REVIEW ARTICLE

A Review on Exploration of Phytomolecules in the Treatment of Peptic Ulcer

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ABSTRACT

Peptic ulcers are defined as the presence of destructions on the mucosa of the gastrointestinal system, which might extend to the muscular layer. Their origin is complex and arises when there is a disruption in the equilibrium between the elements that cause harm and those that protect the mucosa. Peptic ulcers are a significant international health issue, impacting millions of individuals and exhibitingelevated recurrence rates. The enormous range of structural diversity and unique biological activity exhibited by natural products has significantly contributed to the creation and discovery of novel medications. An exhaustive analysis on the investigation of phytomolecules in the management of gastricabscess might offer important considerate of the existing data regarding the utilization of these compounds. This review may analyze and combine the results of several research to discover potential of phytomolecules, explain how they work, and evaluate their safety and effectiveness. This data can contribute to the advancement of efficacious and secure therapeutic alternatives for peptic ulcer. By advocating for the utilization of natural therapies and plant-based medications, the aim is to enhance the health results of individuals suffering from peptic ulcer.

Keywords: Peptic ulcer, Pathophysiology, Phytomolecules, Flavonoids, Alkaloids, Terpenoids.

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INTRODUCTION

Peptic ulcer is defined the erosion of protective mucosal layer in the abdominus and duodenum, leading to sores.[1] The number of peptic ulcers and their complications has gone down since effective acid-suppressing drugs were created and *Helicobacter pylori* infections were found and treated .[2] Nevertheless, peptic ulcer disease continues to pose a significant clinical burden, with an annual diagnosis rate of around 1 in 1000 individuals in Western cultures.[3] Peptic ulcers happen when the protective systems of the stomach and duodenal lining are out of balance with the harmful effects of gastric acid and pepsin.[4] The development of peptic ulcers is likely caused by an imbalance amongdestructive forces, such as HCL, bile juice, and *H. pylori*, and self-protective factors.[5] The diagnosis is often established by endoscopic inspection of the upper GIT, and most gastralsores are managed with medical treatment.[6] Therapeutic endoscopy, interventional radiology, and surgery are typically employed to address problems arising from peptic ulcer disease, including bleeding, perforation, and outflow blockage.[7] A significant proportion of those diagnosed with stomach ulcers, namely, thirty-five per cent, will experience severe consequences. While the death rates associated with gastralsore disease remain relatively short, the widespread occurrence of condition and the consequent physical discomfort, distress, and financial burden are significantly burdensome.[8] Medicinal herbs and their separated components, which are natural products, take widely utilized in investigationalreplicas of peptic sores. These phytomolecules include alkaloids, glycosides, phenolic compounds, saponins, terpenoids, and flavonoids .[9]

METHODOLOGY

Protocol and Registration

The current a systematic review was done and reported following the established standards of the recommended PRISMA criteria for documenting items for meta-analyses and systematic examinations.

Information Sources

The literature was examined using the specified academic and accessible research databases, namely PubMed/Medline, Science Direct, and Google Scholar. Additional articles were obtained by manual searching.

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Search Methods

The search was conducted using the following Boolean algorithms: PubMed/MEDLINE (Treatment of peptic ulcers OR Phytochemicals utilized in peptic ulcer treatment OR Prevention of peptic ulcers OR Biologically active compounds used in gastric ulcer dealing OR Impact of flavonoids on gastric ulcers OR Impact of alkaloids on peptic ulcers OR Impact of glycosides on peptic ulcers OR Impact of terpenoids on peptic ulcers OR Impact of saponins on peptic ulcers OR Impact of phenolic compounds on peptic ulcers) AND (Peptic ulcer disease OR Pathophysiology of peptic ulcers AND Science Direct (Phytochemicals used in peptic ulcer treatment OR Phytochemicals derived from plants used in gastric ulcer dealing) AND (Gastric ulcer disease OR Pathogenesis of gastric ulcers) To enhance the identification of suitable research, a manual search was conducted on Google Scholar using unrestricted keywords relating to phytoconstituents, phytomolecules, or phytochemicals utilized for the management of gastric ulcers.

Phytomolecules Used in Treatment of Peptic ulcer

Kaempferol

Kaempferol standsas a prevalent flavonol in popular several foods, including vegetables and fruits. Multiple studies have illustrated the extensive array of pharmacological properties exhibited by kaempferol, including its antioxidant, cardioprotective, and anticancer effects. Additionally, it enhances nitric oxide (NO) production and improves gastrointestinal mucua.[10] Kaempferol exhibits an repressing effect on the growth of *H. pylori* in laboratory conditions, with a minimum inhibitory dose of 0.05 mmol/L. Additionally, it mitigates the inflammatory response induced by this pathogen.[11]

Kaempferide

Kaempferide is a flavonol derivative of kaempferol that has been methylated at the O position. The compound was extracted from green propolis and effectively protected against ulcers caused by HCl, ethanol, indomethacin, and pylorus ligation.[12] Carbenoxolone was used as a positive control. Furthermore, kaempferide augmented the amount of gastric mucus.[13]

Quercetin

Quercetin, a flavonol is mostly present in apples, onions grapes.[14] It possesses several beneficial effects.[15] The gastroprotective properties of quercetin were evaluated in rats using an ethanol-induced ulcer model.[16,17] Quercetin also controls programmed cell death and the functioning of COX and NOS. Quercetin shields the gastric mucosa of rats and Caco-2 cells from oxidative stress and inflammation caused through indomethacin.[18,19] Furthermore quercetin inhibit the activation of nuclear factor caused by indomethacin.[20] It has been demonstrated that quercetin significantly reduces the levels of the IL-1βand TNF-α)in mice.[21,22,23]

Morin

Morin is a flavonoid that has shown promise in the management of gastric ulcers because of its antioxidant and anti-inflammatory properties.[24] Studies have verified that morin protects the mucosa of the duodenum and stomach from many substances that can cause ulcers, such as ethanol, NSAIDs, stress, and pyloric ligation. Among other things, it functions by inducing mucus production, boosting antioxidant enzyme activity, regulating immune responses, lowering acidity, and avoiding *H. pylori* infection. These findings suggest that morin might be added to existing treatments or used as a preventive approach to treat peptic ulcers, perhaps reducing the likelihood of recurrence.[25,26]

Rutin

Rutin, a flavonoid component, has demonstrated tremendous promise in the treatment of peptic ulcers because of its gastroprotective properties.[27] Studies have investigated the anti-ulcerogenic properties of rutin in ulcer induction models employing ethanol, stress, and ischemia-reperfusion-induced stomach mucosal ulcers.[28,29] In order to give its protective qualities, rutin has been found to produce more mucus, boost the activity of antioxidant enzymes, and inhibit the stomach proton pump.[30,31] Additionally, rutin has shown promise in controlling nitric oxide generation, reducing oxidative stress, and protecting the stomach from harm from indomethacin. Studies shown that peptic ulcers, offering a secure and effective way to manage and prevent the development of gastric ulcer.[32]

Quercitrin

Quercitrin is a compound that is derived from the flavonoid quercetin by a process of glycosylation.[33] Quercitrin is a compound in which quercetin is modified by the addition of an alpha-L-rhamnosyl group at position 3 through a glycosidic bond.[34] It is derived from the *Solidago chilensis*, it is commonly also referred to as "Brazilian arnica". Quercitrin was found to inhibit the reduction of stomach glutathione levels.[35]

Catechin

Through a variety of mechanisms, a flavanol component of green tea called catechin has demonstrated promise in the management of gastric ulcers Its proven potent anti-inflammatory and antioxidant qualities bolster its gastroprotective advantages. Green tea's anti-secretory properties, which are primarily responsible for its ability to prevent peptic ulcers.[36,37] Furthermore, it has been discovered that catechin upregulates Nrf2 in the NSAIDs model both in vivo and in vitro and increases the activity of intracellular antioxidant enzymes.[38] Catechin has the ability to modify immunological responses in gastric tissue and decrease inflammatory processes driven by free radicals.[39-41] Derivatives of catechin have demonstrated the capacity to hinder the explosion and pathogenicity of the bacteria accountable for ulcers, *H. pylori*.[42,43]

Baicalein

Baicalein is a flavone that is primarily originatefrom the root of *S. baicalensis*. It is a powerful antioxidant that can also fight cancer and bacteria. Baicalein had a protective effect on the stomach in contradiction of lesions caused by acetified ethanol and pylorus ligature in mice.[44] The mechanism behind this

action involves the suppression of cyclooxygenase (COX) and an increase in nitric oxide (NO) activity.[45] Baicalein exhibited cytoprotective benefits through stimulating gastric mucus production, elevation of antioxidant levels such as GSH, and inhibition of MPO activity. Baicalein suppresses the activity of H+-K+-ATPase, hence demonstrating its anti-secretory effect.[46] Baicalein also exhibits *in-vitro* inhibition of *H. pylori*, supporting its antiulcer activity.[47]

Baicalin

Baicalin is a compound. Baicalin is a compound classified as a flavone glycoside, specifically the glucuronide form of baicalein. *Scutellaria baicalensis* contains this compound, an active component in Chinese herbal medicine.[48] It exhibits positive effects on the protection of neurons, the prevention of tumour growth, the safeguarding of the heart, the prevention of various disease and the reduction of oxidative stress.[49] The underlying mechanism of these effects involves the modification of Nfr2 and suppression of *H. pylori*.[50,51]

Chrysin

Chyrsin is a flavonoid compound that has demonstrated gastroprotective qualities against peptic ulcers. The compound can be referred to as 5,7-dihydroxy-2-phenylchromen-4-one.[52] Chrysin is recognized for its properties that combat cancer, reduce inflammation, act as an antioxidant, and lower cholesterol levels.[53] The primary method by which chrysin exhibits its anti-ulcer benefits is through its cytoprotective and anti-inflammatory activity. [54] It suppresses the activity of pro-inflammatory cytokines and prevents the movement of macrophages.[55]

Isoorientin

Isoorientin is a flavone C-glycoside. The substance is derived from botanical sources such as *Gentiana triflora and Eremurus spectabili*.[56] It demonstrates several biological characteristics, including analgesic, neuroprotective, and hepatoprotective activities.[57] The GI protective efficacy of isoorientin was assessed in a rat model of stomach injury produced by indomethacin. The potential mechanism underpinning gastroprotective action may entail a reduction in the concentration of MDA.[58,59]

Pinostrobin

Pinostrobin is a flavanone that is derived from the plant *Boesenbergia rotunda*. It indicated the management of gastrointestinal problems, such as peptic ulcers.[60] The substance has strong antioxidant, anti-inflammatory, antiviral, and anticancer effects. Pinostrobin exhibited gastroprotective benefits through the preservation of the stomach mucosa.[61]

Genistein

The primary source of genistein is predominantly extracted from *Genista tinctoria*; however, it is now understood that the primary sources are *Glycine max* or *Soy hispida*.[62,] Genistein had a gastroprotective effect in animal experiments.[63] The gastroprotective impact of this mechanism is achieved by the reduction of inflammation, the reduction in oxidative stress, and the restoration of neuroprotective function.[64]

Rutaecarpine

Rutaecarpine is an alkaloid compound in *Bouchardatia neurococca, Zanthoxylum dimorphophyllum, and Evodia rutaecarpa*. These effects are achieved by the enhanced secretion of the neuropeptide thyrocalcitonin gene-related peptide. This neuropeptide facilitates a range of protective effects on the gastrointestinal system, including enhanced blood flow to the mucosal lining, suppression of stomach acid production, prevention of cell death, and mitigation of oxidative damage.[65] Another study found that rutaecarpine boosts the activity of dimethylarginine dimethylaminohydrolase, and reduces the levels of asymmetric dimethylarginine this leads to an enhancement in the generation of nitric oxide (NO) and a decrease in stomach damage.[66]

2-Phenylquinoline

At a dosage of 50 mg/kg, 2-phenylquinoline exhibited anti-ulcer efficacy *via* inhibiting inflammatory mediators. Furthermore, the management of 2-phenylquinoline resulted in a reduction in the quantity of gastric juice then overall acidity.[67] Additionally, it contributes to gastroprotective properties by augmenting the synthesis of nitric oxide.[68]

Nicotine

Nicotine is a transparent to pale yellow or brown liquid chemical in the *Nicotiana tabacum* plant.[69] Nicotine decreased the ulcerative lesions, likely by promoting increased mucus production, as seen by the rise in pH and gastric volume. Nicotine also enhanced the synthesis of nitric oxide, leading to an increase in mucosal output.[70,71]

Chelerythrine

Chelerythrine is a chemical compound. Chelerythrine is a benzophenanthridine alkaloid extracted from the roots of two plants, *Zanthoxylum simulans and Chelidonium majus.* Chelerythrine exhibits a gastroprotective effect oncemanaged orally at dosages of 1, 5, and 10 mg/kg. It achieves this by decreasing the acidity level of gastric juice, increasing the pH, and promoting mucus formation.[72]

Piplartine

Piplartine shows various activities such as cytotoxicity, genotoxicity, anticancer activity, inhibition of blood vessel formation, pain relief, anxiety reduction, antidepressant properties, prevention of atherosclerosis, regulation of blood sugar levels, antibacterial activity, the ability to kill parasites causing leishmaniasis, trypanosomiasis, and schistosomiasis, as well as protection of the stoma ch lining.[73,74,75]

Ascaridole

Ascaridole is a naturally occurring chemical molecule that falls under bicyclic monoterpenoids.[76] A unique bridging peroxide functional group in the structure of Ascaridole characterizes it.[77] It is extracted from *Athamanta macedonica* and *Achillea millefolium* and is kept from other substances. Ascaridole primarily functions as a highly effective anti-leishmanial

agent. Oral management of ascaridole at doses of 10 and 20 mg/kg demonstrates gastroprotective benefits by reducing the production of acid and pepsin.[78]

Eucalyptol

Eucalyptol is a naturally occurring cyclic ether and monoterpenoid. Eucalyptol is a constituent found in several mouthwash and cough suppressant products. It regulates the excessive mucus production in the airways and treats asthma by inhibiting anti-inflammatory cytokines. Eucalyptol is a potent remedy for nonpurulent rhinosinusitis. Topical use of eucalyptol has been found to alleviate inflammation and discomfort effectively. exhibits cytotoxic effects on leukaemia cells in a laboratory setting. Eucalyptol is obtained chiefly from eucalyptus globules. Eucalyptol demonstrates gastroprotective activity through many mechanisms, including the enhancement of mucus production and a reduction in levels of SH, LOP, and MPO. Additionally, it is accountable for the growth and division of cells.[79]

CONCLUSION

Peptic ulcer is the most prevalent disorder of the gastrointestinal tract (GIT) in clinical practice, affecting between 5 and 10% of the population throughout their lifetime. Above statement is especially true regarding phytomolecules, which likely comprise the most extensive category of secondary metabolites found in plants. Particular interest has been directed towards phytomolecules on account of their health-promoting properties. A substantial body of research has examined the impacts of phytomolecule compounds on human health over the last decade. Studies demonstrate a range of biological activities within the domain of gastroprotection, such as cytoprotective, antioxidant, and anti-secretory effects, as well as *H. pylori* infection inhibition. It was discovered that these phytomolecules also protect the mucosa of the gastrointestinal tract against necrotic agents and lesions induced by various experimental ulcer models. Furthermore, the phytomolecules examined in this review have the potential to serve as a substitute for existing therapies or as a supplement to them. Hence, these compounds may possess a therapeutic potential that is both more efficacious and less deleterious in the context of gastric ulcer treatment. Additionally, more research and clinical trial required to conduct to investigate the ability of phytomolecules in the treatment of peptic ulcer

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