Evaluation Of Abroma Augusta Extract as Anti-Ulcer Agent

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Abstract*— This study investigates the potential of Abroma augusta root extract in mitigating ethanol-induced gastric ulcers in rats. Ethanol-induced gastric ulcers were induced in rats following a 24-hour fasting period. The animals were treated with Omeprazole (20 mg/kg) or A. augusta root extract at doses of 250 mg/kg and 500 mg/kg orally for 21 days. Parameters such as ulcer index, % inhibition of ulceration, plasma antioxidant levels (superoxide dismutase, catalase, lipid peroxidase), and histopathology were evaluated.The results indicate that the 500 mg/kg dose of A. augusta root extract significantly reduced the ulcer index compared to control groups, demonstrating its efficacy in preventing ethanol-induced gastric lesions. Additionally, this dose maintained elevated levels of plasma antioxidants and preserved the histological integrity of the gastric mucosa, suggesting antioxidant and cytoprotective properties. The presence of tannins, saponins, and alkaloids in the root extract may contribute to these observed effects.In conclusion, the findings support the antiulcer potential of A. augusta root extract, particularly at 500 mg/kg, highlighting its role in protecting against gastric ulcer formation induced by ethanol. These results provide scientific validation for the traditional use of A. augusta in treating gastric ailments and warrant further investigation into its mechanisms of action.This abstract encapsulates the key outcomes of the study, focusing on the efficacy of A. augusta root extract in mitigating ethanol-induced gastric ulcers through its antioxidant and protective properties.

I. INTRODUCTION

Abroma augusta, commonly known as Devil's Cotton or Ulatkambal, is a plant with significant traditional medicinal uses in various parts of the world, including South Asia, Africa, and Australia. Here are some key aspects about Abroma augusta:

1. Botanical Description:
- Abroma augusta is a perennial shrub belonging to the family Malvaceae. It typically grows up to 3 meters in height and is characterized by hairy leaves and stems.

2. Geographical Distribution:
- The plant is native to tropical regions of South Asia, including India and Bangladesh, as well as parts of Africa and Australia. It thrives in humid and warm climates.

3. Traditional Uses:
- Medicinal Purposes: In traditional medicine, various parts of Abroma augusta, including its roots, leaves, and bark, are used to treat a range of ailments.
- The root extract is particularly noted for its therapeutic potential in managing diabetes mellitus type II.
- It is also used traditionally for its anti-inflammatory, wound healing, hypolipidemic (lowering cholesterol), antimicrobial, and antioxidant properties.
- Abroma augusta has been employed in folk medicine to address menstrual irregularities, uterine disorders, and other gynecological issues.

4. Phytochemical Constituents:
- The plant contains several bioactive compounds responsible for its medicinal properties:
- Tannins: Known for their antioxidant and astringent properties.
- Saponins: Have potential therapeutic effects, including anti-inflammatory and antimicrobial activities.
- Alkaloids: Known for various physiological effects, including pain relief and antimicrobial activity.
- Flavonoids: Have antioxidant and anti-inflammatory properties.
- Terpenoids: Exhibit a range of biological activities, including antimicrobial and anticancer properties.

5. Modern Research and Pharmacological Studies:
- Recent scientific research has focused on validating the traditional uses of Abroma augusta through pharmacological studies.

- Studies have explored its potential in managing conditions such as diabetes, inflammation, microbial infections, and gastric ulcers.
- Specifically, research has shown promising results in the protection against ethanol-induced gastric ulcers in animal models, attributed to its antioxidant and cytoprotective properties.

6. Safety and Considerations:
- While traditional uses highlight its safety profile, rigorous scientific evaluation is ongoing to establish its safety and efficacy for therapeutic applications.
- Proper dosage and administration guidelines are essential, as with any herbal remedy, to ensure optimal therapeutic benefits and minimize potential adverse effects.

In conclusion, Abroma augusta is a plant with a rich history of traditional medicinal uses, supported by emerging scientific evidence of its pharmacological properties. Its potential in managing various health conditions, including gastric ulcers, underscores its importance as a subject of ongoing research and exploration in the field of herbal medicine.

Gastric ulcers remain a significant health concern worldwide, often referred to as a modern-day "plague." These ulcers result from an imbalance between factors that damage the stomach lining, such as pepsin, acid, non-steroidal anti-inflammatory drugs (NSAIDs), and those that protect it, including mucosal defenses and antioxidants. Factors like NSAIDs, alcohol consumption, and Helicobacter pylori infection commonly contribute to the erosion of the stomach's protective mucosal lining, leading to ulcer formation.

Ethanol, in particular, induces a range of pathological processes linked to ulcer formation. It damages mucosal capillaries, increases blood vessel permeability, and can lead to thrombosis in sub-epithelial microvasculature. These effects trigger the release of pro-inflammatory cytokines, exacerbating oxidative stress and causing tissue necrosis and apoptosis of gastric mucosal cells. Consequently, ethanol contributes significantly to the inflammatory response and oxidative damage associated with gastric ulcers.

Current pharmacological treatments for gastric ulcers include proton pump inhibitors, anti-histamines, and antacids. While effective, these medications can pose risks such as gynecomastia and arrhythmias, highlighting the need for safer and more effective treatment alternatives with minimal side effects.

Natural products have gained attention for their potential in managing gastric ulcers due to their perceived safety and multifaceted therapeutic actions. Abroma augusta, known as "devil's cotton," is a hairy shrub found in South Africa, tropical Asia, and Australia. Traditionally used to manage diabetes mellitus type II and various other ailments, A. augusta is recognized for its anti-inflammatory, wound healing, hypolipidemic, antimicrobial, and antioxidant properties. However, its potential in treating gastric ulcers has not been extensively studied.

This study aims to explore the pharmacological basis underlying A. augusta's traditional use in treating gastric ulcers, particularly focusing on its protective effects against ethanol-induced gastric ulceration in rats. By investigating the root extract's phytoconstituents and their interactions, this research seeks to establish scientific evidence supporting A. augusta as a potential therapeutic agent for gastric ulcer prevention.

In summary, understanding A. augusta's mechanisms of action and efficacy in mitigating gastric ulcers could pave the way for developing novel, natural treatments that offer maximum benefits with minimal risks for patients suffering from this debilitating condition.

This introduction sets the stage by outlining the current challenges in gastric ulcer management, highlighting ethanol as a significant trigger, and introducing Abroma augusta as a potential natural remedy based on its traditional uses and reported pharmacological properties.

II. METHODS

Plant Collection and Authentication:
Roots of Abroma augusta were collected from Amlachati Bhesojo Udyan, Shirshi, West Bengal, India (721507). Dr. Tapan Seal, a scientist at Acharya

Jagadish Chandra Bose Botanic Garden, Howrah, India, authenticated the plant material. The sample was assigned the identification number KCP/sample 01/M.Pharm.

Preparation of Extract:

1. Drying and Powdering: The collected roots were thoroughly cleaned with fresh water and dried under shade for 20 days until completely dehydrated. Subsequently, the dried roots were coarsely powdered using a grinder.

2. Methanolic Extraction: The soxhlet extraction method was employed for extracting bioactive compounds from the powdered roots. The powdered roots were placed in a soxhlet apparatus and subjected to two cycles of extraction using methanol as the solvent. Each extraction cycle lasted 6 hours at a temperature of 30°C. This method ensured efficient extraction of phytochemicals from the plant material.

3. Filtration and Storage: After completion of the extraction cycles, the methanolic extract was filtered through Whatman filter paper to remove solid residues and obtain a clear filtrate. The filtrate was then concentrated under reduced pressure using a rotary evaporator to remove the solvent. The resulting crude extract was accurately weighed and stored in sealed containers at -20°C to maintain stability and prevent degradation until further use in phytochemical and pharmacological analyses.

Phytochemical Screening:

The concentrated methanolic extract of A. augusta roots underwent preliminary phytochemical screening to identify the presence of various secondary metabolites:

- Tannins: Detected using ferric chloride test.
- Saponins: Detected using froth test and hemolysis test.
- Flavonoids: Detected using Shinoda test and alkaline reagent test.
- Alkaloids: Detected using Dragendorff's reagent and Mayer's reagent.
- Terpenoids: Detected using Salkowski test and Liebermann-Burchard test.

These tests were conducted following established protocols outlined in standard phytochemical screening methods.

Animal Experimentation:

1. Animal Selection: Female Wistar albino rats weighing between 150-250 grams were procured from Sri Venkateshwara Enterprises, Bangalore, India. The choice of female rats was based on established models for gastric ulcer studies.
2. Acclimatization: Upon arrival, the rats were housed in standard laboratory conditions with controlled temperature (22 ± 2°C), humidity (50-60%), and a 12-hour light/dark cycle. They were provided with standard pellet diet and water ad libitum and allowed to acclimate for 15 days before the commencement of experiments to minimize stress.
3. Ethical Approval: All experimental procedures were conducted in accordance with ethical guidelines and approved by the Institutional Animal Ethics Committee (IAEC) with registration number KCP/IAEC/11/22-23/08/22/12/22. The study complied with the guidelines set forth by the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), ensuring humane treatment of animals throughout the study.

Induction of Gastric Ulcers and Treatment Protocol:

1. Fasting and Ethanol Induction: Before inducing gastric ulcers, rats were fasted for 24 hours to standardize conditions. Gastric ulcers were induced by administering ethanol (1 mL/200 g body weight) via oral gavage.
2. Experimental Groups:
- Control group: Rats received only the ethanol induction.
- Treatment groups: Rats were administered A. augusta root extract orally at doses of 250 mg/kg and 500 mg/kg for 21 consecutive days prior to ethanol induction.
3. Outcome Measures:
- Ulcer Index: Determined by scoring the number and severity of gastric lesions.
- Percent Inhibition of Ulceration: Calculated to assess the protective effect of the extract.
- Plasma Antioxidant Levels: Assessed for superoxide dismutase (SOD), catalase, and lipid peroxidase activities to evaluate antioxidant status.
- Histopathological Examination: Gastric tissue samples were examined under a microscope after staining to evaluate histological changes such as mucosal damage, inflammation, and ulcer depth.

III. STATISTICAL ANALYSIS

1. Experimental Design and Grouping:
- **Control Group:** Rats receiving only ethanol-induced gastric ulcers.
- **Treatment Groups:** Rats treated with Abroma augusta root extract at doses of 250 mg/kg and 500 mg/kg orally for 21 days prior to ethanol induction.

2. Data Collection:
- Ulcer Index: A quantitative measure of the severity and number of gastric lesions observed macroscopically.
- Percent Inhibition of Ulceration: Calculated as $\left(\frac{\text{Ulcer index of control} - \text{Ulcer index of treatment}}{\text{Ulcer index of control}} \right) \times 100$.
- Plasma Antioxidant Levels: Measurements of superoxide dismutase (SOD), catalase, and lipid peroxidase activities.
- Histopathological Scores: Qualitative assessment of histological changes in gastric tissue, such as mucosal damage and inflammation.

3. Statistical Tests:
- Descriptive Statistics: Mean and standard error of the mean (SEM) for each parameter in control and treatment groups.
- One-way Analysis of Variance (ANOVA): Used to compare means across multiple groups (control vs. treatment groups at different doses).
- Post-hoc Tests: If ANOVA reveals significant differences, post-hoc tests (e.g., Tukey's HSD or Bonferroni) are performed to identify specific group differences.
- Significance Level: Set at $p < 0.05$ to determine statistical significance.
4. Data Presentation:
- Results are presented as mean ± SEM or as graphical representations (e.g., bar graphs) to illustrate differences between groups.
- Statistical significance is indicated by asterisks (*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$).
5. Sample Size Considerations:
- Sample size calculations were based on previous studies or power analysis to ensure adequate statistical power to detect significant effects.
6. Ethical Considerations:
- All experimental procedures followed ethical guidelines approved by the Institutional Animal Ethics Committee (IAEC) to ensure humane treatment of animals and compliance with regulatory standards.

This statistical analysis plan outlines the methodology for evaluating the efficacy of Abroma augusta root extract in mitigating gastric ulcers induced by ethanol in rats. It includes the selection of appropriate statistical tests, interpretation of results, and considerations for ensuring robustness and reliability of findings. Adjustments may be made based on specific study protocols and data distributions encountered during the analysis phase.

Certainly! Here's a concise conclusion based on the available information regarding Abroma augusta root in the treatment of gastric ulcers:

CONCLUSION

Abroma augusta, traditionally known for its medicinal properties, has shown promising potential in the treatment of gastric ulcers. The plant's root extract, rich in bioactive compounds such as tannins, saponins, alkaloids, flavonoids, and terpenoids, exhibits diverse pharmacological activities including antioxidant, anti-inflammatory, and cytoprotective effects.

Research investigating the efficacy of Abroma augusta root extract in ethanol-induced gastric ulcer models has demonstrated significant protective effects. Administration of the extract reduced ulcer index scores, indicating mitigation of mucosal damage. Furthermore, the extract enhanced plasma antioxidant levels, including superoxide dismutase, catalase, and lipid peroxidase, which are crucial in combating oxidative stress—a key factor in ulcer formation.

Histopathological examinations have revealed preserved gastric mucosal integrity and reduced inflammatory responses in treated animals. These findings suggest that Abroma augusta root extract not only protects against ulcerative damage but also supports tissue repair and maintains mucosal barrier function.

While traditional use supports its safety profile, ongoing research aims to elucidate optimal dosage,

formulations, and potential mechanisms of action to enhance its therapeutic application. Further clinical studies are warranted to validate these preclinical findings and explore its potential as a natural alternative or complementary therapy for gastric ulcers.

In summary, Abroma augusta root presents a promising avenue in ulcer treatment, leveraging its traditional knowledge and emerging scientific evidence to potentially offer effective, safe, and natural therapeutic options for managing gastric ulcers.

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