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Review Article

COMPLEMENTARY AND ALTERNATIVE APPROACHES TO TREAT PEPTIC ULCER

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ABSTRACT
Peptic ulcer is considered as one of the most common disorder among gastrointestinal ailments all over the world which is mainly caused by *Helicobacter pylori* infection, abundant use of NSAIDs, excessive alcohol intake and stress etc. Treatment of peptic ulcer with synthetic drugs such as proton pump inhibitors, H_2 receptor antagonists and other non-steroidal anti-inflammatory drugs reported to have adverse effects, relapses and drug interactions. Medicinal plants containing active phyto-constituents have been proven as useful source in the prevention and treatment of various diseases including gastrointestinal problems. Demands of herbal medicines are increasing in both developed and developing countries due to growing recognition of natural plants having lesser or no side effects, relatively less toxic, economical and easily available in surrounding place. Therefore, medicinal plants stand out as being exceptional for its ethnic, ethno botanical and ethno pharmaceutical uses. In this review an attempt has been made to compile some plants which may be used in treatment or prevention of peptic ulcers. This article summarizes the antacid, anti-ulcer and gastro protective properties of the most commonly available medicinal plants.
Keywords: Peptic ulcer, medicinal plants, therapeutic effects

INTRODUCTION

Peptic ulcer is one of the most common disorders of the gastrointestinal system, which causes discomfort to the patients, disrupting their daily routines and causes mental distress[1]. It is defined as a break off in the continuity of the stomach mucosa or duodenum as a consequence of some factors such as non-steroidal anti-inflammatory drugs (NSAIDs), gastric acids and pepsin which finally causes lesions in intestinal mucosa[2]. Several reports indicated that old age group patients are more prone to develop gastric ulcer while younger individuals have higher risk of duodenal ulcers[3,4]. Numerous factors such as complex imbalance between gastric offensive factors like acid, pepsin secretion, *Helicobacter pylori* (*H. pylori*), bile salts, some medications like NSAIDs, lipid per oxidation, ethanol, nitric oxide (NO) and defensive mucosal factors like prostaglandins, gastric mucus, blood flow, mucosal cell shedding, cellular renovation, glycoproteins, mucin secretion, proliferation and antioxidant enzymes like catalase (CAT), superoxide dismutase (SOD) and glutathione level involves in the pathogenesis of ulcer. Several other factors are also responsible for progression of peptic ulcers like tumor necrosis factor-α (TNF α), reactive oxygen species (ROS), release of histamine, incidence of apoptosis and bile acids secretion[5,6]. Synthetic drugs such as proton pump inhibitors, H_2 receptors, cytoprotectants, demulcents, anti-cholinergics and antacids are used for the treatment of peptic ulcer but these drugs produce several side effects in the body[5]. Proton pump inhibitors (Omeprazole, Lansoprazole) may cause abdominal pain, nausea, constipation, diarrhea and H_2 receptor antagonists (Cimetidine) may cause loss of libido and gynaecomastia. Due to the adverse/side effects by the use of these synthetic drugs, people prefer medicinal plants for the treatment of diseases because herbal medicines are considered safe for the treatment of peptic ulcers with lesser adverse effects, relatively less toxic, economical and effective, extensive research is carried out on medicinal plants to search potent antiulcer agents[6,7]. About 70 % of patients with peptic ulcer disease are infected by bacterium *Helicobacter pylori*. This organism destructs the protective coating of the stomach and duodenum and allows the digestive juices to irritate the sensitive lining below[8,9]. Non-steroidal anti-inflammatory drugs (NSAIDs) which include aspirin, ibuprofen, naproxen, piroxicam, fenoprofen, indomethacin, diclofenac, tolmetin, oxaprozin, ketoprofen, sulindac, nabumetone, etodolac, and salsalate are acidic and are the most common cause of ulcer. They block prostaglandins in the stomach, which help maintain blood flow and protect it from injury. People suffering with Zollinger-Ellison syndrome have tumors in the pancreas and duodenum that produce gastrin, a hormone that stimulates gastric acid production which leads to ulcer production. Other causes of ulcers are those factors that may direct damage the wall of the stomach or duodenum, such as heavy use of alcohol, radiation therapy, burns, and physical injury. Abdominal pain is the most common symptom of a peptic ulcer. The pain is aggravated by stomach acid coming in contact with the ulcerated area. The pain typically may be felt anywhere around the abdomen, last from a few minutes to several hours, aggravated at empty stomach, sometime temporarily relieved by eating certain foods that buffer stomach acid or by taking an acid-reducing medication, disappear and then return for a few days or weeks. Less often, ulcers may cause severe signs or symptoms such as, vomiting of blood, which may appear red or black, dark blood in stools nausea, unexplained weight loss, appetite changes[10,11]. Genetic factors may predispose to the development of ulcer, increasing age, chronic pain from any cause such as fibromyalgia, arthritis, repetitive stress injuries (like carpal tunnel syndrome), or persistent back pain, leading to

continuous use of aspirin or NSAIDs, alcohol abuse, living in crowded, unsanitary conditions increases the risk of *H. pylori* infection, immune abnormalities are the major risk factors of peptic ulcer. Lifestyle factors, including chronic stress, coffee drinking (even decaf), and smoking, may make more susceptible to damage from NSAIDs or *H. pylori* if subject are a carrier of this organism.

Synthetic drugs for the treatment of peptic ulcer

- Histamine blockers
- Proton pump blockers
- Selective anti cholinergic drugs
- Cxtoprotective agents
- Sucralfate

Adverse effects of synthetic drugs used for the treatment of Peptic ulcer

Proton pump inhibitor (Omeprazole) inhibits the oxidative metabolism of some drugs by the hepatic microsomal enzyme system. Experimental studies in normal human subjects have demonstrated that omeprazole significantly increases plasma diazepam concentration and significantly decreases total body clearance[12]. Toxicological studies in different animal species have shown that high doses of omeprazole can produce histologic abnormalities in the gastric mucosa. Treatment with omeprazole (40 to 400 mmol/kg per day) for a prolonged period causes mucosal endocrine cell hyperplasia. Hyperplasia of oxyntic mucosal cells has also been observed in experimental dogs and in mice. Another concern regarding the ongoing use of omeprazole has been bacterial overgrowth in the achlorhydric stomach. Significant increases in bacterial number and in concentrations of nitrites and nitrosamines were examined. After cessation of the drug, these alterations had completely reversed. Still, there are no reports of illness regarding the bacterial overgrowth in patients treated with omeprazole[13-15]. Several side effects have been noted for the currently available H_2-receptor antagonists. A number of dose-dependent neuropsychiatric effects have been reported with the use of cimetidine such as agitation, confusion, lethargy, and mental depression[16]. These have been most frequently noted in elderly patients and in those with hepatic or renal dysfunction in whom drug metabolism is altered. Increased penetration of cimetidine into the cerebrospinal fluid has been reported for patients with hepatic disease. Symptoms have rapidly disappeared, when cimetidine administration has been reduced or eliminated. Similarly, significant neuropsychiatric effects reported for ranitidine also rapidly reverse with appropriate dose reduction[17,18]. The most frequently reported side effect associated with pirenzepine therapy is dry mouth and blurred vision. The major side effect of treatment with prostaglandin is diarrhea, uterine bleeding and the spontaneous abortions. The abortifacient property of prostaglandins is of major concern both in terms of danger to pregnant women and in terms of potential abuse by those wanting to terminate pregnancy[19]. The reported side effects concern with sucralfate include constipation, dizziness, dry mouth, skin rash, headache, diarrhea, nausea, and abdominal discomfort[20].

Herbal Treatment for Peptic Ulcer

Due to the adverse/side effects by the use of synthetic drugs as described above, medicinal plants may be the safer source for the treatment of peptic ulcers because of lesser adverse effects, relatively less toxic, economical, and effective. Extensive research has been carried out on medicinal plants to search potent antiulcer agents. Several experimental evidences proved that the herbs have gastro protective activities against gastric mucosal injury induced by ethanol[21], ischemia reperfusion[22], indomethacin[21], alcohol toxicity[23] or stress[24] in rat. Herb-induced gastro protection mechanism varies according to the nature and chemical constituents of the herbs. Plant induced gastro-protection is probably related to inhibition of acid plus pepsin secretion[25], cyto-protection by enhancement of epidermal growth factor content in gastric juice, nitric oxide and H^+, K^+ ATPase inhibitory activity in gastric tissue, PGE_2 in plasma, an increase in mucosal thickness[26] and mucus content in the gastric mucosa[27], inhibition of endothelin in plasma, bactericidal activity, inhibition of the growth and activity of *Helicobacter pylori*[28] and antioxidant activities[29], isolated or in combination are responsible for gastric mucosal protection[30]. Moreover, they are involved in enhancing effect on NOS inhibitor expression, gastric microcirculation[31], increasing the bioavailability of arachidonic acid, resulting in biosynthesis of the cyto-protective prostaglandins in the stomach[32]. Furthermore, herbs have also been reported to cause marked inhibition of the release of leukotrienes, which cause mucosal tissue injury and hypoxemia[33]. Researchers have evaluated many medicinal plants for antiulcer potential to achieve a favorable outcome. Large numbers of medicinal plants have been shown to possess gastro-protective effects such as *Nigella sativa*[34], *Pongamia pinnata*[35], *Momordica charantia*[36], *Moringa oleifera*[37], *Curcuma longa*[38], *Aurantii fructus immaturus*[39]. Details of some medicinal plants are given below.

Medicinal Plants used to Treat Peptic Ulcer

***Adhatoda vasica* Nees.**

Family: Acanthaceae. Parts used: Roots and leaves. Local name: Brehankar. Chemical constituents: Adhatodic acid, alkaloids, essential oil, volatile odorous principle, vasicine, vasicinol and salts. Medicinal uses: It is used in cough, asthma and chronic bronchitis Pharmacological activities: It is insecticidal, anti rheumatic and antiseptic. Study: Shrivastava *et al* reported the anti-ulcer activity of *Adhatoda vasica*. Two types of ulcer models were used for study. One was ethanol induced and second was pylorus ligation plus aspirin-induced model. There was significant anti-ulcer activity of *Adhatoda vasica* in experimental rats as compared to control group. Eighty percent activity was observed in ethanol-induced ulceration model. This study showed that *Adhatoda vesica* has anti-ulcer activity and validates its use in peptic ulcer[40].

***Carica papaya* L.**

Family: Caricaceae; Part used: Fruit. Chemical constituents: Terpenoids, alkaloids, flavonoids, carbohydrates, glycosides, saponins, and steroids. Medicinal uses: It is used in bacterial infections, stomach ulcer, toxicity induced kidney failure and constipation. Pharmacological activity: It is immunostimulant and ulcer healer. Study (1): Indran *et al* reported the protective effect of *Carica papaya* L leaf extract against alcohol induced acute gastric damage and blood oxidative stress in rats[41]. Study (2): In another study conducted by Ezike *et al*, (2009), reported efficacy of *Carica papaya* in gastric ulcer. Aqueous and ethanol extracts of this plant were used for study. Gastric ulcer was induced by ethanol and indomethacine in rat models. Ulcer index was significantly reduced in both experimental models as compared to control

group. Methanol extract was more effective in indomethacin-induced ulcers and aqueous extract was more effective in gastric ulcers induced by ethanol. Intestinal motility was inhibited more in methanol treated models as compared to aqueous extract model. When aqueous and ethanol extract were given at dose of 5,000 mg/kg, there was no lethality or signs of acute toxicity in mice after 24 hours[42]. Study (3): In another study conducted by Chen *et al*, (1981) reported antiulcer activity of this plant. This study was conducted using rats. Histamine induced acid secretions and exogenous ulcer was relieved by use of *Carica papaya*. *Carica papaya* was found effective in protecting exogenous ulcer. Histamine induced acid secretion was significantly reduced by *Carica papaya*. Furthermore crystalline papain was found effective in histamine induced acid secretion and exogenous ulcer. This study showed that papain has ulcer-protective potential[43].

Asparagus racemosus

Family: Liliaceae, Parts used: Roots and leaves. Chemical constituents: Sitosterol; benzaldehyde, undecanyl cetanoate. quercetin 3 glucoronide, saccharine and mucilage. The root extract shows inhibitory effect on the digestive enzymes, lipase and trypsin and lead to the stoppage in the degradation of food material in the intestinal tract. Medicinal uses: It is used o treat peptic ulcer disease. Pharmacological activities: It also acts mucilaginous, diuretic, anti dysenteric, demulcent, antispasmodic and aphrodisiac. Study (1): Bhatnagar *et al* reported the antiulcer and antioxidant activity of *Asparagus racemosus* and *Withania somnifera* in rats. A study was conducted to investigate anti-secretory and anti-ulcer activity of these plants. Ranitidine was used as standard drug. Indomethacin was used to induce ulcer. Study indicated that methanolic extract of *Asparagus racemosus* and *Withania somnifera* reduce ulcer. Methanolic extract was given at dose of 100 mg/kg/day. Extract was administered orally. Extracts were given for fifteen days. Efficacy of *Asparagus racemosus* was more significant in ulcer induced by indomethacin and *Withania somnifera* was effective in stress-induced gastric ulcer. Results of plants extracts were similar to standard drug ranitidine[44]. Study (2): In another study, Bhatnagar reported the efficacy of *Asparagus racemosus* Willd. against indomethacin plus pyloric ligation-induced gastric ulcer in rats. Indomethacin plus PL-induced gastric ulceration model was used in the study. Treatment was given for fifteen days. Crude extract of plant was used at dose of 100 mg/kg/day. Extract was given orally. Extract exhibited significant effect as compared to control. Gastric lesion was reduced by use of extract that was comparable to a standard drug ranitidine. Ranitidine was given at dose of 30 mg/kg/ day. Extract was given orally. Volume of gastric secretion was also reduced significantly. This study showed that plant has antiulcer activity that is comparable to standard drug ranitidine[45].

***Momordica dioica* Wall.**

Family: Cucurbitaceae, Part used: Fruit. Chemical constituents: It contains steroidal components, triterpenes, phenolic contents and alkaloids. Medicinal uses: It is used in piles, bowel infections and urinary complaints. Pharmacological activity: It is anti-ulcer, nephroprotective, antioxidant and hepatoprotective. Study: Vijayakumar *et al* reported the antiulcer activity of hydroalchol extract of *Momordica dioica* roxb. Hydro alcoholic extract of this plant was used for antiulcer activity. Dose of extract was 100, 200 and 400 mg/kg body weight. Dose was administered orally. Drug was given twice daily. Duration was five days. Aim was to prevent ulcer induced by ethanol, cold-restraint stress and pylorus ligation. H^+-K^+ ATPase activity was estimated in ulcer models induced by ethanol. Antioxidant enzyme activities were performed in cold-restraint stress-induced ulcer model. Output of acid, gastric juice volume and value of pH was estimated in pylorus ligation-induced ulcer model. There was significant reduction in ulcer induction in animals pretreated with extract as compared to control group. All parameters were significantly improved in animal treated with extract. Effects of extract were dose dependent. This study indicated that plant extract has anti-peptic ulcer activity[46].

Bergenia ciliata

Family: Berginaceae, Parts used: Root. Chemical constituents: It contains flavonoids, saponins, alkaloids, amino acids and carbohydrates. Medicinal uses: It is used in fever, diarrhea, pulmonary infections and wound. Pharmacological activity: It is anti-inflammatory, cytoprotective, anti-tussive, anti-oxidant, anti-malarial and antibacterial. Study: Kakub *et al* reported the cytoprotective effects of *Bergenia ciliata* extract on gastric ulcer in rats. This plant was used in treatment of peptic ulcer in South Asia. Rats were used for study. Ulcer was induced by ethanol/HCl, indomethacin and pylorus ligation. Aqueous and methanol extracts of plant were used for study. Dose of extract was 15, 30 and 60 mg/kg body weight. Extract was given after one hour of ulcerogenic treatment. Animals were sacrificed after three hours ad their stomach was examined for extent of lesion. Mucus weight and acid level in stomach was also determined. Aqueous extract was more effective than methanol extract in reducing lesion of ulcer. This activity is attributed its cytoprotective effects that was evident from mucosal barrier enhancement[47].

***Nigella sativa* L.**

Family: Ranunculaceae, Parts used: Seeds. Chemical constituents: It contains melanthin, nigellin, nigellone, cymene, d-limonene and carvone. Medicinal uses: It is used in intestinal worm infestation, diarrhea, dysentery, tumors, stomatitis and rhinitis. Pharmacological activity: It is gastro protective and antiseptic. Study (I): Khaled and his colleagues concluded in their study that *Nigella sativa* has gastro protective potential. They carried out study in hypo thyroidal rats and found that *Nigella sativa* oil prevents formation of stress gastritis[48]. Study (2): Kanter *et al* reported the gastro protective activity of *Nigella sativa* L. oil and its constituent, thymoquinone against acute alcohol-induced gastric mucosal injury in rats[49]. Study (3): In another study, *Nigella sativa* was investigated for its efficacy in *H. pylori* infection in non-ulcer dyspeptic patients. This study was conducted in King Fahd Hospital of the University Saudi Arabia. This study was conducted in 2007-2008. 88 patients were included in this study. *H. pylori* were detected via histopathologically and urease test. There were total four groups of patients. One group having 23 patients received triple therapy (clarithromycin, amoxicillin and omeprazole). 2nd group having 21 patients received Ig *Nigella sativa* and forty milligram omeprazol. 3rd group having 21 patients received 2 g *Nigella sativa* and omeprazole. 4th group having 23 patients received 3 g *Nigella sativa* and omeprazole. Parameter for eradication of *H. pylori* was negative *H. pylori* stool antigen test four weeks after end of treatment. *H. pylori* eradication was 82.6 % in fist group receiving triple therapy.

47.6 % was in patients treated with 1 gram of *Nigella sativa*. 66.7 % eradication rate was in 3rd group receiving 2 g *Nigella sativa*. 47.8 % eradication rate was in 4th group receiving 3 g *Nigella sativa*. There was no significant difference in triple therapy group and patients receiving 2 g *Nigella sativa*. There was significant eradication rate in triple therapy as compared to other doses of *Nigella sativa*. All groups showed similar improvement in dyspepsia symptoms. *Nigella sativa* has anti-*H. pylori* activity and can be used as antibiotics in *H. pylori* infection[50].

Aronia melanocarpa

Family: Caesalpiniaceae, Parts used: Leaves. Chemical constituents: It contains triterpenes, sorbitol, fructose and anthocyanin. Medicinal uses: It is used in eye infections, jaundice and liver inflammatory disorders. Pharmacological activity: It is hepatoprotective. Study: Valcheva *et al* reported the effect of *Aronia melanocarpa* fruit juice on indomethacin-induced gastric mucosal damage and oxidative stress in rats. It contains phenolic compounds. Fruit juice of this plant was used for study. Ulcer was induced by indomethacin in rats. Extract was given orally and dose of extract was 5, 10 and 20 ml $kg^{(-1)}$. Extracts were given 1 h before the subcutaneous administration of indomethacin and dose of indomethacin was 30 mg $kg^{(-1)}$. Estimation of gastric ulcer formation was done morphologically and histologically after 4 hours of administration of indomethacin. Indomethacin induced gastric lesions were reduced in rats pretreated with extracts. Extract increased the gastric mucus production[51].

Cassia fistula

Family: Fabaceae, Parts used: Pulp, root, bark and pods. Chemical constituents: It contains glycosides, xanthone, procyanidin, epicatechin, epiafzelechin, cyclopropenoid and fatty acids like vernolic acid, malvalic acid and sterculic acid. Medicinal uses: It is used in chest pain, joint pain, migraine, dysentery and amenorrhea, swelling and peptic ulcer. Pharmacological activity: It is anti-secretory. Study: Karthikeyan *et al* reported the antiulcer activity of ethanol leaf extract of *Cassia fistula*[52].

***Bauhinia variegata* Linn.**

Family: Fabaceae, Parts used: Bark. Chemical constituents: It contains aromadendrene, lanceol, nerolidol, bisabolene, selinine, curcumene, methyl-decane and β-Farnesene. Medicinal uses: It is used in carcinoma of stomach, gastrointestinal disorders and hepatitis. Pharmacological activity: It is hepatoprotective, antimicrobial, anti diabetic. Study: Rajkapoor *et al* reported the antiulcer effect of *Bauhinia variegata* in rats[53].

Terminalia macroptera

Family: Combretaceae. Parts used: Bark. Chemical constituents: It contains chebulinic acid, chebulagic acid, rutin, corilagin, shikimic acid, methyl gallate and chebulic acid trimethyl ester. Medicinal uses: This is used in pulmonary tuberculosis, hepatitis, diarrhea and dysentery. Pharmacological activity: This plant has antibacterial and hepatoprotective activity. Study: Silva *et al* reported the anti-helicobacter pylori activity of *Terminalia macropteramv* root[54].

***Moringa oleifera* Lam**

Family: Moringaceae. Parts used: Root and leaves. Chemical constituents: It contains thiocarbamate glycosides, acetylated carbamate, spirochin, pterygospermin, mucilage, tocopherol and resin. Medicinal uses: It is used in bacterial infections, skin papilloma and diabetes mellitus. Pharmacological activity: It is antipyretic and hypoglycemic. Study: Ruckmani *et al* reported the anti-ulcer activity of the alkali preparation of the root and fresh leaf juice of *Moringa oleifera* Lam[55].

Jasminum grandiflorum

Family: Oleaceae. Parts used: Whole plant. Chemical constituents: Resin, salicylic acid, benzyl acetate, benzyl benzoate, phytol, jasmone, methyljasmonate, linalool, geranyl linalool and isophytol. Medicinal uses: It is used to treat headache and mouth ulceration. Pharmacological activity: It is astringent, anthelmintic, deobstruent, diuretic and emmenagogue. Study: Umamaheswari *et al* reported the antiulcer and in vitro antioxidant activities of *Jasminum grandiflorum*[56].

***Mentha arvensis* Linn**

Family: Labiatae. Parts used: Whole plant. Chemical constituents: Volatile oil, menthone, menthol, isomenthone, methyl acetate, neomenthol, piperione, isomenthol and pulegone. Medicinal uses: It is used in stomach ulcer, rheumatic pain, indigestion, spleen disease, asthma and jaundice. Pharmacological activity: It is aromatic, carminative, stimulant, antispasmodic, antiseptic, emmenagogue and stomachic. Study: Ramesh *et al*, (2009) reported the activity of various extracts of *Mentha arvensis* Linn against drug induced gastric ulcer in mammals[57].

***Tectona grandis* Linn**

Family: Verbenaceae, Parts used: Stem. Chemical constituents: It contains unsaturated resinic acid, fatty oil and quinine like substance tectoquinone. Medicinal uses: It is used in peptic ulcer. Pharmacological activity: It is hair tonic. Study: Pandey *et al* (1982) reported the efficacy of this plant in experimental ulcers and gastric secretion[58].

***Ocimum basillicum* Linn**

Family: labiatae. Parts used: Leaves, seeds and root. Chemical constituents: It contains 1-linalool terpinene, methyl cinnamate and essential oil. Medicinal uses: It is used in gonorrhea, diarrhea and chronic dysentery. Pharmacological activity: It is ant-helmintic and anti-secretary. Study: Singh reported the gastric anti-ulcer activity of fixed oil of *Ocimum basilicum* Linn. and its possible mechanism of action[59].

***Ocimum sanctum* Linn**

Family: labiatae. Parts used: Leaves, seeds and roots. Chemical constituents: It contains elemene, caryophylline and eugenol. Medicinal uses: It is used in peptic ulcer. Pharmacological activity: It is demulcent, expectorant, anti-periodic, febrifuge, mucilaginous, stomachic and aromatic. Study: Mandal *et al* reported that *Ocimum sanctum* has anti-ulcer activity[60].

***Passiflora foetida* Linn**

Family: Passifloraraceae. Parts used: Fruits and leaves. Chemical constituents: Terpenoids, alkaloids, flavonoids, saponins and proteins. Medicinal uses: It is used in asthma, giddiness and headache. Pharmacological activity: It is anti-

oxidant, anti-ulcer and anti-inflammatory. Study: Sathish *et al* reported the antiulcer and antioxidant activity of ethanol extract of *Passiflora foetida*[61].

Arctium lappa

Family: Asteraceae. Parts used: Root. Chemical constituents: It contains lappaol, matairesinol, arctiin, arctigenin and daucosterol. Medicinal uses: It is used in chronic infection, arthritis, rheumatism, skin diseases, sciatica, gout, fever, boils, styes, carbuncles, canker sores, indigestion, kidney diseases, wounds, swellings and hemorrhoids. Pharmacological activity: It is diaphoretic, anti-rheumatic and antacid. Study: De Silva *et al*. reported that *Arctium lappa* L. accelerates the healing of acetic acid-induced gastric ulcer in rats[62].

Cedrus deodara

Family: Pinaceae. Parts used: Stem (oil). Chemical constituents: It contains 5-p-trans-coumaroylguinic acid, protocatechuic acid and dibutyl phthalate. Medicinal uses: It is used in peptic ulcer, inflammation, hyperlipidemia and abdominal pain. Pharmacological activity: It is lactagogue and tonic. Study: Kumar and his colleagues reported the gastric anti secretory and antiulcer activities of *Cedrus deodara* (Roxb.) Loud. in Wistar rats[63].

Cinnamomum tamala

Family: Lauraceae. Local name: Tejpat. Parts used: Young petioles or twigs. Medicinal uses: It is used in painful urination. Pharmacological activity: It is gastro protective, immunomodulant, hypoglycemic and anti-oxidant. Study: Gastro protective activity of *Cinnamomum tamala* leaves on experimental gastric ulcers in rats has been reported[64].

Acacia nilotica

Family: Mimosaceae. Parts used: Younger and softer twigs, stem bark. Chemical constituents: It contains flavonoid compounds, malic acid, catechin, calcium, potassium, gum arabic, tannins and mucilages. Medicinal uses: It is used toothache and abdominal pain. Pharmacological activity: It is anti-diarrheal, anti-diabetic, tonic, styptic, expectorant, nutritive, aphrodisiac, demulcent and astringent. Study: Gastro protective effect of *Acacia nilotica* young seedless pod extract has been reported[65].

Aegle marmelos

Family: Rutaceae. Parts used: Leaves. Chemical constituents: It contains monoterpene, sesquiterpene, limonene, ocimene and phallandrene. Medicinal uses: It is used in dysentery, diarrhea, tumor, cardiovascular disorders, bacterial infections, giardiasis, hyperlipidemia, diabetes mellitus, inflammation and malaria. Pharmacological activity: It is gastro protective, hepatoprotective, anti-hyperlipidemic, hypoglycemic and anti-oxidant. Study: Antiulcer activity of *Aegle marmelos* linn has been reported[66].

Acanthus ilicifolius

Family: Acanthaceae. Parts used: Leaves. Medicinal uses: It is used as fermentations in rheumatism and Neuralgia. Pharmacological activity: It is antioxidant, hepatoprotective and gastro protective. Study: Gastro protective effect of *Acanthus ilicifolius* has been reported[67].

Leucas indica

Family: Lamiaceae. Parts used: Leaf. Medicinal use: It is used to treat jaundice and headache. Pharmacological activity: It is anti-oxidant and antiulcer. Study: Anti-ulcer activity of *Leucas aspera spreng* has been reported[68].

Hyptis suaveoens

Family: Lamiaceae. Parts used: Whole plant, leaf, seed and root. Medicinal uses: It is used to treat catarrh, skin diseases, insomnia, small pox, skin eruption, diarrhea, eye complaints and body ache. It stimulates secretion of milk. Pharmacological activity: It is hepatoprotective, cytoprotective, anti-diabetic and anti-inflammatory. Study: Gastro protective activity of *Hyptis suaveolens* has been reported[69].

Bauhinia purpurea

Family: Fabaceae, Parts used: Leaf and bark. Medicinal uses: It is used to treat sores, boils and diarrhea. Pharmacological activity: It is wound healer, antiulcer and hepatoprotective. Study: Antiulcer activity of the chloroform extract of *Bauhinia purpurea* leaf has been reported[70].

CONCLUSION

Present review demonstrated the plants those have efficacy to protect or treat gastric ulcer induced by various factors such as *Helicobacter pylori*, aspirin, indomethacin, alcohol etc. Many plants have been screened by *in vivo* and *in vitro* possessing anti-ulcer activity and can be used as alternative source to treat ulcer. Still further researches are required to find out the active ingredients and phytoconstituents in order to valid the scientific and authentic uses of these medicinal plants in gastrointestinal ailments.

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