Review Article

POTENTIAL GASTROPROTECTIVE MEDICINAL PLANTS: AN OVERVIEW

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ABSTRACT

A solemn gastrointestinal disorder, peptic ulcer represented by erosions in mucosal linings of stomach and duodenum entailed for a well targeted remedial agent. Numerous drugs acting for the treatment of peptic ulcer is available, but limitations (side effects, occurrence of relapses, drug interactions) of these agents have focused and shifted the search for a novel molecules ensuring better protection and with minimal side effects. Herbal based formulations of medicinal plants are gaining popularity which being on focus, thereby ensures for a better treatment of ulcer. A combination of modern research with the Ayurvedic (herbal based plants) knowledge is in needed to develop standard procedures for standardization of herbs for anti-ulcer activity. The present review focuses on the different medicinal plants having gastroprotective activity.

Key words: Antiulcer activity, peptic ulcer, medicinal plants, gastroprotective.

INTRODUCTION

A peptic ulcer, or stomach ulcer, as one of the most widespread gastrointestinal disorder relies on the existence of acid and peptic activity in gastric juice with breakdown of the mucosal defense system.¹ It's prevalence being attributed due to an variance between the offensive (acid, pepsin, *Helicobacter pylori*) and defensive factors (prostaglandins, nitric oxide, bicarbonate secretion, gastric mucus, innate resistance of the mucosal cell factors).²

The common factors responsible for causing peptic ulcer are *Helicobacter pylori* (a gram negative rod, accountable for gastric and duodenal ulcers, gastric adenocarcinoma and gastric B-cell lymphoma)³, Non-steroidal anti-inflammatory drugs (chronic administration of NSAIDs possibly have various adverse impact on gastrointestinal effects associated with gastric or duodenal ulceration manifested with erosions, hemorrhage and perforation)^{4,5}, psychological stress (release of histamine augment mast cell degranulation, gastric motility, vagal over activity, decreased gastric mucosal blood flow and decreased prostaglandin synthesis)⁶, dietary factors (consumption of caffeine, alcohol abuse, spicy food in humans and salt consumption can induce gastritis on experimental animals)^{7,8},

acid-pepsin hyper secretion, smoking, intake of tobacco, rapid gastric emptying and Zollinger-Ellison syndrome (gastrin-secreting tumors).^{9,10}

Approach of Treatment

The current drug remedial modalities available for peptic ulcer is employed with proton pump inhibitors (omeprazole, pantoprazole, rabeprazole, etc), histamine receptor blockers (ranitidine, famotidine, etc), synthetic prostaglandin E1 (misoprostol), antacids (aluminium hydroxide and magnesium trisilicate combination), and antibiotics (clarithromycin and metronidazole).³ Potentially beneficial but many of them have several adverse effects, development of tolerance and recurrent infections often occur within a few weeks especially in case of *H. pylori*. Incessant efforts for searching of new novel anti-ulcer moiety are on progress intended to have fewer side effects with its potency. In recent years, demands of identification and evaluation of new drugs probably of plant origin are gaining popularity for treating peptic ulcer. Hence, herbal medicines are considered as better substitute for the treatment of peptic ulcer with lesser adverse effects.^{11,12}

Various medicinal plants with gastroprotective effect (for peptic ulcer) used traditionally

Plant source	Common name	Pharmacological study
<i>Aloe vera</i> (Liliaceae)	Aloe, kumara, Musabber.	The effects of <i>A. vera</i> (200 mg/kg, orally) on indomethacin induced ulcers in rats have been explored. There was a significant dose dependent reduction in ulcer index, ulcer number and sizes. Further histopathological studies confirmed the anti-ulcerogenic activity of <i>A. vera</i> . ¹³ Another study confirmed the gastroprotective potential of <i>A. vera</i> (50, 100 and 150 mg/kg) leaf gel extract against pylorus ligation, indomethacin, and stress-induced ulcerative damage in rats. Results showed a significant reduction in ulcer scores, gastric secretions, free acidity, total acid output and ulcerative index along with significant increase in mucus production which confirms the antiulcer activity of <i>A. vera</i> gel extract due to its anti-inflammatory, mucus stimulatory and antioxidant potential. ¹⁴

<i>Andrographis paniculata</i> (Acanthaceae)	Creast, Kariyat, Indian Echinacea.	Studies confirming the antiulcer and antioxidant activity of aqueous and ethanolic leaf extract of <i>A. paniculata</i> (250 and 500 mg/kg) against ethanol induced gastric ulcerative lesions in rats. Data obtained with the reduction in pH and aggravation of mucus production scientifically supports the anti-ulcer and antioxidant activity of the plant. ¹⁵ The hydromethanolic extract of <i>A. paniculata</i> (200 and 400 mg/kg/day) possess significant anti-ulcer activity in Indomethacin and Indomethacin plus pylorus ligation induced gastric ulcer in rats. Thus, the extract proves the gastroprotective and antisecretory effects by strengthening the gastric mucosa, decreasing the acidity of gastric juice and pepsin activity as well as restores the imbalance antioxidant activity. ¹⁶
<i>Argyrea speciosa</i> (Convolvulaceae)	Hawaiian baby woodrose.	The results of butanol fraction of <i>A. speciosa</i> leaf (50, 100 and 200mg/kg), study demonstrated the gastroprotective activity, possibly due to free radical scavenging activity against ethanol, aspirin, cold-restraint stress and pylorus ligation induced ulcers. Assessment of antioxidant enzymes activity carried along with various gastric secretion parameters like volume of gastric juice, acid output, and pH value confirms the anti-ulcer activity. ¹⁷
<i>Acanthus ilicifolius</i> (Acanthaceae)	Holly-leaved acanthus, Sea holly, Holy mangrove.	In recent studies, methanolic extract of <i>A. ilicifolius</i> leaves (200 and 400 mg/kg) significantly decreased gastric volume, acidity, and peptic activity against ethanol, indomethacin, stress, and pylorus ligated rats. ¹⁸ Similarly another study conducted of <i>A. ilicifolius</i> (100 and 200 mg/kg), whereby results as observed a dose-dependent gastroprotective activity against ethanol induced gastric ulcerations. ¹⁹
<i>Asparagus racemosus</i> (Asparagaceae)	Satavar, Satavari, Shatamuli.	The antisecretory and anti-ulcer activity of <i>A. racemosus</i> (100 mg/kg/day) against indomethacin plus pyloric ligation-induced gastric ulcer in rats was studied. Crude extract significantly reduced the volume of gastric secretion, free acidity and total acidity confirming its anti-ulcerogenic activity. ²⁰ The methanolic extract of fresh roots of <i>A. racemosus</i> (25–100 mg/kg) was studied on different gastroduodenal ulcer models. A significant increased in the mucosal defensive factors like mucus secretion, cellular mucus, life span of cells and anti-oxidant property restores the ulcer. ²¹
<i>Azadirachta indica</i> (Meliaceae)	Neem, nim, Indian lilac, nimmi, limbo.	The anti-ulcer effect aqueous extract of neem leaf to block gastric lesions in rat has been carried out against pylorus-ligation and mercaptomethyl imidazole induced acid secretion with an importance on acid secretion, oxidative damage and apoptosis. Assessment of the therapeutic effect confirms its activity. ²² In recent studies, aqueous and ethanolic leaf extract of <i>A. indica</i> (400 mg/kg) was investigated in pylorus ligation, cold restrains stress and forced swimming endurance models. There was a significant reduction in gastric volume, free acidity, total acidity, combined acidity and ulcer index which affirm to have potential anti ulcer activity. ²³
<i>Berberis vulgaris</i> (Berberidaceae)	European barberry, Barberry.	The present study was designed to evaluate the gastroprotective efficacy of <i>B. vulgaris</i> (300, 600, 900 mg/kg) seeds against aspirin induced gastric toxicity in male adult albino mice. Results depicted as significant reduction in ulcer area, ulcer score and ulcerative index in treated group ensuring its gastroprotective activity. ²⁴
<i>Bauhinia variegata</i> (Caesalpiniaceae)	Kachnar, Kaniar.	Studies as explored the ethanolic and aqueous extract of root of <i>B. variegata</i> (200 and 400 mg/kg) against pylorus ligation, ethanol, and aspirin induced gastric ulcer. The extract significantly inhibited gastric mucosal damage and reduced the basal gastric acid secretion. ²⁵
<i>Bauhinia purpurea</i> (Fabaceae)	Orchid tree.	An attempt to establish the anti-ulcer activity of the chloroform extract of <i>B. purpurea</i> leaf was carried out. A statistical increase in the gastric wall mucus production and pH of gastric content, and significant reduction in the total volume and total acidity of the gastric content in the pylorus ligation assay confirms the activity. ²⁶
<i>Butea frondosa</i> (Fabaceae)	Palash, Flame of the Forest.	The alcoholic extract of <i>B. frondosa</i> to protect the gastro-duodenal lining from injury inflicted by acetic acid and pyloric ligation in rats was carried out. A decline in the formation of alkaline phosphatase and pepsin with (300 and 500 mg/kg) of the extract was observed implying possible gastro-protective action. ²⁷
<i>Carica papaya</i> (Caricaceae)	Papitta.	In recent studies, the aqueous seed extract of <i>C. papaya</i> (50 and 100mg/kg), was evaluated in rats against ethanol induced gastric ulcer which protected the gastric mucosa against ethanol effect by significantly reducing the gastric juice volume and gastric acidity. ²⁸ Another recent study conducted confirms the anti-ulcerogenic activity of aqueous extract of <i>C. papaya</i> seed on indomethacin-induced peptic ulcer in male albino rats. Pretreatment with the aqueous extract exhibited anti-ulcerogenic and antioxidant effects due to the enhanced antioxidant enzymes. ²⁹
<i>Curcuma xanthorrhiza</i> (Zingiberaceae)	Temu lawak, java turmeric.	Evaluating the ethanolic leaf extract of <i>C. xanthorrhiza</i> against ethanol-induced gastric ulcerative lesions in rats was carried out whereby the ulcer area, superoxide dismutase and malondialdehyde were studied for the anti-ulcer activity. ^{30,31}
<i>Careya arborea</i> (Lecythidaceae)	Wild guava, Ceylon oak, Patana oak.	Studies as reported the ethanolic stem bark extract of <i>C. arborea</i> (300 and 600 mg/kg) which significantly reduced the ulcer score, gastric volume, acidity and ulcerative index thereby confirming the gastroprotective activity. ³²
<i>Cenostigma macrophyllum</i> (Fabaceae)	Carrasco, Caneleiro.	The hydroalcoholic leaf extract of <i>C. macrophyllum</i> (100 and 200 mg/kg) against indomethacin, cold stress, ischemia and ethanol-induced gastric damage has been evaluated in rats and mice. Results as reported where a significant inhibition of ulcerative lesions along with increase in catalase levels in all gastric ulcer models treated groups were observed thereby assuring its activity. ³³
<i>Desmodium gagicum</i> (Leguminosae)	Shaparni.	The evaluation of the ethanolic extract of <i>D. gagicum</i> (200 mg/kg) for its anti-ulcerogenic potential in different-induction models was observed. The efficacy of the extract was noticed due to its antioxidant activity suggesting the free radical scavenging property. Further, the reduced acid output and the cytoprotective ability were depicted in different induced ulcer models confirming its activity. ³⁴
<i>Euphorbia neriifolia</i> (Euphorbiaceae)	Common milk hedge.	In a study conducted, extract of <i>E. neriifolia</i> showed very prominent protection against ethanol-induced ulceration plus pyloric ligated ulceration. A significant decrease in gastric lesions and pH of gastric content as well as total and free acidity was observed thereby restraining its property. ³⁵
<i>Embilica officinalis</i> (Euphorbiaceae)	Indian goosber, Amla.	The antisecretory and anti-ulcer activities of the ethanolic extract of <i>E. officinalis</i> (250 and 500 mg/kg) employing different experimental models in rats were explored. The results of the study as demonstrated depicts that the extract significantly inhibit the basal gastric secretion and ulcero-genicity induced by pylorus ligation, indomethacin and noxious chemicals and by hypothermic restraint stress in rats claiming its activity. ³⁶

<i>Eugenia jambolana</i> (Myrtaceae)	Jambu, Black plum, jamun.	Reports as manifested of the ethanolic extract of <i>E. jambolana</i> against gastric ulcers induced by 2 h cold restraint stress (CRS), aspirin, 95% ethanol and 4 h pylorus ligation (PL) in rats indicates that the extract has gastro-protective properties mainly through promotion of mucosal defensive factors and antioxidant status and decreasing lipid peroxidation. ³⁷
<i>Ficus religiosa</i> (Urticaceae)	Sacred fig, Arasha-maram.	In a recent study performed where the hydroalcoholic extract of <i>F. religiosa</i> (250 and 500 mg/kg) in rats against pylorus ligation, absolute ethanol and aspirin induced gastric ulcer significantly decreases the ulcer index value when compared to control, thereby depicting as an anti-ulcerogenic agent. ³⁸
<i>Ficus arnottiana</i> (Moraceae)	Paraspipal, Plaksha.	An attempt to demonstrate gastroprotective activity of methanolic leaf extract of <i>F. arnottiana</i> against ethanol induced gastric ulcerative lesions has been carried out. A significant dose dependent decrease in ulcer index, total gastric acid output and gastric volume were observed in the treatment group. Further histopathological studies confirm its antioxidant property thereby assuring its gastroprotective activity. ³⁹
<i>Glycyrrhiza glabra</i> (Leguminosae)	Liquorice.	In an experiment conducted, <i>G. glabra</i> (250, 500, and 750 mg/kg) was evaluated for its anti-ulcerogenic activity. Results exhibited a significant reduction in ulcer score, gastric volume, gastric pH, and total acid output along with the formation of gastric lesions thereby exhibiting an anti-ulcerogenic effect that could be related with increase in gastric mucosal defensive factors. ⁴⁰
<i>Guiera senegalensis</i> (Combretaceae)	Ghana, Bouquet.	The demonstration of gastroprotective potential of aqueous leaf extract of <i>G. senegalensis</i> (50, 100 and 200 mg/kg) has been carried out against aspirin and ethanol induced ulcerative damage in rats. It has been proven that the extract possess enough potential as an anti-ulcerogenic agent as with the reduction in ulcer area, ulcer score, ulcerative index and acidity and an enhancement of the mucus secretion in gastrointestinal mucosa. ⁴¹
<i>Hibiscus rosa sinensis</i> (Malvaceae)	Changing rose, Chembaruthi.	A study conducted with the aqueous and alcohol extracts of <i>H. rosa sinensis</i> (250 and 500 mg/kg) roots highlight significant anti-ulcer activity in pylorus ligated rats which precisely confirmed that these extracts possess enough potential as an anti-ulcerogenic agent. ⁴²
<i>Hemidesmus indicus</i> (Apocynaceae)	Indian sarsaparilla.	The anti-ulcerogenic activity of aqueous ethanolic extracts of the roots of <i>H. indicus</i> was carried out in different experimental models. Results as observed whereby there is a decrease in aggressive factors like pepsin and proteins and increase in defensive factor like pH, hexose, hexosamine, fucose and sialic acid which is an indication of increase in mucin activity. ⁴³
<i>Ipomoea batatas</i> (Convolvulaceae)	Sweet Potato.	The methanolic extract of <i>I. batatas</i> tubers (400 and 800 mg/kg) was administered to wistar rats induced by aspirin and cold stress. A significant reduction of ulcer scores, ulcerative index along with it an enhanced levels of superoxide dismutase, catalase and glutathione peroxidase was observed thereby acting as a gastroprotective agent. ⁴⁴
<i>Ixora pavetta</i> (Rubiaceae)	Torch tree.	An experiment explored the anti-ulcer activity of ethanolic flower extract of <i>I. pavetta</i> (200 mg/kg) in rats against aspirin. A significant reduction in gastric acid secretions, stomach acidity, ulcer scores and ulcer index was observed. Further, histopathological studies confirm the significant reduction of gastric ulcerative lesions in treatment group ensuring its activity. ⁴⁵
<i>Jasminum sambac</i> (Oleaceae)	Arabian jasmine.	The anti-ulcerogenic activity was carried out by the ethanolic leaf extract of <i>J. sambac</i> (62, 125, 250 and 500 mg/kg). Results as revealed a significant reduction in total acid output, ulcer score and ulcer index. Further antioxidant level and histopathological studies highlights its activity. ⁴⁶
<i>Larrea divaricata</i> (Zygophyllaceae)	Chaparral.	In a study conducted, the methanolic extract of <i>L. divaricata</i> leaves (300 and 400 mg/kg) was carried out against absolute ethanol and 0.6 N HCl induced ulcer in rats. Analysis of the results as depicted a dose dependent ulcer protection in case of the treatment group thereby showing its anti-ulcerogenic activity. ⁴⁷
<i>Leucas lavandulifolia</i> (Labiatae)	Gumma.	The display of the methanolic extract of the <i>L. lavandulifolia</i> plant exhibited anti-ulcer activity by the significant decrease in ulcer index and gastric acid output in different ulcer models in a dose dependent manner. ⁴⁸
<i>Lawsonia inermis</i> (Lythraceae)	Henna, Mehandi.	An evaluation of alcoholic, aqueous and chloroform leaf extracts of <i>L. inermis</i> (200 and 400 mg/kg) in albino rats against aspirin and pylorus ligation were studied At the end of the study, extracts shown a significant reduction in the gastric volume, acidity and ulcer index supporting its gastroprotective activity. ⁴⁹
<i>Mentha longifolia</i> (Lamiaceae)	Wild mint.	Results of the study as carried out supported the gastroprotective efficacy of ethanolic extract of <i>M. longifolia</i> (100 and 200 mg/kg) against different ulcer models. Also, the histopathological evaluation carried out of the extracts significantly has an impact against aspirin and alcohol-induced gastric ulcerative lesions depicting its activity. ⁵⁰
<i>Mangifera indica</i> (Anacardiaceae)	Mangaai, Mango tree.	The ethanolic seed extract of <i>M. indica</i> has been carried out against alcohol induced ulcerative damage in rats. A significant decrease in ulcer area, ulcer score, ulcerative index and acidity in treatment group is observed and reduction in lipid peroxidation henceforth supporting a strong reason for the gastroprotective activity. ⁵¹ A study conducted with the flower decoction of <i>M. indica</i> (250, 500, and 1000 mg/kg orally) in experimental rats. Analysis of the results as depicted a significant reduction in the gastric juice volume and acidity, thereby providing a strong evidence for gastroprotective activity. ⁵² Further, a recent study demonstrated the gastroprotective activity of <i>M. indica</i> kernel (200 and 400 mg/kg) alone and in combination with vitamin C, vitamin D and zinc sulfate in ethanol and pylorus ligation in rats. Results as obtained whereby a notable reduction were observed in ulcer score, ulcer index, gastric volume, total acid output and curative ratio. Further, histopathological analysis and antioxidant activity carried out strongly supports the anti-ulcer activity. ⁵³
<i>Morinda citrifolia</i> (Rubiaceae)	Indian mulberry, Noni, Beach mulberry.	A recent study being carried out confirms the gastroprotective potential of aqueous fruit extract of <i>M. citrifolia</i> (200 and 400 mg/kg) induced by pylorus ligation. From the results, finally it can be concluded that the respective extract possess anti-ulcer activity due to significant reduction in ulcerative index, total acid output and gastric volume. ⁵⁴
<i>Mimosa pudica</i> (Fabaceae)	Touch me not.	The demonstration of the ethanolic leaf extracts of <i>M. pudica</i> (100 mg/kg) in albino rats in different experimental models was carried out to affirm the gastroprotective activity. There was a significant decrease in ulcerative index, total acidity and gastric volume, thereby providing a knowledge which can be used as an anti-ulcer agent. ⁵⁵

<i>Myrtus communis</i> (Myrtaceae)	Myrtle.	The study as carried out with the fruits of <i>M. communis</i> against gastric ulcer induced by ethanol, indomethacin, and pylorus ligation confirms the gastroprotective activity with the suppression of gastric secretion and acidity and by uplifting the mucosal barrier. ⁵⁶
<i>Musa paradisiaca</i> (Musaceae)	Banana, Kela.	A study demonstrated the anti-ulcer efficacy of aqueous extract leaves of <i>M. paradisiaca</i> (250 and 1000 mg/kg) against aspirin induced model. A significant dose dependent reduction in the ulcer parameters confirms the gastroprotective activity. ⁵⁷
<i>Oryza sativa</i> (Gramineae)	Rice paddy.	An experimental demonstration was being carried out with the extract of <i>O. sativa</i> bran (1 mL/day) for 4 days induced by swimming stress and pylorus ligation in rats. Here analysis of the results within the treatment group exhibited a significant reduction in the gastric acid secretion thereby affirming the gastroprotective activity. ⁵⁸
<i>Ocimum sanctum</i> (Labiatae)	Tulsi.	Studies as reported the anti-ulcer activity of <i>O. sanctum</i> (100 and 200 mg/kg) per orally. A significant reduction in the anti-ulcer activity with the enhancement of the antioxidant potential of gastric mucosa thus reducing mucosal damage against ethanol induced gastric ulcer revealed the gastroprotective property. ⁵⁹ Further another study as carried out for the evaluation of gastroprotective potential of aqueous and ethanolic leaf extract of <i>O. sanctum</i> (100, 200 and 400 mg/kg) against pylorus ligation and stress induced ulcerative damage in rats. A significant decrease in the gastric volume, ulcer index, ulcer scores, total acidity and total acid output may be the reason for anti-ulcer activity. ⁶⁰
<i>Panax ginseng</i> (Araliaceae)	Kanji, Asiatic ginseng.	The gastroprotective activity of <i>P. ginseng</i> (150 and 300 mg/kg) in different experimental models has been evaluated. Gastric injury induced by different models significantly reduced the gastric acid secretion and thereby have an impact in mucus secretion, thus confirming the activity. ⁶¹
<i>Pterolobium hexapetalum</i> (Fabaceae)	Indian Redwing.	A recent study conducted with the aqueous and methanolic leaf and fruit extracts of <i>P. hexapetalum</i> (50 and 100 mg/kg) against pylorus ligation induced ulcer in experimental rats. Analysis of the results as revealed a significant dose dependent reduction in the treatment group thereby supporting the gastroprotective activity. ⁶²
<i>Psidium guyava</i> (Myrtaceae)	Guava.	A study was performed with the methanolic leaf extract of <i>P. guyava</i> (500 and 1000 mg/kg) orally against ethanol induced ulcer in rats. Further results as evaluated showed a significant reduction in ulcer parameters thereby affirming the gastroprotective activity. ⁶³
<i>Premna serratifolia</i> (Verbenaceae)	Munney, Agnimantha.	A recent study conducted confirms the anti-ulcer activity of the methanolic bark extract of <i>P. serratifolia</i> (200 and 400 mg/kg) against aspirin induced model in rats. A significant reduction in ulcerative damage and gastric acidity were observed which might be the reason for the anti-ulcer and cytoprotective activity of the plant. ⁶⁴
<i>Rhus coriaria</i> (Anacardiaceae)	Sumach.	Studies as reported the anti-ulcer activity of the hydro alcoholic extract of <i>R. coriaria</i> (145 and 248 mg/kg) orally in rats against ethanol induced gastric ulcer. Results as depicted a significant increase in healing of gastric ulcers thereby ensuring its gastroprotective activity. ⁶⁵
<i>Rheum emodi</i> (Polygonaceae)	Rhubarb, Tursak.	The present study was conducted to carry out the anti-ulcer activity of ethanolic extract of rhizomes of <i>R. emodi</i> (50 and 100 mg/kg) on pylorus ligation model in rats. A significant reduction in the ulcer index, volume and total acidity, along with an increase in pH of gastric fluid confirms the activity of the extract. ⁶⁶
<i>Swietenia mahagoni</i> (Meliaceae)	West Indies Mahogany.	A present study assessed the anti-ulcer activity of ethanolic leaf extract of <i>S. mahagoni</i> (200 and 500 mg/kg) in ethanol induced rat model. Results as observed a significant increase in mucus production and a decrease in the gastric parameters in the treatment group thereby responsible for gastroprotective potential of plant. ⁶⁷
<i>Shorea robusta</i> (Dipterocarpaceae)	Sal tree.	A recent study carried out with the extract of <i>S. robusta</i> (150 and 300 mg/kg) orally in rats against ethanol and pylorus ligation induced gastric ulcer for the gastroprotective activity. A significant increase in the gastroprotective activity was observed with the extract thereby ensuring its anti-ulcer activity. ⁶⁸
<i>Tamarindus indica</i> (Caesalpinaceae)	Tamarind tree.	An experimental demonstration being carried out with the methanolic extract of the seed coat of <i>T. indica</i> (100 and 200 mg/kg) in pylorus ligation induced ulcer model. A significant decrease in the total volume of gastric juice and total acidity of gastric secretion was observed in the treatment group hence forth claiming the gastroprotective activity. ⁶⁹
<i>Tinospora cordifolia</i> (Menispermaceae)	Guduchi.	A study was conducted to evaluate the anti-ulcer activity with the aqueous extract of <i>T. cordifolia</i> (400 mg/kg) in different ulcer inducing experimental models. Results as observed a significant reduction in gastric volume, total acidity and ulcer index. Also, histopathological observation of the stomach affirms the gastroprotective activity of the extract. ⁷⁰
<i>Withania somnifera</i> (Solanaceae)	Indian ginseng, Winter cherry.	The current study was carried out to assess the preventive effect of <i>W. somnifera</i> (250 and 500 mg/kg) orally in ethanol induced ulcer model. A significant decrease in the ulcer determining parameters was observed in the treatment groups hence forth proving that it can be used as anti-ulcer agent. ⁷¹
<i>Zingiber officinalis</i> (Zingiberaceae)	Ginger.	In recent studies, the aqueous extract of <i>Z. officinale</i> (200 and 400mg/kg) was conducted by indomethacin-induced gastric damage in rats. A significant percentage inhibition of gastric ulcers was observed in the treatment group which found to be effective as an anti-ulcerogenic agent. ⁷²

CONCLUSION

The conclusion of the current review focused on the medicinal plants and their extracts having remarkable anti-ulcer activity against different gastric ulcer inducing models in rats. The level of the gastroprotective activity of different plant extracts are carried out on the basis of the different parameters as ulcer index, ulcer score, ulcer area, pH of gastric mucosa, curative ratio, histopathological observation and antioxidant potential. A significant variation in these parameters was observed with the plant extracts thereby ensuring it as safe for peptic ulcer. Along

with the alteration of the above parameters, a significant rise in the level of defensive mechanism (muco-protective activity) is crucial. The results of the above mentioned medicinal plants could avert ulcer in a dose-dependent manner in rats. So far hard work for those medicinal plants which has been used as a traditional medicine since past should be through in modern day medicaments as a safe, non-toxic herbal formulation for ulcer patients. A need for further research is necessary to separate and characterize the active constituents of those medicinal plants in response to their pharmacological activities. The fact arises that the experimental analysis of different medicinal plants for

gastric ulcer is enormous, but few have count through the clinical trial process and being marketed. Hence a need for appropriate utilization of time, resources, manpower is indispensable thereby for an impending herbal drug to be globally effective.

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