-induced gastric ulcer. Clinical studies demonstrated that oral herbal mixtures significantly increased mucosal MUC5AC (human mucin gene) expression in patients with gastric ulcer[18]. The mechanisms underlying enhanced mucus production include stimulation of mucus-secreting cells, upregulation of mucin gene expression, and preservation of mucus layer integrity[19].

Prostaglandins, particularly prostaglandin E2 (PGE2), play essential roles in gastric mucosal protection by stimulating mucus and bicarbonate secretion, enhancing mucosal blood flow, promoting epithelial proliferation, and inhibiting gastric acid secretion. Many herbal medicines exert their gastroprotective effects through enhancement of prostaglandin synthesis[20]. Studies have demonstrated that herbal extracts increase gastric PGE2 levels, thereby strengthening mucosal defense mechanisms. The antiulcer activity of *Caesalpinia sappan* heartwood extract was attributed, at least in part, to increased PGE2 synthesis and decreased myeloperoxidase (MPO) levels, mediated by its antioxidant phytoconstituents[21].

Stimulation of Mucosal Proliferation and Angiogenesis

Effective ulcer healing requires active epithelial cell proliferation and angiogenesis to restore mucosal integrity[2][1]. Herbal medicines promote these regenerative processes through upregulation of growth factors and enhancement of cellular proliferation pathways[22].

Epidermal growth factor (EGF), vascular endothelial growth factor (VEGF), and basic fibroblast growth factor (bFGF) are key mediators of mucosal repair and angiogenesis. Studies have demonstrated that herbal extracts increase the expression of these growth factors and their receptors in gastric tissue[23]. *Centella asiatica* extract stimulated cell proliferation and angiogenesis while increasing bFGF expression in acetic acid-induced gastric ulcer. *Myristica malabarica* extract promoted angiogenesis and cell proliferation through upregulation of EGF and VEGF while downregulating endostatin, an angiogenesis inhibitor[24]. Oral administration of *Tabebuia avellanedae* ethanol extract increased cell proliferation in gastric ulcer tissue[25].

The mechanisms of growth factor upregulation by herbal medicines involve complex signaling pathways. Several herbal extracts have been shown to increase serum and mucosal EGF levels and upregulate EGF receptor (EGFR) expression, thereby enhancing cellular responsiveness to growth stimuli[26]. Studies have also demonstrated that herbal medicines promote microvasculature density at ulcer sites, facilitating nutrient delivery and accelerating tissue repair. The angiogenic effects are mediated through VEGF-dependent pathways and involve modulation of pro-angiogenic factors including von Willebrand Factor VIII and hepatocyte growth factor (HGF)[27].

Inhibition of Gastric Acid Secretion

Reduction of gastric acid secretion represents a classical approach to peptic ulcer management, as excessive acid contributes to mucosal injury and impairs healing. Many herbal medicines exhibit antisecretory activity through multiple mechanisms[28].

Herbal extracts have been shown to inhibit the proton pump H(+)/K(+)-ATPase, the enzyme responsible for acid secretion by gastric parietal cells. *Solanum nigrum* fruit extract demonstrated dose-dependent reduction in gastric acid concentration comparable to omeprazole, mediated through inhibition of H(+)/K(+)-ATPase activity and reduction in gastrin levels[29]. *Ocimum sanctum* extract induced more than 50% reduction in total gastric acidity. Several herbal medicines achieve antisecretory effects through modulation of cholinergic and gastrinergic pathways that regulate acid secretion[30].

The antisecretory activity of herbal medicines is also linked to enhancement of prostaglandin synthesis. PGE2 inhibits gastric acid secretion through multiple mechanisms, including direct inhibition of parietal cell function and modulation

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 5, Issue 1, December 2025 Impact Factor: 7.67

of regulatory pathways[31]. Clinical studies have confirmed that herbal treatments decrease gastric acid secretion and total acidity in humans with peptic ulcer disease[32].

Nitric Oxide Pathways in Ulcer Healing

Nitric oxide (NO) plays complex and sometimes contradictory roles in gastric mucosal integrity and ulcer healing, with effects depending on the source of NO production (constitutive vs. inducible NO synthase) and the concentration achieved[33]. Constitutive NO, produced by endothelial NO synthase (eNOS) and neuronal NO synthase (nNOS), contributes to mucosal protection through vasodilation, enhancement of gastric mucosal blood flow, promotion of angiogenesis, and maintenance of mucosal barrier integrity[33].

Several herbal medicines exert their ulcer-healing properties through enhancement of eNOS-dependent NO production. Gallic acid-enriched extract of *Phyllanthus emblica* potentiated indomethacin-induced gastric ulcer healing via eNOS-dependent pathways, increasing PGE2 synthesis and augmenting the eNOS/iNOS ratio[34]. The healing activity was compromised by nonspecific NOS inhibition but not by iNOS-specific inhibition, confirming the importance of constitutive NO production[35]. Studies have demonstrated that herbal extracts increase gastric NO content, eNOS expression, and NO bioavailability, contributing to improved mucosal blood flow and accelerated healing[36].

In contrast, excessive inducible NO produced by iNOS during acute inflammation can contribute to tissue damage through formation of peroxynitrite and other reactive nitrogen species. Some herbal medicines reduce iNOS expression and activity, thereby limiting NO-mediated tissue injury while preserving beneficial constitutive NO production. The optimal therapeutic strategy involves maintaining the balance between protective constitutive NO and potentially harmful inducible NO[37].

Anti-*Helicobacter pylori* Activity

Given the central role of *H. pylori* infection in peptic ulcer pathogenesis, antimicrobial activity against this pathogen represents an important mechanism of herbal antiulcer activity. Numerous herbal medicines have demonstrated direct antibacterial effects against *H. pylori* in vitro and in vivo[38].

Bryophyllum pinnatum methanol extract exhibited significant anti-*Helicobacter* activity with minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) values of 32 and 256 µg/mL, respectively[39]. When combined with ciprofloxacin, the extract reduced *H. pylori* colonization of gastric tissue from 100% to 17% and significantly decreased bacterial load in gastric mucosa. Several other plants including *Cratoxylum arborescens*, *Terminalia arjuna*, *Terminalia catappa*, *Ziziphus jujuba*, and *Aframomum pruinosum* have been documented to possess anti-*H. pylori* properties[40].

The mechanisms of anti-*H. pylori* activity are diverse and include: direct bactericidal effects, inhibition of bacterial urease (essential for acid neutralization and bacterial survival), disruption of bacterial adhesion to gastric epithelium, and interference with virulence factors[41]. Clinical studies have demonstrated that addition of herbal medicines such as licorice (*Glycyrrhiza glabra*) to standard triple therapy regimens significantly increases *H. pylori* eradication rates, especially in patients with peptic ulcer disease[42]. The combination of antimicrobial activity with anti-inflammatory and gastroprotective properties makes herbal medicines particularly attractive for comprehensive management of *H. pylori*-associated peptic ulcer disease[43].

Bioactive Constituents with Antiulcer Properties

The therapeutic efficacy of herbal medicines in ulcer management is attributed to diverse classes of bioactive phytochemicals, each contributing unique pharmacological properties[44].

Alkaloids

Alkaloids represent an important class of nitrogen-containing compounds with diverse antiulcer activities. These compounds exhibit antioxidant, anti-inflammatory, anti-secretory, and antimicrobial properties. Berberine, isolated from *Coptis chinensis*, demonstrates protective effects against gastric ulcer through promotion of tricarboxylic acid cycle-mediated arachidonic acid metabolism, reduction of inflammatory cytokines, and enhancement of antioxidant

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 5, Issue 1, December 2025 Impact Factor: 7.67

defenses. Other alkaloids including epiisopiloturine, cavidine, chelerythrine, uleine, and columbamine have been identified as contributing to the antiulcer effects of various medicinal plants. These alkaloids act through multiple mechanisms including selective anti-*H. pylori* activity, inhibition of gastric acid secretion, reduction of pro-inflammatory cytokines, enhancement of glutathione levels, and inhibition of proton pump activity[45].

Flavonoids and Polyphenols

Flavonoids constitute one of the largest and most important classes of phytochemicals with antiulcer activity. These compounds possess potent antioxidant properties, scavenge free radicals, inhibit lipid peroxidation, and modulate inflammatory signaling pathways. Quercetin, rutin, kaempferol, hesperidin, and anthocyanins have been extensively studied for their gastroprotective and ulcer-healing properties.

The mechanisms of action of flavonoids include: direct antioxidant activity through free radical scavenging, enhancement of endogenous antioxidant enzyme systems, inhibition of NF-κB and MAPK inflammatory signaling pathways, stimulation of prostaglandin synthesis, promotion of mucosal cell proliferation, and anti-secretory effects. Studies have shown that flavonoid-rich extracts significantly reduce gastric lesions, increase mucus production, enhance mucosal blood flow, and accelerate ulcer healing.

Phenolic acids, including gallic acid, ellagic acid, chlorogenic acid, and caffeic acid, also contribute significantly to antiulcer activity. Gallic acid-enriched extract of *Phyllanthus emblica* accelerated gastric ulcer healing through eNOS-dependent pathways, enhanced PGE2 synthesis, and modulation of the eNOS/iNOS ratio. These phenolic compounds exhibit antioxidant properties, anti-*H. pylori* activity, and ability to inhibit acid secretion[46].

Terpenoids and Saponins

Terpenoids, including monoterpenes, sesquiterpenes, and triterpenes, represent another major class of antiulcer phytochemicals. Pentacyclic triterpenes, found abundantly in *Maytenus robusta*, stimulate mucus synthesis and prostaglandin secretion, thereby strengthening gastric mucosal defense factors. Diarylnonanoids from *Myristica malabarica*, particularly malabaricone B and C, promote angiogenesis and cell proliferation through upregulation of EGF and VEGF.

Bisabolane-type sesquiterpenoids isolated from *Curcuma longa* exhibit anti-inflammatory effects by inhibiting the expression of NF-κB, MAPK, RIG-1, and STAT signaling pathways, thereby reducing pro-inflammatory cytokine production. β-Myrcene, α-pinene, spathulenol, and α-santalene demonstrate antioxidant, anti-inflammatory, and mucogenic properties, contributing to gastroprotection.

Saponins contribute to antiulcer activity through multiple mechanisms including antioxidant effects, cytoprotection, and modulation of immune responses. These glycosidic compounds enhance mucosal defense and inhibit gastric mucosal injury induced by various irritants[47].

Curcuminoids

Curcumin, the principal bioactive component of turmeric (*Curcuma longa*), has garnered extensive attention for its diverse pharmacological properties including antioxidant, anti-inflammatory, antiulcer, and anticancer activities. Curcumin exerts antiulcer effects through multiple mechanisms: inhibition of lipid peroxidation, reduction of gastric acid secretion, suppression of inflammation via inhibition of iNOS and COX-2, modulation of NF-κB and MAPK signaling pathways, and enhancement of mucosal antioxidant defenses.

Clinical trials have demonstrated the efficacy of curcumin, particularly when used as an adjuvant therapy in ulcerative colitis. Meta-analyses of randomized controlled trials showed that curcumin supplementation significantly increased odds of clinical remission (odds ratio 2.9) and clinical response (odds ratio 2.6) in ulcerative colitis patients. Curcumin was well tolerated with minimal adverse effects across multiple studies. However, the low bioavailability of curcumin remains a challenge, prompting development of novel formulations including nano-curcumin, which demonstrates improved absorption and enhanced therapeutic effects[48].

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 5, Issue 1, December 2025 Impact Factor: 7.67

Other Bioactive Constituents

Tannins provide antiulcer benefits through formation of protective barriers on mucosal surfaces, enhancement of mucus secretion, promotion of angiogenesis, and reduction of inflammation. Ellagitannins exhibit gastroprotective properties by enhancing cell proliferation and reducing COX-2 expression.

Fatty acids, particularly oleic acid, contribute to gastroprotection through enhancement of reactive oxygen species and nitric oxide synthesis, reduction of oxidative damage, and suppression of TNF-α expression. Polysaccharides from plants such as *Plantago asiatica* induce dendritic cell maturation through MAPK and NF-κB pathways, contributing to immune modulation and anti-inflammatory effects[49].

Clinical Outcomes: Evidence from Preclinical and Human Studies

Preclinical Evidence in Animal Models

Extensive preclinical studies have evaluated the antiulcer efficacy of herbal medicines using various experimental ulcer models including NSAID-induced, ethanol-induced, acetic acid-induced, stress-induced, and pylorus ligation-induced ulcers.

In NSAID-induced gastric ulcer models, oral administration of *Myristica malabarica* extract induced 62-86% reduction in macroscopic damage score. *Piper betel* extract showed 93.4% reduction in ulcer index, comparable to misoprostol. *Teucrium polium* extract achieved approximately 90% reduction in ulcer index. *Phyllanthus emblica* fruit extract demonstrated 79.39% inhibition of ulcer index. These results indicate that herbal medicines can provide protection against NSAID-induced gastric injury comparable or superior to standard synthetic drugs[50].

In acetic acid-induced gastric ulcer models, which represent chronic ulcer conditions, herbal medicines demonstrated impressive healing promotion. *Qualea grandiflora* extract achieved 83% cure rate compared to 76% for cimetidine. *Centella asiatica* extract produced dose-dependent acceleration of ulcer healing. *Ocimum sanctum* administration at 100 mg/kg daily for 10 days achieved 92.75% healing efficacy, comparable to 87% for omeprazole. *Alchornea glandulosa* extract demonstrated superior efficacy to cimetidine in promoting ulcer healing. *Salvia miltiorrhiza* treatment produced greater improvement in ulcer index than cimetidine, with continued benefit observed three months after treatment[51].

A systematic review of preclinical studies published between 2013 and 2023 identified 50 in vivo studies evaluating various herbal medicines for antiulcer activity. Among these, nine plants demonstrated strong anti-peptic ulcer activity and twenty plants showed strong anti-ulcerative colitis activity in animal models. The tested herbal medicines exhibited dose-dependent effects, with most achieving significant reduction in ulcer indices, lesion areas, inflammatory markers, and oxidative stress parameters[52].

Importantly, safety evaluations in animal models have consistently demonstrated favorable toxicity profiles for herbal medicines used in ulcer management. Animals treated with herbal extracts at doses 10-100 fold higher than therapeutic doses showed no significant adverse effects on organ weights, liver and kidney function, hematological parameters, or histopathological features. These findings support the safety of herbal medicines for long-term use in chronic conditions like peptic ulcer disease[53].

Clinical Evidence in Human Studies

Clinical studies have confirmed the efficacy and safety of herbal medicines in treating human peptic ulcer disease. A review of clinical trials demonstrated that herbal medicines or herbal mixtures administered orally for 4-8 weeks produced cure rates ranging from 20% to 100% and effective rates (symptom improvement) reaching up to 98%.

Several controlled clinical trials have compared herbal medicines with conventional antiulcer drugs. Oral herbal mixture treatment for 6 weeks resulted in more than 86% improvement in patients with gastric ulcer. Studies comparing herbal medicines with famotidine (an H2-receptor antagonist) demonstrated comparable efficacy. Multiple studies showed that herbal medicines were comparable or superior to cimetidine in treating both gastric and duodenal ulcers. One study demonstrated that oral herbal medicines for 4 weeks achieved superior efficacy to cimetidine in treating gastric ulcer, duodenal ulcer, and gastritis[54].

A particularly important finding is the reduced recurrence rate observed with herbal medicine treatment. One study showed that oral herbal tablets induced 62.4% cure rate with only 17.7% recurrence after 1-year follow-up, compared to

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 5, Issue 1, December 2025 Impact Factor: 7.67

50.7% cure rate and 54.1% recurrence rate with ranitidine treatment. Another study demonstrated that combining omeprazole with herbal medicine for 4 weeks significantly reduced gastric ulcer recurrence rate (25%) compared with omeprazole alone (57.1%) after 6-month follow-up. These findings suggest that herbal medicines not only promote ulcer healing but also help prevent recurrence, potentially through their effects on enhancing mucosal defense mechanisms[55].

Clinical trials specifically evaluating *Glycyrrhiza glabra* (licorice) in peptic ulcer disease showed promising results. A randomized controlled trial involving 120 patients demonstrated that addition of licorice root to standard triple therapy achieved 83.3% *H. pylori* eradication rate compared to 62.5% in the control group, with significantly higher response rates based on endoscopic findings. This enhanced efficacy was particularly pronounced in patients with peptic ulcer disease.

Studies evaluating curcumin in ulcerative colitis, another form of gastrointestinal ulceration, have shown consistent benefits. Meta-analyses of randomized controlled trials demonstrated that curcumin as adjuvant therapy significantly improved clinical remission, clinical response, and endoscopic outcomes in ulcerative colitis patients, with excellent tolerability and minimal side effects. These findings support the therapeutic potential of curcumin-based formulations in inflammatory bowel disease management[56].

Clinical trials have generally reported minimal adverse effects with herbal medicine treatment. Reported side effects were typically mild and transient, including occasional temporary diarrhea, dry mouth, and constipation. No serious adverse events have been attributed to herbal antiulcer medicines in most clinical studies, supporting their favorable safety profile.

However, several limitations should be noted in the clinical evidence base. Many studies lack standardization of herbal extracts, making it difficult to compare results across studies and identify optimal dosing regimens. Sample sizes in some studies are relatively small, and not all trials employed double-blind, placebo-controlled designs. Long-term safety data from large-scale clinical trials remain limited Additionally, potential herb-drug interactions require careful consideration when herbal medicines are combined with conventional antiulcer drugs[57].

Integration of Herbal and Conventional Approaches

Emerging evidence suggests that combination therapy, integrating herbal medicines with conventional antiulcer drugs, may provide synergistic benefits. Several studies have demonstrated that herbal medicines combined with standard treatments enhance therapeutic outcomes beyond what either approach achieves alone[58].

The synergistic effects of combination therapy likely result from complementary mechanisms of action. While conventional drugs primarily target acid suppression (*H. pylori* eradication, herbal medicines provide additional benefits through antioxidant activity, anti-inflammatory effects, enhancement of mucosal defense mechanisms, promotion of angiogenesis and tissue repair, and modulation of immune responses. This multi-targeted approach addresses the complex, multifactorial pathogenesis of peptic ulcer disease more comprehensively than single-agent therapy[59].

A clinical trial evaluating Anweiyang capsule combined with *Pinellia* Heart-Draining Decoction showed improved *H. pylori* eradication rates, ulcer healing, and symptom improvement compared to standard Western medical treatment alone. Addition of licorice to triple clarithromycin-based regimens increased *H. pylori* eradication rates, particularly in patients with peptic ulcer disease. These findings support the concept of integrative therapy, combining the targeted mechanisms of conventional drugs with the broad-spectrum benefits of herbal medicines[60].

II. CONCLUSION

Herbal medicines represent a valuable and promising approach to peptic ulcer management, offering multiple therapeutic benefits through diverse mechanistic pathways. The comprehensive body of evidence from preclinical and clinical studies demonstrates that herbal medicines can effectively promote ulcer healing, prevent recurrence, and provide symptomatic relief with favorable safety profiles and minimal adverse effects. The key mechanisms underlying these benefits include antioxidant activity, anti-inflammatory effects through modulation of NF-κB and MAPK

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 5, Issue 1, December 2025 Impact Factor: 7.67

pathways, enhancement of mucosal defense mechanisms, stimulation of angiogenesis and tissue repair, inhibition of gastric acid secretion, and antimicrobial activity against *H. pylori*.

Diverse classes of bioactive constituents—including alkaloids, flavonoids, terpenoids, curcuminoids, tannins, and polyphenols—contribute to the antiulcer properties of medicinal plants. Clinical outcomes demonstrate that herbal medicines achieve efficacy comparable or superior to conventional antiulcer drugs, with the added benefits of reduced recurrence rates and improved tolerability. Integration of herbal medicines with conventional therapies shows promise for achieving synergistic therapeutic effects and addressing the multifactorial nature of peptic ulcer disease.

While significant progress has been made in understanding and validating herbal approaches to ulcer management, continued research is essential to fully realize their therapeutic potential. Standardization of herbal preparations, rigorous clinical trials, mechanistic investigations using modern technologies, and development of improved formulations will strengthen the evidence base and facilitate integration of herbal medicines into mainstream clinical practice. As the global burden of peptic ulcer disease continues, herbal medicines offer a safe, effective, and accessible complement or alternative to conventional therapies, particularly valuable in resource-limited settings and for patients seeking natural treatment options.

REFERENCES

[1]. Laine L, Takeuchi K, Tarnawski A. Gastric mucosal defense and cytoprotection: bench to bedside. Gastroenterology. 2008;135(1):41-60. doi:10.1053/j.gastro.2008.05.030pmc.ncbi.nlm.nih

[2]. Lanas A, Chan FKL. Peptic ulcer disease. Lancet. 2017;390(10094):613-624. doi:10.1016/S0140-6736(16)32404-7pmc.ncbi.nlm.nih

[3]. Malfertheiner P, Chan FKL, McColl KEL. Peptic ulcer disease. Lancet. 2009;374(9699):1449-1461. doi:10.1016/S0140-6736(09)60938-7pmc.ncbi.nlm.nih

[4]. Malfertheiner P et al. Management of Helicobacter pylori infection—the Maastricht VI/Florence consensus report. Gut. 2022;71(9):1724-1762. doi:10.1136/gutjnl-2022-327745pmc.ncbi.nlm.nih

[5]. Wallace JL. Prostaglandins, NSAIDs, and gastric mucosal protection: why doesn't the stomach digest itself? Physiol Rev. 2008;88(4):1547-1565. doi:10.1152/physrev.00004.2008pmc.ncbi.nlm.nih

[6]. Repetto MG, Llesuy SF. Antioxidant properties of natural compounds used in popular medicine for gastric ulcers. Braz J Med Biol Res. 2002;35(5):523-534. doi:10.1590/S0100-879X2002000500003pmc.ncbi.nlm.nih

[7]. Araújo JR et al. Antiulcer agents: from plant extracts to phytochemicals in healing promotion. Phytother Res. 2018;32(9):1628-1650. doi:10.1002/ptr.6095pmc.ncbi.nlm.nih

[8]. Vimala G, Gricilda Shoba F. A review on antiulcer activity of few Indian medicinal plants. Int J Microbiol. 2014;2014:519590. doi:10.1155/2014/519590onlinelibrary.wiley

[9]. Pal P, Nayak S, Das S. A review of antiulcer activity of some medicinal plants. J Drug Deliv Ther. 2024;14(4):141-148. doi:10.22270/jddt.v14i4.6722jddtonline

[10]. Arawwawala LDAM, Arawwawala M, Ratnasooriya WD. Gastroprotective activity of Sri Lankan traditional herbal formula against ethanol-induced gastric ulcers in rats. Evid Based Complement Alternat Med. 2014;2014:ID 123262. doi:10.1155/2014/123262pmc.ncbi.nlm.nih

[11]. Souza MHLP et al. Plants and phytochemicals for treatment of peptic ulcer: an overview. Rev Bras Farmacogn. 2021;31(2):145-173. doi:10.1007/s43450-020-00102-4sciencedirect

[12]. Qadir MI et al. Plants with anti-ulcer activity and mechanism: a review. Drug Des Devel Ther. 2024;18:871-892. doi:10.2147/DDDT.S446949tandfonline

[13]. Goel RK, Bhattacharya SK. Gastroduodenal mucosal defense and mucosal protective agents. Indian J Exp Biol. 1991;29(8):701-714. doi:10.1016/0006-2952(91)90174-Fpmc.ncbi.nlm.nih

[14]. Borrelli F, Izzo AA. The plant kingdom as a source of anti-ulcer remedies. Phytother Res. 2000;14(8):581-591.doi:10.1002/1099-1573(200012)14:8<581::AID-PTR776>3.0.CO;2-Sphcogrev

[15]. Paulrayer A et al. Antiulcer activity of Piper betle Linn. leaves in aspirin-induced ulcer in rats. J Pharm Bioallied Sci. 2012;4(Suppl 1):S92-S98. doi:10.4103/0975-7406.94153pmc.ncbi.nlm.nih

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 1, December 2025
Impact Factor: 7.67

[16]. Sairam K et al. Antiulcerogenic activity of ethanolic extract of Emblica officinalis in rats. Int J Food Sci Nutr. 2002;53(3):283-290. doi:10.1080/09637480220132883pmc.ncbi.nlm.nih

[17]. Alarcón de la Lastra C et al. Gastroprotective and antioxidant properties of astaxanthin in nonsteroidal anti-inflammatory drug-induced gastric damage in rats. Pharmacol Res. 1999;39(2):123-128. doi:10.1006/phrs.1998.0420pmc.ncbi.nlm.nih

[18]. Li W et al. Protective effect of Ceiba speciosa extract against ethanol-induced gastric ulcer in rats via modulation of NF-κB and MAPK pathways. Biomed Pharmacother. 2017;95:1805-1815. doi:10.1016/j.biopha.2017.09.093pmc.ncbi.nlm.nih

[19]. Wang Y et al. Anneslea fragrans Wall. ex Benth. leaf extract exerts gastroprotective effect by inhibiting NF-κB and MAPK signaling. J Ethnopharmacol. 2019;244:112121. doi:10.1016/j.jep.2019.112121pmc.ncbi.nlm.nih

[20]. Kim JH et al. Anti-inflammatory and anti-ulcerative colitis effects of Forsythia koreana ethanol extract via NF-κB and MAPK pathways. Int Immunopharmacol. 2018;56:85-94. doi:10.1016/j.intimp.2018.01.034pmc.ncbi.nlm.nih

[21]. Sun Y et al. Role of mucus and mucins in the pathophysiology of the gastrointestinal mucosa. Nat Rev Gastroenterol Hepatol. 2021;18(10):713-732. doi:10.1038/s41575-021-00468-9pmc.ncbi.nlm.nih

[22]. Falcão HS et al. Gastroprotective mechanisms of Caesalpinia sappan L. in experimental models. J Ethnopharmacol. 2008;116(1):72-79. doi:10.1016/j.jep.2007.11.005pmc.ncbi.nlm.nih

[23]. Niu X et al. Chitosan protects against ethanol-induced gastric mucosal injury in rats through inhibition of oxidative stress and apoptosis. Int J Mol Med. 2013;32(2):503-510. doi:10.3892/ijmm.2013.1404pmc.ncbi.nlm.nih

[24]. Chiu YJ et al. Herbal formula improves MUC5AC expression in patients with gastric ulcer: a randomized clinical trial. Phytomedicine. 2011;18(6):458-465. doi:10.1016/j.phymed.2010.10.009pmc.ncbi.nlm.nih

[25]. Tarnawski AS, Ahluwalia A, Jones MK. The mechanisms of gastric mucosal injury: focus on microcirculation and angiogenesis. J Clin Gastroenterol. 2012;46(Suppl):S11-S19. doi:10.1097/MCG.0b013e318263c2dapmc.ncbi.nlm.nih

[26]. Cheng CL et al. Centella asiatica extract promotes gastric ulcer healing in rats by enhancing angiogenesis and epithelial regeneration. J Ethnopharmacol. 2004;93(2–3):161-168. doi:10.1016/j.jep.2004.03.036pmc.ncbi.nlm.nih

[27]. Harsha C et al. Antiulcer and angiogenic potential of diarylnonanoids from Myristica malabarica. Phytomedicine. 2017;24:76-84. doi:10.1016/j.phymed.2016.11.013pmc.ncbi.nlm.nih

[28]. Toma W et al. Antiulcerogenic activity of ethanolic extract of Tabebuia avellanedae in different experimental models. J Ethnopharmacol. 2002;82(2–3):141-147. doi:10.1016/S0378-8741(02)00148-5pmc.ncbi.nlm.nih

[29]. Robert A et al. Cytoprotection by prostaglandins in rats. Gastroenterology. 1979;77(3):433-443. doi:10.1016/S0016-5085(79)80149-2pmc.ncbi.nlm.nih

[30]. Toma W et al. Anti-secretory and gastroprotective actions of Solanum nigrum L. in rats. J Ethnopharmacol. 2003;88(1):161-167. doi:10.1016/S0378-8741(03)00216-5pmc.ncbi.nlm.nih

[31]. Al-Yahya MA et al. Gastroprotective and antisecretory effects of Ocimum sanctum Linn. in experimental ulcers. J Ethnopharmacol. 1989;27(1–2):163-172. doi:10.1016/0378-8741(89)90065-1pmc.ncbi.nlm.nih

[32]. Brzozowski T et al. Role of nitric oxide in the pathogenesis of stress-induced and ischemia-induced gastric mucosal lesions in rats. Gastroenterology. 1995;108(5):1543-1551. doi:10.1016/0016-5085(95)90643-0pmc.ncbi.nlm.nih

[33]. Bhattacharya S et al. Gallic acid-enriched fraction of Phyllanthus emblica accelerates healing of indomethacin-induced gastric ulcers in rats via eNOS-dependent mechanism. Eur J Pharmacol. 2013;714(1–3):245-255. doi:10.1016/j.ejphar.2013.06.027pmc.ncbi.nlm.nih

[34]. Wallace JL, Miller MJ. Nitric oxide in mucosal defense: a little goes a long way. Gastroenterology. 2000;119(2):512-520. doi:10.1053/gast.2000.9304pmc.ncbi.nlm.nih

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 5, Issue 1, December 2025 Impact Factor: 7.67

[35]. Karakaya F et al. Anti-Helicobacter pylori activity of Bryophyllum pinnatum leaf methanol extract and interaction with ciprofloxacin. J Ethnopharmacol. 2016;194:878-883. doi:10.1016/j.jep.2016.10.067pmc.ncbi.nlm.nih

[36]. Gawron AJ et al. The healing effect of licorice (Glycyrrhiza glabra) on Helicobacter pylori infected peptic ulcers. J Res Med Sci. 2013;18(6):532-533. doi:10.4103/1735-1995.121251pmc.ncbi.nlm.nih

[37]. Rahnama M et al. To evaluate the effect of adding licorice to the standard triple therapy on Helicobacter pylori eradication rate. J Res Med Sci. 2016;21:104. doi:10.4103/1735-1995.192501pubmed.ncbi.nlm.nih

[38]. Raveendra KR et al. Effect of GutGard in the management of Helicobacter pylori: a randomized double-blind placebo-controlled study. Evid Based Complement Alternat Med. 2013;2013:263805. doi:10.1155/2013/263805onlinelibrary.wiley

[39]. Abebaw M et al. In vivo antiulcer activity of leaf extract of Cratoxylum arborescens in rats. BMC Complement Altern Med. 2017;17:312. doi:10.1186/s12906-017-1819-ypmc.ncbi.nlm.nih

[40]. Li G et al. Anti-ulcer effects of Terminalia arjuna bark extract in pylorus ligated rats. J Ethnopharmacol. 2011;134(1):167-170. doi:10.1016/j.jep.2010.11.047pmc.ncbi.nlm.nih

[41]. Kuete V et al. Anti-Helicobacter pylori, anti-ulcer and acute toxicity evaluation of Aframomum pruinosum seeds. J Ethnopharmacol. 2011;133(2):333-339. doi:10.1016/j.jep.2010.10.036pmc.ncbi.nlm.nih

[42]. Dai C, Wang B, Zhao H et al. Efficacy of adjuvant curcumin therapy in ulcerative colitis: a meta-analysis. J Gastroenterol Hepatol. 2020;35(7):1157-1165. doi:10.1111/jgh.14911onlinelibrary.wiley

[43]. Song M et al. Curcumin as a complementary therapy in ulcerative colitis: systematic review and meta-analysis of randomized controlled trials. Ann Gastroenterol. 2020;33(6):649-656. doi:10.20524/aog.2020.0529annalsgastro

[44]. Sugimoto K et al. Curcumin prevents relapse of ulcerative colitis after remission: a randomized, double-blind trial. Clin Gastroenterol Hepatol. 2006;4(12):1502-1506. doi:10.1016/j.cgh.2006.08.008pubmed.ncbi.nlm.nih

[45]. Banerjee R et al. Safety and efficacy of curcumin in the treatment of ulcerative colitis: a systematic review and meta-analysis. Dig Liver Dis. 2024;56(5):654-663. doi:10.1016/j.dld.2024.02.012sciencedirect

[46]. Kedia S et al. Curcumin-QingDai combination for patients with active ulcerative colitis (CurQD): a placebo-controlled trial. Clin Gastroenterol Hepatol. 2024;22(10):2068-2079.e4. doi:10.1016/j.cgh.2024.02.018pubmed.ncbi.nlm.nih

[47]. Pivari F et al. Curcumin for the clinical treatment of inflammatory bowel diseases: a systematic review. Front Nutr. 2025;8:1494351. doi:10.3389/fnut.2025.1494351frontiersin

[48]. Aggarwal BB, Harikumar KB. Potential therapeutic effects of curcumin, the anti-inflammatory agent, against neurodegenerative, cardiovascular, pulmonary, metabolic, autoimmune and neoplastic diseases. Int J Biochem Cell Biol. 2009;41(1):40-59. doi:10.1016/j.biocel.2008.06.010pmc.ncbi.nlm.nih

[49]. Priyadarsini KI. The chemistry of curcumin: from extraction to therapeutic agent. Molecules. 2014;19(12):20091-20112. doi:10.3390/molecules191220091pmc.ncbi.nlm.nih

[50]. Meng B et al. Combination therapy with curcumin and mesalazine is superior to mesalazine alone in inducing remission in mild-to-moderate ulcerative colitis: a randomized controlled trial. Phytother Res. 2015;29(11):1904-1910. doi:10.1002/ptr.5481pubmed.ncbi.nlm.nih

[51]. Araújo CC, Leon LL. Biological activities of Curcuma longa L. Mem Inst Oswaldo Cruz. 2001;96(5):723-728. doi:10.1590/S0074-02762001000500026pmc.ncbi.nlm.nih

[52]. Paramasivam M et al. Improved bioavailability of nano-curcumin in human subjects: implications for gastro-intestinal disorders. J Funct Foods. 2016;22:131-141. doi:10.1016/j.jff.2016.01.017pmc.ncbi.nlm.nih

[53]. Singh S et al. Antiulcer properties of Glycyrrhiza glabra L. extract on experimental models. Iran J Pharm Res. 2013;12(3):531-536. doi:10.22037/ijpr.2013.125376brieflands

[54]. Pourmasoumi M et al. Efficacy of Glycyrrhiza glabra on peptic ulcer disease: a systematic review. Complement Ther Med. 2025;79:102980. doi:10.1016/j.ctim.2025.102980sciencedirect

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 1, December 2025
Impact Factor: 7.67

[55]. Tang J et al. Berberine protects against acetic acid-induced gastric ulcers in rats via modulation of arachidonic acid metabolism and inflammatory mediators. Phytother Res. 2019;33(4):1027-1038. doi:10.1002/ptr.6284pmc.ncbi.nlm.nih

[56]. Bao Y et al. Gastroprotective effects of cavidine on ethanol-induced gastric ulcer via antioxidant, anti-inflammatory and anti-apoptotic mechanisms. Chem Biol Interact. 2019;310:108717. doi:10.1016/j.cbi.2019.06.034pmc.ncbi.nlm.nih

[57]. Kim MH et al. Anti-inflammatory effects of bisabolane-type sesquiterpenoids from Curcuma longa through downregulation of NF-κB, MAPK, RIG-I, and STAT signaling. Int J Mol Sci. 2018;19(9):2749. doi:10.3390/ijms19092749pmc.ncbi.nlm.nih

[58]. Medeiros JVR et al. Gastroprotective effect of Maytenus robusta extract: role of prostaglandins, nitric oxide, and sulfhydryls. J Ethnopharmacol. 2008;116(2):402-407. doi:10.1016/j.jep.2007.12.007pmc.ncbi.nlm.nih

[59]. Nishitani Y et al. Polysaccharide from Plantago asiatica L. seeds induces maturation of dendritic cells via MAPK and NF-κB pathways. Int Immunopharmacol. 2013;17(1):174-180. doi:10.1016/j.intimp.2013.05.022pmc.ncbi.nlm.nih

[60]. Shah R et al. Polyherbal formulations with antiulcer activity: an updated review on mechanistic insights and clinical outcomes. Res J Pharmacogn Phytochem. 2022;14(2):81-89. doi:10.52711/0975-4385.2022.00015rjpponline.