

EVALUATION OF PHYTOCHEMICALS AND ANTIULCER ACTIVITY OF MIMOSA PUDICA

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How to cite this chapter:

Divyapriya, S., Dr Rajathi, K., & Sneha, S.
(2024). EVALUATION OF
PHYTOCHEMICALS AND ANTIULCER
ACTIVITY OF MIMOSA PUDICA. In Book
Chapter on AI and the Multidisciplinary
Landscape: Technology, Commerce and
Business (Version 1, pp. 98–110). Surya
Publications, Tamilnadu, India.

<https://doi.org/10.5281/zenodo.13923796>

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Accepted: 28.09.2024

Published: 12.10.2024



Abstract

Medicinal plants have been identified and used throughout human history. Plants have the ability to synthesize a wide variety of chemical compounds that are used to perform important biological function, and to defend against attack from predators such as insects, fungi, herbivorous mammals. The anti – ulcer activity of the plant of Mimosa pudica was evaluated by employing ethanol and pylorus ligation ulcer models. These models represent some of the most common causes of gastric ulcer in humans. Gastric hyperacidity and gastro duodenal ulcer is a very common global problem today. Peptic ulcers results from an imbalance between defensive (cytoprotective) and offensive factors (gastric acid). Major aggressive factors are acid, pepsin, and bile salts. Defensive factors mainly involve mucous bicarbonate secretion and prostaglandins.. The concentration of flavonoids in Mimosa pudica, an important medication for the treatment of this disease. This is because flavonoids possess anti oxidant properties, antihistaminic and anticholinergic activity which plays a major role in repairing the gastric damage. The present study entitled antiulcer effect helicobacter pylori of Mimosa pudica on pylorus ligation and ethanol induced rats.

Key Words: *Mimosa pudica, Gastro duodenal ulcer, Helicobacter pylori.*

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Medicinal plants have been identified and used throughout human history. Plants have the ability to synthesize a wide variety of chemical compounds that are used to perform important biological function, and to defend against attack from predators such as insects, fungi, herbivorous mammals. Nature has been a source of medicinal agents for thousands of years. Terrestrial plants have been used as medicines in Egypt, China, India and Greece from ancient time and an impressive number of modern drugs have been developed from them (Samuelson *et al.*, 2021). Plant natural product chemistry has played an active role in generating a significant number of drug candidate compounds in a drug discovery program (Koduru 2018). Plants are richest resource of drugs of traditional systems of medicine, modern medicines, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs (Hammer *et al.*, 2021).

Peptic ulcer is the most common gastrointestinal disorder in clinical practice. Considering the several side effects (arrhythmia's, impotence, funaecomastia and haematopoeitic changes) of modern medicine. There is evidence concerning the participation of reactive oxygen species in the etiology and pathophysiology of human diseases, such as neurodegenerative disorders, inflammation, viral infections, autoimmune pathologies and digestive system disorders such as gastrointestinal inflammations and gastric ulcer (Richard *et al.*, 2020). The formation of peptic ulcers depends on the presence of acid and peptic activity in gastric juice plus a breakdown in mucosal defences. There are two major factors that can disrupt the mucosal resistance to injury: non-steroidal anti-inflammatory drugs (NSAIDs) e.g. aspirin and *Helicobacter pylori* infection. As a matter of fact, many drugs were used to treat this disease but many of them cause adverse effects (Chan FKL *et al.*, 2022). Large number of medicinal plants and dietary nutrients have been shown to possess gastro – protective activity (Borrelli *et al.*, 2021). On the other hand, gastric ulcer disease and acute gastritis represent disorders in which the integrity of the mucosal barrier is impaired and ulceration occurs even though the amount of acid and pepsin produced is normal or subnormal. Moreover, one would anticipate that agents that are effective in healing or preventing ulcers (Richard *et al.*, 2020). *Mimosa pudica* is well known for its rapid plant movement. In the evening the leaflets will fold together and the whole leaf droops downward. It then re-opens at sunrise. This type of motion is termed as nyctinastic movement. The foliage closes during darkness and reopens in light. All the five parts of the plant leaves, flowers, stems, roots, and fruits are used as medicines in the traditional healthcare systems. Unani Healthcare System it is useful in the treatment of diseases arising from blood

impurities and bile, bilious fevers, piles, jaundice, and leprosy etc. Decoction of root is used with water to gargle to reduce toothache. It is very useful in diarrhea (athisaara), amoebic dysentery (raktaatisaara), bleeding piles and urinary infections (Meenatchisundaram *et al.*, 2019).

II. Materials Methods

Plant Materials

The leaf of *Mimosa pudica* used in this study were collected from the local field of Thrissur, Kerala. After collection of the leaf, it was washed clean (with water) air dried and reduced to powdery form using a moter and pestle.

Preparation of Aqueous Extract *Mimosa Pudica*

The leaf powder of *Mimosa pudica* was weighed (100g) and transferred to sterile beaker and is mixed with 1000ml of distilled water and 5ml of chloroform. Placed in room temperature for three days and filter the solution through Whatmann No.1 paper. The filtered solution was used as extract.

Phytochemical Study

Chemical tests were carried out on aqueous extract for the qualitative determination. Phytochemical analysis was performed according to the standard methods.

Experimental Design

Pylorus Ligation Ulcer Model

Grouping of animals: The animals are divided into four groups, six rats in each group.

Group I: Serves as only pylorus ligation.

Group II: Serves as pylorus ligation + standard (Pantaparazole 10mg/kg).

Group III: Serve as pylorus ligation + 200mg *Mimosa plant* extract/kg.

Group IV: Serves as pylorus ligation + 400mg *Mimosa plant* extract/kg.

Ethanol Induced Ulcer Model

Grouping of animals: The animals are divided into four groups, six rats in each group.

Group I: Serves as only ethanol.

Group II: Serves as ethanol + standard (Pantaparazole 10mg/kg).

Group III: Serve as ethanol + 200mg *Mimosa pudica* leaf extract/kg

Group IV: Serves as ethanol + 400mg *Mimosa pudica* leaf extract/kg

Histopathology

The gastric tissue samples were fixed in neutral buffered formalin for 24 h. Sections of tissue from stomachs were examined histopathologically to study the ulcerogenic and/ or anti-ulcerogenic activity of *Mimosa pudica*. The tissues were fixed in 10% buffered formalin and were processed using a tissue processor. The processed tissues were embedded in paraffin blocks and about 5µm thick sections were cut using a rotary microtome. These sections were stained with hematoxylin and eosin using routine procedures. The slides were examined microscopically for pathomorphological changes such as congestion, haemorrhage, oedema and erosions using an arbitrary scale for the assessment of severity of these changes.

III. Results

Phytochemical Study

The phytochemical analysis of aqueous extract of *Mimosa pudica* showed the presence of alkaloids, flavonoids, saponins, phenols, steroids, glycosides and tannins. Medicinal plants play an important role in human health cure. They have lesser side effects and are effective in certain disorders and based on experience in the use of plant products against common diseases. Herbal drugs have gained importance in recent years because of their efficacy and effectiveness.

Evaluation of Antiulcer Activity

Pylorus Ligation Ulcer Model

Table 1: Effect of Aqueous Extract of *Mimosa Pudica* Against Pylorus Ligation Induced Gastric Ulcer in Rats.

Test	Only pylorus ligation	Pylorus ligation standard	Pylorus ligation 200mg	Pylorus ligation 400mg
Free acidity (ml)	7.75±1.159	3.95±0.823-a	5.58±1.150-a	5.25±0.889-a
Gastric PH	4.00±0.616	3.45±0.911	3.86±0.641	2.95±0.420
Gastric volume (ml)	10.75±2.754	5.25±0.957-a	4.73±0.618-a	4.15±1.660-a
Total acidity (ml)	11.45±4.285	4.55±2.222-a	7.23±3.175	5.88±2.100
Ulcer index	7.25±0.957	2.75±0.957-a	5.75±0.957	4.00±0.816-a

Group 1 = Only pylorus ligation, **Group 2** = Pylorus ligation + standard (Pantoprazole 10mg/kg), **Group 3** = Pylorus ligation + 200mg *Mimosa pudica* plant extract/kg, **Group 4** = Pylorus ligation + 400mg *Mimosa pudica* plant extract/ kg

Pylorus ligation induced gastric ulcers occur because of an imbalance between aggressive factors and the maintenance of mucosal integrity through the endogenous defence mechanisms (Piper DW *et al.*, 2018). The cause of gastric ulcer after pyloric ligation is believed to be due to increase in gastric hydrochloric acid secretion and/ or stasis of acid. Ulcer caused by pyloric ligation is due to increased accumulation of gastric acid and pepsin leading to auto digestion of gastric mucosa and break down of the gastric mucosal barrier. The aqueous extract of the *Mimosa pudica* in the doses of 200 and 400mg/kg produce a reduction in the ulcer index, gastric volume, free acidity, and gastric pH significantly in comparison with control group. The results of the present study indicate that the aqueous extract of *Mimosa pudica* significantly reduces the total volume of gastric juice, free and total acidity of gastric secretion and also has activity against gastric ulcer in rats.

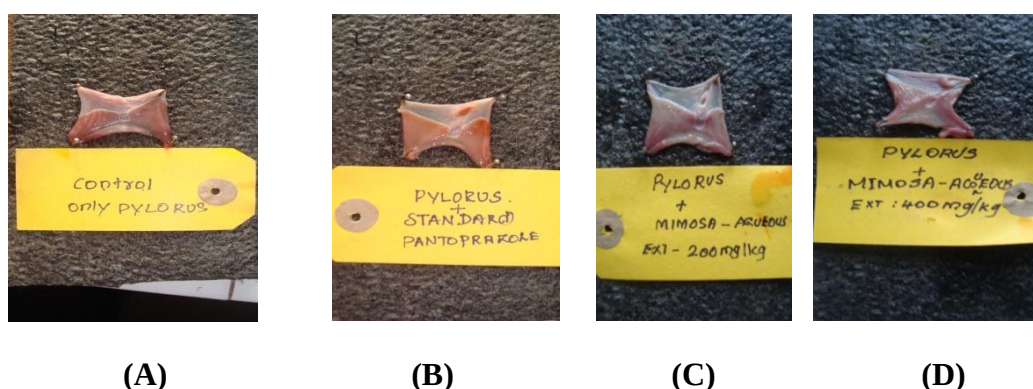


Figure 1: Effect of Extract against Pylorus Ligation Induced Gastric Ulcer in Rats
Stomach of (A) Only Pylorus, (B) Pylorus + Standard Pantoprazole, (C) Pylorus + Extract (200mg/kg), (D) Pylorus + Extract (400mg/kg).

Histopathological examination pylorus ligation induced ulcer model

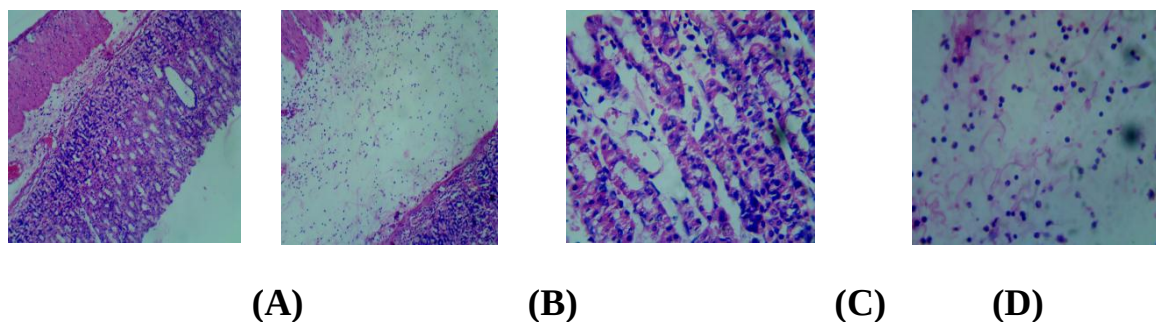


Figure 2 : Group I: Control Pylorus Induced.
Section of (A) Stomach, (B) Submucosal Edema, (C) Cryptitis, (D) Inflammation

Specimen: Stomach

Gross Appearance: Received a specimen of stomach measuring 3.5x2.8x2.0cms.

(PE): Two bits – One block.

Microscopic Appearance: Section studied from the stomach shows normal mucosa. There are neutrophils and few lymphocytic infiltrations in the lamina propria and also within the crypt. The mucosa shows edema and sub mucosa and muscular layer also shows inflammatory infiltrate.

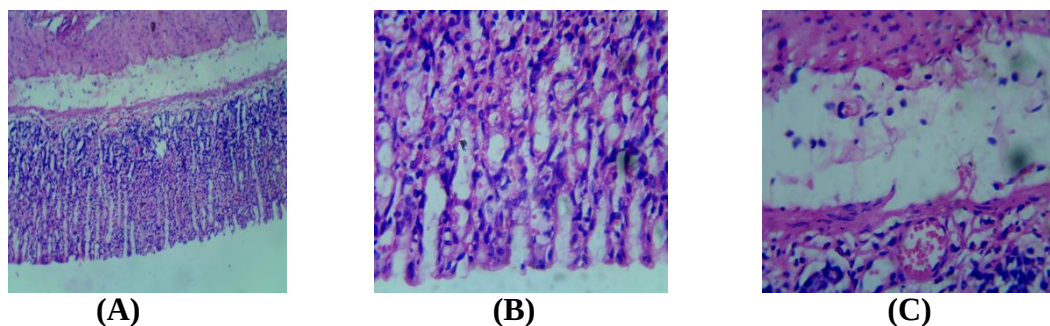


Figure 3: Group –II: Pylorus + Pantaprazole.

Section of (A) Stomach, (B) Decreased Submucosal Edema, (C) No Inflammation

Specimen : Stomach

Gross Appearance: Received a specimen of stomach measuring 3.2x3.0x2.4cms.

(PE): Two bits – One block.

Microscopic Appearance: Section studied from the stomach shows normal mucosa. There is scanty inflammation in the lamina propria and muscular layer. Sub mucosa shows mild edema.

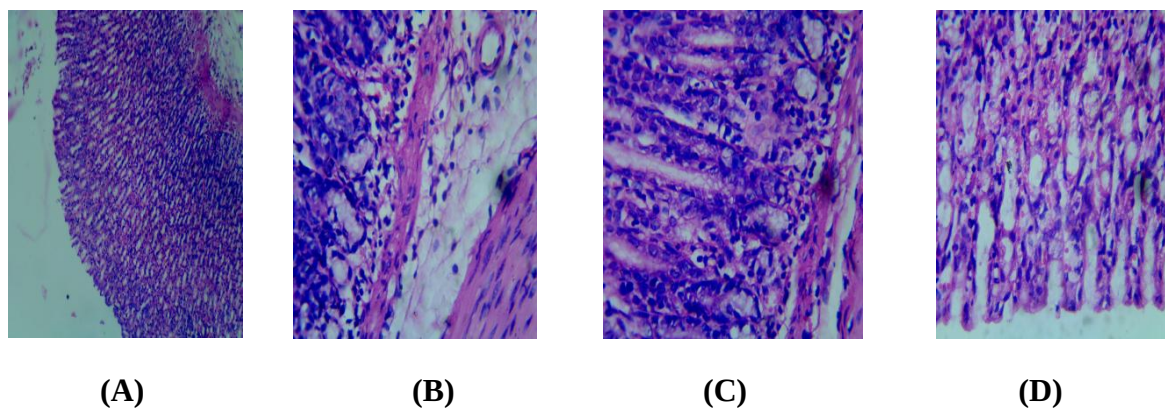


Figure 4: Group –III: Plant Extract -200mg

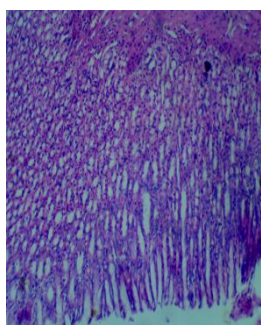
Section of (A) Stomach, (B) Submucosal Edema, (C) Mild Inflammation, (D) No Inflammation

Specimen : Stomach

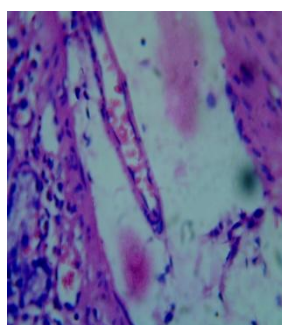
Gross Appearance: Received a specimen of stomach measuring 3.6x3.0x2.5 cms.

(PE): Two bits – One block.

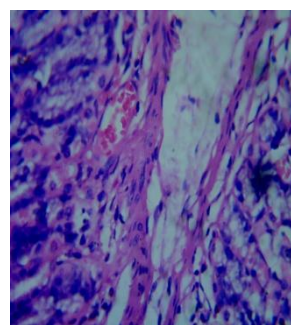
Microscopic Appearance: Section studied from the stomach shows normal mucosa. Lamina propria and sub mucosa shows few lymphocytic infiltrations. Sub mucosa shows mild edema. Muscularis layer show no pathology.



(A)



(B)



(C)

Figure 5: Group –IV: Plant Extract -400mg

Section of (A) Stomach, (B) Decreased Submucosal Edema, (C) No Inflammation

Specimen : Stomach

Gross Appearance: Received a specimen of stomach measuring 3.6x3.0x2.5 cms.

(PE): Two bits – One block.

Microscopic Appearance: Section studied from the stomach shows normal mucosa. There is no evidence of inflammation or edema in the muscularis layer. There is no inflammation in the lamina propria. Submucosa shows normal morphology.

Ethanol Induced Ulcer Model

Table 2: Effect of Aqueous Extract of *Mimosa Pudica* against Ethanol Induced Gastric Ulcer in Rats.

Test	only ethanol	Ethanol + standard	ethanol+200mg kg	ethanol+400mg kg
Number of ulcers(n)	10.50±1.291	3.25±0.957***	8.25±0.957*	6.25±0.957***
Ulcer index (%)	13.00±1.000	3.00±0.816***	9.25±0.957***	7.00±0.816***
Ulcer score (n)	1.75±0.216	0.55±0.191***	1.35±0.191*	1.00±0.141***
Inhibition of ulcer index (%)	0.00±0.000	76.85±6.448***	28.50±9.612***	45.70±9.735***
Values are expressed as the mean ± S.D; Statistical significance (p)calculated by one way				

ANOVA followed by dunnett's ***P < 0.001, **P < 0.01, *P < 0.05, calculated by comparing treated groups with **only ethanol** group

Group 1 = Only ethanol

Group 2 = Ethanol + standard (Pantoprazole 10mg/kg)

Group 3 = Ethanol + 200mg *Mimosa pudica* plant extract/kg

Group 4 = Ethanol + 400mg *Mimosa pudica* plant extract/ kg

Various mechanisms are thought to be involved in the ulcer production in different experimental models. Hence, it is not possible to propose a single mechanism for antiulcer effect of the accumulated gastric juice is believed to be responsible for producing ulcers in the pyloric ligated rats (Goswami *et al.*, 1997). Ulcer index parameter was used for the evaluation of antiulcer activity since ulcer formation is directly related to factors such as gastric volume, free acidity and total acidity. Ethanol induced gastric injury is associated with significant production of oxygen free radicals leading to increased lipid peroxidation, which causes damage to cell and cell membrane (Cheesman KH 1993).

The aqueous extract of the *Mimosa pudica* in the doses of 200 and 400mg/kg produce a reduction in the ulcer index, number of ulcers, ulcer score, inhibition of ulcer index significantly in comparison with control group.

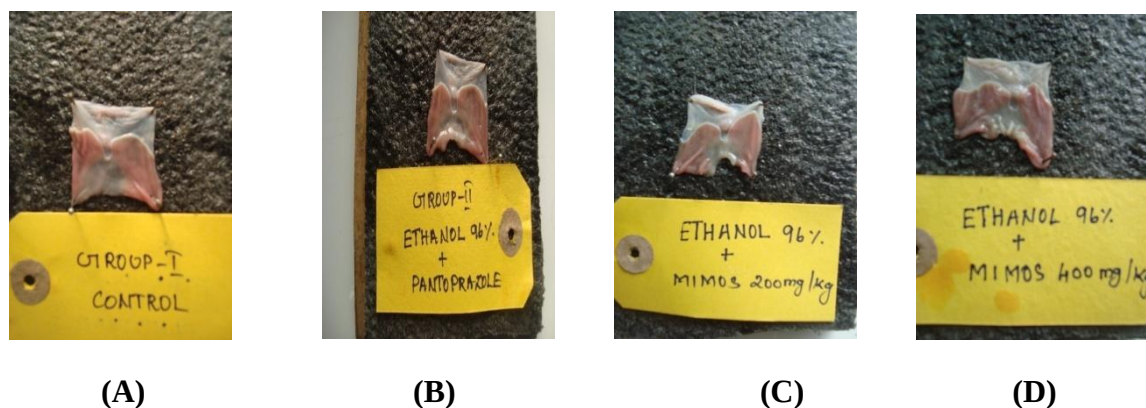


Figure 6: Effect of Extract against Ethanol Induced Gastric Ulcer in Rats

Stomach of (A) Only Ethanol, (B) Ethanol + Standard Pantoprazole, (C) Ethanol + Extract (200mg/kg), (D) Ethanol + Extract (400mg/kg).

Histopathological examination of ethanol induced gastric ulcer model

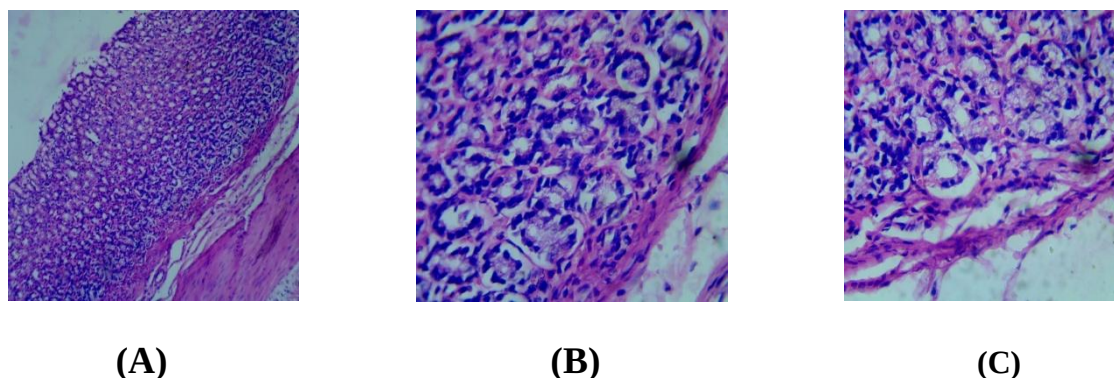


Figure 7: Group –I: Control Ethanol Induced

Section of (A) Stomach, (B) Decreased Submucosal Edema, (C) No Inflammation

Specimen : Stomach

Gross Appearance: Received a specimen of stomach measuring 3.6x2.8x2.4 cms.

(PE): Two bits – One block.

Microscopic Appearance:

Section studied from the stomach shows normal mucosa. Lamina propria and sub mucosa shows very focal lymphocytic infiltrations. Sub mucosa shows mild edema. Muscularis layer show no pathology.

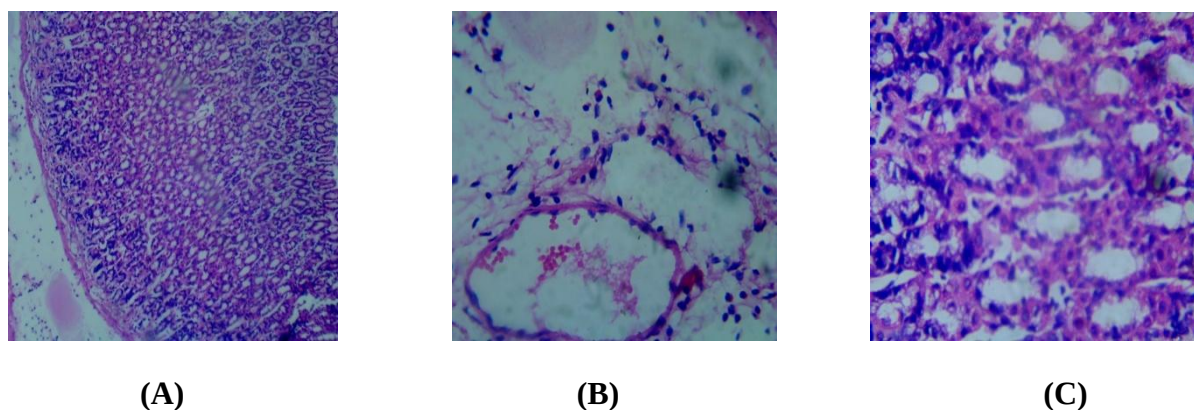


Figure 8: Group –II: Standard (Pantaprazole)

Section of (A) Stomach, (B) Decreased Submucosal Edema, (C) Inflammation

Specimen : Stomach

Gross Appearance: Received a specimen of stomach measuring 3.3x2.8x2.4 cms.

(PE): Two bits – One block.

Microscopic Appearance:

Section studied from the stomach shows normal mucosa. The lamina propria shows normal. Muscularis propria and submucosa all are shows normal morphology. There is no evidence of inflammation or edema.

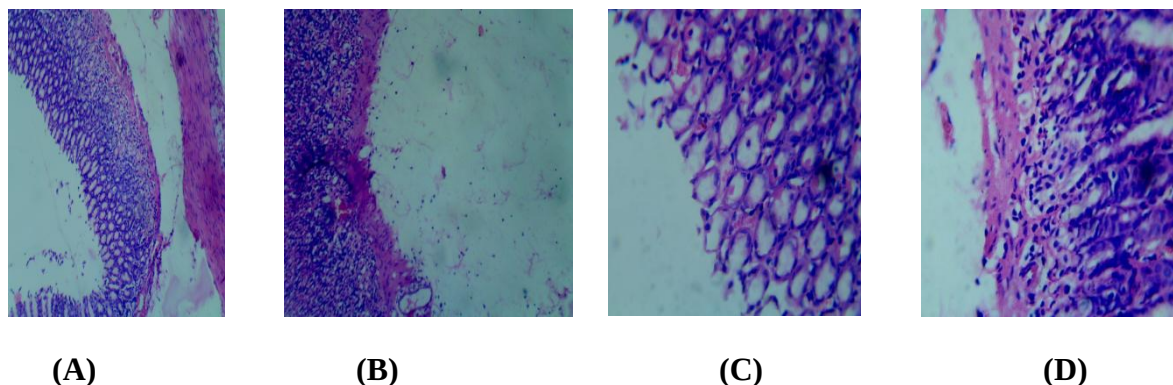


Figure 9: Group –IV: Extract -200mg - Mimosa Aqueous

Section of (A) Stomach, (B) Submucosal Edema, (C) Inflammatory Cell in Lumen, (D) Mild Inflammation

Specimen : Stomach

Gross Appearance: Received a specimen of stomach measuring 3.5x3.2x2.4 cms.

(PE): Two bits – One block.

Microscopic Appearance:

Section studied from the stomach shows normal mucosa. There is mild inflammation seen in the lamina propria. The inflammation seen within the crypt (cryptitis). Submucosa shows edema. Muscularis layer show no pathology.

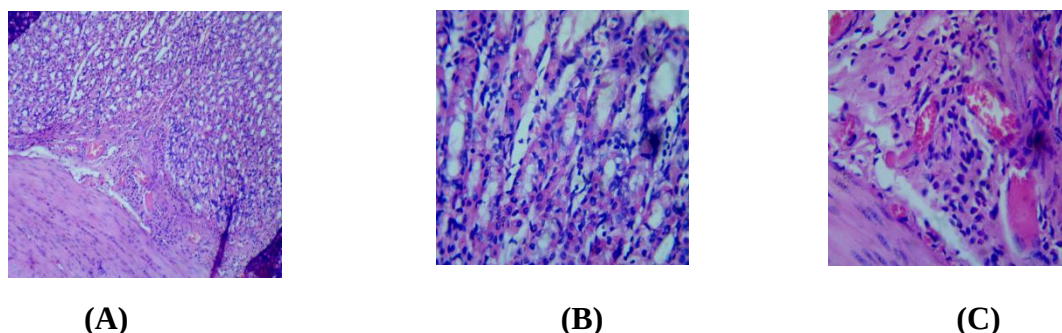


Figure 10: Group –V: Extract –400mg - Mimosa Aqueous

Section of (A) Stomach, (B) Inflammation in the Cryptitis, (C) Inflammation and Congestion

Specimen : Stomach

Gross Appearance: Received a specimen of stomach measuring 3.4x3.2x2.8 cms.

(PE): Two bits – One block.

Microscopic Appearance:

Section studied from the stomach shows normal mucosa. Lamina propria shows mild lymphocytic infiltrations. Submucosa shows congestion with mild inflammation.

IV. Discussion

The anti – ulcer activity of the plant of *Mimosa pudica* was evaluated by employing ethanol and pylorus ligation ulcer models. These models represent some of the most common causes of gastric ulcer in humans. Gastric hyperacidity and gastro duodenal ulcer is a very common global problem today. Peptic ulcers results from an imbalance between defensive (cytoprotective) and offensive factors (gastric acid). Major aggressive factors are acid, pepsin, helicobacter pylori and bile salts. Defensive factors mainly involve mucous bicarbonate secretion and prostaglandins. The preliminary phytochemical studies on *Mimosa pudica* revealed that, the aqueous extract of *Mimosa pudica* contain presence of alkaloids, flavonoids, saponins, phenols, steroids, glycosides and tannins. The concentration of flavonoids in *Mimosa pudica*, an important medication for the treatment of this disease. This is because flavonoids possess anti oxidant properties, antihistaminic and anticholinergic activity which plays a major role in repairing the gastric damage. In toxicity study, four groups of rats of (six animals per group) were administered orally a single dose of aqueous extract of *Mimosa pudica* leaves. Pylorus ligation induced ulcers are due to auto digestion at the gastric mucosa and breakdown of the gastric mucosal barrier. In case of pyloric ligation, ulcer formation is mainly due to the stasis at the gastric juice and stress. The result of the present study indicate that the aqueous extract of the *Mimosa pudica* significantly reduces the ulcer index, gastric volume, free acidity, and gastric pH and also has activity against gastric ulcers in rats (Table 1).

Pretreatment of rats with *Mimosa pudica* extracts produced a dose dependent protection in the ethanol induced ulceration model as compared to control group. The extract also significantly reduced gastric mucosa lesion compared with the control group in the ethanol induced ulcer. The percentage of inhibition of mucosa lesion was 28% and 45% for group treated with (200mg and 400mg/kg of extract) compared to 76% caused by

pantoprazole (10mg/kg) (Table2). The result of the present study aqueous extract of the *Mimosa pudica* in the doses of 100 and 200mg/kg produce a reduction in the ulcer index, number of ulcers, ulcer score, and inhibition of ulcer index significantly in comparison with control group. Histological observations of Pylorus ligated ulceration and Ethanol induced ulceration, showed comparatively extensive damage to the gastric mucosa, edema and leucocytes infiltration of the submucosal layer. Rats that received pretreatment with the plant extract had comparatively better protection of the gastric mucosa as proven by reduction in ulcer area, reduced or absence of submucosal edema and leucocytes infiltration.

V. Conclusion

The anti ulcer effect observed in the present study mainly due to a possible relationship between the protection of mucosal injury, inhibition of acid secretion and the antioxidant nature of *Mimosa pudica*. The aqueous extract of *Mimosa pudica* presents anti – secretory and cytoprotective mechanism. This study indicates that *Mimosa pudica* extract has a potential antiulcer activity.

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