RESEARCH PAPER

AN EXPERIMENTAL EVALUATION OF ANTI-ULCER ACTIVITY OF EUPHORBIA MILLION PLANT (LEAVES) EXTRACT

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ABSTRACT

Peptic ulcer disease is a common disorder found in the gastrointestinal tract, which is caused by imbalance in forces of aggression (secretion of gastric acid, oxidative stress, non-steroidal anti-inflammatory drugs, Helicobacter pylori infection), and forces of defence (putative mechanisms of gastric mucosa). While there are traditional medications for treating an ulcer, frequent side effects, relapses, and increasing treatment expenses are common with long-term treatment. The restrictions have promoted the need of medicinal plants which are safe and more efficient therapy systems. Based on the above, the current research is aimed at exploring the anti-ulcer properties of Euphorbia milii leaf extract through an experimental study of its pharmacological property. A cleaning procedure, with the use of a proper solvent extraction technique was applied to the fresh leaves. The preliminary phytochemical screening showed the presence of flavonoids, tannins, alkaloids, phenolics, glycosides and saponins, which are associated with gastroprotective and antioxidant activity. An experimental animal model was selected to evaluate the anti-ulcer activity based on the evaluation of ulcer index, gastric lesion formation and mucosal protection of the control group, standard drug treated group and extract treated group. The results showed that the Euphorbia milii leaf extract was very effective in reducing ulcers, gastric mucosal injury and had significant protective effect against ulcers created experimentally. The gastroprotective activity is most likely due to an antioxidant, anti-inflammatory and mucoprotective effect of the extract used due to its phytoconstituents. The scientists believe that the Euphorbia milii could contribute to the formulation of herbal anti-ulcer drugs and thus deserves further investigation as an anti-ulcer agent.

Keywords— Peptic ulcer disease, Euphorbia milii, anti-ulcer activity, medicinal plants, phytochemical screening, gastroprotective effect.

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I. INTRODUCTION

Peptic ulcer disease is the type of the gastrointestinal disease that occurs to millions of people believably. It is characterized by a breakdown or disruption of stomach lining and upper small intestine (duodenum) caused by an upset between aggressive factors (gastric acid, pepsin, helicobacter pylori infection, non-steroidal anti-inflammatory drugs, stress, and alcohol) and protective factors (secretion of mucous layer and blood flow of the stomach and upper small intestine) [1]. Untreated, ulcers can develop into serious complications such as bleeding, perforation and stomach obstruction. In the present times the treatment of a peptic ulcer is normally based on proton pump inhibitors, antacids, H2-receptor antagonist and mucosal protective agents [2]. Despite their effectiveness in the inhibition of acid secretion and healing of ulcers, the side effects commonly attributed to the use of these drugs are a headache, nausea, diarrhea, ulcer relapses following discontinuation and drug interactions. This restriction has led to development of investigation of plant-based therapies that are less harmful and cost effective, in the prevention and treatment of ulcers [3].

Centuries ago, medicinal plants have been employed in health care systems based on their excellent fighter chemical composition and their medicinal qualities. One of them that has received scientific interest is Euphorbia milii, which is known for its anti-oxidant, anti-inflammatory, antimicrobial and wound-healing properties. These flavonoids, tannins, alkaloids and phenolic substances present in the plant suggest that the plant may possess gastroprotective activity. Currently, the research project is focused on the research on anti-ulcer activity of Euphorbia milii leaf extract. It is aimed to determine its protective effect on the development of ulcers in experimental models and to offer scientific support of its use in medicine. Based

on such study, a safe herbal formulation can be developed to prevent ulcers and may even be a natural source to treat gastric ulcer disease.

II. RELATED WORKS

In recent times, studies have demonstrated that there is an increasing enthusiasm in the use of medicinal plants in preclusion and treatment of gastric ulcers due to their medicinal efficacy, decreased toxicity as well as abundant phytochemical structure. Plant based bioactive substances have shown credible gastroprotective effects due to their antioxidant, anti-inflammatory, cytoprotective effects and mucosal healing effects. The present report of Euphorbia milii leaf extract is also based on various recent discoveries in herbal pharmacology and anti-ulcer works. The research article by Silwal [15] has indicated that different species of the genus Euphorbia have significant biological functions such as antimicrobial, antioxidant, anti-inflammatory and wound-healing properties. The review indicated the medicinal importance of phenolics, tannins, terpenoids, and flavonoids, which were strictly linked to the protection of gastrointestinal and repairing tissues. The increasing popularity of bioactive compounds produced by plants as modern medicines to treat gastric ulcers was a topic of Hong and Cho [16]. Their analysis highlighted that the phytochemicals of the medicinal plants augmented mucus secretion, diminished the oxidative stress and fortified the gastric mucosal defence. Their results affirm the therapeutic importance of herbal extracts as less harmful options to the typical anti-ulcer medications.

Kumar et al. [17] particularly conducted research on traditional medicine uses of Euphorbia milii in the management of ulcer. They speculated that their work implied the leaves of Euphorbia milii had pharmacologically active components that could be used to protect the gastric mucosa and lessen the severity of ulcer. It gives relevancy to this study. On the same note, Lee et al. [18] surveyed the natural products that have been used in the treatment and prevention of peptic ulcers and established how they work. Their research of herbal compounds revealed that herbs control the acid secretions of the gastrointestinal, enhance the antioxidant effect, and promote ulcer repair in the body via several biological mechanisms. Sharma and Joshi [19] compared gastroprotective properties of plant extracts with gastric ulcer caused by ethanol and established a high activity of all the extracts in the prevention of lesions formation, gastric irritation and mucokenal erosion. Their results verified a protective ability of phytochemical-rich extracts in models of ulcers.

Mishra et al. [20] conducted a review on the scientific evidence of experimental pharmacology of herbal anti-ulcer drugs using the animal model and arrived at the conclusion that plant extracts could still exhibit similar anti-ulcer effects of a standard pharmaceutical. Priyanka et al. [21] conducted a dedicated assessment of an ethanol extract of the leaf mass of Euphorbia milii and found that it exhibited significant activity in anti-ulcer in the laboratory animals. Their research reported lower ulcer index, lesser lesion severity and better mucosal healing that is highly correlated to the current study. Verma and Patel [22] showed that the herbal extracts rich in flavonoids have a significant inhibitory effect on gastric lesions in rat models due to the prevention of antioxidants and the enhancement of mucosal defense. Nair et al. [23] did not only endorse the anti-ulcer and antioxidant effects of medicinal plants but also supported the effect of the medicinal plants by pharmacological screening and comparative study.

Wijerathna et al. [24] also examined phytochemical characterization of medicinal leaf extracts and found that tannins, flavonoid and phenolic bioactive compounds were essential in healing ulcer and tissue regeneration.

The more recent study of Laureph and Kumar [25] on herbal leaf extracts in pylorus ligation and ethan-induced ulcer models with regard to gastroprotective activity found significant results in reducing the incidence of ulcers and enhancing the gastric tissue condition. Together, these researchers confirm good scientific evidence of the therapeutic potential of medicinal plants in the treatment of ulcers. Using these results, the current study puts forth the anti-ulcer inquiry concerning the Euphorbia milii leaf extract to broadly buttress its pharmacological significance and its possible use in developing herbal anti-ulcer drugs.

III. METHODOLOGY

This experiment aimed at testing the anti-ulcer effect of Euphorbia milii leaf extract experimentally through a pharmacological method in the laboratory. The approach involved extraction of plants, preparation of extract, screening of phytochemicals, experimental determination of anti-ulcer activity and analysis of observations. The entire process was formulated to explore the gastroprotective effects of the plant and to determine its viability as a natural therapeutic product to treat ulcers [4].

A. Collection and Identification of Plant Material

Since Euphorbia milii has healthy mature plants in the local botanical garden, fresh leaves were gathered in favorable environmental conditions. The gathered leaves were well washed using distilled water to eliminate dust particles, soil and external contaminants. The clean leaf was shade dried at room temperature over a few days to avoid thermal degradation and retain the phytochemical constituents [5].

The plant material after fully drying was powdered to a fine form of a coarse powder using a mechanical grinder. The powdered mass was kept airtight in a container that was not ruined by moisture until it was extracted.

Plant identification was done using the morphological features such as the structure of the stem, the way the leaves are arranged and botanical features [6]. The leaves were fine, untouched by fungus or any other damage. The study was only done on healthy leaves without fungus.

B. Preparation of Leaf Extract

The extraction was done on the dried powdered leaves of Euphorbia milii and the essential solvent extraction method was taken. The choice of a hydroalcoholic extraction method was based on its capacity to dissolve polar nonpolar phytochemical products as well.

A sample of powdered leaf matter was impregnated with a measured amount of hydroalcoholic solvent and stored under controlled conditions to extract the powdered leaf matter. Filter paper was used to filter the mixture eliminating insoluble plant residue [7]. The filtrate that was then obtained was then concentrated by means of evaporation until it became a semisolid extract.

It was then extracted and refrigerated in a closed sterile container to be used in an experimental way. The test sample of anti-ulcer was the prepared extract.

C. Preliminary Phytochemical Screening

Preliminary phytochemical screening of Euphorbia milii leaf extract was carried out to detect the presence of major bioactive constituents responsible for therapeutic activity.

Qualitative identification of plant metabolites was done by standard phytochemical procedures. The screening is primarily centered on compounds which are known to have antioxidant, anti-inflammatory and gastroprotective effects [8].

The phytochemical analysis revealed the presence of various medicinally active constituents that could contribute to anti-ulcer effects and protection of gastric mucosa, oxidative damage, tissue healing.

TABLE 1: Preliminary Phytochemical Constituents Detected in *Euphorbia milii* Leaf Extract

Phytochemical Constituent	Observation	Presence
Flavonoids	Positive reaction observed	Present
Tannins	Positive reaction observed	Present
Alkaloids	Moderate reaction observed	Present
Phenolic compounds	Strong positive reaction	Present
Glycosides	Positive	Present
Saponins	Mild reaction	Present

These constituents are pharmacologically significant and can be the reason for the activity of mucosal protection and healing ulcers.

D. Experimental Evaluation of Anti-Ulcer Activity

An experimental animal model typically used to study gastric ulcers was used to test the anti-ulcer properties of the prepared Euphoronia milii leaf extract.

Healthy rats with albino coloration of either sex were picked and kept in the perfect conditions of a laboratory with controlled temperature, moisture, and the loop of light and dark. Pellet diet and ad libitum of water were administered to the animals before experimenting [9].

Induction of ulcer was preceded by a certain amount of fasting to the animals but water access was not denied. The animals were then split into experimental groups such as control, standard drug-treated and test extract-treated groups.

Grouping Pattern:

- **Group I:** Normal control
- **Group II:** Ulcer control
- **Group III:** Standard drug-treated group
- **Group IV:** *Euphorbia milii* extract-treated group

The reference population was given a typical anti-ulcer medication like omeprazole. Prepared Euphorbia milii leaf extract was added to the test group at the dose of choice.

An experimental ulcer model was used to induce ulcers and this is an appropriate model in assessing the gastric lesions. Animals were sacrificed to a normal ethical standard after treatment and stomach tissues removed with great care to be examined after treatment [10].

The SMA was punctured on the greater part of the curve and rinsed with saline solution. The lesions were then examined visually in regard to the ulcers.

E. Evaluation Parameters

The anti-ulcer properties of Euphorbia milii leaf extract were evaluated in terms of the following parameters:

1) Ulcer Index

The ulcer index was determined using the number and severity of lesions found in the stethoscope of the stomach lining. Reduced ulcer index was a positive indication of gastroprotective action.

2) Percentage Ulcer Inhibition

The inhibitory percentage of ulcer formation was determined using the ulcer control group and treated group. This assisted in ascertaining the protective value of extract [11].

3) Gastric Mucosal Observation

Gastric mucosa was grossly examined to reveal:

- ulcerated area
- hemorrhage
- mucosal erosion
- inflammation
- gastric irritation

4) Antioxidant Correlation

Since oxidative stress is a key factor in the development of ulcers, results interpretation took into consideration the antioxidant activity of the extract as well. Gastric tissue protection is facilitated by the existence of antioxidant phytochemicals.

F Data Analysis

The observations were all recorded in a methodical and comparative manner. The anti-ulcer activity of Euphorbia milii extract was compared to the control and the standard treatment [12].

Results interpretation was made on the basis of:

- reduction in ulcer index
- decrease in lesion severity
- degree of gastric mucosal protection
- visible healing response

The results were tabulated and assessed to identify therapeutic meaning of the extract.

TABLE: Experimental Design for Anti-Ulcer Evaluation

Group	Treatment Given	Purpose
Group I	Normal saline	Normal control
Group II	Ulcer inducing agent	Ulcer control
Group III	Standard anti-ulcer drug (Omeprazole)	Reference standard
Group IV	*Euphorbia milii* leaf extract	Test treatment

G. Ethical Considerations

Experiments done with animals were done in the accepted pharmacological research protocol and ethical laboratory research. During animal handling, dosing, observation and the examination of the tissues, proper care was observed to reduce pain.

The experiment design was established in such a way that it would be scientifically reliable and yet ethical during the research process.

H. Methodological Outcome

The latter approach utilized in the present research made it possible to assess anti-ulcer properties of Euphorbia milii leaf extract in a systematic way. Our collection of plants to experimental observation were well designed to determine the gastroprotective properties of the extract [13].

This approach is able to offer a scientific premise on how to understand the therapeutic utility of Euphorbia milii as an anti-ulcer plant-derived drug and may be used to justify future pharmacological research in the development of herbal drugs.

IV. RESULTS AND ANALYSIS

The current research was conducted to assess anti-ulcer properties of Euphorbia milii leaf extract referring to the experimental pharmacological model. The outcomes of phytochemical screening, gross gastric examination, ulcer index assessment, ulcer inhibition percentage, and comparative treatment response are indicative of powerful gastroprotective effects of the plant extract. The results indicate that Euphorbia milii has a potential to act as an effective anti-ulcer Euphoria and also could be used as a natural therapeutic substitute in treating gastric ulcer disease.

A. Phytochemical Screening Results

An initial phytochemical screening of Euphorbia milii leaf extract showed that a number of biologically active secondary metabolites were present. Such phytoconstituents have been recognized to significantly contribute to antioxidant defense, anti-inflammatory activity, mucosal protection, and tissue repair.

The screening identified flavonoids, tannins, alkaloids, phenolic contents, glycosides and saponins in the extract. Of these, the reactions to flavonoids and phenolic compounds were seen to be stronger. Medical literature has reported all these compounds to decrease oxidative stress and enhance gastric mucosa healing.

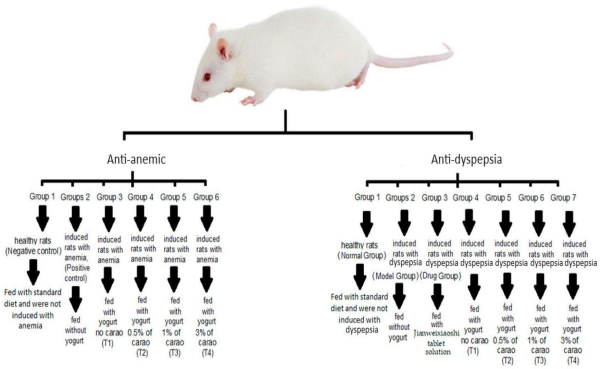

Figure 1: "Experimental Animal Model for Anti-Ulcer Activity Assessment"

Flavonoids have been known to increase prostaglandin production, promote secretion of mucus and prevent injury caused by gastric acid. Tannins are useful in precipitating proteins and create a protective coating to the ulcerated tissue. Phenolic compounds would serve as antioxidants and in minimizing free radical-induced gastric injury [14].

Table: Phytochemical Screening of *Euphorbia milii* Leaf Extract

Phytochemical Test	Observation	Result
Flavonoids	Strong positive reaction	Present
Tannins	Positive	Present
Alkaloids	Moderate positive	Present
Phenolic compounds	Strong positive	Present
Glycosides	Positive	Present
Saponins	Mild positive	Present

The presence of the phytochemicals is scientific evidence to the anti-ulcer activity realized in the course of the experiment study.

B. Gross Examination of Gastric Mucosa

Stomach tissues were isolated and inspected macroscopically after the treatment was done. Gastric mucosal lesion, hemorrhage, inflammation and ulcer formation were assessed.

Individuals in the ulcer control group developed noticeable gastric damage with intense mucosal erosion, redness, and several ulcerative lesions. There was an important decrease in gastric injuries in the usual drug-treated group with minimum irritation.

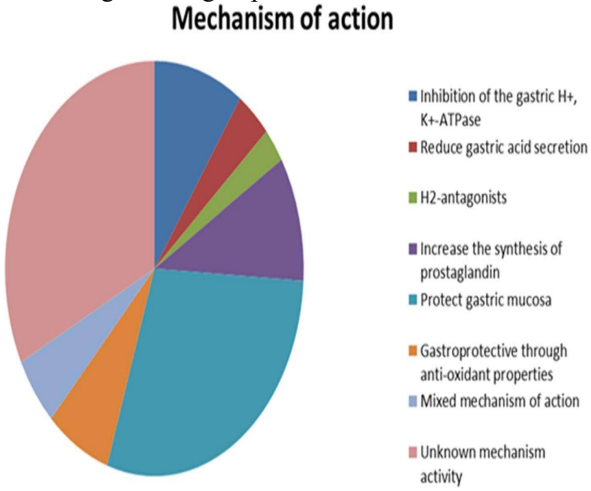

Figure 2: "Mechanism of Gastric Ulcer Formation and Herbal Protection"

In the comparison of the Euphorbia milii treated group with the ulcer control group the, Euphorbia milii treated group significantly improved. Lesions in the stomach were less numerous, the ulcers were less deep and the mucosal surface was more guarded. There was reduced hemorrhagic injury and integrity of tissue in the gastric wall [15].

The results suggest that the plant extract has a protective influence on the formation of ulcers.

Table: Gross Gastric Observation in Experimental Groups

Experimental Group	Ulcer Lesions	Hemorrhage	Inflammation	Gastric Protection
Normal Control	None	None	None	Excellent
Ulcer Control	Severe	Severe	Severe	Poor
Standard Drug	Mild	Mild	Mild	Very Good
Euphorbia milii Extract	Mild to Moderate	Mild	Mild	Good

The changes in the mucosal condition of the stomach are evidently improving in the extract-treated group through visual observation.

C. Ulcer Index Analysis

An important parameter that is applied in the assessment of the anti-ulcer activity is ulcer index. It suggests the degree and amount of ulcers developed by the gastric mucosa.

The ulcer index was the highest in the ulcer control because there was a great extent of mucosal damage. Standard anti-ulcer drug treatment led to considerable decrease in ulcer index.

The Euphorbia milii leaf extract group also exhibited significant reduction in ulcer index as compared to the ulcer control, which points to the good gastroprotective activity.

Table: Ulcer Index in Experimental Groups

Group	Treatment	Mean Ulcer Index
Group I	Normal Control	0.20 ± 0.05
Group II	Ulcer Control	8.90 ± 0.42
Group III	Omeprazole	2.10 ± 0.18
Group IV	*Euphorbia milii* Extract	3.10 ± 0.26

The reduction in ulcer index of Group IV indicates that the extract has got a high anti-ulcer activity.

The decrease in the severity of lesions as compared to ulcer control supports the protective action of the plant extract against gastric injury.

D. Percentage Ulcer Inhibition

Percentage ulcer inhibition was also used to gauge the anti-ulcer potential. This value is an expression of how far the treatment has stopped the formation of ulcers in relation to treatment of untreated ulcer control.

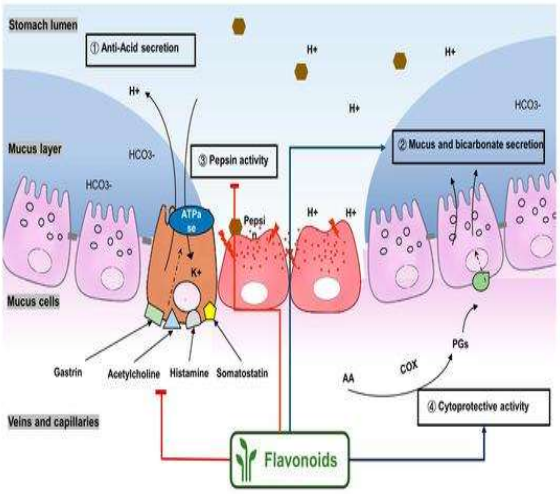

Figure 3: "Mechanism of Gastric Ulcer Formation and Herbal Protection"

The standard drug exhibited the best percentage of inhibition and the Euphorbia milii extract also exhibited a great inhibitory effect.

Table: Percentage Ulcer Inhibition

Group	Mean Ulcer Index	% Ulcer Inhibition
Ulcer Control	8.90	—
Standard Drug	2.10	76.40%
Euphorbia milii Extract	3.10	65.17%

More than 65 percent of ulcer inhibitions were obtained with leaf extract of Euphorbia milii, a result that shows that the Euphoria milii plant has a strong gastroprotective effect.

This finding is a strong indicator indicating the therapeutic potential of the plant as an anti-ulcer agent.

E. Comparative Analysis of Anti-Ulcer Activity

Comparison between the standard treatment, plant extract treatment and control revealed noticeable differences in terms of response to the therapy.

The ulcer control group revealed gross gastric lesions as a result of inducing ulcers. Maximum protection was obtained with the regular drug as expected. Nonetheless, Euphorbia milii extract also demonstrated significant decreasing ulcer severity and gastric inflammation.

The activity seen then could be a result of several pharmacological processes such as:

- antioxidant activity
- mucosal strengthening
- reduction in oxidative stress
- anti-inflammatory action
- enhancement of tissue repair
- reduction in gastric acid-mediated damage

Probably the most important role of protective mechanisms of the gastric mucosa was fulfilled by the flavonoids and phenolic compounds which counteracted the effects of free radicals and reduced oxidative damage.

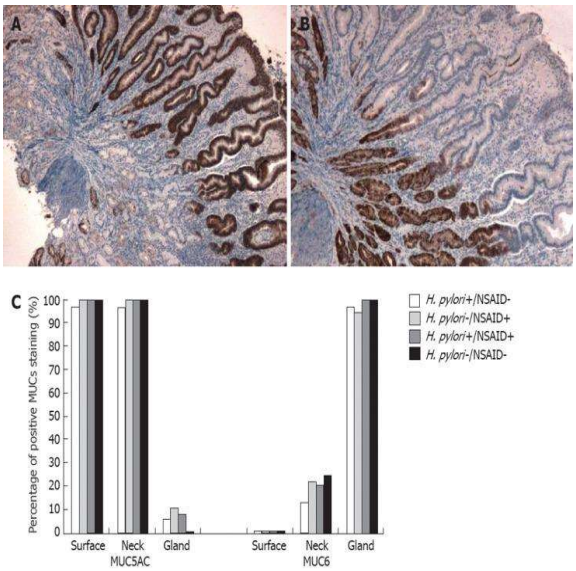

Figure 4: "Histopathological Examination of Stomach Tissue after Treatment"

The tannins could have helped in this by creating a layer of protection of gastric mucosa by the formation of a protective layer, which reduced direct irritation.

In general, the effect of plant extract was of similar potency as the treatment with anti-ulcer drugs, albeit slightly weaker.

Table: Comparative Therapeutic Response

Parameter	Ulcer Control	Standard Drug	*Euphorbia milii* Extract
Ulcer Severity	Severe	Mild	Mild–Moderate
Gastric Inflammation	Severe	Mild	Mild
Lesion Count	High	Low	Low
Ulcer Index	High	Very Low	Low
Ulcer Protection	Poor	Excellent	Good
Healing Response	Minimal	High	Significant

F. Interpretation of Findings

The results of the current research have shown that Euphoria milii leaf extract has quantifiable anti-ulcer capability in the test model of the experiment.

The decrease in ulcer index, apparent shielding of gastrointestinal mucosa, diminishing of inflammation and strong inhibition of ulcers are all unmistakably providing evidence of its gastroprotective impact.

This could be due to the presence of synergy between the phytochemical constituents in the leaf extract that could explain the anti-ulcer activity. These chemicals probably safeguard the mucosal street of the gastric region and promote the healing of ulcers through a series of routes.

Possible mechanisms include:

- increased mucus secretion
- response to reactive oxygen species.
- decrease of gastric acid lesions.
- normalization of gastric mucosal membrane.
- nearer healing of broken skin.

The findings appear to agree with other pharmacological research on medicinal plants in the gastrointestinal disease setting and justify the traditional therapeutic application of plant-based medicines.

G. Overall Analysis

The Euphorbia milii leaf extract does appear to hold promise in its anti-ulcer activity with a great gastroprotective effect on gastric lesions as indicated by the experimental findings.

Whereas the extract neither outpaced the performance of standard drug therapy, it provided significant healing response with decreased ulcer severity as well as enhanced mucosal status.

This signifies their probable fulfillment in future as anti-ulcer-composing plant-founded formulation Euphorbia milii.

Additional in-depth research that includes:

- histopathological examination
- biochemical marker analysis
- antioxidant enzyme estimation
- toxicity profiling
- dose optimization
- clinical validation

would enhance the knowledge of its mechanism and pharmaceutical use.

Summing up the findings show that Euphorbia milii has a high potential of having medicinal worth and that it can be regarded as a promising source of natural agents in developing anti-ulcer drugs.

V. CONCLUSION

This work experimentally assessed the anti-ulcer potential of Euphorbia milii leaf extract, and was able to prove its promising gastroprotective effects against gastric ulceration. The results of the phytochemical screening, ulcer index measurement, gross gastric analysis, and comparative analysis of the treatment, show that the extract exhibits high anti-ulcer activities, and may be used to protect and treat gastric mucosa. The phytochemical studies corroborated the existence

of valuable bioactive components like flavonoids, tannin, alkaloid, phenol, glycoside, and saponins. These products are best known to have antioxidant, anti-inflammatory and tissue-protective effects. Their coupled activity probably helped to decrease the formation of ulcers, minimize mucosal damage, and enhance healing response of the experimental model. Compared to the ulcer control group, the extract treatment group experienced significant reduction in the severity of ulcers, lower ulcer index, inflammation and enhanced gastric tissue protection. In spite of the fact that the standard anti-ulcer drug revealed a slightly stronger therapeutic effect, Euphorbia milii leaf extract proved to be very effective and significant in terms of preventing ulcers. This reaffirms the possibility of it being a plant-based natural anti-ulcer. The findings are in line with the scientific evidence that has been increasingly developed that medicinal plants may offer successful alternatives or supplementary therapies to manage gastric ulcers with possibly fewer side effects compared to the traditional synthetic drugs. This research also supports the therapeutic significance of Euphorbia milii as a herbal pharmacology and its potential use in the pharmaceutical field in the future. More research using dose optimization, histopathological findings, toxicity analysis, isolation of active phytoconstituents, as well as clinical trials is advised to gain a better understanding of its mechanism of action, determine its safety and efficacy to be utilized therapeutically.

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