

An Overview on Anti-Ulcer Activity of Some Indian Medicinal Plants

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Abstract

Ulcer is a common gastrointestinal disorder now-a-days most of the people affected. Ulcer basically an inflamed break in the skin or the mucous membrane lining the alimentary tract. Ulceration occurs when there a disturbance of the normal equilibrium caused by either enhanced aggression or diminished mucosal resistance. It may be regular uses of the drug, irregular food habits, stress, and so forth. The herbal and natural are practiced world-wide for the treatment of antiulcer since ancient times. The various herbal plants are claimed to posses antiulcer activity. The combination of traditional and modern knowledge can produce better antiulcer drug with fewer side effects. In the review attempts have been made to know about some medicinal plants which may be used in Ayurvedic as well as modern science for the treatment and prevention of ulcer

Keywords: Ulcer, Peptic Ulcer, antiulcer Activity, modern medicine

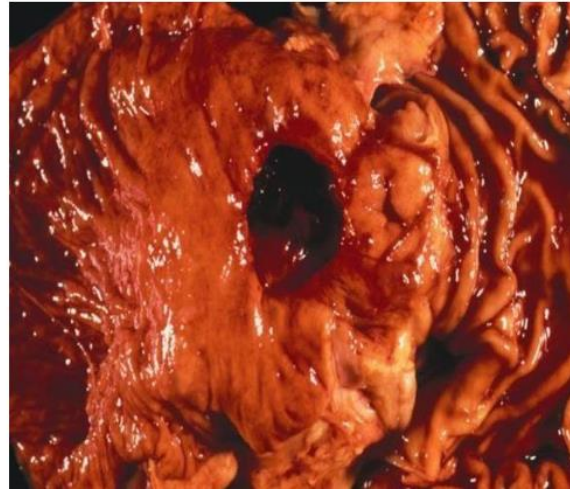
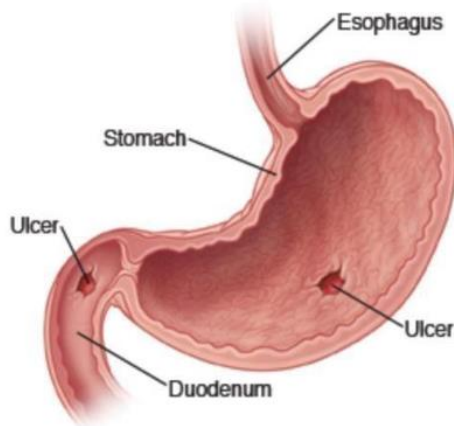
INTRODUCTION

Ulcer is a break on the skin, in the lining of an organ, or on the surface of a tissue. Ulcers are open sores or wounds caused by the erosion of tissue. Ulcers are most Common on the skin of the lower extremities and in the Gastrointestinal tract, although they may be encountered at almost any site. There are many types of ulcer such as mouth ulcer, esophagus ulcer, peptic ulcer, and genital ulcer. Among these the peptic ulcer is seen mostly common in peoples. Peptic ulcer occurs in that part of the gastrointestinal tract (g.i.t.) which is exposed to gastric acid and pepsin, i.e. the stomach and duodenum. The etiology of peptic ulcer is not clearly known. Peptic ulcer disorder arises due to imbalance between defensive factor (gastric mucus and bicarbonate secretion, prostaglandins, nitric oxide, high mucosal blood flow, innate resistance of the mucosal cells) and the aggressive (acid, pepsin, NSAIDs, bile and H. pylori).

Classification

The two most common types of peptic ulcer are called “gastric ulcer” and “duodenal ulcer.” The gastric ulcer or duodenal ulcer may at same time to any people

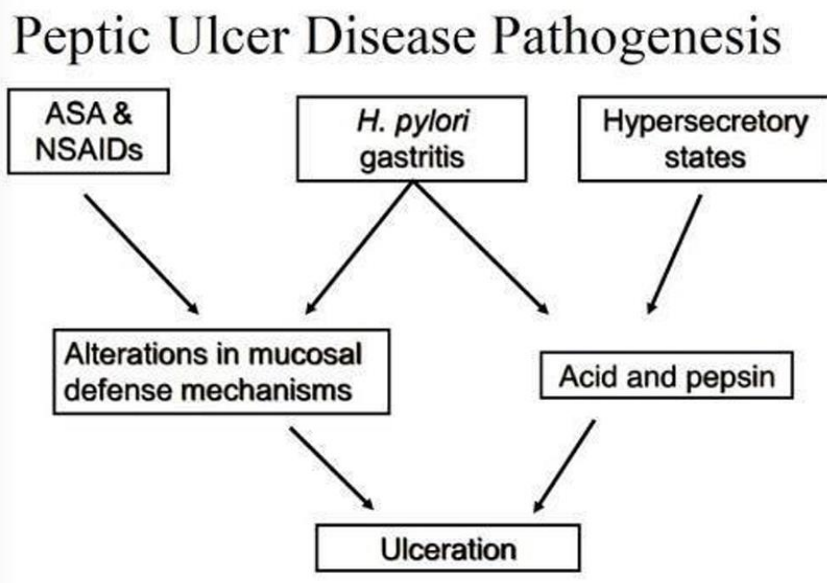
1. Gastric ulcers that occur on the inside of the stomach and characterized by pain; ulcers are common in older age group. Eating may increase pain rather than relieve pain.
2. Duodenal ulcers that occur on the inside of the upper portion of your small intestine (duodenum) and are characterized by severe pain with burning sensation in upper abdomen that awakens patients from sleep.



The most common symptom of a peptic ulcer is stomach pain. In some cases, peptic ulcer can be life threatening with symptoms like bloody stool, severe abdominal pain, and cramps along with vomiting blood. Peptic ulcer disease can also occur if you have a rare condition called Zollinger-Ellison syndrome (gastrinoma). This condition forms a tumor of acid-producing cells in the digestive tract. These tumors can be cancerous or noncancerous. The cells produce excessive amounts of acid that damages stomach tissue.

Pathophysiology:

The pathophysiology of peptic ulcer disease involves an imbalance between offensive (acid, pepsin, and *Helicobacter pylori*) and defensive factors (mucin, prostaglandin, bicarbonate, nitric oxide, and growth factors). Peptic ulcers are once believed to be caused by spicy food and stress; these have been found to be aggravating factors.



The two most important etiological factors in the development of Peptic Ulcer Disease:

1. *Helicobacter pylori* infection
2. Nonsteroidal anti-inflammatory drugs (NSAIDs)

1. H.pylori bacterial infection : H. pylori commonly infects the stomach.

About 50% of the world’s population has an H. pylori infection, often without any symptoms. Researchers believe people can transmit H. pylori from person to person, especially during childhood.

2. NSAID's:

NSAID's are more commonly responsible for gastric ulcers than duodenal ulcers.

NSAID's cause ulcers by following mechanism:

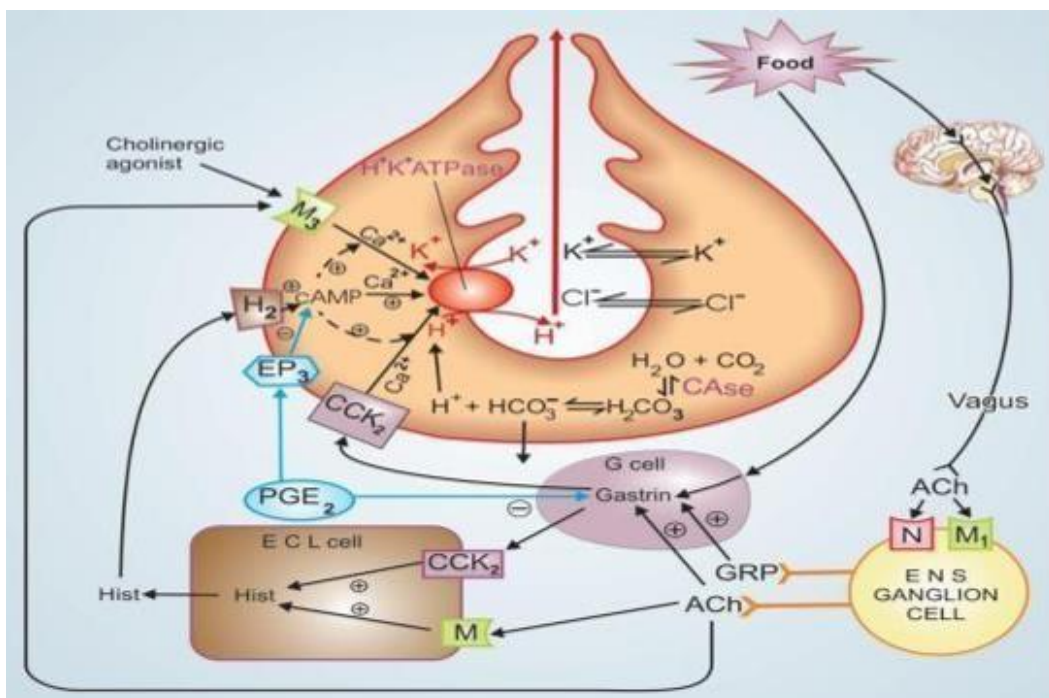
- Inhibit systemic prostaglandins production
- Decreases blood flow • Decreases mucus production
- Inhibits leucocyte adhesion.

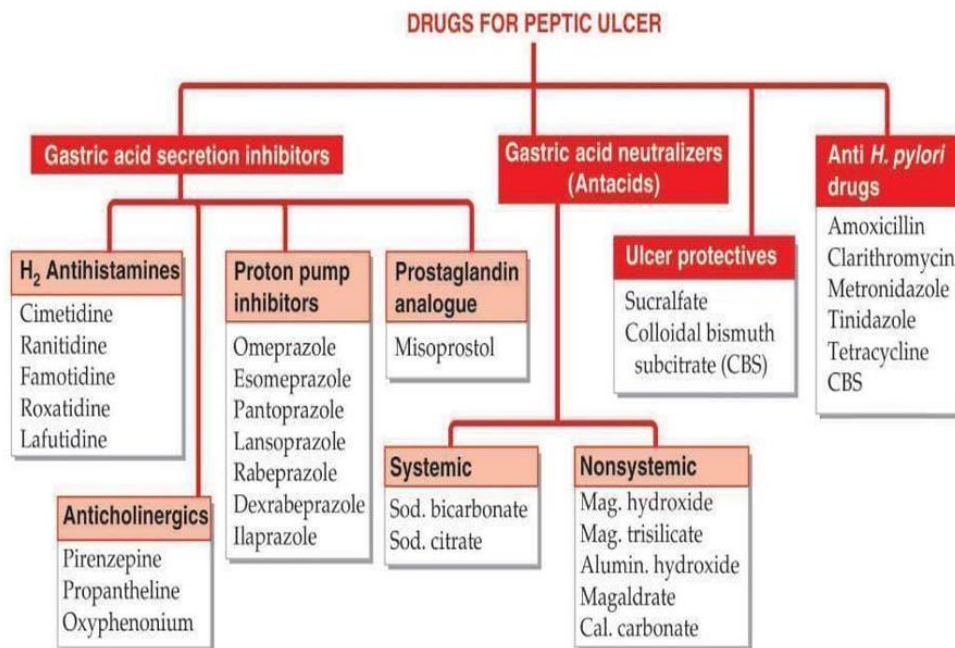
Antral G-cells produce gastrin on stimulation by dietary no peptides. Gastrin mainly stimulates release of histamine from in entero-chromaffin like (ECL) cell and weakly stimulates proton pump itself. Parietal cells secrete H* in the lumen through H K- ATPase (proton pump). Vagus nerve (via ACh) help in increasing acid by three mechanisms:

- Direct stimulation of proton pump
- Stimulation of ECL-cells to release histamine
- Direct release of gastrin (by action of G-cells)

Peptic ulcer is one of the world’s major gastrointestinal disorders and affecting 10% of the world population. About 19 out of 20 peptic ulcers are duodenal. An estimated 15000 deaths occur each year as a consequence of peptic ulcer.

Annual incidence estimates of peptic ulcer hemorrhage and perforation were 19.4–57 and 3.8–14 per 100,000 individuals, respectively. The average 7-day recurrence of hemorrhage was 13.9% and the average long-term recurrence of perforation was 12.2%. In the Indian pharmaceutical industry, antacids and antiulcer drugs share 6.2 billion rupees and occupy 4.3% of the market share.





Experimental Models Used for Peptic Ulcer

Several models are used experimentally for testing or evaluating anti-peptic ulcer activity of drugs/agents, and these include the following:

1. water-immersion stress or cold-water-restraint or cold-restraint stress,
2. NSAIDs- (indomethacin, aspirin, and ibuprofen) induced gastric ulcers,
3. ethanol-induced gastric ulcers,
4. acetic acid-induced gastric ulcers,
5. histamine-induced gastric ulcers,
6. reserpine-induced gastric ulcers,
7. serotonin-induced gastric ulcers,
8. pylorus-ligated-induced peptic ulcers,
9. diethyldithiocarbamate- (DDC)-induced peptic ulcers,
10. methylene blue-induced ulcers,
11. ischemia-reperfusion- (I-R-) induced gastric ulcers,
12. cysteamine-induced duodenal ulcers,
13. indomethacin-histamine-induced duodenal ulcers.
14. ferrous iron-ascorbic acid-induced gastric ulcers
15. acetic acid-H. pylori-induced ulcers

NSAIDs Induced Mucosal Damage

Non-steroidal anti-inflammatory drugs (NSAIDs) such as indomethacin, aspirin and ibuprofen are known to cause gastric ulcers, especially when abused. This phenomenon has been employed in the development of NSAIDs-induced gastric ulcer models in rats. The model is important in investigating the potential usefulness of anti-secretory and cytoprotective agents since the underlying pathophysiology involves gastric acid secretion and mucosal prostaglandin synthesis. It is the most commonly used ulcer model in antiulcer studies. The frequency of usage could be attributed to the fact that NSAID induced peptic ulcers

are the second most common etiology of peptic ulcers aside those caused by *Helicobacter pylori*. NSAIDs are known to induce ulcers by inhibiting prostaglandin synthetase in the cyclooxygenase pathway. Prostaglandins are found in many tissues including the stomach, where they play a vital protective role via stimulating the secretion of bicarbonate and mucus, maintaining mucosal blood flow and regulating mucosal cell turnover and repair. Thus, the suppression of prostaglandin synthesis by NSAIDs results in increased susceptibility to mucosal injury and subsequently gastric ulceration.

The pathogenesis of NSAIDs-induced gastric ulceration includes the NSAID blocking the activities of the cyclooxygenase enzymes (COX-1 and COX-2) hence leading to reduced mucus and bicarbonate secretion, decreased mucosal blood flow, impaired platelet aggregation, alteration of microvascular structures leading to epithelia damage, reduced angiogenesis, and increased leukocyte adherence. Increased production of reactive oxygen species (ROS), increased lipid peroxidation, and neutrophil infiltration also play a role in oxidative mucosal damage by NSAIDs. NSAIDs also inhibit gastric peroxidases and may increase mucosal hydrogen peroxide and hydroxyl ion levels that will cause oxidative mucosal damage. NSAIDs, particularly those of acidic nature, can directly kill epithelial cells. Various mechanisms have been proposed for this cytotoxic action of NSAIDs, including the induction of osmotic lysis subsequent to trapping of charged NSAIDs with the epithelial cells and death of the epithelial cell subsequent to uncoupling of oxidative phosphorylation. NSAIDs can also reduce mucus and bicarbonate secretion, thus decreasing the effectiveness of the juxtamucosal pH gradient in protecting the epithelium. Furthermore, NSAIDs disrupt the layer of surfaceactive phospholipids on the mucosal surface, independent of effects on prostaglandin synthesis. Such an action would render the mucosa less able to resist damage induced by luminal acid.

Pylorus-Ligated-Induced Peptic Ulcer (Shay’s Method)

Ligation of the pylorus induces ulcers that serve as a useful model for investigating the efficacy of drugs on gastric secretions. The ligation of the pyloric end of the stomach causes accumulation of gastric acid in the stomach that produces ulcers. These ulcers result from auto digestion of the gastric mucosa leading to a breakdown of the gastric mucosal barrier. So, basically an increase in acid-pepsin accumulation due to pylorus obstruction may cause subsequent mucosal digestion. The model is useful for evaluating the effects of anti-secretory drugs that reduce secretion of gastric aggressive factors such as acid and pepsin. The model is also useful for assessing the cytoprotective effects of drugs that increase secretion of mucus. Animals are fasted for 36–72 hours prior to pylorus ligation. In this model, the pylorus is ligated by means of the “Shay” technique under ether anaesthesia

The drug or test material is administered orally 1 hour before the pylorus is ligated. The animals are killed 18–20 hours later and ulcers are assessed.

Sr No.	Name	Family	Type of extract	Active constituents	Anti- ulcer activity
01	Acacia arabica	Fabaceae	Gum	Phenolic compounds, tannins and flavonoids	Stress induced gastriculcer
02	Adansonia digitata	Malvaceae	Pulp, leaves	Phobaphene, mucilage contain tannins,	prevent intestinal ulcer

03	Aegle marmelos	Rutaceae	Leaves	Flavonoids, tannins and saponin	reduced the gastric ulcer by 2.8%
04	Allium sativum	Garlic	Juice	Volatile oils, allin, allicin	Amaryllidaceae (Liliaceae) Antiulcer Activity: gastric and duodenal ulcers
05	Aloe vera	Asphodelaceae	Gel	Barbalin, isobarbalin, saponins	A. vera enhance mucous resistance and resulted in decrease.
06	Annona squamosa	Annonaceae	Seeds	Tannic acid	Reduce ulcer
07	Azadirachta indica	Meliaceae	Seeds	Stearic acid and palmitic acid	inhibits gastric lesions induced by restraint cold stress, indomethacin and ethanol. In stress ulcer mode
08	Ginseng	Araliaceae	Roots, leaves, stem	Polysaccharides, triterpenoids, flavonoids	gastroprotective activity
09	Ficus amottiana	Moraceae	Leaf	Sterols, alkaloids, tannins, phenols, carbohydrates	treatment of gastric ulcer. antiulcer activity against aspirin plus pylorus ligation
10	Terminalia billerica	Combretaceae	Seeds, bark	Tannins, Gallic acids, ellagic acid,	suppressed the peptic ulcer
11	Curcuma longa	Zingiberaceae	Rhizomes	Phenolic, tannins, flavonoids	: neutralizing and inhibiting the secretion of stomach acid
12.	Zingiber officinalis	Zingiberaceae	Roots	Phenolic compounds, flavonoids	ulcer-preventive properties
13	Panax binnatidus	Araliaceae	Rhizomes	Phenolic compounds, proteins, flavonoids	gastric mucous membrane protective effect
14	Kochia scoparia	Amaranthaceae	Fruits	Phenolic compounds, flavonoids	gastroprotective
15	Swertia chirata	Gentianaceae	Whole plant	Tannins, flavonoids	Protection of gastric ulcer

16	Bauhinia racemosa	Fabaceace	Flower buds	Phenolic flavonoids	compounds,	Gastric ulcer inducing by pyloric ligation.
17	Calliandra portoticensis	Fabaceace	Leaves	Phenolic flavonoids, saponin	compounds proteins,	Used gastrointestinal

Adansonia digitata

Traditional use: In Ayurvedic. Fresh juice of the leaves mixed with powdered ginger together with the expressed juice of the fresh root of *Salvadora indica* is applied with considerable benefit to indolent syphilitic ulcer. Leaves are used as fomentations and poultices for irritable inflammatory ulcers.



Acacia Arabica

Traditional use: In Ayurvedic. As gargle it is useful as wash in haemorrhagic ulcer and wounds. Bruised tender leaves formed into a poultice and applied to ulcers act as stimulant and astringent.

Recent Studies: *Acacia senegal* gum protected against cold restraint stress-induced gastric ulcer in rats. Aqueous extract of *A. arabica* gum showed protection against meloxicam-induced intestinal damage and attenuated intestinal enzymes activity.



Aegle marmelos

Traditional use: In Folk Medicine. The fruit of *A. marmelos* is traditionally used for the treatment of ulcer among the kani tribes in Kanyakumari district, Tamil Nadu, India.

Recent Studies: Ulcers are induced by aspirin plus pylorus ligated gastric ulceration in rats and aqueous extract of leaves is to be administered orally for 21 days, daily dose of 1gm/kg. International Journal of Microbiology 3. The result indicated a significant reduction in the ulcer lesion count compared to control.



Allium sativum

Traditional use: In Ayurvedic Mustard or coconut oil in which garlic has been fried is an excellent application for maggots infesting ulcers, ulcerated surfaces, and wounds. Garlic juice mixed with 3 or 4 parts of ordinary or distilled water has been used as a lotion for washing wounds and foul ulcers

Recent Studies: The extract of *A. sativum* bulb juice was administered at the doses of 250 and 500mg/kg orally in rats, against cysteamine induced gastric ulcer. The extract significantly increases healing of gastric ulcer and prevents the development of experimentally induced gastric and duodenal ulcers in rats.



Aloe vera

Traditional use: In Ayurvedic. Leaves are being used successfully in America in the local treatment of chronic ulcers. First the pain diminishes and after a few weeks the ulcers heal

Recent Studies: In Recent Studies. Aloe vera powder was mixed with gum acacia; the solution was administered orally in rats at dose of 200mg/kg against indomethacin induced gastric ulcer. The extract showed significant antiulcer activity comparable to control.



Annona squamosa

Traditional use: In Ayurvedic. Decoction of the bark is a useful wash in ulcers. A preparation known as kanchanara guggula made of the following ingredients is useful in ulcers: take the bark of *Bauhinia variegata* (10 parts), 3 myrobalans, ginger, blackpepper, long-pepper, bark of *Crataeva nurvala*, cardamoms, cinnamon, and Tejptra leaves, each one part. Powder them all and add guggula (15 parts) to make a pill mass. This is given in doses of half a tola every morning with a decoction of *Sphaeranthus mollis* or of *Triphala* or of catechu

Recent Studies: The ethanolic and aqueous extract of root of *B. variegata* was administered at the doses of 200 and 400mg/kg orally, in rats against pylorus ligation, ethanol, and aspirin induced gastric ulcer. The extract significantly inhibited gastric mucosal damage and reduced the basal gastric acid secretion.



Azadirachta indica

Traditional use: In Ayurvedic. A poultice of leaves mixed with sesamum seeds is very useful in unhealthy ulcerations

Recent Studies: Azadirachta indica leaf extract protected against pylorus ligation and cold restraint stress induced gastric ulcer in rats.



Ginseng

Traditional use: Through the ages, the root has been used in the treatment of asthenia, atherosclerosis, blood and bleeding disorders, erectile dysfunction, hypertension, liver dysfunction, and colitis, as well as to relieve the effects of aging, cancer, postmenopausal disorder, and senility.



Terminalia Billerica

Traditional use: Traditional use of Terminalia billerica in the treatment of liver disease.



Curcuma Longa

Traditional use: Curcuma longa has been commonly used as a traditional remedy for a variety of symptoms such as inflammation, gastritis and gastric ulcer.

Recent Studies: When C. longa extract was administered per os to pylori-ligated rat stomachs, it reduced gastric acid secretion and protected against the formation of gastric mucosal lesions.



Balsamodendron mukul

Traditional use: In Ayurvedic. Guggul gumis mixed with lime juice or coconut oil; it is applied as a plaster or in the form of a lotion in indolent ulcers. Gum obtained from other species, *B. pubescens* found in Sind, Karachi, and Baluchistan, is used as ointment in bad ulcers such as Delhi sores, combined with sulphur, catechu, and borax.



Bauhinia variegata

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Berberis aristata

Traditional use: In Ayurvedic. Crude extracts known as rasaut (in Hindi) are prepared from the root; bark mixed with honey is useful application to ulcerations of the skin.



Beta vulgaris

Traditional use: In Ayurvedic. A decoction of the root with a little vinegar added is excellent for all kinds of ulcers and running sores.



Careya arborea

Traditional use: *In Ayurvedic*. Leaves made into a pulp and used as poultice 3 to 4 times a day rapidly heal obstinate ulcers.

Recent Studies: The ethanol stem bark extract of *C. arborea* was administered at the doses of 300 and 600mg/kg orally in rats for 5 days against ethanol, cold restraint stress, and pylorus ligation induced ulcer models. The extract significantly increases healing of gastric ulcer as compared to control.



Carica papaya

Traditional use: In Folk Medicine. It is largely used in tropical folk medicines. The ripe fruit is edible and unripe can be eaten cooked for indolent ulcer. The unripe fruit can be cooked as parts of salads, jellies, and stews while the ripe fruits are usually eaten raw without the skin or seed. Intake of the unripe fruit of the plant has been linked with an antiulcer effect.

Recent Studies: The aqueous seed extract of *C. papaya* was administered at the doses of 50 and 100mg/kg orally, in rats against ethanol induced gastric ulcer. The extract protected the gastric mucosa against ethanol effect. *C. papaya* extract significantly reduced the gastric juice volume and gastric acidity



Euphorbia nerifolia

Traditional use: In Ayurvedic. Plant juice is largely used with clarified or fresh butter as an application to unhealthy ulcers and scabies.

**Ficus religiosa**

Traditional use: In Ayurvedic. Bark is useful in ulcers in infusion or decoction (simple kashayam) with a little honey.

Recent Studies: The hydro alcoholic extract leaves of *F. religiosa* were studied at two dose levels (250 and 500 mg/kg, oral) in rats against absolute ethanol, aspirin, and pylorus ligation induced gastric ulcer. The extract significantly decreases the ulcer index value when compared to control.

**Galega purpurea**

Traditional use: In Ayurvedic. Root powdered and mixed with honey is applied to ulcers.



Acacia nilotica (L)

Traditional use: Pharmacological data base reports have revealed significant antiinflammatory, antioxidant, antidiarrhoeal, antihypertensive and antispasmodic, antibacterial, anthelmintic, antiplatelet aggregatory, anticancer and acetyl cholinesterase (AChE) inhibitory activities.

**Nerium Indicum**

Traditional use: It is an efficient useful treatment in conditions like snake bite, ulcer, cardiac disease, asthma, renal and vesicle calculi, chronic stomach disease, skin related problem, joint pain, leprosy, cancer, etc.

**Basella Rubra**

Traditional use: Ayurveda recommends Baselle in the treatment of several conditions such as anaemia, cough, dysentery and diarrhoea and as a poultice and in the treatment of mouth ulcers in south India.



Falcaria vulgaris

Traditional use: Falcaria vulgaris is a herb with various applications in traditional medicine, including treatment of skin and gastric ulcers, liver diseases and gastrointestinal problems.

**Manilkara Hexandra Roxb.**

Traditional use: Abstract Manilkara hexandra (Roxb; Family: sapotaceae) is reported to exert preventive effect in several experimental ulcer models. However, there is no report of M. hexandra on gastric ulcer healing property.

**Albizia lebbek**

Traditional use: Phytoconstituents found in Albizia lebbek are having the properties to suppress the histamine induced allergic reactions like bronchospasm, pulmonary eosinophilia spreading skin disease like erysipelas, and anaphylaxis in food allergies.



Agaractum conyzoids

Traditional use: The plant has been used in traditional folk medicine in Africa and South America to treat a variety of ailments. A common custom is to treat burns and wounds.

Recent Studies: Laboratory studies have verified the antibacterial activity of Ageratum conyzoides extracts against the human pathogens *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Escherichia coli*.



Glycyrrhiza glabra L.

Traditional use: It is used in folk medicine for treatment of stomach disorders including peptic ulcers.

Recent Studies: The hydroalcoholic extract of *Glycyrrhiza glabra* L. (HEGG) was evaluated for antiulcerogenic activity and acute toxicity profile in mice. Various doses of HEGG (50-200 mg/kg) were administered orally to animals of different groups.



Capsicum

Traditional use: In the Unani medicine system, it is used to prevent cold, sinus infection, sore throat, spermaturia, prostate catarrh, digestion, and to increase blood flow (Khare, 2004).

Recent Studies: It is also used to improve digestion and circulation, prevent bleeding from ulcers, and prevent cold, sinus infection, and sore throat (Batiha et al., 2020).



Spathodea falcata

Traditional use: *Spathodea falcata* is used in Indian folk medicine as an antiulcerogenic agent.

Recent Studies: This study was intended to evaluate the antiulcer property of various extracts of bark of *Spathodea falcata* at different dose levels in ethanol induced and indomethacin induced gastric ulcer models. It was observed that oral administration of all the extracts shows significant reduction in ulcer lesion index as well as increase in volume and pH of GIT.



Calendula officinalis

Traditional use: *Calendula officinalis* (Calendula), belonging to the family of Asteraceae, commonly known as English Marigold or Pot Marigold is an aromatic herb which is used in Traditional system of medicine for treating wounds, ulcers, herpes, scars, skin damage, frostbite and blood purification.



Swertia chirayita Traditional use: The Ayurvedic Pharmacopoeia of India); used in skin diseases. Other properties: anti-inflammatory (experimentally, the benzene extract was comparable with phenylbutazone and betamethasone in induced arthritis); hypoglycaemic (xanthone, swerchirin, lowers blood sugar), astringent, stomachic (in dyspepsia and diarrhoea); antimalarial (before the discovery of Peruvian bark), anthelmintic; antiasthmatic, bechic; and as a liver tonic (several active principles are hepatoprotective).



Panax Japonicus

Traditional use: The rhizome of *Panax japonicus* C.A. Meyer (family Araliaceae) is a natural medicine used as a stomachic and as an anti-inflammatory medicine and also sometimes used in place of Ginseng.



Zingiber officinale

Traditional use: Ginger (rhizome of *Zingiber officinale* Roscoe) is a widespread herbal medicine mainly used for the treatment of gastrointestinal (GI) disorders including: dyspepsia, nausea and diarrhea.



Terminalia bellirica

Traditional use: Triphala is a widely used herbal formulation in Indian traditional medicine that consists of fruits derived from three tree varieties: *Embilica officinalis* (Indian gooseberry), *Terminalia belerica* (Belleric myrobalan), and *Terminalia chebula* (Chebulic myrobalan).

DISCUSSION

Historically, diet was considered one of the primary causes of peptic ulcer disease. However, current knowledge indicates that diet probably has little influence on the pathogenesis of duodenal ulcers.

Diet is of almost importance in the treatment of ulcer. Milk cream, butter, fruits and fresh, raw and boiled vegetables, natural foods and natural vitamin supplements are the best diet for an ulcer patient. Bananas and milk which are considered an ideal diet for the patients who are in an advanced state of the disease.

Deficiency of certain essential fatty acids necessary for prostaglandin production has been examined as a possible risk factor. However, the incorrect use of the natural products offers dangers to society, so it is important to identify the active compounds, linking its structure with the biological activity and report the correct manner to use them with regards to dose, route of administration and frequency of use. The natural active compounds classes or secondary metabolites as alkaloids, flavonoids, saponins, tannins and others have attracted researchers to investigate their chemical, toxicological and pharmacological features.

Aspirin is a nonsteroidal anti-inflammatory drug which induces ulcers by inhibiting prostaglandin synthesis in the stomach by blocking the cyclooxygenase enzymes. Nonsteroidal anti-inflammatory drugs also cause an inflammatory response increasing the reactive oxygen species in the gastric mucosa. Previous studies have shown that the leaves of *A. indica* possess reactive oxygen species scavenging activity, suggesting the role of antioxidation as one of the mechanisms responsible for its gastro-protective action. In the present study, AE in all doses caused a significant reduction in the UI and an improvement in the PI, indicating a possible involvement of the prostaglandin pathway. Mechanistic studies measuring levels of prostaglandin, myeloperoxidase, and pro-inflammatory cytokines (interleukin 8, tumor necrosis factor- α) could elucidate this reasoning.

Cold restraint causes both psychological and physical stress to the rats. The induced stress releases histamine in the stomach, which leads to increased acid secretion and decreased mucus production, ultimately leading to ulcers. AE caused a dose-dependent significant reduction in the UI in this model, suggesting the role of histamine in its mechanism, as suggested by a previous study. An earlier study revealed that *A. indica* prevented stress-induced DNA fragmentation in the gastric mucosal cells, thus preventing their apoptosis. The mast cell stabilization activity of *A. indica* inhibiting the release of histamine is also postulated as one of the mechanisms involved in its anti-secretory action.

Phytochemical studies of *A. indica* have revealed that the leaves are a rich source of potentially bioactive alkaloids, flavonoids, tannins, and saponins. High-performance thin layer chromatography and gas chromatography mass-spectrometry studies have determined that the leaves contain several compounds such as nimbinic acid B, nimbolide B, azadirachtins, 6 deacetylnimbin, azadiradione, nimonol, epoxyazadiradione, quercetin-3-O- β -D-glucosamine, myricetin-3-O-rutinoside, quercetin-3-O-rutinoside, kaempferol-3-O-rutinoside, kaempferol-3-O- β -D-glucoside, quercetin-3-O- α -L-rhamnoside, hydroxyphenylacetic acid, phytol, 4cycloocten-1-ol, 8,8'-(iminodi-2,1-phenylene) bis-, 1,3-diphenyl-2-azafluorene, 3 β -lup-20(29)-en-3-ol, 3 β lup-20(29)-en-3-yl acetate, germanicol, and cyclic sulfides. Flavonoids and saponins are known to exhibit a myriad range of pharmacological activities, hence the antiulcer activity of the leaves of *A. indica* could be attributed to its flavonoids and saponins. However, the role of other secondary alkaloids cannot be eliminated. Future mechanistic studies could help determine the exact pharmacodynamics and mode of action of the bioactive alkaloids of *A. indica*.

The pyloric ligation-induced ulcer model evaluates the anti-secretory and gastroprotective effects of investigational agents. The ligation of the pyloric end of the stomach leads to accumulation of gastric acid which causes ulcers due to the auto-digestion of the mucosa. AE caused a significant decrease in the gastric volume, free acidity, and total acidity compared to the control group, indicating an anti-secretory

mechanism. The anti-secretory activity could be due to the inhibition of the H⁺ -K⁺ -ATPase enzyme. The UI and PI are parameters commonly used to determine the gastro-protective effect of investigational agents. AE in all doses caused a significant reduction in the UI and an improvement in the PI compared to the control group, indicating a gastro-protective effect.

Conclusion

From this study we can conclude that studies with plant Sources can result in novel and effective pattern of treatment. Current stalemates of modern medicine in the management of various ailments incline research tendencies to traditional Medicine. In this respect, traditional medicine has introduced Good protocols for treatment of various gastrointestinal Disorders. All of the remedies presented here had adequate Evidence from traditional or scientific source for their efficacy in management of ulcers. There are various medicinal plants and their extracts (containing active chemical constituents, e.g., tannins and Flavonoids) that have significant antiulcer activity in in Vivo experiments on animal models. Ayurveda, the oldest medicinal system in the world, provides leads to find therapeutically useful compounds from plants. Therefore, Ayurvedic knowledge supported by Modern science is necessary to isolate, characterize, and Standardize the active constituents from herbal sources for Antiulcer activity. The combination of traditional and modern Knowledge can produce better drugs for the treatment of Peptic ulcer with fewer side effects.

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