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Review Article

**Antiulcer Properties of Herbal Drugs: A Review**Dayananda Bhoumik<sup>\*1</sup>, Birhanetensay Masresha<sup>1</sup> and Arunabha Mallik<sup>2</sup><sup>1</sup>Department of Pharmacy, College of Health Sciences, Mekelle University, Mekelle, Ethiopia<sup>2</sup>Department of Phamacology, Srikrupa Institute of Pharmaceutical Sciences, Siddipet, India

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Herbal medicines are very important to cure the various ailments of human. Demands of the herbal medicines are increasing in both developed and under developed countries due to growing recognition of natural plants being lesser of side effect, easily available in surrounding place with low cost. Peptic ulcer disease is one of the common gastrointestinal disorders in clinical practice. The common forms of peptic ulcer are duodenal ulcer, gastric ulcer, NSAIDs induced ulcer and stress ulcer. Gastric ulcers occur commonly at old age and lower socio-economic class of individuals. Many synthetic drugs are used for the treatment of peptic ulcers but cause various adverse effects. Hence herbal medicines stand out as being exceptional for its ethnic, ethno botanical and ethno pharmacological use. In this review attempts have been made to know the antiulcer drug of natural origin with their suggested medicinal part, screening methodology and type of extract used for evaluation and investigation to prove its use. The objective of present review is to compile literature and the antiulcer properties of the most commonly employed herbal medicines.

**Keywords:** Peptic ulcer, Antiulcer, Herbal drugs, Phytochemicals.**1. Introduction**

Traditional medicine using herbal drugs exists in every part of the world. The major areas are Chinese, Indian and European traditions. The philosophies of these traditional medicines have some resemblance to each other but differ widely from modern western medicine. In view of the progress of western medicine not only new synthetic drugs but also herbal drugs have to fulfill the international requirements on quality, safety and efficacy. Herbal drugs have the advantage of being available for patients in the geographical area of the special traditional medicine. The development procedure of herbal drugs for world-wide use has to be different from that of synthetic drugs [1].

Practically every country develops its own medical system, which includes the ancient civilization of China, Egypt and India. Thus, the Indian medical System-Ayurveda came into existence. The raw materials for ayurvedic medicines were mostly obtained from plant

sources in the form of crude drugs such as dried herbal powders or their extracts or mixture of products [2]. Also, Siddha, Unani and Tibb are traditional health care systems which have been flourishing for many centuries. Apart from these systems there has been a rich heritage of ethnobotanical usage of herbs by various colorful tribal communities in the country [3].

Peptic ulcers are chronic and in most cases solitary lesions that develop in any part of the gastrointestinal tract which have been exposed to the aggressive action of acid-peptic juices [4]. The lesser curvature of the stomach and the first part of the duodenum are the most common sites of peptic ulcers and are called gastric ulcers and duodenal ulcers respectively. Gastric hyperacidity and gastro duodenal ulcer is a very common global problem today. Peptic ulcer is a lesion of gastric or duodenal mucosa. The modern approach to control gastric ulceration is to inhibit

gastric secretion, to promote gastric protection, block apoptosis and stimulate epithelial cell proliferation for effective healing [5].

Peptic ulcer disease is one of the common gastrointestinal disorders in clinical practice. The common forms of peptic ulcer are duodenal ulcer, gastric ulcer, NSAIDs induced ulcer and stress ulcer. Among these the duodenal ulcer is more common in adult males. Gastric ulcers occur commonly at old age and lower socio-economic class of individuals. Although the exact cause of ulceration is not known, gastric acid and pepsin are responsible for maintaining the lesion once it is produced. Peptic ulceration occurs only in areas which are bathed by acid gastric juice. Stomach and first portion of duodenum are bathed by acid gastric juice. In the second portion of duodenum bile and pancreatic juice flow. This is why; the term peptic ulcer refers to ulceration of the parts which might be acted upon by acid peptic juice namely the stomach, the first portion of duodenum [6]. Peptic ulcers also occur at the lower end of the oesophagus, on the jejunal side of a gastroenterostomy, and in Meckel's diverticulum[7].

Peptic ulcer is one of the common diseases in human population. Due to rapid development and civilizational constraints including a stressed lifestyle, the incidences of peptic ulcer are increasing. The estimates of incidence of peptic ulcer vary ranging between 3–10%. An estimated 15,000 deaths occur each year due to Peptic ulcer disease (PUD). Approximately four million people suffer from peptic ulcers in the United States and 3.6 lakh new cases are reported each year. About 1 lakh patients yearly

are treated in hospitals and about 3000 people die each year due to PUD. The male to female ratio for duodenal ulcer is three to one and gastric ulcer about 1.5 to 2.1[8].

Imbalances in mucosal defensive and offensive factors are the main causes of gastric ulcers. Treatment of gastric ulcers is usually focused on mitigating the aggressive effects of acid secretion. But currently a class of cytoprotective agents, which act by protecting the gastric mucosa from agents without effecting secretion of acid are of interest today[9]. In gastric or duodenal peptic ulcers, the mucosa has been attacked by digestive juices to such an extent that the subjacent connective tissue layer (submucosa) gets exposed. When the equilibrium between the corrosive hydrochloric acid and acid-neutralizing mucous, which forms a protective layer on the mucosal surface, is shifted in favor of hydrochloric acid, self digestion occurs. Various hypotheses have been proposed to understand the biochemical changes taking place during ulcer generation. Increased gastric motility [10], vagal hyperactivity [11], mast cell degranulation[12], reduced flow of blood to the gastric mucosa[13] and decreased prostaglandin levels during conditions involving stress are involved in generation of gastric ulcers. Reactive oxygen species plays a role in experimental gastric damage induced by ischemia and reperfusion [14], hemorrhagic shock [15] and ethanol administration [16]. *Helicobacter pylori*, a pathogen is known to be the most common cause of gastric ulcer in humans.

Several medicinal plants have been reported with potent anti-ulcer activity. The details are shown in table 1.

**Table 1: Medicinal plants with antiulcer properties, reported phytochemicals and mechanism**

Botanical name, family, common English name	Parts used	Solvent used	Reported active constituents	Screening method (model) applied	Underlying mechanism	Reference
<i>Moringa oleifera</i> (Family; Moringaceae) English: Drumstick	Root-bark	Ethanol	Alkaloids, flavonoids, proanthocyanidins cinnamates	Ethanol & pylorus ligation-induced gastric ulceration.	Increase the pH of gastric content	Choudhary et al[17]
<i>Guiera senegalensis</i> (Family; Combretaceae) English: Guer (Wolof)	Leaves	Aqueous	Alkaloids, tannin like galloylquinic acid, flavonoids	Ethanol, water immersion & Aspirin induced ulcer models.	Decrease ulcer index	Akuodor et al[18]
<i>Strophanthus hispidus</i> (Family; Apocynaceae) English: Arrow poison (Ghana, Irvine)	Root	Ethanol	Glycoside, alkaloids, resin, mucilage & rhamnose sugar	Ethanol, HCl- & pyloric ligation-induced gastric ulcer models	Possess anti-ulcerogenic effect	Ishola et al[19]
<i>Parkia speciosa</i> (Family; Fabaceae) English: Bitter bean or stink bean	Leaves	Ethanol	Terpenoids, phenolic compounds, flavonoids	Ethanol-induced gastric mucosa injury in rats	Increase anti-oxidant defen –se enzymes Glutathione	Al Batran et al[20]
<i>Piper tuberculatum jacq.</i> (Family; Piperaceae) English: Black pepper	Fruits	Dichloro-methane	Alkaloids, flavonoids, tannins	Ethanol induced acute lesions	Increase gastric mucus & Glutathione levels	Burci et al[21]

<b><i>Caesalpinia pyramidalis</i></b> (Family; Fabaceae) English: Catingueira	Inner Bark	Ethanol	Phenolic compounds, tannins, flavonoids	Ethanol- & NSAIDs-induced ulcer models	Increase in mucus production	Ribeiro <i>et al</i> [22]
<b><i>Morus alba</i></b> (Family; Moraceae) English: White mulberry	Whole plant	Column chromatography	Steroid (albosteroid), Phenolic components	Pylorus ligation & ethanol-induced ulcer models	Reduce GR & LPO	Ahmad <i>et al</i> [23]
<b><i>Oxalis corniculata L.</i></b> (Family; Oxalidaceae) Eng.: Creeping wood sorrel or Indian sorrel	Whole Plant	Methanol	Glycosides, Phenolic cpds, flavonoids, tannin, phytosterols	Pylorus ligation & indomethacin-induced gastric ulceration	Antisecretory action by decreasing total gastric juice	Sakat <i>et al</i> [24]
<b><i>Lafoensia pacari A. St.-Hil</i></b> (Family; Lythraceae) English:Mangava-brava	Stem Bark	Methanol	Pyrogalic tannins saponins, steroids, phenols, triterpen -oids,	Ethanol, indomethacin, cold-restraint stress induced ulcer	Decrease in NP-SH level, inhibition of TNF- $\alpha$ , IL-17	Tamashiro <i>et al</i> [25]
<b><i>Bauhinia purpurea L.</i></b> (Family; Fabaceae) English: Butterfly Tree	Leaves	Chloroform	Flavonoid & tannin	Ethanol & Indomethacin-induced gastric ulcer	Antiulcer, anti secretory action attributed to its phytochemicals	Hisam <i>et al</i> [26]
<b><i>Mimusops hexandra</i></b> (Family; Sapotaceae) English: Palu, Palai or Rayan	Bark	Diethyl ether , Et acetate & aqueous	Flavonoids(quercetin), procyanidins, saponins, triterpenoid	Ethanol-HCl, aspirin- & acetic acid- induced gastric damage	Decrease elevated level of lipid peroxidation	Modi <i>et al</i> [27]
<b><i>Momordica dioica</i></b> Roxb (Fam.; Cucurbitaceae) English: Spine gourd	Fruits	Hydroalcohol	Alkaloids, fragrant extractive matter, trace manganese in ash	Stress and pylorus ligation-induced ulcers	Decrease in the level of H <sup>+</sup> K <sup>+</sup> ATPase	Vijayakumar <i>et al</i> [28]
<b><i>Terminalia belerica Roxb.</i></b> (Fam.; Combretaceae) Eng.: Beleric myrobalan	Fruits	70% methanol	Tannins, ellagic acid, ethyl gallate, galloyl glucose, $\beta$ -sitosterol	Ethanol & pylorus ligation-induced ulcers	Increase resistance to necrotizing agents	Jawanjal <i>et al</i> [29]
<b><i>Acacia nilotica</i></b> Linn. (Family; Fabaceae) English:Gum arabic tree	Young seed less pods	Ethanol, hydroethanol & aqueous	Phenolic components	Swimming stress, NSAID & Pylorus ligation induced gastric	Reduction of gastric acid secretion, show muco protection	Bansal <i>et al</i> [30]
<b><i>Pithecellobium dulce</i></b> (Family; Fabaceae) English: Tamarind, Madras Thorn	Fruits	Hydroalcohol	Glycoside like quercetrin, poly phenolic constituents, saponin	Chemical and stress induced ulcer models	Decrease H <sup>+</sup> K <sup>+</sup> ATPase, myelo- peroxidase	Megala <i>et al</i> [31]
<b><i>Melastoma malabathricum</i></b> Linn. (Fam.Melastomataceae) English: Indian Rhododendron	Leaves	Methanol	Flavonoids, triterpenoids & alkaloids.	Ethanol and Indomethacin-induced gastric ulcer	Decrease ulcer index in ethanol induced gastric ulcer	Zabidi <i>et al</i> [32]
<b><i>Aerva persica</i></b> Merrill (Fam. Amaranthaceae) English: Kapok Bush	Roots	Ethanol	Flavonoids, ascorbic acid, flavanone glucosides	Ethanol and pylorus ligation induced gastric ulcer	Decrease malonaldehyde & increase of glutathione	Vasudeva <i>et al</i> [33]
<b><i>Calophyllum brasiliense</i></b> Camb (Fam.; Calophyllaceae) English: Guanandi	Stem bark	Hexane	Chromanone acids	Ethanol & Indomethacin-induced gastric ulcer	Reduction of MDA and CAT levels	Lemos <i>et al</i> [34]
<b><i>Zingiber montanum</i></b> (Family; Zingiberaceae) English: Cassumunar ginger	Rhizome	MeOH	Zerumbone, terpineol, essential oil	1N HCl induced gastric lesions	Exhibit cyto - protective effect against noxious agent	Al-Amin <i>et al</i> [35]

<b><i>Achyranthes aspera</i></b> (Fam. Amaranthaceae) English: Prickly chaff flower, devil's horsewhip	Leaves	Ethanol	Flavonoids, saponins & tannins	Pylorus ligation & chronic ethanol induced ulcer	Reduce volume of gastric juice and total acidity	Das AK et al[36]
<b><i>Musa sapientum</i></b> (Family: <i>Musaceae</i> ) English: Banana	Unripe fruit	Ethanol, methanol Etacetate	Polyphenols, monomeric flavonoid (leucocyanidin)	Indomethacin-induced ulcer	Antiulcer effect due to presence of flavonoid (leucocyanidin)	Prabha et al[37]
<b><i>Quassia amara</i> (L.)</b> (Fam.; Simaroubaceae) English: Amargo, Bitter-ash, Bitter-wood	Bark	Methanol	Quassin & 2 methoxycanthin-6-one, beta-sitosterol, gallic acid	Indomethacin-induced ulcer	Inhibition of histamine H <sub>2</sub> receptor	Raji et al[38]
<b><i>Brassica oleracea</i></b> (Family; Brassicaceae) English: Wild cabbage	Leaves	Aqueous	Flavonoid, phenolic compounds	Acetylsalicylic acid- induced ulcer	Inhibit the gastric damage	Carvalho et al[39]
<b><i>Rhizophora mangle</i> L.</b> (Fam.; Rhizophoraceae) English: Red mangrove	Bark	Ethyl acetate, butanol	Flavonoids, quercetin glycoside, tannins	Acetylsalicylic acid- induced ulcer	Upregulation of COX-2 & EGF, enhance PGE <sub>2</sub>	de-Faria et al[40]
<b><i>Samanea saman</i> (Jacq) merr</b> (Family; Fabaceae) English: Rain tree	Bark	Methanol	Flavonoids, tannins, terpenoids & saponin	Ethanol and stress induced gastric lesions	Reduce free acidity & volume of acid secretion	Arumugam et al[41]
<b><i>Brassica oleracea</i></b> (Family; Brassicaceae) English: Wild cabbage	Leaves	Hydro alcohol	Flavonoid, phenolic compounds	Ethanol-induced ulcer model	Synthesis of mucus, increase pH & decrease H <sup>+</sup> ions	Lemos et al[42]
<b><i>Polyalthia longifolia</i></b> (Family; Annonaceae) English: Indian mast tree or Indian fir tree	Leaves	Methanol	Alkaloids, tannins, saponins, glycosides	Ethanol and EtOH/HCl induced ulcer	Reduction of ulcer index	Chanda et al[43]
<b><i>Amaranthus tricolor</i> L.</b> (Fam.; Amaranthaceae) English: Ornamental plant, Tumble pigweed	Leaves	Ethanol, pet ether, Etacetate	Glycosides, phenolic compounds, flavonoids & saponins	Indomethacin & pylorus ligation-induced ulcers	Inhibit gastric secretion, show gastric cytoprotective effect	Devaraj VC et al[44]
<b><i>Marrubium vulgare</i> L.</b> (Family; Lamiaceae) Eng.: White Horehound or Common Horehound	Leaves	Methanol	Flavonoids, diterpene marrubiin, tannins, saponins, alkaloids	Ethanol-induced ulcers	Acts on nitric oxide & endogenous sulfhydryls	Paula de Oliveira et al[45]
<b><i>Bauhinia purpurea</i></b> (Family; Fabaceae) English: Orchid tree, Camel's Foot Tree	Leaves	Aqueous	Saponins & sugar-free polyphenols	Ethanol & indomethacin induced gastric ulcer	Increase gastric wall mucus secretion	Zakaria et al[46]
<b><i>Andrographis paniculata</i></b> (Family; Acanthaceae) English: Green chirayta	Whole plant	Hydro alcohol	Tannins, steroids, triterpenoids, saponins	Cysteamine induced duodenal ulcer	Reduce lipid peroxidation, preserve mucin content	Saranya et al[47]
<b><i>Picralima nitida</i></b> (Family; Apocynaceae) English: Akuamma plant	Seeds	Methanol	Alkaloids, cardiac glycosides, saponins & terpenes.	Aspirin-pylorus-ligation model.	Reduced gastric emptying time	Mathew et al[48]
<b><i>Raphinus sativus</i> Linn</b> (Family; Cruciferae) English: Radish, daikon, Japanese radish	Leaves	Ethanol, pet ether, Etacetate	Glucosinolates, isothiocyanates, phenolic compounds	acetic acid & pylorus ligation induced ulcer	Decrease the ulcer index, total acidity and free acidity	Devaraj et al[49]
<b><i>Passiflora foetida</i> L.</b> (Fam.; Passifloraceae) English: Wild maracuja, wild water lemon	Whole plant	Ethanol	Glycosides, phenolic compounds, flavonoids, phytosterol	Ethanol & aspirin induced gastric ulcer	Reduce lipid peroxidation & increase glutathione	Sathish et al[50]

<b>Tamarindus indica L.</b> (Family; Fabaceae) English: Tamarind fruit, Tamarindo	Seed coats	Methanol	Glycoside like quercetrin, poly phenolic constituents, saponin	Ibuprofen, alcohol & pylorus ligation induced gastric lesions	Reduce the total vol. of gastric juice, free and total acidity	Kalra et al[51]
<b>Caesalpinia pulcherrima Linn.</b> (Family; Leguminosae) English: Peacock flower	Aerial parts	Ethanol, aqueous	Flavonoids, triterpene, saponin, sterols, tannins	pylorus ligation & aspirin induced ulcer	Decrease the ulcer score	Sharma et al[52]
<b>Terminalia chebula Retz.</b> (Fam.; Combretaceae) English: Myrobalan	Fruit	Hydro -alcoholic	Triterpenoids, tannins, Phenolic compounds, flavonoids	Aspirin, ethanol and cold restraint stress-induced ulcer methods	Reduce the total vol. of gastric juice & increase pH	Sharma et al[53]
<b>Cedrus deodara.</b> (Family; Pinaceae) English: deodar cedar, Himalayan cedar, or deodar	Wood	Steam distillation	Flavonoids, essential oil like $\alpha$ -terpineol, linalool	Pylorus-ligated & ethanol induced gastric lesions in rats.	By protecting mucosal layer of stomach from ulceration	Kumar et al[54]
<b>Morinda citrifolia L.</b> (Family; Rubiaceae) English: Indian mulberry	Unripe fruits	Aqueous	Polyphenol, flavonoids, tannins, carotenoids, ascorbic acid	Acute gastritis induced by ethanol and serotonin, and chronic gastric ulcer induced by acetic acid	Suppress the development of gastric lesions	Mahattanadul et al[55]
<b>Syzygium aromaticum</b> (Family; Myrtaceae) English: clove	Flower buds	Chloroform	Volatile terpenes, phenylpropanoid, essential oil, eugenol	Indomethacin-induced and ethanol/HCl-induced ulcer model	Stimulate the synthesis of mucus	Santin et al[56]
<b>Enicostemma littorale</b> (Family; Gentianaceae) English: White head	Aerial Parts	Methanol	saponins, steroids, sapogenin, triterpenoids, flavonoids & xanthenes	Aspirin, ethanol, and pyloric ligation-induced ulcers	Elevate the gastric pH, increase tissue GSH levels	Roy et al[57]
<b>Solidago chilensis Meyen</b> (Family; Asteraceae) English: Fulel	Whole plant	Aqueous	No scientific report available	Ethanol-induced gastric ulcer model in mice	Prevents the formation of gastric lesion.	Bucciarelli et al[58]
<b>Cassia fistula</b> (Fam; Caesalpinaceae) English: golden shower tree	Leaves	Ethanol	Alkaloids, tannins, phenolic compounds, glycosides	Pylorus ligation-induced gastric ulcer	Strengthening of mucosal defense mechanism	Karthikeyan et al[59]
<b>Apium graveolens L</b> (Family; Apiaceae) English: Celery	Whole plant	Ethanol	Flavonoids, vitamin A, B, C, fibers, mineral matters, calcium, phosphorous, iron	Indomethacin, cytodestructive agents (80% ethanol, 0.2 M NaOH and 25% NaCl) and cold restraint stress induced ulcer model	Replenish the depleted levels of GWM and gastric mucosal NP-SH	Al-Howiriny et al[60]
<b>Opuntia ficus indica f. inermis</b> (Family; Cactaceae) English: Nopales or paddle cactus	Root	Methanol	Phenolic and flavonoids contents	80% ethanol induced ulcer in rats	Prevent the depletion of antioxidant enzymes	Alimi et al[61]
<b>Pedaliium murex</b> (Family; Pedaliaceae) English: Large caltrops, Buda Gokhru	Leaves	Aqueous	Flavonoids and mucilage	Ethanol induced gastric lesions in rats	Elevate the level of glutathione	Banji et al[62]

**Table 1 Continue**.....

<b><i>Hedyotis puberula</i></b> (Family; Rubiaceae) English: Indian madder	Whole plant	Methanol	Alkaloid, tannin, terpenoid, saponins, phenol, xanthoprotein	Indomethacin (IND), ethanol & pyloric ligation (PL)-induced gastric ulcer models in rats.	By increasing pH&decrease vol., acidity and pepsin content of gastric secret <sup>n</sup>	Joseph <i>et al</i> [63]
<b><i>Equisetum palustre L.</i></b> (Family; Equisetaceae) English: Horsetail, snake grass, puzzle grass	Aerial parts	Ethanol	Flavonol diglucoside	Indomethacin (IND), ethanol & pyloric ligation (PL)-induced gastric ulcer models in rats.	Improve the cytoprotective mechanisms of the gastric mucosa	Yesilada <i>et al</i> [64]
<b><i>Momordica charantia L.</i></b> (Family;Cucurbitaceae) English: 'Bitter gourd'	Fruits	Methanol	Steroids, triterpenoids, reducing sugars, alkaloids, phenolic compounds, flavonoids, tannins	Acetic acid, pylorus ligation, ethanol induced chronic gastric ulcer	Increase in gastric mucosal contents	Alam <i>et al</i> [65]
<b><i>Baccharis dracunculifolia DC</i></b> (Family; Asteraceae) English: 'Alecrimdo-campo'	Aerial parts	-	Essential oil; non-oxygenated & oxygenated terpenes, cinnamic acid, flavonoids	Ethanol-, stress-, pylorus ligation, NSAID-induced ulcer	Increase in the gastric pH	Massignani <i>et al</i> [66]
<b><i>Benincasa hispida (Thunb.) Cogn.</i></b> (Family;Cucurbitaceae) English: Ash gourd, Petha, Bhuru Kolu or Safed Kolu	Fruit	Pet and Methanol	Triterpenoids, flavonoids, glycosides & sterols	Ethanol-, stress-, pylorus ligated gastric ulcer models	Reduction in vascular permeability and MDA content	Rachchh <i>et al</i> [67]

## 2. Discussion

From this study, it is clear that the medicinal plants play a vital role against on various diseases. Various herbal plants and plants extracts have significant antiulcer activity in animal models. Our review results show that above-mentioned medicinal plants may prevent ulcer with the principle of reported underlying mechanism. A variety of botanical substances have been reported to possess antiulcer activity. We have found that substances such as flavonoids, tannins, alkaloid, glycoside, terpenoid, steroid, saponin and many others possess antiulcer activity with their particular therapeutic importance.

The antiulcer activity of the drug can be attributed to free-radical scavenging property, inhibition of acid secretory parameters, strengthening of gastric mucosal barrier, diminishing in vascular permeability and MDA content, improving the cytoprotective mechanisms of the gastric mucosa, elevating the level of glutathione etc. The different way of mechanism of ulcer inhibition may be occurred due to presence of important phytoconstituents in respective plant extracts. The results of this study indicate that extracts of leaves and whole part of some medicinal plant have good potentials for use in peptic ulcer disease. These possess mucoprotective activity and gastric anti-secretory properties when compared with that of reference

herbal drugs. These extracts are non-toxic even at relatively high concentrations.

## 3. Conclusion

Gastric ulcer one of the most widely spread gastro intestinal disorder believed to be due to an imbalance between aggressive and protective factor. From this study it is concluded that plant extracts have significant antiulcer activity in animal models.

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