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Evaluation of In Vivo Anti Ulcer Potential of Ethanolic Extract of *Tecoma stans* Flower in Albino Rats

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ABSTRACT:

Aims: To evaluate the anti-ulcer activity of ethanolic extract of *Tecoma stans* flowers in albino rats and preliminary phytochemical constituents. **Study design:** Experimental animal based in-vivo study. **Methods:** Flower extract of *Tecoma stans* was screened for phytochemical constituents. Anti-ulcer activity by determination of gastric mucus content ph by using adult albino rats and the animals were divided into 5 groups, Group I(normal control) - Normal saline, Group II(negative control) - Ethanol (96% 5ml/kg), Group III(standard treatment) - Ethanol (96% 5ml/kg)+ Lansoprazole (15mg/kg), Group IV(test group)- Ethanol(96% 5ml/kg)+***Tecoma stans*** extract (200 mg/kg), Group V(test group)- Ethanol (96% 5ml/kg)+***Tecoma stans*** extract (400 mg/kg) respectively. The treatments will be administered orally via gavage for a duration of 7 days, after which the rats will be euthanized, and the gastric mucosa will be examined for ulcer formation. Gastric mucus acid pH and histopathology of stomach were performed.**Results:** The preliminary phytochemical constitutents of the extract was identified as alkaloids, flavonoids, phenolic compounds, saponins and tannins indicating that the bioactive constituents. In the control group, indicating no ulceration or cellular damage. The ethanol-induced ulcer group showed significant mucosal erosion, cellular disruption, and inflammation. The group treated with Lansoprazole showed some improvement in the gastric mucosa. The group treated with 200 mg/kg of *Tecoma Stans* extract exhibited a marked reduction in ulceration. The 400 mg/kg dose of *Tecoma Stans* extract showed the best results, with almost complete restoration of the gastric mucosa. **Conclusion:** These findings suggest that *Tecoma stans* have the protective role against ulcer induced by ethanol and thereby it has the traditional use.

Keywords: *Tecoma stans,* Ethanol, Rats, Ulcer, Anti-ulcer activity, Histopathology

1.INTRODUCTION

An ulcer is a wound or erosion that occur in the protective layer of an organ, skin or digestive tract. According to the gastrointestinal health, the common type of ulcers are stomach ulcers, which form in the inner most layer of stomach or inner most layer of the duodenum[1,2]. A stomach ulcer is an acid produecd lesion in the gastrointestinal tract, often in the stomach or the superior part of the duodenum. The beginning of severe injury to the GI layer, mucosa, and first segment of small intestine that spreads through the mucosal tissue is known as gastric ulcer [1]. The main aspect of gastric ulcer are induced with gram negative *Helicobacter pylori* bacteria with excess secretion of hydrochloric acid, deficient epithelial defence protect form gastric acidity, medications are muscarinic agonist [3]. There are two main types of gastro-duodenal ulcer. The acute gastric ulcer does not spread when it enter to the muscle layer of mucosa unlike to the submucosa layer. It also developed due to neurological damage, burns induced stress which leads to ulcer. In chronic gastric ulcer, the muscular layer has a entire-thickness, and the base is in serosal layer, involving extra gut tissues which includes the both stomach and peptic ulcer of duodenum.

Gastric erosion develops, that the harmful agents damage the stomach layer or when it gets damaged. The internal body damaging factors in the stomach are hydrochloric acid, pepsin, bile reflux, lipid breakdown. Even though the acid reducing agents are available, the agents have many adverse effects; therefore, we have to research for anti-ulcer agents having less adverse effect or not any side effects [4]. However, the antiulcer drugs produce adverse effect or some side effects by the using of drugs for chronic conditions and it may involve the changing of some physiological process of our body. So that the herbal medications are now used to control the adverse or side effects when used in chronic conditions.Therefore, many herbal medicines have proved that it has antiulcer activity to reduce the erosion of the protective lining layer by their potential effective factors [5].

Over past few decades, natural products have emerged as a rich reservoir of bioactive compounds with diverse pharmacological activities. Medicinal plants, in particular, offer multi-targeted therapeutic potential and often present fewer side effects compared to synthetic drugs [6]. *Tecoma stans* is usually called as trumpet flower and it is a yellow coloured flower and the *tecoma stans* flower belongs to the family Bignoniaceae and it is native to the Americas. The common name of the *Tecoma stans* are yellow trumpet brush or it is also called as yellow bells. The family of *Tecoma stans* consists of small tree species. The *Tecoma stans* is an decorative plant and it is fast growing plant in India. It is a widespread species throughout tropical and subtropical areas. It is also native to the various countries like America, West Indies, Mexico, South America. The leaf of *Tecoma stans* extract has been given orally for the treatment of Diabetes mellitus and Abdomen pain[7].

Figure 1: *Tecoma Stans*

2. MATERIALS AND METHODS:

The experimental investigation was reviewed and approved by the Institutional Animal Ethics Committee(IAEC). In accordance with the guidelines of the Committee for the control and Supervision of experiments on Animals. The study conducted in the Department of Pharmacology.

Preparation of Plant extract:

The fresh flowers were collected from local area. The plant was identified and authenticated. The ethanolic extract of *Tecoma stans* was obtained by the extraction procedure described by Masoudi EL et al [8]. The flowers were washed, dried at room temperature for several days. The dired flowers were powdered using a grinder. The powdered material is collected and used for extraction of the drug in solvents by Soxhlet extraction method [9].

Extraction by Soxhlet Apparatus:

Test sample (TS) can be fresh or dried. It needs to be crushed, using a pestle and mortar, to provide a greater surface area. The test sample should be sufficient to fill the porous cellulose thimble (in our experiments we use an average of 14 g of thyme in a 25- x 80-mm thimble).All equipment should be too assembled. Build a rig using stands and clamps to support the extraction apparatus[10].

Following this, 100 g of sample TS and ethanol added to a round bottom flask, which is attached to a Soxhlet extractor and condenser on heating mantle with a controlled temperature of 60-80°C.The solvent is heated using the heating mantle and will begin to evaporate, moving through the apparatus to the condenser. The condensed solvent again go back to the packed material in the jar before collecting in a jar itself. The collection of extraction material in the jar by the colouring of the solvent become clear when dissolved in the ethanol. The plant extract was obtained and it usually takes 7-8hrs to complete an extraction. The solvent has evaporated and the brown extract has obtained and stored it in a refrigerator for future use [11].

Preliminary Phytochemical Analysis

Different phytochemical screening analysis were conducted on the plant extract to identify the presence of major secondary metabolites. Thus, phytochemical test is conducted to detect the presence of Alkaloids, Flavonoids, Resins, glycosides, phenolic and sulfur-containing compounds in *Tecoma stans* flower extract [12,13]. The Phytochemical constituents are the fingerprint of the plant materials, and that suggests the biological and pharmacological activity of the plant material. The therapeutic properties of the *Tecoma stans* depend upon the secondary metabolites and the percentage yield of the extract [14].

The Experimental Animal Used in the Study:

In this study 30 healthy albino rats of either sex of weight 150 to 200gm were selected and housed in the cages for 10 days for adaptation in the laboratory atmosphere. The rats were given by the normal healthy diet and water daily. 12 hours dark and light cycle was maintained. The animals were given fasting for 18 hours before starting of the experiment and the care should be taken for animals [15].

Experimental design:

Ethanol Induced Ulcer Model

The procedure for evaluating the anti-ulcer potential of *Tecoma stans* flower extract begins with the selection of healthy male albino rats (150-200g), which will be acclimatized to laboratory conditions for one week before the study begins. The Ulcer was induced by administrating ethanol [16]. The rats will be divided into five groups and each group consists of six animals.Ulcers will be induced in all groups, except Group I, by administering a single dose of ethanol (96%, 5 ml/kg, orally) to create gastric mucosal injury, which will serve as the model for ulcer formation. Group I will receive normal saline (5 ml/kg) as a vehicle control; Group II will receive only ethanol (96%, 5 ml/kg) to establish ulcers; Group III will be given ethanol (96%, 5 ml/kg) followed by Lansoprazole (15 mg/kg), a standard anti-ulcer drug; Group IV will receive ethanol (96%, 5 ml/kg) followed by *Tecoma stand* flower extract (200 mg/kg), and Group V will receive ethanol (96%, 5 ml/kg) efollowed by *Tecoma stand* flower extract (400 mg/kg). Animals will be fasted for 24 hours before administrating the ethanol.The treatments will be administered orally via gavage for a duration of 7 days, after which the rats will be euthanized, and the gastric mucosa will be examined for ulcer formation. Lansoprazole and *Tecoma stans* extract will be prepared in normal saline, with appropriate doses for each group, while ulcer scoring and histopathological examination of the gastric tissue will help assess the efficacy of each treatment [17].

Histological Examination of the Gastric Mucosa

The gastric wall specimens were fixed with 10% buffer formalin solution for 24hrs prior to paraffin tissue processing. The stomach tissue was dissected at the thickness of 5µm and stained for evaluation of histological examination [18].

3. RESULTS

Extraction of *Tecoma Stans* flower extract

The Soxhlet extraction method was employed for the preparation of *Tecoma Stans* flower extract using ethanol as the solvent. The process was carried out for 4 hours, ensuring continuous solvent reflux and extraction of phytoconstituents from the powdered sample. The extraction system functioned efficiently, with solvent vapors continuously condensing and percolating through the plant material, effectively solubilizing the bioactive compounds. At the end of the extraction process, the solvent was evaporated under reduced pressure using a rotary evaporator to obtain a concentrated crude extract. The yield of the ethanolic extract was calculated and found to be **32.24%**, indicating an excellent extraction efficiency.

Preliminary phytochemical analysis

The phytochemical investigation of the plant extract *Tecoma stans* revealed the secondary metabolites. From the investigation results Alkaloids, Flavonoids, Phenolic compounds, Saponins, and Tannins were identified. The bioactive compounds of *Tecoma Stans* may act by reacting with the hydrogen ions (H+) in the gastric fluid to form neutral molecules, thus increasing the pH of the stomach contents and reducing acidity.

Ethanol Induced Ulcer Model

Determination of Gastric Mucus Content pH

In this study, the Group I – Normal saline shows the pH of 3.8 indicates a baseline acidic in the control group. Group II – Ethanol (96% 5ml/kg) shows the pH of 2.7 shows increased acidity due to ethanol-induced gastric irritation. Group III – Ethanol + Lansoprazole (15mg/kg) shows the pH of 3.5 indicates that lansoprazole reduces acidity compared to ethanol alone, suggesting gastric protection. Group IV – Ethanol + Tecoma stans extract (200 mg/kg) shows the pH of 3.0 shows a slight increase in acidity compared to ethanol, indicating moderate protective effect of the extract.Group V – Ethanol + Tecoma stans extract (400 mg/kg) shows the pH of 3.4 suggests that the higher dose of Tecoma stans extract raises gastric pH, demonstrating a gastroprotective effect.

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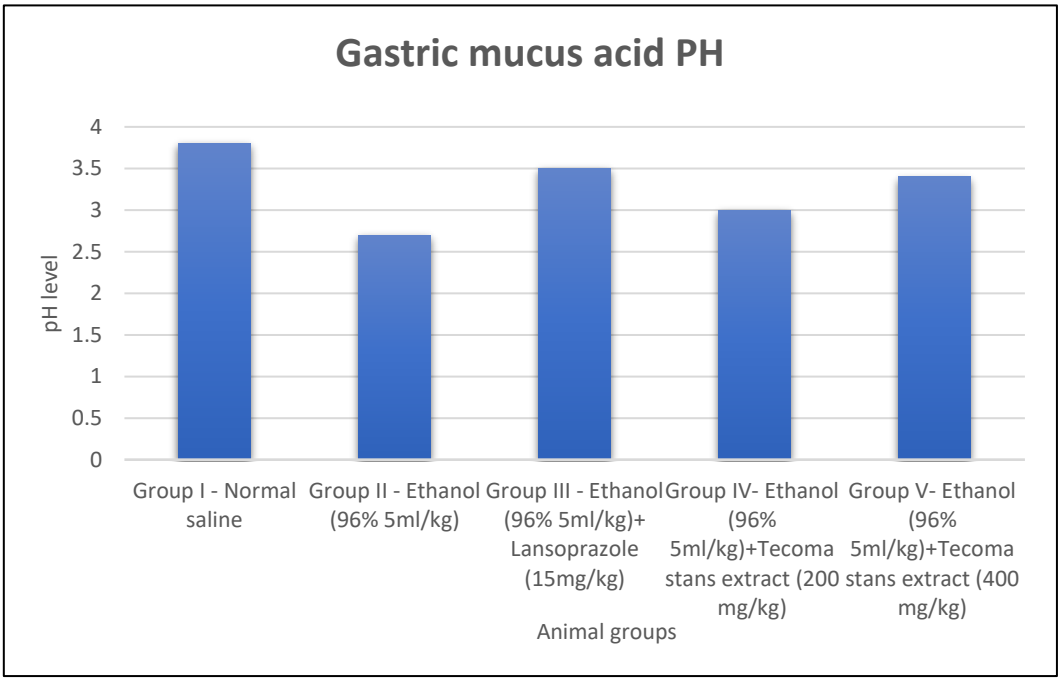
Table 1: The effect of *Tecoma stans* ethanolic extract on gastric content Ph

S.no	Groups	PH
1.	Group I - Normal saline	3.8
2.	Group II - Ethanol (96% 5ml/kg)	2.7
3.	Group III - Ethanol (96% 5ml/kg)+ Lansoprazole (15mg/kg)	3.5
4.	Group IV- Ethanol (96% 5ml/kg)+ ***Tecoma stans*** extract (200 mg/kg)	3.0
5.	Group V- Ethanol (96% 5ml/kg)+ ***Tecoma stans*** extract (400 mg/kg)	3.4



Graph 1: The effect of *Tecoma stans* ethanolic extract on gastric content Ph

Histopathology

The histological images provided correspond to the gastric tissues from different experimental groups, which were subjected to varying treatments aimed at assessing the effects of *Tecoma Stans* (Test Sample) on gastric mucosal damage induced by ethanol. The analysis below provides an interpretation of the images based on the treatment groups.

1. GI (Control) - Normal Group

In this image, the control group (GI) shows a well-preserved gastric mucosal layer with no visible signs of ulceration or damage. The gastric epithelium appears intact with closely aligned cells, and there are no signs of inflammation or cellular disruption. The underlying connective.

2. GII (Ethanol 96% 5ml/kg) - Ethanol-Induced Ulcer Group

The GII, corresponding to the ethanol-induced ulcer group (GII), shows significant histological changes. The gastric mucosa exhibits clear signs of damage, including extensive ulceration. There is a loss of the protective epithelial layer, and the underlying tissue appears inflamed, with infiltration of inflammatory cells. The presence of necrosis and cellular disruption is evident, suggesting that ethanol caused considerable damage to the gastric mucosa, likely through the generation of reactive oxygen species (ROS) and the breakdown of mucosal defenses. This image underscores the well-known ulcerogenic effects of ethanol, which induces oxidative stress, disrupts the mucosal barrier, and promotes inflammation.

3. GIII (Ethanol 96% 5ml/kg + Lansoprazole 15mg/kg) - Ethanol-Induced Ulcer Group Treated with Lansoprazole

In the GIII, the ethanol-induced ulcer group treated with Lansoprazole (GIII) shows some improvement compared to GII. While there is still some degree of mucosal disruption and inflammation, the extent of ulceration appears less severe. The mucosal epithelium is somewhat restored, with fewer areas of necrosis and more intact epithelial layers. This suggests that Lansoprazole, a proton pump inhibitor (PPI), has provided some protection against ethanol-induced mucosal injury by reducing gastric acid secretion, thus allowing for some healing of the gastric lining. The reduced ulceration indicates that Lansoprazole may have mitigated the damage by promoting a more favorable pH environment for the healing process.

4. GIV (Ethanol 96% 5ml/kg + Test Sample 200mg/kg) - Ethanol-Induced Ulcer Group Treated with Test Sample (200mg/kg)

The GIV, showing the group treated with the *Tecoma Stans* extract at 200 mg/kg (GIV), shows marked improvement in gastric mucosal integrity compared to the ethanol-only group (GII). There is a reduction in the severity of the ulcerations, and the epithelial layer appears to have partially regenerated. The underlying tissue appears less inflamed with fewer signs of necrosis and inflammatory cell infiltration. These histological findings suggest that *Tecoma Stans* at this concentration has anti-ulcer properties, likely due to the presence of bioactive compounds such as flavonoids, alkaloids, and phenolics that contribute to antioxidant activity, mucosal protection, and anti-inflammatory effects.

5. GV (Ethanol 96% 5ml/kg + Test Sample 400mg/kg) - Ethanol-Induced Ulcer Group Treated with Test Sample (400mg/kg)

The GV, showing the group treated with *Tecoma Stans* extract at 400 mg/kg (GV), reveals further improvement in gastric mucosal healing compared to the 200 mg/kg dose (GIV). The mucosal layer is more intact, with significantly less ulceration and inflammation. The epithelial lining appears well-formed, and there is minimal cellular damage. This suggests that the higher concentration of *Tecoma Stans* extract provides a stronger protective effect against ethanol-induced ulceration, likely due to enhanced bioactive compound concentration. The reduction in ulceration and the restoration of the epithelial barrier suggest that the extract may be acting by promoting mucus secretion, inhibiting acid production, and reducing oxidative stress, all of which contribute to gastric mucosal healing.

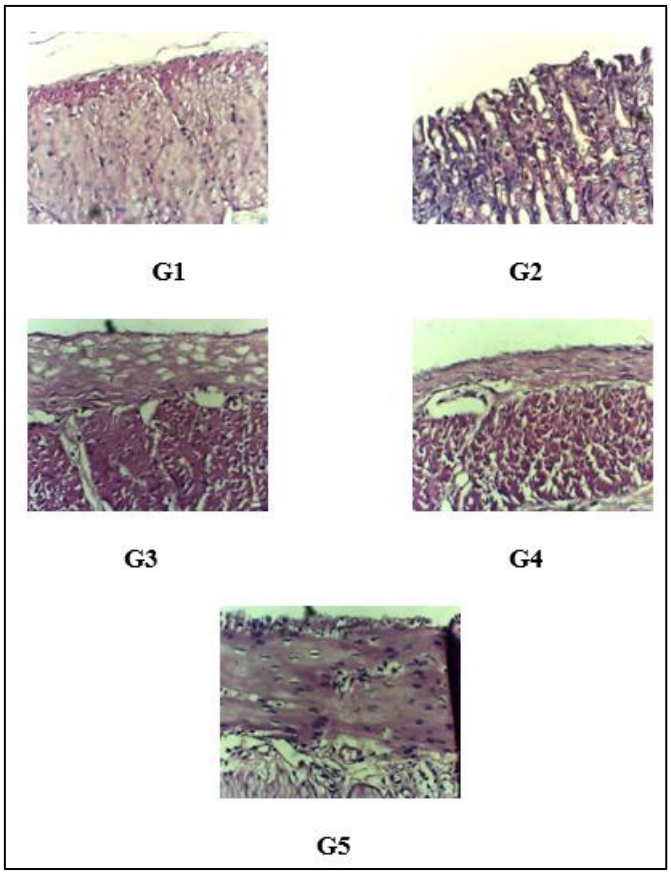


Figure 2. The effect of *Tecoma stans* on the histology of ethanol induced gastric mucosal damage in rats.G1 (Normal control group), G2 (Negative control group), G3 (Lansoprazole (15mg/kg), G4 (200 mg/kg), G5 (400mg/kg) *Tecoma stans extract.*

4. DISCUSSION

The antiulcer property of *Tecoma stans* is evaluated in the present study by qualitative phytochemical screening method and the determination of gastric mucosa content pH.The phytochemical constituents of the plant extract shows the presence of secondary metabolites such as Alkaloids, Flavonoids, Phenolic compounds ,Saponins and Tannins. Thus, secondary metabolites perform to produce antiulcer activity because of their neutralization capability. The antacids that they act by neutralizing gastric acid and also it reduce the gastric pH [19] .*Tecoma Stans* flowers were extracted using Soxhlet extraction with ethanol, a well-established technique for obtaining plant extracts. The process was performed for 4 hours, ensuring efficient extraction of bioactive compounds from the plant material. The yield of the ethanolic extract was calculated to be 32.24%, which indicates a high concentration of phytochemicals in the *Tecoma Stans* flowers. This yield is comparable to other medicinal plants known for their therapeutic properties.

In the control group, gastric tissues exhibited healthy, intact mucosal layers, indicating no ulceration or cellular damage. This group served as the baseline, demonstrating normal gastric mucosal structure.The ethanol-induced ulcer group showed significant histopathological changes, including mucosal erosion, cellular disruption, and inflammation. These changes are consistent with the ulcerogenic effects of ethanol, which induces oxidative stress and damages the gastric mucosa.The group treated with Lansoprazole showed some improvement in the gastric mucosa, with reduced inflammation and partial restoration of the epithelial layer. Lansoprazole's ability to inhibit gastric acid secretion likely contributed to these protective effects. The group treated with 200 mg/kg of *Tecoma Stans* extract exhibited a marked reduction in ulceration and improved mucosal integrity compared to the ethanol-only group. The epithelial layer was partially restored, and inflammation was less severe. The 400 mg/kg dose of *Tecoma Stans* extract showed the best results, with almost complete restoration of the gastric mucosa. The epithelial layer was intact, and signs of inflammation and ulceration were significantly reduced, suggesting a strong protective effect.

5.CONCLUSION :

As per the results, that the ethanolic extract of *Tecoma stans* may determined that it be consider as an antiulcer agents. The results that suggests the *Tecoma stans* extract may act by enhancing the gastric mucosal defense. The plant extract protected the gastric tissues. The plant extract also exhibit the good safety profile at 400mg/kg. Finally the ethanolic extract of *Tecoma stans* derived the anti-ulcer agent.

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AUTHOR CONTRIBUTIONS:

HP; Experiment design and execution of research work, **RS**; Data analysis and interpretation, **SK**; Manuscript preparation and **BS**; Supervision and final approval.

ETHICAL APPROVAL:

This study was conducted in accordance with animal ethical committee. The approval for this study was obtained in SSM College of Pharmacy by animal ethics committee of an institution.

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