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The Protective Role of Pachira Glabra Leaves in Preventing Ethanol-Induced Gastric Ulcer in Rats

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Abstract

Gastric ulcers are a frequent gastrointestinal illness that may be brought on by several things, including alcohol usage. These ulcers can be very harmful to one's health. This investigation looked at the effectiveness of Pachira glabra leaves in preventing ethanol-induced stomach ulcers in rats. A significant number of individuals worldwide are negatively affected by the relatively common condition known as a gastric ulcer. Research on the phytochemistry of P. glabra leaf alcohol extract. Helicobacter pylori's anti-activity was demonstrated in vitro by PGLE. Additionally, the in vivo gastroprotective evaluation of PGLE at various doses, 100, 200, and 400 mg/kg against ethanol-induced ulceration, indicated a dose-dependent gastroprotection similar to omeprazole. Gastric lesions and histological alterations brought on by ethanol were reduced by PGLE. Intriguingly, PGLE demonstrated an anti-inflammatory effect by suppressing nuclear factor B and the pro-inflammatory enzyme cyclooxygenase-2 expression in the ulcer group. Additionally, it prevented apoptosis by raising Bcl-2 expression and lowering Bax expression, which in turn reduced the Bax/Bcl2 ratio and decreased caspase 3 production.

Keywords: Pachira Glabra, Gastric ulcer, Apoptosis, Malvaceae, Phytoconstituents, Inflammation.

Introduction

Demulcents are chemicals that have the potential to produce a protective covering over mucous membranes, which provides relief from pain and inflammation. The fact that these compounds transform into a slimy or gel-like state when they come into touch with water contributes to the calming and protective effects that they have. Inflammation in the gastrointestinal system, including that caused by illnesses such as gastritis may be alleviated with the use of demulcents in some cases. They can assist minimize inflammation and improve healing by establishing a protective barrier (1). The most frequent disorder moving the digestive system is gastric ulcers. They manifest when the elements that defend the stomach lining are outnumbered by those that cause harm to it. The stomach lining, or gastric mucosa, employs several defense mechanisms to fend off the stomach's acidity and digest enzymes. Ulcers of the stomach may be caused by this bacterium. It causes inflammation and ulceration by breaking down the stomach's protective mucus layer and exposing the underlying tissues to acid (2).

The Achillea plant is used for medical purposes, and different components of the place, such as the leaves, flowers, and stems, are all put to good use. Treatment of digestive diseases, inflammation reduction, menstrual cramp relief, and wound healing are only some of the frequent traditional applications of Achillea species. Yarrow, or plants of the genus Achillea, may be found in a broad variety of forms and habitats across the globe. More than a hundred

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species and subspecies of Achillea are now accepted. Species can differ in how they look, what chemicals they contain, and how effective they are as medicine (3). The preventive effects of Pachira glabra leaves have shown promising health advantages for this plant. The Pachira glabra is a tropical tree that grows naturally in Central and South America. It is besides identified as the Malabar chestnut tree. The preventive benefits of Pachira glabra leave on stomach ulcers have been the subject of just a small amount of study. The anti-inflammatory capabilities of Pachira glabra leaves come from the presence of bioactive substances. These chemicals have the potential to lower inflammation and ease its effects (4). Efficiency as an Antioxidant Antioxidants such as flavonoids and phenolic substances are abundant in Pachira glabra leaves. Protecting cells from oxidative stress, which has been linked to many illnesses, antioxidants help neutralize free radicals. Effects on the digestive system Pachira glabra extracts have been the subject of research into their potential gastroprotective effects. Although there is a lack of data on ethanol-induced stomach ulcers, these extracts have shown promise in preserving the gastric mucosa and minimizing damage produced by some ulcerogenic substances (5).

Capacity to repair wounds Pachira glabra leaves have been used for centuries by traditional medicine practitioners to speed the recovery of wounds. There is speculation that the leaves' potential healing and antimicrobial capabilities are what set them apart. The ability to combat diabetes: It has been suggested, based on preliminary research, that extracts from the Pachira glabra plant may have anti-diabetic benefits via enhancing insulin sensitivity and altering glucose metabolism. But further study is required to determine its safety and effectiveness (6). Prescription medications for ulcers Several pharmaceuticals have been investigated for their potential to prevent stomach ulcers caused by ethanol consumption in rats. Reducing gastric acid output and protecting the stomach mucosa is the goal of proton pump inhibitors (PPIs) like omeprazole and H2 receptor antagonists like ranitidine. Organic substances In rat studies, several naturally occurring substances have shown promise in avoiding ethanol-induced stomach ulcers. The stomach mucosa may be shielded from damage because of these substances' antioxidant and anti-inflammatory effects. Plant extracts such as aloe vera, curcumin, and green tea polyphenols are just a few examples of flavonoids (7). Antioxidants Gastric ulcers caused by excessive alcohol use are mostly due to oxidative stress. Reduced stomach mucosal damage is a direct result of antioxidant supplementation, which neutralizes the ROS that cause it. In rat models of ethanol-induced stomach ulcers, antioxidants such as vitamin E, vitamin C, and N-acetylcysteine (NAC) have been demonstrated to have protective benefits. Natural remedies Herbal extracts of many kinds have been studied for their possible use in warding off stomach ulcers. Studies in rats have shown that extracts from plants including licorice (Glycyrrhiza glabra), pomegranate (Punica granatum), and garlic (Allium sativum) may prevent ethanol from causing stomach ulcers (8).

Natural polysaccharides, such as those found in mushrooms or plant gums, have been shown to prevent the development of stomach ulcers in rat models of ethanol poisoning. While promising results have been found in preclinical studies employing rat models, further study is required to validate the effectiveness and safety of these therapies in human individuals. Depending on the drug or intervention being tested, there may be a range of feasible dosing,

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administration, and treatment length options (9). To the best of my knowledge as of the end of this reading in September 2021, the precise effect of Pachira glabra leaves in preventing ethanol-induced stomach ulcers in rats has not been explored or recorded in the scientific literature. As a result, I am unable to comment on the effectiveness of Pachira glabra leaves in preventing or treating stomach ulcers caused by ethanol in rats. While the anti-inflammatory and antioxidant activities of Pachira glabra leaves have been studied for their potential therapeutic applications, their effects on ethanol-induced stomach ulcers have not been studied to the same extent (10). For the latest and most reliable information on this issue, study contemporary scientific literature or contact stomach ulcer and natural remedy, experts. They may be able to provide the newest study on Pachira glabra leaves' ability to prevent ethanol-induced stomach ulcers in rats. The research (11) determines whether or not Ag NPs can prevent stomach ulcers caused by ethanol in rats. Thirty of the rodents were split up into five groups at random. Oral administrations of 175 and 350 ppm/p.o. of Ag NPs were given to the test subjects. The ulcer index decreased and the percentage of ulcer prevention increased, showing that Ag NPs mitigated the harmful effects of ethanol-induced stomach injury. Increased mucus secretion and pH of stomach content, decreased ulcer area, absence of edema, and leucocyte penetration of the subcutaneous layer were all signs of significantly reduced ethanol-induced gastric lesions.

Research (12) decreased GUI and gastric juice volume, and LRG pretreatment was shown to preserve gastric mucosa and normalize gastric acid secretion. By restoring reduced SOD and CAT levels and greatly lowering MDA and MPO concentrations, LRG mitigated the ethanol-induced oxidative stress and lipid peroxidation. LRG also upregulated PGE2 levels and blocked MTL secretion, in addition to decreasing the release of the inflammatory mediator TNF-. TLR-2 and MyD88 protein co-localization in the stomach mucosa of LRG-treated rats was considerably decreased compared to gastric ulcer animals, as validated by immunofluorescence and Western blot studies. The study (13) describes the seeds and leaves of the Pachira glabra tree, a medium-sized tree, are highly prized for their excellent flavor. 7-hydroxy maltol-3-O--D-glucoside (HMGlu) is a novel -pyrone glycoside isolated as a result of phytochemical analysis of an alcohol extract of Pachira glabra leaves. HMGlu's gastro-protective action was evaluated in vivo, and it was shown to be superior at a dosage of 100 mg kg1, which is quite near to the value triggered by the gold standard. The research (14) depicts the protective effects of Heliotropium crispum root methanol extract and fractions against an ethanol-induced stomach ulcer model in rats were investigated. Using Fourier-transform infrared spectroscopy (FTIR), we were able to determine the presence of a wide variety of metabolites with a wide variety of functional groups in the aerial sections of H. crispum. Paralleling these findings, High-Performance Liquid Chromatography (HPLC) identified three major peaks that were ultimately identified as myricetin, quercetin, and kaempferol. The study (15) in vitro hemolytic test was used to study toxicity, while the carrageenan-induced paw edema model and the sulfur dioxide-induced cough model in rats were used to evaluate the acute anti-inflammatory and antitussive effects, respectively. The effects of ethanol on acute and chronic rat gastric ulcer models were analyzed for their gastro-protective properties. Through the use of gas chromatography, their metabolic profiles

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were identified. It was determined that fatal dosages of MLM and MFM were more than 5 g/kg, making them non-toxic to human erythrocytes.

Material and methods

Standard experimental protocols

Nuclear magnetic resonance (NMR) when conducting nuclear magnetic resonance (NMR) investigations on Bruker equipment, the sample is normally housed in a temperature-controlled probe or sample holder maintained at 25 °C. With the Bruker NMR spectrometer, the temperature may be precisely controlled to provide reliable and repeatable results. Many chemicals are liquids at 25 °C, making NMR analysis simpler. However, NMR investigations may be conducted at varying temperatures, allowing for the study of substances in a solid or frozen state as well as the investigation of reactions or dynamic processes at higher temperatures. Flow of this research is shown in (Figure 1)

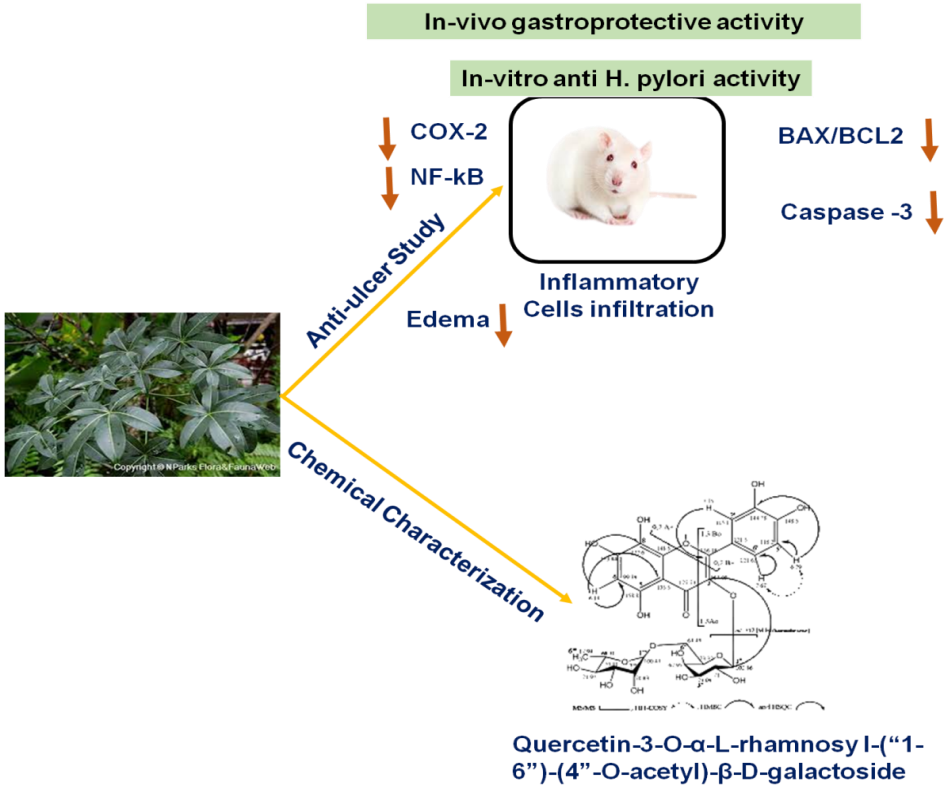

Figure (1): Flow of this research

Biological component

A research endeavor or botanical study may have begun with the gathering of new leaves of P. glabra Pasq (Malvaceae) as trees at the Al-Zohriya botanical park. The flowering plant P. glabra Pasq, or Pavonia glabra, belongs to the Malvaceae family. Al-Zohriya botanical garden is likely a specific location where P. glabra trees are cultivated and maintained for various purposes such as conservation, research, or public display. Botanical gardens offer

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opportunities for researchers, botanists, and plant enthusiasts to study and explore different plant species in a controlled environment.

Estimated phenolic and flavonoids

Standard practice in plant chemical analysis is to use the Folin-Ciocalteu technique and the aluminum chloride colorimetric method to determine common colorimetric tests for determining the total phenolic content of plant extracts the Folin-Ciocalteu technique. In this method, a blue complex is formed when the Folin-Ciocalteu reagent is reduced by phenolic chemicals. The extract's hue is related to the number of phenolic chemicals it contains. The total phenolic content may be inferred from the measured color intensity using spectrophotometric analysis. Total flavonoid concentration in plant extracts is typically estimated using the aluminum chloride colorimetric technique. The capacity of flavonoids to form stable compounds with aluminum ions is crucial to the success of this technique. The addition of an aluminum chloride reagent causes the extract to transform into a yellow complex. The concentration of flavonoids is calculated from a calibration curve established using known standards and the absorbance of this complex at a certain wavelength is measured using a spectrophotometer.

PGLE cytotoxicity in vitro

Cell lines

The MCF-7 cell line is a popular choice for research into human breast cancer. In 1970, it was isolated from a metastatic breast cancer location. The MCF-7 cell line is useful for researching hormone receptor-positive breast cancer since it expresses both the estrogen and progesterone receptors. Breast cancer research has made considerable use of MCF-7 cells to learn more about the disease's biology, molecular pathways, and therapeutic responses. They have helped greatly in the assessment of endocrine medicines including selective estrogen receptor modulators (SERMs) and aromatase inhibitors, and the creation of a better knowledge of hormone signaling in breast cancer. In addition to being hormone receptor-positive, MCF-7 cells also display features of luminal epithelial cells and are therefore often utilized in studies of the processes underlying the development, progression, and dissemination of breast cancer. They have also been exploited in the assessment of potential therapeutic drugs targeting particular molecular pathways associated with breast cancer in preclinical studies.

In vitro anti-H-pylori action of PGLE

Helicobacter pylori ATCC 43504 cells were used to evaluate PGLE's (the test drug) in vitro antibacterial efficacy. Following recommendations made by the National Committee for Clinical Laboratory Standards in 1998, the team used a broth microwell dilution technique. The sample is diluted in a broth medium and then added to microwell plates containing bacterial cells for testing. The protocol would have included the entire experimental setup, including the concentration of PGLE, the dilution series, and the length of incubation. Scientists often culture H. pylori on a microwell plate and then add PGLE diluted in broth

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medium at increasing concentrations. After the appropriate circumstances for the interaction between the cells and the test material have been established, the plate will be incubated.

The absorbance of the solubilized formazan product would be determined by a spectrophotometer. The absorbance readings would show how effective PGLE is as an antimicrobial agent against H. pylori by correlating the level of color development with the survival of the cells. A negative control and a positive control were employed. In this particular experiment, the solvent dimethyl sulfoxide (DMSO), which is often used as a control in biological and biochemical research, was chosen to serve as the negative control. It is done this way to guarantee that any effects detected are not attributable to the solvent itself, but rather to the chemicals that are being examined.

The minimum inhibitory concentration (MIC) values were used to assess the efficiency of the PGLE (presumably referring to a test substance or extract). This was done to determine the effectiveness of the PGLE. To conduct this evaluation, dose-response curves for the PGLE have to be constructed. Dose-response curves were generated by graphing the concentration of the PGLE (or standard) on the x-axis and the related response (inhibition, growth inhibition, cell viability, etc.) on the y-axis. These curves were built using the data that was acquired. The curves provide a graphical depiction of the dose-dependent response by describing the connection between the concentration of the PGLE and its action on the target. The values for the minimum inhibitory concentration (MIC) of the PGLE were calculated based on the dose-response curves that were generated. The minimal inhibitory concentration (MIC) is the lowest concentration of the PGLE that is capable of inhibiting the target organism's growth or activity to a considerable degree. This information contributes to a better understanding of the PGLE's potential therapeutic or biological action and provides light on how successful it is as a therapy or intervention.

Gastroprotective effect of PGLE in vivo

Drugs and chemical compounds

Dimethyl Sulfoxide (DMSO) is a popular organic solvent in the life sciences. To dissolve chemicals, especially those that are hydrophobic (not soluble in water), DMSO is often used as a solvent or carrier. It dissolves a wide range of molecules, both polar and non-polar, including salts, carbohydrates, proteins, peptides, and chemical compounds of varying sizes. It is common practice to add DMSO as a negative control in experiments to rule out the possibility that the solvent itself is responsible for any noticeable effects. DMSO may interfere with particular assays or interact with certain cellular processes; therefore it's vital to keep that in mind when interpreting experimental data.

Analytical statistics

The mean ± SD is used to represent continuous variables. One-way analysis of variance (ANOVA) was used for the statistical analyses, and Tukey-Kramer was used as a post hoc test. Data on ulcer index were analyzed using the Kruskal-Wallis test, followed by the Dunn post-test. $\rho<0.05$ Is used to determine if a probability value is significant. The third edition of

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the GraphPad Instat program was used for all statistical studies. GraphPad Prism version 7 software was used to create the graphs.

Result and Discussion

Estimated phenolic and flavonoids

The total flavonoids and total phenolic contents of Pahira glabra methanol extract (PGLE) were calculated to be 109.33±0.01 g of quercetin/mg of material and 84.40±0.28 and 93.35±0.01 g of gallic acid/mg of sample, respectively. Table 1 displays the total phenolic and flavonoid concentrations of PGLEs.

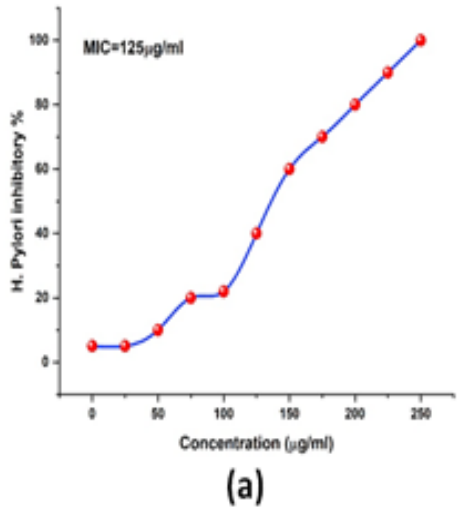
Table (1): p. Glabra leaf phenolic and flavonoids results

Sample	Entire favonoids content (µg of quercetin/mg of sample)	Entirety phenolic content (µg of gallic acid/mg of the sample)
n-Butanol soluble fraction of P. glabra methanol extract	33.73±0.01	173.60±0.34
P. glabra methanol extract	109.33±0.01	84.40±0.28
Ethyl acetate-soluble P. glabra methanol extract	123.32±0.15	345.38±0.56

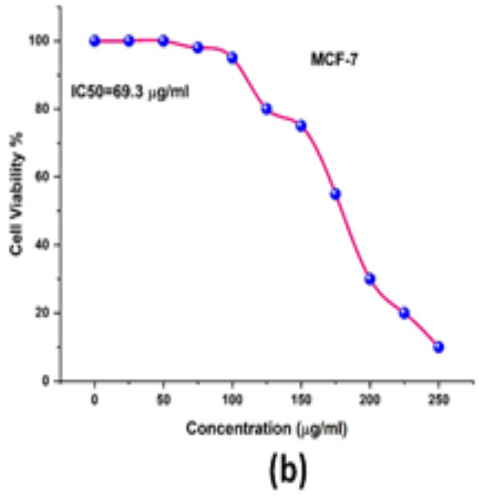
The Biological research on PGLE

PGLE anti-Helicobacter pylori and cytotoxic properties in vitro

The average inhibitory concentration (IC50) of PGLE in opposition to the feasibility of the MCF-7 cell lines was 69.3µg/ml, indicating moderate inhibitory action. In contrast, cytotoxic activities of P. Glabra alcohol extract (PGLE) were extremely poor against both HepG-2 and A-549 cells, with IC50 values over 500µg/ml, dazzling the protection of PGLE. The outcomes are shown in (Figure. 2a, b, c and d).



(a)



(b)

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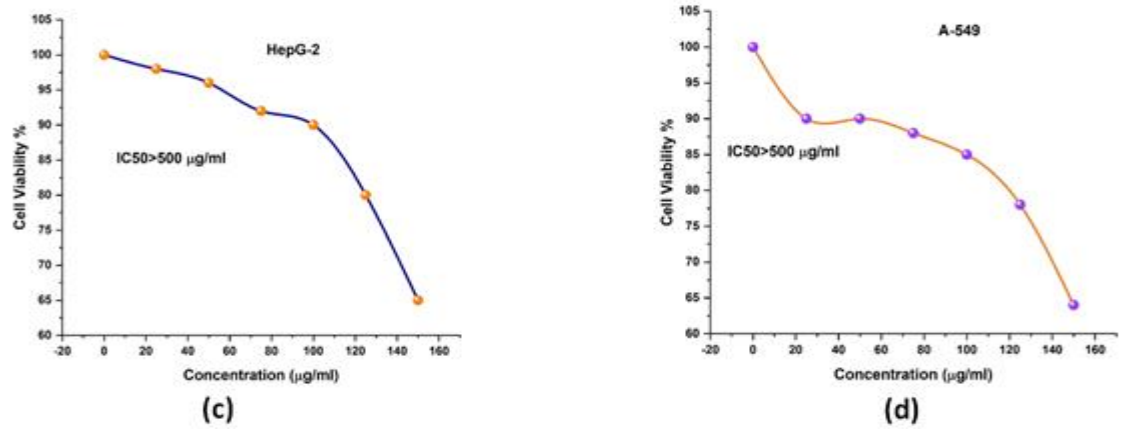

Figure (2): Helicobacter pylori is inhibited by P. Glabra leaves methanol extract

Evaluation of the Gastroprotective effects of PGLE in vivo

Lesions that were ulcerated and hemorrhagic demonstrated that ingestion of ethanol caused substantial damage to the stomach mucosa of the test subjects. In addition, when compared to the organize group, rats that had been treated with ethanol showed an important increase in the number of ulcers and lesions (Figure. 3a, b). In addition, the supervision of omeprazole or PGLE at different dosages (100, 200, and 400 mg/ kg) exhibited a significant reduction in the lesions index in comparison to the group that was treated with ethanol (Figure. 3a, b). In the stomach tissues of the control rats. The effects were detected in rats that had ulceration caused by ethanol exposure. Ethanol is a poisonous toxin that may cause serious damage to the lining of the stomach, which can lead to ulcers in the stomach.

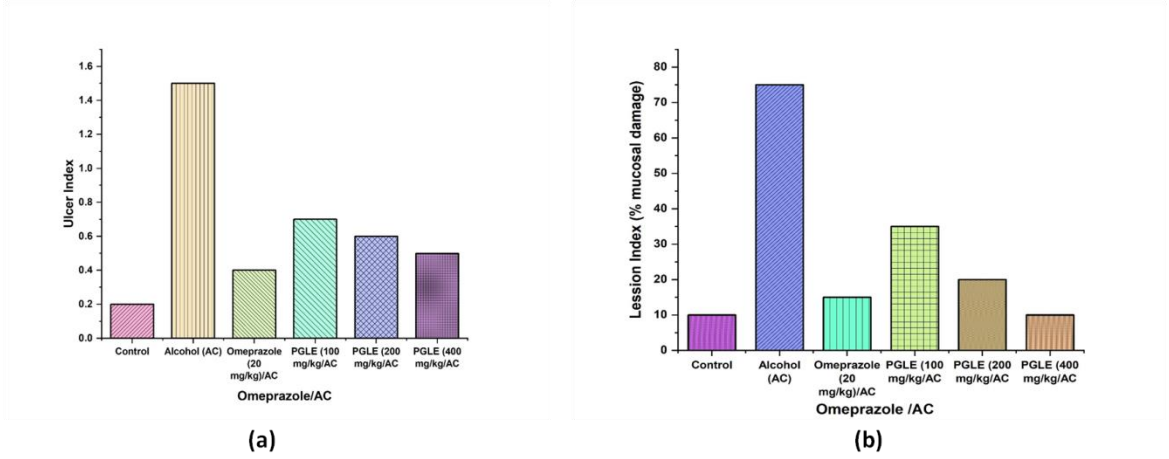

Figure (3): Effect of dosages PGLE on AC-induced gastric lesion

It may be inferred from the term "ethanol-ulcerated rats presented stomach with pronounced ulcers" that the rats who were subjected to ethanol acquired considerable ulcerations in their stomachs as a result of being exposed to the substance. Ingestion of ethanol may have contributed to the development of open sores or lesions on the gastric mucosa, which is the lining of the stomach that protects the contents of the stomach. According to the report, ulcers were produced in rats, and as a result, substantial edema (the buildup of fluid) and infiltration

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of inflammatory cells were seen in the submucosal layer of the rats' stomachs. It seems from this that the production of an ulcer led to a large amount of inflammation as well as the retention of fluid in the layer that lies underneath the stomach mucosa.

This occurred when the rats were given the drug. At a dosage of 100 mg/kg of PGLE, the mucosa looked to be intact; nonetheless, there was diffuse infiltration of inflammatory cells, as well as edema (swelling), and congestion of blood vessels in the submucosal layer. This suggests that the PGLE therapy resulted in some degree of mucosal repair, even though inflammation and fluid buildup were still present. Mucosa remained intact even with a larger dosage of 200 mg/kg, although there was still edema, congestion of blood vessels, and only a few specific sites with inflammatory cell infiltration in the submucosal layer. It seems from this that a larger dosage of PGLE led to a greater decrease in inflammation as well as an improvement in the repair of the submucosal layer when compared to a lesser dose. According to the information that was presented, the level of expression of NF-kB, also known as nuclear factor kappa B, was reduced in the groups of rats that were pretreated with PGLE (at a dosage of 400 mg/kg) and omeprazole (at a dose of 20 mg/kg). Inflammation and immunological responses are two of the many physiological processes that are regulated by the transcription factor known as NF-B. NF-B plays a critical role in this regulation. An upregulation of NF-B activity is often linked to an increase in inflammatory response as well as tissue damage.

The fact that NF-B expression was reduced implies that treatment with either PGLE or omeprazole led to a reduction in NF-B activity. The lower levels of NF-B expression are suggestive of a possible dampening of the inflammatory response shown in (Figure 4a and 4b). In the statement, it is said that there was a substantial decrease in optical density (OD) of 45-49% in the groups that were pretreatment with omeprazole and PGLE, respectively. According to the measurements of the optical density meter, there was a drop in the amount of NF-B expression that occurred with this fall in OD. This decline was seen as a notable fall in optical density (OD) that was 48% lower than before. The drop in optical density indicates that the treated group saw a reduction in the presence or activity of COX-2.

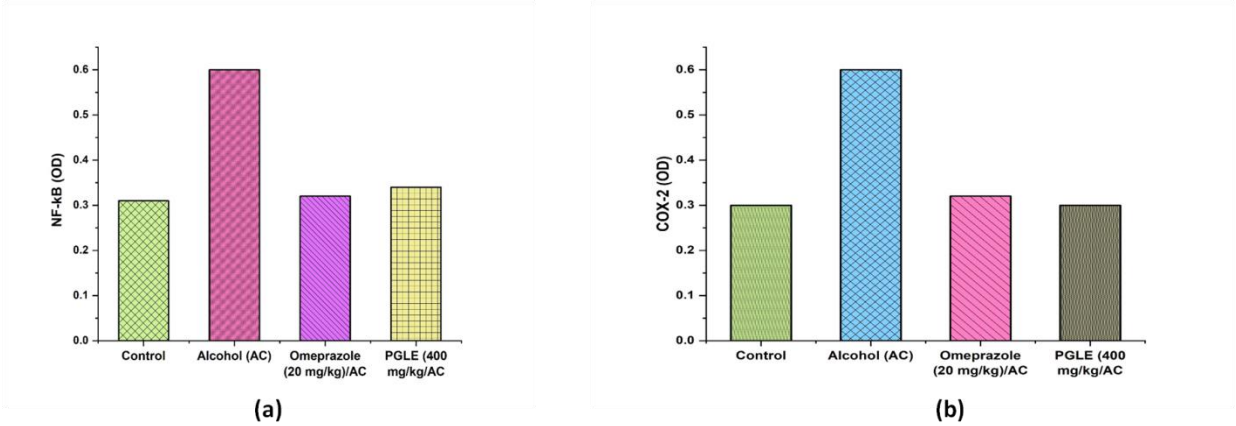

Figure (4): The PGLE Effect: Methanol Extract of P. glabra Leaves

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Additionally, the decrease in OD was equivalent to the group that was treated with ethanol, which suggests that the impact of the PGLE pretreatment was comparable to the control group that was treated with ethanol. According to this comparison, PGLE, at the dose that was used, was able to produce a status of COX-2 staining known as a mild-positive status. This status means that the staining intensity was lowered but was not eliminated (Figure. 4b).
It is crucial to note that to properly comprehend the relevance of these results and the consequences they have, further background about the research or experiment in question would be required.

Ethanol-induced stomach mucosal apoptotic damage is reduced by PGLE pretreatment (400 mg/kg)

It was determined by the quantitative analysis of the immunoreactivity that alcohol led to a 31% rise in the optical density (OD) of Bax positively stained cells in comparison to the group that served as the control. This shows that alcohol use led to an increase in the presence of or activity of Bax, which is a protein, linked with apoptosis or programmed cell death. The OD of Bcl-2 positively stained cells was considerably reduced by alcohol, falling by 35%. A protein known as Bcl-2 is recognized for having anti-apoptotic capabilities, which means that it helps to prevent cell death. The decrease in Bcl-2 staining shows that exposure to alcohol-induced a drop in the presence or activity of Bcl-2, perhaps encouraging an environment that is more favorable to apoptosis (Figure. 5a, b).

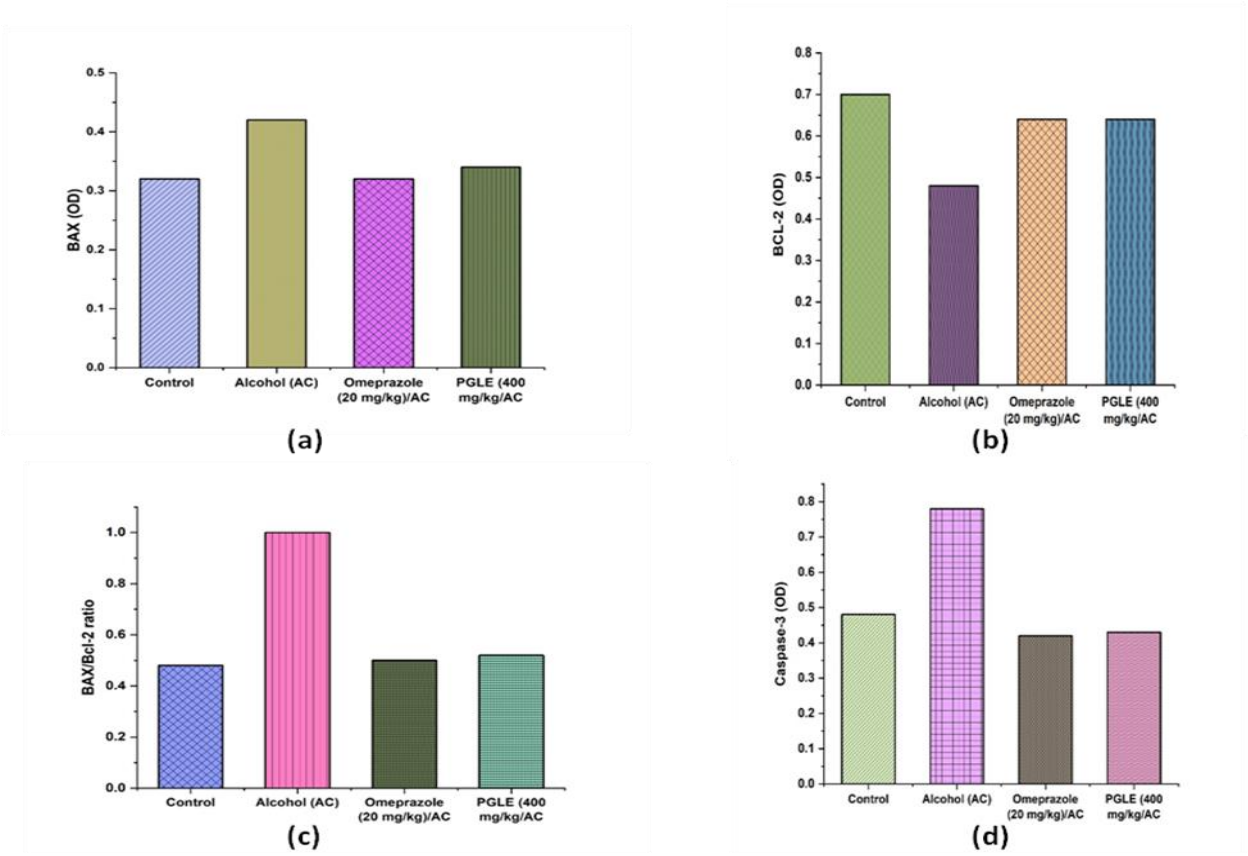

Figure (5): Methanol extract of P. glabra leaves: the PGLE effect

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The IHC was additionally definite by measure OD, which showed that PGLE considerably lowered the OD of Bax optimistic cells by twenty percent while increasing the OD of Bcl-2 appearance by forty percent when compared to the alcohol group (Figure. 5b, c). Following treatment with PGLE, the Bax/Bcl-2 index showed a significant decrease, statistically decreasing by 48% in comparison to the alcohol group and becoming closer to the value seen in the control (Figure 5d).

Discussion

The condition known as stomach ulcer is, in point of fact, quite common and influences a sizeable section of people around the globe (16). These sores may be caused by several different factors. Abuse of alcohol is recognized as one of the possible etiological variables that might lead to the development of stomach ulcers. Consuming alcohol in excessive amounts or continuously may cause disruptions in the normal functioning of the mucosa lining the stomach. This can result in damage to the mucosa as well as an increased chance of developing gastric ulcers (17). The erosion of the stomach mucosal barrier may result in increased permeability, which allows acid and other toxic chemicals to permeate the underlying tissues, resulting in inflammation and ulceration. This can be caused by the erosion of the barrier. This mechanism is linked to a disruption in the control of H+/K+-ATPase, which further exacerbates acid secretion and is a contributing factor in the formation of stomach ulcers.

In the context of gastric ulcers as an experimental model to investigate the pathophysiology of human ulcerative illness as well as prospective therapeutics for treating human ulcerative disease (18). Alcohol-induced stomach ulcers, scientists may learn more about the mechanisms underpinning ulcer development and progression in people. This information may aid in the investigation of the causes of human ulcerative disorders like peptic ulcers and provide direction for the creation of effective treatments. Omeprazole blocks stomach acid production by reducing the activity of the H+/K+ ATPase enzyme. Omeprazole helps reduce acid production, which lessens the corrosive effects of stomach acid on the gastrointestinal mucosa (19). To evaluate the efficacy of various therapeutic measures or experimental therapies in ethanol-induced ulcer models, omeprazole is often employed as a reference or positive control.

Macroscopic and histological data show that administering 100% alcohol to rats causes severe ulcers of the stomach mucosa (20). Hemorrhagic lesions, defined by bleeding, are a common presentation of ethanol-induced stomach ulcers in rats. Several variables contribute to the development of hemorrhagic lesions in ethanol-induced stomach ulcers. Coagulopathy, or abnormal blood clotting, is a contributing cause. Hemorrhage in the stomach mucosa may be made worse by alcohol since it interferes with the body's natural clotting mechanism. Alcohol, Helicobacter pylori infection (21). The ulcer's development and severity are both heavily influenced by this inflammatory response. Leukocytes (including neutrophils) and macrophages are recruited and activated by the immune system when a stomach ulcer

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develops due to the production of inflammatory mediators. These immune cells are involved in the inflammatory process and move to the ulcer and surrounding tissue. In addition to neutrophils, macrophages are also important in the inflammatory response that leads to stomach ulcers. They cause more inflammation and tissue damage by releasing cytokines and reactive oxygen species, among other inflammatory mediators.

The inducible enzyme cyclooxygenase-2 (COX-2) is pivotal in the inflammatory response. Prostaglandins are powerful lipid mediators. Including inflammation, where they are produced from arachidonic acid. When exposed to inflammatory stimuli such as cytokines, growth factors, and other pro-inflammatory signals, COX-2 expression is elevated but not present under normal circumstances (22). Once activated, COX-2 stimulates the local synthesis of prostaglandins, most notably prostaglandin E2 (PGE2). Increased COX-2 expression and prostaglandin synthesis in response to mucosal erosion and inflammation are attempting to kick off the healing process and restore tissue integrity. Mucosal injury and poor healing may occur when the delicate balance between protective and harmful effects is upset, as can happen in situations of persistent inflammation or high COX-2 activity.
Significant inhibition foundation in gastric tissue was seen after pretreatment with PGLE (perhaps referring to a particular extract or chemical) at a dosage of 400 mg/kg. The transcription factor NF-B is very important in controlling the expression of inflammatory genes. Activation of NF-B causes it to go into the nucleus (23). Proinflammatory prostaglandins are a byproduct of the enzyme cyclooxygenase-2 (COX-2). Increased production of COX-2 is associated with the development of stomach ulcers and the subsequent inflammatory response and mucosal damage that results. Protein expressions of p65, a subunit of NF-B, were reported to return to normal in gastric tissue after administration of PGLE at the specified dosage. This data indicates that COX-2 and other pro-inflammatory genes were less likely to be transcribed after treatment with PGLE (24). The inflammatory response associated with stomach ulcers may be suppressed in part because PGLE therapy reduces COX-2 expression, hence reducing the synthesis of pro-inflammatory prostaglandins.

The proteins Bax and Bcl-2 play crucial roles in controlling apoptosis, or programmed cell death. Bax stimulates apoptosis, whereas Bcl-2 inhibits it. Concurrently, Bcl-2 protein expression decreases, resulting in a weaker anti-apoptotic signal. A higher ratio of Bax to Bcl-2 is produced as a consequence, which further encourages apoptosis. Apoptosis is likely produced in the stomach tissue damaged by ethanol-induced ulcers, as shown by the overexpression of Bax, the downregulation of Bcl-2, and an enhanced Bax/Bcl-2 ratio. In addition, ethanol-induced stomach ulcers are characterized by an upregulation of caspase-3, an enzyme crucial to the last stages of apoptosis. The cleavage of several cellular proteins by caspase-3 is a hallmark of apoptotic cells and is responsible for their signature morphological and biochemical alterations.

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Plants contain a flavonoid molecule called quercetin, which has been demonstrated to have several health benefits. These include acting as a powerful antioxidant and preventing the development of the Helicobacter pylori (H. pylori) bacterium (25). The bacterium Helicobacter pylori (H. pylori) are a major contributor to the development of stomach ulcers and gastritis. Quercetin's antibacterial properties have been shown against H. pylori, suggesting that it may be used to limit the proliferation of this bacterium and its subsequent negative effects on the stomach mucosa. In addition, quercetin may scavenge free radicals and lessen oxidative stress due to its powerful antioxidant characteristics. Alcohol use causes mucosal injury in the setting of ethanol-induced ulcers. Quercetin's antioxidant properties help mitigate the effects of oxidative stress on stomach tissue and prevent further damage from occurring.

Conclusion

The first detailed study on phytochemical investigation of P. glabra leaf components identified from the ethyl acetate fraction of a methanol extract of P. glabra leaves. In addition, this research provides novel information on the gastroprotective effects of PGLE in ethanol-induced stomach ulcers, for the first time. Our results show that the extract has anti-inflammatory characteristics, which it exerts mostly via interfering with the NF-B signaling pathway, which is one of its most potential uses. Furthermore, by increasing Bcl-2 expression and decreasing Bax expression, and by simultaneously suppressing caspase-3 expression, PGLE significantly suppressed the ethanol-mediated mitochondrial route of apoptosis in gastric mucosa. PGLE's gastroprotective benefits are similar to those mediated by omeprazole, the gold standard antiulcer medication. As a result, P. glabra is a likely option for the treatment of stomach ulcers and a potential rich reservoir, as shown in our research. However, further research is needed to fully understand how PGLE may be used in practice.

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