



---

## A review on management of peptic ulcer by herbal-based medications

Prinsi Sahpuriya\*, Vinita Singh, Reenu Yadav, Vinod Kumar Gauttam

IES Institute of Pharmacy, IES University, Bhopal, Madhya Pradesh, India

---

### Abstract

Peptic ulcer is a serious public health issue caused by the infection of *Helicobacter pylori* and regular intake of non-steroidal anti-inflammatory drugs (NSAIDs), conventional proton pump inhibitors (PPIs) and histamine-2 (H2) receptor antagonists. The application of herbal medicine in stomach diseases is due to its anti-inflammatory, anti-microbial, and anti-oxidant. Moreover, herbal medicine can be effective in inflammatory and supporting the healing of would ulcer. The present review focuses on the various plants based approaches for the treatment of peptic ulcer that proved to be a therapy with lesser side effects and improved therapeutic efficacy. In future, herbal therapeutics will have a greater impact on the anti-ulcer treatment, replacing the several conventional treatment regimes. Abundant natural materials have been explored for the peptic ulcer treatment.

**Keywords:** peptic ulcer, herbal treatment; conventional treatment approaches; phytoconstituents; inflammation

---

### Introduction

Peptic ulcer disease, which encompasses both stomach and duodenal ulcers, has been a severe hazard to the world's population for over two centuries, with substantial morbidity and death. The advancement of understanding about the etiopathogenesis of peptic acid disease from an acid-driven disease to an infectious disease has opened this area up for a variety of investigations in order to uncover the best available management options of this disease. The discovery of *Helicobacter pylori* (*H. pylori*) sparked a lot of interest in the microbe's significance. The eradication of this bacterium has been determined to be critical in reducing peptic ulcer complications (Prabhu and Shivani, 2014) [29].

Mucosal disruption in individuals with acid peptic disease has traditionally been thought to be caused by a hypersecretory acidic environment combined with dietary variables or stress. *H. pylori* infection, alcohol and tobacco intake, use of nonsteroidal anti-inflammatory medicines (NSAIDs), and Zollinger–Ellison syndrome are all risk factors for peptic ulcer development (Kuna *et al.*, 2019) [22] as shown in Figure 1.

Inhibition of stomach acid secretion, enhancement of gastro-protection, preventing apoptosis, and stimulation of epithelial cell proliferation are some of the newer treatments for peptic ulcers. Histamine receptor antagonists, prostaglandin analogues, proton pump inhibitors, cytoprotective agents, antacids, and anticholinergics are some of the common drugs used to treat ulcers. However, most of these drugs have unpleasant side effects or drug interactions, and they can even alter the body's biochemical mechanisms with long-term use. Hence, herbal medicines are generally used in such chronic cases, wherein drugs are required to be used for long periods (Bandyopadhyay *et al.*, 2002) [4]. Peptic ulcers are acid-induced lesions found in the stomach and duodenum characterized by denuded mucosa with the defect extending into the submucosa or muscularis propria. Lesions that do not reach this depth are called erosions. In the United States, the prevalence of self-reported physician-diagnosed peptic ulcer disease was 10% in 1990, and the approximate incidence is about 500,000 new cases per a year. Overall, however, the risk of mortality and need for hospitalizations due to PUD has been decreasing worldwide (Vaira *et al.*, 1994; Wu *et al.*, 2021) [44, 48]. Declining incidence rates occurred in recent years, but the patients were older and had more comorbidity. The ASA score was associated with both short-term mortality and long-term survival (Dadfar and Edna, 2020) [8]. It is a chronic disease, with activation and remission periods and its pathogenesis is characterized by the imbalance between the factors that damages the mucosa (chloride acid, pepsin, and ulcerogenic drugs) and those that protect it (mucosal barrier, prostaglandins, and mucosal secretion) (Vomero and Colpo, 2014) [47]. Ethanol, nicotine and ingestion of drugs, in particular, non-steroidal anti-inflammatory drugs (NSAIDs) (e.g., aspirin) are considered as the major causative factors in the development of acute mucosal damage and gastric ulcers.

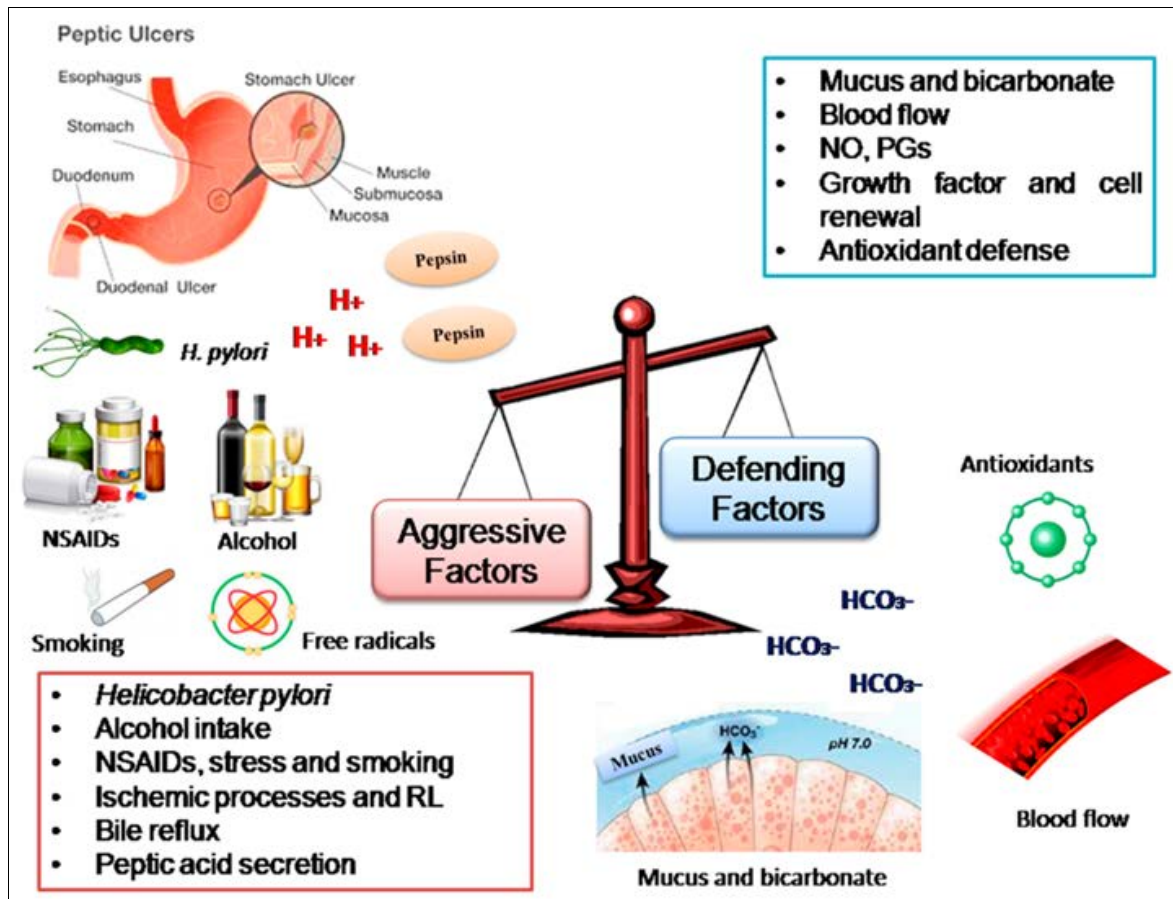


Fig 1: Schematic representation of peptic ulcer etiopathogenesis (Serafim *et al.*, 2020).

### Management of peptic ulcer by alternative therapy

Patients with chronic ulcer diseases exploit complementary and alternative treatment options to manage their conditions better and improve well-being (Amaeze *et al.*, 2018) [2]. In most of the sub-Saharan African countries, use of herbal medications is widely practiced during stomach ulcer for various reasons despite uncertainties on their pharmacological profiles (Tengia-Kessy and Msalale, 2021) [43].

#### *Aegle marmelos*

The therapeutic benefits of *Aegle marmelos* (L.) have been widely reported in indigenous Indian medical systems, including astringent, antidiarrheal, antidysertery, demulcent, antipyretic, antiulcer, anti-inflammatory, and anticancer effects. The fruit extract of *A. marmelos* has a high antioxidant activity. As a result, it protects the stomach mucosa from *Helicobacter pylori*-Lipopolysaccharide (HP-LPS)-induced ulceration by reducing secretory parameters and activating antioxidant mechanisms (Ramakrishna *et al.*, 2015) [31]. As an antiscorbutic and stomatic agent, fruit pulp is used in a milk-sugar mixture. It is possible to cure an intestinal ulcer, as well as chronic constipation and indigestion (Sarkar *et al.*, 2020) [36].

#### *Acacia arabica*

In Ayurvedic medicine, *Acacia arabica* can be used as a gargle or a wash for hemorrhagic ulcers and wounds. Tender leaves that have been bruised and made into a poultice and put to ulcers work as a stimulant and astringent (Vimala and Gricilda Shoba, 2014) [46]. An antiulcer effect has been shown in a hydroethanolic extract of immature seedless *Acacia nilotica* pods. The antiulcer activity of the extract is thought to be due to the phenolic component (Bansal and Goel, 2012) [5]. Leucorrhoea, haemorrhages, wounds, ulcers, and a decoction for diarrhoea and vaginal discharges are all cured with bark (Roqaiya *et al.*, 2015) [32].

#### *Adansonia digitata*

Traditionally, fresh leaf juice of *Adansonia digitata* mixed with powdered ginger, as well as the expressed juice of the fresh root of *Salvadora indica*, are used to treat indolent syphilitic ulcers with great success. Irritable inflammatory ulcers are treated with fomentations and poultices made from the leaves (Vimala and Gricilda Shoba, 2014) [46]. Flavonoids, steroids, vitamins, fatty acids, and terpenoids were found in the chemical composition of this plant, in addition to tannin. In numerous recent research papers, flavonoids, terpenoids, tannins, (Owoyele and Bakare, 2018) [28] vitamin C and fatty acids have been shown to have, antisecretory, antiulcer, and ulcer healing activities (Dalu, 2018) [9].

***Aloe barbadensis***

*Aloe barbadensis* is well-known for its anti-inflammatory, anti-bacterial, wound-healing, and ulcer-prevention capabilities, as well as its ability to heal wounds (Hekmatpou *et al.*, 2019) <sup>[20]</sup>. Peptic ulcers have been shown to respond effectively to aloe vera juice and a combination of aloe vera and papaya fruit juice. In all of the studies, however, Aloe vera juice mixed with papaya fruit juice performed better. This could be because the blended beverage contains phytonutrients and phytochemicals (Gopinathan and Naveenraj, 2013) <sup>[15]</sup>. Anti-ulcer activities of *A. vera* have been connected to anti-inflammatory qualities, healing effects, mucus stimulatory effects, stomach secretion modulation, and the presence of lectins, among other mechanisms. The lectins inhibit aminopyrine from being absorbed by parietal cells. As a result, the extract's remarkable ability to reduce gastric acid secretion may be due to a direct influence on acid-producing cells (Hamman, 2008) <sup>[17]</sup> (Sharma *et al.*, 2014) <sup>[39]</sup>.

***Solidago chilensis***

*Solidago chilensis* Meyen is also known as "vara dorada," is a South American natural plant that has long been used in traditional medicine as an anti-inflammatory, diuretic, and treatment for gastrointestinal problems. In gastric ulcer models of Swiss mice and L929 cells, the gastroprotective activity of *S. chilensis* methanol leaf extract (100 and 300 mg/kg) was investigated (De Barros *et al.*, 2016) <sup>[10]</sup>. Because of the presence of flavonoids (especially quercitrin and afzelin), which are linked to its antioxidant and anti-secretory properties in addition to its beneficial effect on mucus production, leaf extract promotes gastroprotection and exerts gastric healing benefits through diversified and complementary modes of action (Sharifi-Rad *et al.*, 2018) <sup>[38]</sup>.

***Beta vulgaris***

Extracts from *Beta vulgaris* (Beet root) plants were found to have antioxidant, antidiabetic, immunostimulatory, anticancer, antibacterial, anti-inflammatory, antiulcer, and hypoglycemic properties in recent pharmacological research <sup>[24]</sup>. Alkaloids, flavonoids, carbohydrates, saponins, and polyphenols were discovered during a preliminary phytochemical screening of beet root. In both the ethanol generated ulcer model and the pylorus ligation ulcer model, ethanolic extract of *Beta vulgaris* roots provided considerable protection (Samyuktha *et al.*, 2017) <sup>[35]</sup>.

***Moringa oleifera***

*Moringa oleifera* is used in traditional medicine, which makes extensive use of seeds, leaves, oil, sap, bark, roots, and flowers. Moringa leaves have been found to provide a balanced nutritional profile, including vitamins, minerals, amino acids, and fatty acids (Moyo *et al.*, 2011) <sup>[25]</sup>. It contains a variety of components, including carotenoids (Ramesh Kumar Saini *et al.*, 2014) <sup>[33]</sup>, tocopherols ( $\alpha$ ,  $\gamma$ ,  $\delta$ ) (R. K. Saini *et al.*, 2014) <sup>[34]</sup>, flavonoids, and phenolic acids (Amaglo *et al.*, 2010) <sup>[3]</sup> (Coppin *et al.*, 2013) <sup>[7]</sup>. Sucrose, amino acids, alkaloids, and flavonoids like rhamnetin, isoquercitrin, and kaempferitrin are found in flowers (Siddhuraju and Becker, 2003) <sup>[41]</sup> (Vergara-Jimenez *et al.*, 2017) <sup>[45]</sup>. In the ibuprofen-induced stomach ulcer model and the pyloric ligation test (Dhimmar *et al.*, 2015) <sup>[13]</sup>, the extract of leaves significantly reduced ulcer index, and there was also a substantial reduction in cysteamine-induced duodenal ulcers and stress ulcers (Devaraj *et al.*, 2007) <sup>[12]</sup>. Bisphenols and flavonoids may play a role in this characteristic (Debnath and Guha, 2007) <sup>[11]</sup>.

***Artemisia absinthium***

The leaves of *Artemisia absinthium* have essential oil secreting hairs/glandular trichomes and protective T-hairs that protect the plant from high temperatures and extended drought (Martini *et al.*, 2020) <sup>[24]</sup> (Hayat *et al.*, 2009) <sup>[19]</sup>. Lactones, terpenoids (e.g., trans-thujone,  $\gamma$ -terpinene, 1,4-terpeniol, myrcene, bornyl acetate, cadinene camphene, trans-sabinyl acetate, guaiazulene, chamazulene, camphor, and linalool), essential oils, organic acids, tannins, phenols and resins) were amongst (Omer *et al.*, 2007) <sup>[27]</sup>. It also contains flavonoids (e.g. quercitrin), flavonoid glycosides such as isoquercitrin, isorhamnetin-3-*O*-rhamnose glucoside, isorhamnetin-3-*O*-glucoside, quercetin-3-*O*-D-glucoside, quercetin-3-*O*-rhamnoglucoside, and phenolic acids (coumaric, chlorogenic, syringic, salicylic, and vanillic acids) which donate to free radical scavenging mechanism (Kordali *et al.*, 2005) <sup>[21]</sup>. study reported that methanol, hexane, chloroform, and ethanol extracts of *A. absinthium* displayed antiulcer characteristic in ulcerogenic rats induced by acetylsalicylic acid (Batiha *et al.*, 2020) <sup>[6]</sup>. Extracts from the whole herb and roots of *A. absinthium* obtained using different solvents (hexane, chloroform, methanol, ethanol, carbon tetrachloride) were administered to the rodents both before and after they had get acetylsalicylic acid. The extracts from the plant did not affect the activity of mucin; however, they caused a significant inhibition in the volume of gastric juice, a reduce in the secretion of gastric acid and pepsin, and a lowering in digestion rate (Szopa *et al.*, 2020) <sup>[42]</sup>.

***Zingiber officinale***

The rhizomes of *Zingiber officinale* have been used since antiquity in the various traditional systems of medicine to manage cold, fever, hypertension, sore throats, infectious diseases, arthritis, rheumatism, sprains, muscular aches, pains, cramps, dementia, migraine, nervous diseases, gingivitis, toothache, asthma, diabetes, stroke, and also used as home remedy in manage various gastric disease like constipation, dyspepsia, belching, bloating, gastritis, epigastric discomfort, gastric ulcerations, indigestion, nausea, diarrhea and vomiting (Giacosa *et al.*,

2015)<sup>[14]</sup> (Haniadka *et al.*, 2013)<sup>[18]</sup> (Lete and Allué, 2016)<sup>[23]</sup>. The major constituents in ginger rhizomes are carbohydrates (50–70%), terpenes, lipids (3–8%) and phenolic compounds (Grzanna *et al.*, 2005)<sup>[16]</sup>. Terpene components of ginger consist zingiberene,  $\alpha$ -curcumene,  $\alpha$ -farnesene,  $\beta$ -sesquiphellandrene, and  $\beta$ -bisabolene, while phenolic compounds contain gingerol, shogaol, and paradols. The special odor of ginger is related to bisabolene and zingiberene. While the pungent flavor is due to volatile oils of shogaols (18–25%) and gingerols (23–25%). Besides these components, amino acids, raw fiber, ash, protein, phytosterols, vitamins (e.g. vitamin A and nicotinic acid), and ginger also contain minerals. Other gingerol- or shogaol-related compounds (1–10%), which have been reported in ginger rhizome, are including 6-paradol, 6- gingerdione, 1-dehydrogingerdione, and 10-gingerdione, 4- gingerdiol, 6-gingerdiol, 8- gingerdiol, and 10-gingerdiol, and diarylheptanoids (Nikkhah Bodagh *et al.*, 2019)<sup>[26]</sup> (Ali *et al.*, 2008)<sup>[11]</sup> (Prasad and Tyagi, 2015)<sup>[30]</sup>. The gastroprotective effects of GGE03, a steamed ginger preparation, against acute stomach ulcers in a rat model. Protective mechanisms appear to be (i) augmentation of gastric defensive mechanisms as evidenced by increased mucosal PGE<sub>2</sub> synthesis and total nitric oxide, (ii) augmentation of gastric antioxidation capability, and (iii) inhibition of inflammation. The overall data support that GGE03 is a potential pharmacological agent for gastritis patients (Shin *et al.*, 2020)<sup>[40]</sup>.

**Table 1:** List of plants used in management of peptic ulcer

S. No	Plant name	Part use	Chemical constitute	Model used	Reference
1	<i>Aegle marmelos</i>	Fruit pulp, Bark	flavonoids, tannins, and saponins	ethanol induced gastric ulcer model	12,13
2	<i>Acacia Arabica</i>	Leaf, Bark	Luvangetin	pylorus ligation induced gastric ulcers in rats	14,15,16
3	<i>Adansonia digitata</i>	Leaf	Flavonoids, terpenoids, tannins, vitamin C, fatty acids.	pylorus ligation and ethanol induced models	14,17,18
4	<i>Aloe barbadensis</i>	Leaf	aloin, isobarbaloin, and emodin	indomethacin induced gastric ulcer model	19,20,21,22
5	<i>Solidago chilensis</i>	Leaf	Flavonoids (quercitrin, quercetin and rutin), diterpenes (solidagenone)	gastric ulcer models of Swiss mice	23,24
6	<i>Beta vulgaris</i>	Root, Bulb	alkaloids, flavonoids, carbohydrates, saponins, polyphenols	pylorus ligation ulcer model	24,25
7	<i>Moringa oleifera</i>	Seeds, leaves, oil, sap, bark, roots, and flowers	rhamnetin, isoquercitrin	ibuprofen-induced gastric ulcer model and in pyloric ligation test	26-35
8	<i>Zingiber officinale</i>	Rhizomes	zingiberene, $\beta$ -bisabolene, $\alpha$ -farnesene, $\beta$ -sesquiphellandrene, $\alpha$ -curcumene, gingerol, paradols, shogaol	gastric ulcers in a rat model	42-49

## Conclusion

For the management of peptic ulcer, modern medication therapies are used. In this mostly proton pump inhibitors (PPIs) and histamine-2 (H2) receptor antagonists are used. But there are some limitations exist with therapies, which can be overcome by some alternative therapies. Traditional medication therapies are useful in the prevention and treatment of Peptic ulcer diseases. Hence this review briefly described current knowledge about the gastric mucosal protection, traditional medicine & modern medicine used in the treatment of Peptic Ulcer. Traditional medication therapies and conventional therapies are a valuable armamentarium in clinical medicine, but appropriate recognition of high-risk cases, selection of a specific drug, choice of peptic ulcer prophylaxis and monitoring after therapy are necessary to reduce the risk of adverse events.

## References

1. Ali BH, Blunden G, Tanira MO, Nemmar A. Some phytochemical, pharmacological and toxicological properties of ginger (*Zingiber officinale* Roscoe): A review of recent research. *Food Chem. Toxicol.* 2008. <https://doi.org/10.1016/j.fct.2007.09.085>
2. Amaeze OU, Aderemi-Williams RI, Ayo-Vaughan MA, Ogundemuren DA, Ogunmola DS, Anyika EN. Herbal medicine use among Type 2 diabetes mellitus patients in Nigeria: understanding the magnitude and predictors of use. *Int. J. Clin. Pharm.* 2018, 40. <https://doi.org/10.1007/s11096-018-0648-2>
3. Amaglo NK, Bennett RN, Lo Curto RB, Rosa EAS, Lo Turco V, Giuffrida A *et al.* Profiling selected phytochemicals and nutrients in different tissues of the multipurpose tree *Moringa oleifera* L., grown in Ghana. *Food Chem.* 2010, 122. <https://doi.org/10.1016/j.foodchem.2010.03.073>
4. Bandyopadhyay U, Biswas K, Chatterjee R, Bandyopadhyay D, Chattopadhyay I, Ganguly CK. Gastro Protective effect of Neem (*Azadirachta indica*) bark extract: Possible involvement of H<sup>+</sup>-K<sup>+</sup>-ATPase

- inhibition and scavenging of hydroxyl radical. *Life Sci*, 2002, 71. [https://doi.org/10.1016/S0024-3205\(02\)02143-4](https://doi.org/10.1016/S0024-3205(02)02143-4)
5. Bansal VK, Goel RK. Gastroprotective effect of *Acacia nilotica* young seedless pod extract: Role of polyphenolic constituents. *Asian Pac. J. Trop. Med.* 5, 2012. [https://doi.org/10.1016/S1995-7645\(12\)60092-3](https://doi.org/10.1016/S1995-7645(12)60092-3)
  6. Batiha GES, Olatunde A, El-mleeh A, Hetta HF, Al-rejaie S, Alghamdi S *et al.* Bioactive compounds, pharmacological actions, and pharmacokinetics of wormwood (*Artemisia absinthium*). *Antibiotics*, 2020. <https://doi.org/10.3390/antibiotics9060353>
  7. Coppin JP, Xu Y, Chen H, Pan MH, Ho CT, Juliani R *et al.* Determination of flavonoids by LC/MS and anti-inflammatory activity in *Moringa oleifera*. *J. Funct. Foods* 5, 2013. <https://doi.org/10.1016/j.jff.2013.09.010>
  8. Dadfar A, Edna TH. Epidemiology of perforating peptic ulcer: A population-based retrospective study over 40 years. *World J. Gastroenterol.* 26, 2020. <https://doi.org/10.3748/WJG.V26.I35.5302>
  9. Dalu D. Anti-Ulcer Activity of *Leea Indica* in Wistar Albino Rats. *Arch. Nanomedicine Open Access J*, 2018, 1. <https://doi.org/10.32474/anoaj.2018.01.000105>
  10. De Barros M, Mota Da Silva L, Boeing T, Somensi LB, Cury BJ, De Moura Burci L *et al.* Pharmacological reports about gastroprotective effects of methanolic extract from leaves of *Solidago chilensis* (Brazilian arnica) and its components quercitrin and afzelin in rodents. *Naunyn. Schmiedebergs. Arch. Pharmacol*, 2016. 389. <https://doi.org/10.1007/s00210-015-1208-0>
  11. Debnath S, Guha D. Role of *Moringa oleifera* on enterochromaffin cell count and serotonin content of experimental ulcer model. *Indian J. Exp. Biol*, 2007, 45.
  12. Devaraj VC, Asad M, Prasad S. Effect of leaves and fruits of *Moringa oleifera* on gastric and duodenal ulcers. *Pharm. Biol*, 2007, 45. <https://doi.org/10.1080/13880200701212924>
  13. Dhimmam N, Patel NM, Gajera V, Lambole V. Pharmacological activities of *Moringa oleifera*: An overview. *Res. J. Pharm. Technol.* <https://doi.org/10.5958/0974-360X.2015.00079.7>
  14. Giacosa A, Morazzoni P, Bombardelli E, Riva A, Porro GB, Rondanelli M. Can nausea and vomiting be treated with Ginger extract? *Eur. Rev. Med. Pharmacol. Sci*, 2015, 19.
  15. Gopinathan S, Naveenraj D. Gastroprotective and Anti-ulcer activity of Aloe vera juice, Papaya fruit juice and Aloe vera and Papaya fruit combined juice in Ethanol induced Ulcerated rats. *Int. J. Drug Dev. Res*, 2013, 5.
  16. Grzanna R, Lindmark L, Frondoza CG. Ginger - An herbal medicinal product with broad anti-inflammatory actions. *J. Med. Food*, 2005. <https://doi.org/10.1089/jmf.2005.8.125>
  17. Hamman JH. Composition and applications of Aloe vera leaf gel, 2008. *Molecules*. <https://doi.org/10.3390/molecules13081599>
  18. Haniadka R, Saldanha E, Sunita V, Palatty PL, Fayad R, Baliga MS. A review of the gastroprotective effects of ginger (*Zingiber officinale* Roscoe), 2013. *Food Funct.* <https://doi.org/10.1039/c3fo30337c>
  19. Hayat MQ, Ashraf M, Ajab Khan M, Yasmin G, Shaheen N, Jabeen S. Diversity of foliar trichomes and their systematic implications in the genus *Artemisia* (Asteraceae). *Int. J. Agric. Biol*, 2009, 11.
  20. Hekmatpou D, Mehrabi F, Rahzani K, Aminiyani A. The effect of aloe vera clinical trials on prevention and healing of skin wound: A systematic review. *Iran. J. Med. Sci.* <https://doi.org/10.30476/ijms.2019.40612>
  21. Kordali S, Cakir A, Mavi A, Kilic H, Yildirim A. Screening of chemical composition and antifungal and antioxidant activities of the essential oils from three Turkish *Artemisia* species. *J. Agric. Food Chem*, 2005, 53. <https://doi.org/10.1021/jf048429n>
  22. Kuna L, Jakab J, Smolic R, Raguz-Lucic N, Vcev A, Smolic M. Peptic Ulcer Disease: A Brief Review of Conventional Therapy and Herbal Treatment Options. *J. Clin. Med*, 2019, 8. <https://doi.org/10.3390/jcm8020179>
  23. Lete I, Allué J. The effectiveness of ginger in the prevention of nausea and vomiting during pregnancy and chemotherapy. *Integr. Med. Insights*, 2016. <https://doi.org/10.4137/IMI.S36273>
  24. Martini MC, Zhang T, Williams JT, Abramovitch RB, Weathers PJ, Shell SS. *Artemisia annua* and *Artemisia afra* extracts exhibit strong bactericidal activity against *Mycobacterium tuberculosis*. *J. Ethnopharmacol*, 2020, 262. <https://doi.org/10.1016/j.jep.2020.113191>
  25. Moyo B, Masika PJ, Hugo A, Muchenje V. Nutritional characterization of *Moringa* (*Moringa oleifera* Lam.) leaves. *African J. Biotechnol*, 2011, 10. <https://doi.org/10.5897/ajb10.1599>
  26. Nikkhhah Bodagh M, Maleki I, Hekmatdoost A. Ginger in gastrointestinal disorders: A systematic review of clinical trials. *Food Sci. Nutr.* <https://doi.org/10.1002/fsn3.807>
  27. Omer B, Krebs S, Omer H, Noor TO. Steroid-sparing effect of wormwood (*Artemisia absinthium*) in Crohn's disease: A double-blind placebo-controlled study. *Phytomedicine*, 2007, 14. <https://doi.org/10.1016/j.phymed.2007.01.001>
  28. Owoyele BV, Bakare AO. Analgesic properties of aqueous bark extract of *Adansonia digitata* in Wistar rats. *Biomed. Pharmacother*, 2018, 97. <https://doi.org/10.1016/j.biopha.2017.10.079>
  29. Prabhu V, Shivani A. An overview of history, pathogenesis and treatment of perforated peptic ulcer disease with evaluation of prognostic scoring in adults. *Ann. Med. Health Sci. Res*, 2014;4:22. <https://doi.org/10.4103/2141-9248.126604>

30. Prasad S, Tyagi AK. Ginger and its constituents: Role in prevention and treatment of gastrointestinal cancer. *Gastroenterol. Res. Pract*, 2015. <https://doi.org/10.1155/2015/142979>
31. Ramakrishna YG, Savithri K, Kist M, Devaraj SN. Aegle marmelos fruit extract attenuates *Helicobacter pylori* Lipopolysaccharide induced oxidative stress in Sprague Dawley rats. *BMC Complement. Altern. Med*, 2015, 15. <https://doi.org/10.1186/s12906-015-0915-x>
32. Roqaiya M, Begum W, Jahufer R. *Acacia arabica* (Babool) - A review on ethnobotanical and unani traditional uses as well as phytochemical and pharmacological properties. *Int. J. Pharm. Phytopharm. Res*, 2015, 4.
33. Saini, Ramesh Kumar, Shetty NP, Giridhar P. Carotenoid content in vegetative and reproductive parts of commercially grown *Moringa oleifera* Lam. cultivars from India by LC-APCI-MS. *Eur. Food Res. Technol*, 2014, 238. <https://doi.org/10.1007/s00217-014-2174-3>
34. Saini RK, Shetty NP, Prakash M, Giridhar P. Effect of dehydration methods on retention of carotenoids, tocopherols, ascorbic acid and antioxidant activity in *Moringa oleifera* leaves and preparation of a RTE product. *J. Food Sci. Technol*, 2014, 51. <https://doi.org/10.1007/s13197-014-1264-3>
35. Samyuktha K, Chinnala KM, Prathiba G, Rajendhar D, Reddy PS. Evaluation of anti-ulcer activity of ethanolic root extract of *Beta vulgaris* in rats. *Int. J. Basic Clin. Pharmacol*, 2017, 6. <https://doi.org/10.18203/2319-2003.ijbcp20170330>
36. Sarkar T, Salauddin M, Chakraborty R. In-depth pharmacological and nutritional properties of bael (*Aegle marmelos*): A critical review. *J. Agric. Food Res*, 2020. <https://doi.org/10.1016/j.jafr.2020.100081>
37. Serafim C, Araruna ME, Júnior EA, Diniz M, Hiruma-Lima C, Batista L. A Review of the Role of Flavonoids in Peptic Ulcer (2010-2020), 2020. *Molecules*. <https://doi.org/10.3390/molecules25225431>
38. Sharifi-Rad M, Fokou PVT, Sharopov F, Martorell M, Ademiluyi AO, Rajkovic J *et al.* Antiulcer agents: From plant extracts to phytochemicals in healing promotion. *Molecules*, 2018. <https://doi.org/10.3390/molecules23071751>
39. Sharma P, Kharkwal AC, Kharkwal H, Abdin MZ, Varma A. A review on pharmacological properties of aloe vera. *Int. J. Pharm. Sci. Rev. Res*, 2014, 29.
40. Shin JK, Park JH, Kim KS, Kang TH, Kim HS. Antiulcer activity of steamed ginger extract against ethanol/HCl-induced gastric mucosal injury in rats. *Molecules*, 2020, 25. <https://doi.org/10.3390/molecules25204663>
41. Siddhuraju P, Becker K. Antioxidant properties of various solvent extracts of total phenolic constituents from three different agroclimatic origins of drumstick tree (*Moringa oleifera* Lam.) leaves. *J. Agric. Food Chem*, 2003, 51. <https://doi.org/10.1021/jf020444+>
42. Szopa A, Pajor J, Klin P, Rzepiela A, Elansary HO, Al-Mana FA *et al.* *Artemisia absinthium* L.—importance in the history of medicine, the latest advances in phytochemistry and therapeutical, cosmetological and culinary uses. *Plants*, 2020. <https://doi.org/10.3390/plants9091063>
43. Tengia-Kessy A, Msalale GC. Understanding forgotten exposures towards achieving Sustainable Development Goal 3: a cross-sectional study on herbal medicine use during pregnancy or delivery in Tanzania. *BMC Pregnancy Childbirth*, 2021, 21. <https://doi.org/10.1186/s12884-021-03741-5>
44. Vaira D, Holton J, Miglioli M, Menegatti M, Mule P, Barbara L. Peptic ulcer disease and *Helicobacter pylori* infection. *Curr. Opin. Gastroenterol*, 1994. <https://doi.org/10.1097/00001574-199401000-00015>
45. Vergara-Jimenez M, Almatrafi MM, Fernandez ML. Bioactive components in *Moringa oleifera* leaves protect against chronic disease. *Antioxidants*, 2017. <https://doi.org/10.3390/antiox6040091>
46. Vimala G, Gricilda Shoba F. A review on antiulcer activity of few indian medicinal plants. *Int. J. Microbiol*, 2014. <https://doi.org/10.1155/2014/519590>
47. Vomero ND, Colpo E. Nutritional care in peptic ulcer. *Arq. Bras. Cir. Dig*, 2014. <https://doi.org/10.1590/S0102-67202014000400017>
48. Wu Y, Murray GK, Byrne EM, Sidorenko J, Visscher PM, Wray NR. GWAS of peptic ulcer disease implicates *Helicobacter pylori* infection, other gastrointestinal disorders and depression. *Nat. Commun*, 2021, 12. <https://doi.org/10.1038/s41467-021-21280-7>