

Evaluation of Antiulcer Activity of *Rhynchosia beddomei*

B. Mamatha¹, K. Yamimi², T. Shanthipriya³, B. Athulya⁴

¹Assistant Professor, ^{2,3,4}Students

^{1,2,3,4}Department of pharmacology, JNTUH University College of pharmaceutical sciences, Sulthanpur
Correspondence to author: B. Mamatha

Abstract:

Peptic ulcer disease is a common gastrointestinal disorder caused by an imbalance between aggressive factors such as gastric acid secretion and the protective mechanisms of the gastric mucosa. Stress plays a crucial role in the development of gastric ulcers by increasing acid secretion, reducing mucosal blood flow, and inducing oxidative damage. Although several synthetic antiulcer drugs are available, their prolonged use is often associated with adverse effects, which has led to increased interest in herbal medicines as safer alternatives.

The present study was designed to evaluate the antiulcer activity of *Rhynchosia beddomei* using the cold-water immersion stress-induced ulcer model in Wistar albino rats. The plant material was extracted using the Soxhlet extraction method. The antiulcer activity of the extract was evaluated at two dose levels, 150 mg/kg and 300 mg/kg, administered orally. Ranitidine (10 mg/kg, p.o.) was used as the standard drug. Animals were divided into five groups comprising normal control, stress control, standard-treated, and test-treated groups.

Stress-induced ulcers were produced by subjecting the animals to cold water immersion. After the experimental procedure, gastric parameters such as gastric juice volume, pH, free acidity, total acidity, ulcer area, and percentage of ulcer protection were assessed. The extract of *Rhynchosia beddomei* showed a significant and dose-dependent reduction in gastric acidity and ulcer index, along with an increase in gastric pH when compared to the stress control group. The higher dose exhibited effects comparable to the standard drug.

The observed antiulcer activity may be attributed to the presence of phytochemicals with antioxidant and cytoprotective properties. The results suggest that *Rhynchosia beddomei* possesses significant antiulcer potential and supports its use as a natural gastroprotective agent.

Key words: Evaluation, Antiulcer Activity, *Rhynchosia beddomei*, Fabacea.

INTRODUCTION

Peptic ulcer disease is characterized by painful sores or lesions in the stomach wall or the first portion of the small intestine, known as the duodenum. It is also termed as peptic ulcer or gastric ulcer, which is a breach in the gastric wall or, some instances, in the lower portions of the esophagus [1]. It is a recurrent and persistent condition manifested by right upper quadrant pain. Epidemiological studies indicated that peptic ulcer is the most frequent gastrointestinal malady globally, with high fatality rates [2]. The disorder is widespread worldwide, with annual incidences ranging from 0.10% to 0.19% for physicians and 0.03% to 0.17% for hospital-diagnosed peptic ulcers [3]. It is caused by a high accumulation of offensive factors and a lack of protective factors in the stomach [4].

Herbal products are widely utilized by the majority of the population in impoverished nations to alleviate various health problems [5]. According to the world health organization (WHO) report, natural products are used by nearly 80% of the population in Africa due to their affordability, availability, and minimal

untoward effects [6, 7]. Almost 25% of modern medicines in drug formulary and many other synthetic equivalents are derived from herbal remedies [8].

Rhynchosia beddomei Baker (Fabaceae, vernacular name - adavivuluva) is a rare and endemic medicinal plant distributed in Seshachalam hills of Eastern Ghats of Andhra Pradesh, India [9]. The leaves of *R. beddomei* were used for wounds, cuts, boils and rheumatic pains by Adivasi tribes (Sugali, Yana di, Erukala) inhabiting the forests of Eastern Ghats of Andhra Pradesh, India [10]. The plant material was reported to contain flavonoid compounds viz., Flavones, flavonols and flavanones [11]. The leaves of the *R. beddomei* were reported to possess significant antimicrobial activity [12].

The aim of the present study is to evaluate the “**anti-ulcer activity of *Rhynchosia beddomei***” using suitable experimental models.

MATERIALS AND METHOD:

PLANT MATERIAL:

PLANT PART USED:

In the present study, the aerial parts (leaves/stem) of *Rhynchosia beddomei* were selected for evaluation. The aerial parts are known to contain a high concentration of bioactive phytoconstituents such as flavonoids and phenolic compounds, which contribute to antioxidant and cytoprotective activities.

COLLECTION AND AUTHENTICATION OF PLANT MATERIAL:

The plant material of *Rhynchosia beddomei* was collected from a suitable natural habitat during the right season. The collected plant was washed thoroughly with water to remove adhering soil and impurities. It was then shade-dried at room temperature and coarsely powdered for further experimental use.

JUSTIFICATION FOR SELECTION OF PLANT:

The selection of *Rhynchosia beddomei* for the present study is based on its traditional medicinal use and the presence of bioactive phytoconstituents with potential antiulcer activity. Flavonoids and phenolic compounds present in the plant are known to enhance gastric mucosal defense and reduce oxidative stress, which is a key factor in stress-induced ulcer formation.

Moreover, the increasing adverse effects and limitations of synthetic antiulcer drugs highlight the need for safer and effective alternatives. Hence, *Rhynchosia beddomei* was chosen to scientifically validate its antiulcer potential using experimental models.

EXTRACTION PROCEDURE:

EXTRACTION OF RHYNCHOSIA BEDDOMEI BY SOXHLET EXTRACTION:-

Preparation of Plant Material:

The collected aerial parts of *Rhynchosia beddomei* were washed thoroughly with water to remove dust and foreign matter. The plant material was shade dried at room temperature until a constant weight was obtained. The dried material was then coarsely powdered using a mechanical grinder and stored in an airtight container for further use.

Soxhlet Extraction Procedure:

- About 50 g of the dried coarse powder of *Rhynchosia beddomei* was accurately weighed.
- The powdered material was packed into a Filter paper thimble and placed inside the Soxhlet extractor.
- A clean and dry round-bottom flask was filled with 400 mL of solvent- methanol.
- The Soxhlet apparatus was assembled by connecting the extractor to the round-bottom flask and a condenser on the top.

- The solvent was heated using a heating mantle, allowing it to reflux and siphon through the plant material.
- The extraction was continued for 6–8 hours or until the siphon tube solvent became colorless, indicating complete extraction.
- After completion of extraction, the solvent containing the extract was allowed to cool.
- The extract was then filtered and concentrated by evaporating the solvent on a water bath at controlled temperature.
- The dried extract obtained was weighed to calculate percentage yield and stored in a desiccator for further experimental studies.

Calculation of Percentage Yield:

$$\text{Percentage Yield} = \text{Weight of dried extract} / \text{Weight of plant material} \times 100$$

Storage of Extract:

The dried extract was stored in an airtight container at 4°C until further pharmacological evaluation.

EXPERIMENTAL ANIMALS:

Healthy Wistar albino male rats, weighing 150–200 g, were used for the present study. The animals were procured from a CPCSEA-approved animal house. They were housed in polypropylene cages under standard laboratory conditions with a temperature maintained at 25 ± 2 °C, relative humidity of 50–60%.

DRUGS AND CHEMICALS:

The standard drug used in the present study was **Rabeprazole**, a proton pump inhibitor, which was obtained from a reputed pharmaceutical source and used as a reference antiulcer agent. Rabeprazole was administered orally at a dose of 10 mg/kg body weight.

The test extract consisted of the **Soxhlet extract of Rhynchosia beddomei**. The dried plant material was extracted using a suitable solvent-**methanol** and concentrated under elevated temperature. The extract was administered orally at two dose levels, **150 mg/kg- low dose and 300 mg/kg- high dose**, body weight, suspended in a suitable vehicle.

EXPERIMENTAL DESIGN:**GROUPING OF ANIMALS:**

Group I: Normal control.

Group II: Stress-induced ulcer control.

Group III: Stress-induced ulcer + Standard drug (Ranitidine 10 mg/kg, p.o.)

Group IV: Stress-induced ulcer + Test drug (Rhynchosia beddomei extract) 150 mg/kg, p.o. Group V: Stress-induced ulcer + Test drug (Rhynchosia beddomei extract) 300 mg/kg, p.o.

INDUCTION OF STRESS-INDUCED ULCER:**COLD WATER IMMERSION METHOD:**

Stress-induced gastric ulcers were produced in Wistar albino male rats using the cold-water immersion stress method. The animals were fasted for 24 hours prior to the experiment, with free access to water. The rats were then randomly divided into five groups, each consisting of six animals.

After the respective drug treatments, the animals were individually forced to swim in a glass cylinder containing water up to a height of 35 cm, maintained at a temperature of 25 °C, for a period of 4 hours to induce stress ulcers.

At the end of the experimental period, the animals were sacrificed using a high dose of anesthetic ether. The abdomen was opened, and the stomach was carefully removed. Each stomach was opened along the greater curvature, rinsed gently with normal saline, and examined macroscopically for gastric lesions using a dissecting microscope (10×).

The gastric contents were collected into centrifuge tubes and centrifuged at 1000 rpm for 10 minutes. The volume of the gastric juice was measured, and the pH was determined using a digital pH meter. The supernatant was further used for the estimation of free acidity and total acidity. The ulcer area (UA) was calculated, and the percentage protection offered by the treatments was determined.

EVALUATION PARAMETERS:

1. VOLUME OF GASTRIC JUICE:

The gastric contents were centrifuged at 1000 rpm for 10 minutes, and the volume of the clear supernatant was measured and expressed in milliliters (mL).

2. pH:-

The pH of the gastric juice was measured using a digital pH meter. Prior to measurement, the pH meter was calibrated using standard buffer solutions. The electrode was then immersed in the gastric supernatant, and the pH value was recorded once the reading stabilized.

3. DETERMINATION OF FREE ACIDITY AND TOTAL ACIDITY:-

One milliliter of the gastric supernatant was pipetted out and diluted to 10 mL with distilled water. The pH of the solution was recorded using a pH meter. The solution was then titrated against 0.01 N sodium hydroxide (NaOH) using Topfer's reagent (dimethylaminoazobenzene) as an indicator.

The appearance of an orange color indicated the endpoint for free acidity. Titration was continued further using phenolphthalein as an indicator until a pink color was obtained, which represented total acidity.

The acidity was calculated using the following formula:

$$\text{Acidity} = \text{Volume of NaOH} \times \text{Normality} \times 100 / 0.1$$

4. TOTAL ULCER INDEX:-

The ulcer area for each animal was determined by summing the lengths of all visible lesions. The mean ulcer index for each group was calculated by averaging the ulcer scores of all animals in that group.

$$\text{Ulcer Index (UI)} = \text{Total ulcer area of all animals in a group} / \text{Number of animals}$$

STATISTICAL ANALYSIS:

The experimental data were expressed as mean \pm SEM for six animals in each group. Statistical analysis was carried out using one-way analysis of variance (ANOVA) followed by Dunnett's multiple comparison test to compare the treated groups with the stress-induced ulcer control group. The value of $p < 0.05$ was considered statistically significant.

RESULTS:

In the present study, the effect of *Rhynchosia beddomei* extract on gastric secretory parameters was evaluated using the cold-water immersion stress-induced ulcer model in Wistar albino rats.

Table 1: Effect of *Rhynchosia beddomei* extract on gastric secretory parameters

| GROUPS | Gastric Juice Volume (in ml) | pH | Total Acidity | Total Ulcer Index |
|--|------------------------------|-------------|---------------|-------------------|
| 1. Control | 3.54 ± 0.12 | 3.22 ± 0.28 | 60.3 ± 0.06 | 95.5 ± 0.10 |
| 2. Disease Control | 1.92 ± 0.08 | 1.45 ± 0.09 | 110.2 ± 0.36 | 128.3 ± 0.13 |
| 3. Lower Dose (150mg/ml) | 1.45 ± 0.09 | 2.27 ± 0.06 | 69.7 ± 0.05 | 95.6 ± 0.10 |
| 4. Higher dose (300mg/ml) | 2.42 ± 0.05 | 2.96 ± 0.07 | 53.1 ± 0.03 | 92.1 ± 0.09 |
| 5. Standard Drug (Rabeprazole-10mg/ml) | 3.26 ± 0.08 | 3.05 ± 0.12 | 40.6 ± 0.02 | 80.7 ± 0.12 |

In the present study, the effect of *Rhynchosia beddomei* extract on gastric secretory parameters was evaluated using the cold-water immersion stress-induced ulcer model in Wistar albino rats.

The normal control group showed normal gastric physiological parameters with adequate gastric juice volume, higher pH, and lower free and total acidity. In contrast, the stress-induced ulcer control group exhibited a significant decrease in gastric pH along with a marked increase in free acidity and total acidity, indicating severe gastric mucosal damage due to stress exposure.

Pretreatment with *Rhynchosia beddomei* extract at 150 mg/kg (low dose) produced a noticeable reduction in gastric acidity and a moderate increase in gastric pH when compared to the disease control group. The high-dose extract (300 mg/kg) showed a more pronounced protective effect by significantly reducing free and total acidity and restoring gastric pH towards normal values.

The standard drug rabeprazole produced significant gastroprotection by normalizing gastric juice volume, increasing gastric pH, and markedly reducing acidity levels. The effects observed with the high dose of *Rhynchosia beddomei* were comparable to those of the standard drug.

Overall, the results demonstrate that *Rhynchosia beddomei* extract exhibits dose-dependent antiulcer activity against stress-induced gastric ulcers, as evidenced by improvement in gastric secretory parameters.

DEMONSTRATION:

Effect of *Rhynchosia beddomei* extract on gastric juice volume:

The graph depicts the effect of *Rhynchosia beddomei* extract on gastric juice volume in stress-induced ulcerated rats. The disease control group showed a marked reduction in gastric juice volume when compared with the normal control group, indicating severe gastric mucosal damage due to stress. Treatment with the extract at 150 mg/kg produced a moderate improvement in gastric juice volume, whereas the higher dose (300 mg/kg) showed a significant restoration toward normal values. The standard drug rabeprazole exhibited a pronounced protective effect, comparable to the normal control group. The results suggest a dose-dependent protective effect of the extract on gastric secretory function.

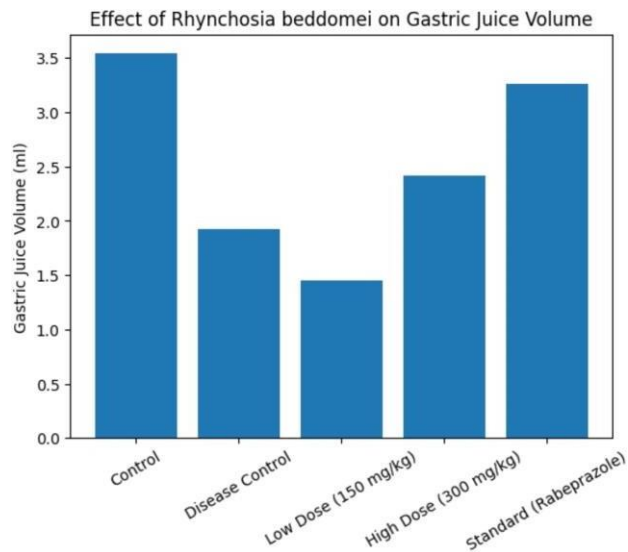


Figure 1: Effect of Rhynchosia beddomei extract on gastric juice volume

Effect of Rhynchosia beddomei extract on gastric pH:

The graph illustrates changes in gastric pH across different experimental groups. Stress exposure caused a significant decrease in gastric pH in the disease control group, reflecting increased gastric acidity.

Administration of Rhynchosia beddomei extract resulted in a dose-dependent increase in gastric pH. The higher dose (300 mg/kg) produced a greater elevation in pH compared to the lower dose (150 mg/kg). The standard drug rabeprazole showed a marked increase in gastric pH, approaching normal control values. These findings indicate the acid-suppressing potential of the plant extract.

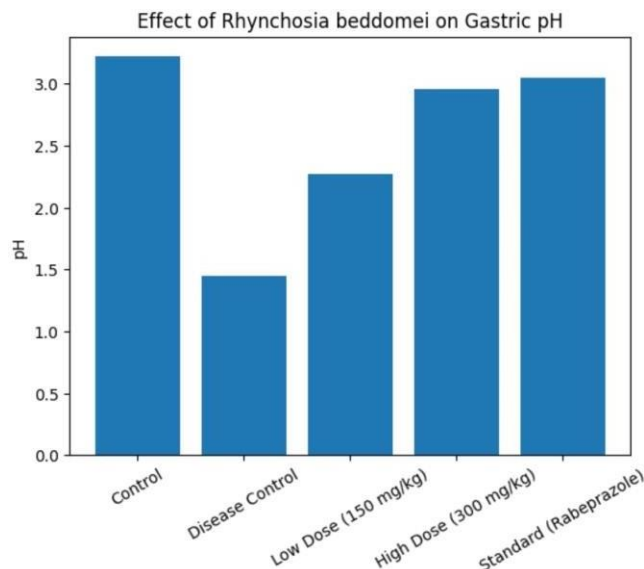


Figure 2: Effect of Rhynchosia beddomei extract on gastric Ph

Effect of Rhynchosia beddomei extract on total acidity:

This graph demonstrates the effect of Rhynchosia beddomei extract on total gastric acidity in stress-induced ulcer models. The disease control group exhibited a significant increase in total acidity compared to the normal control group. Treatment with the extract significantly reduced total acidity in a dose-dependent manner. The higher dose showed a more pronounced reduction in acidity than the lower dose. The standard drug rabeprazole produced the maximum decrease in total acidity. The reduction in total acidity suggests the anti-secretory activity of the extract.

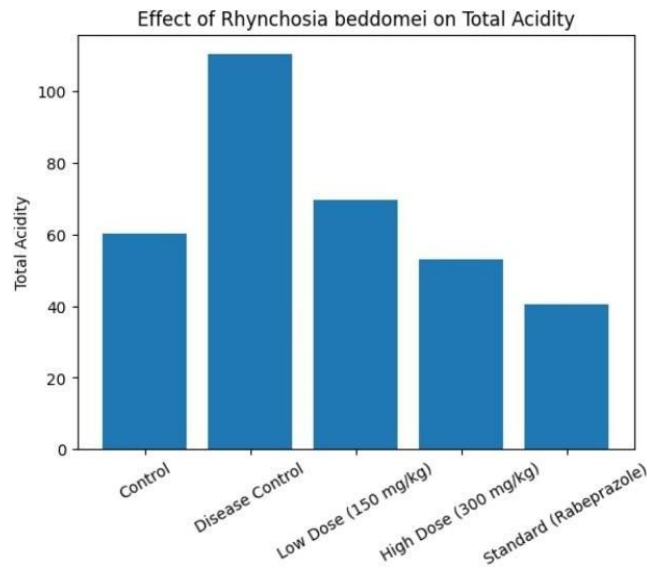


Figure 3: Effect of *Rhynchosia beddomei* extract on total acidity

Effect of *Rhynchosia beddomei* extract on ulcer index:

The graph represents the effect of *Rhynchosia beddomei* extract on the total ulcer index in stress-induced ulcerated rats. A significant increase in ulcer index was observed in the disease control group compared to the normal control group, confirming successful induction of ulcers. Treatment with the extract significantly reduced the ulcer index in a dose-dependent manner. The higher dose (300 mg/kg) exhibited greater ulcer protection compared to the lower dose (150 mg/kg). The standard drug rabeprazole showed the highest ulcer protective effect. The observed reduction in ulcer index indicates the gastroprotective and anti-ulcer potential of *Rhynchosia beddomei*.

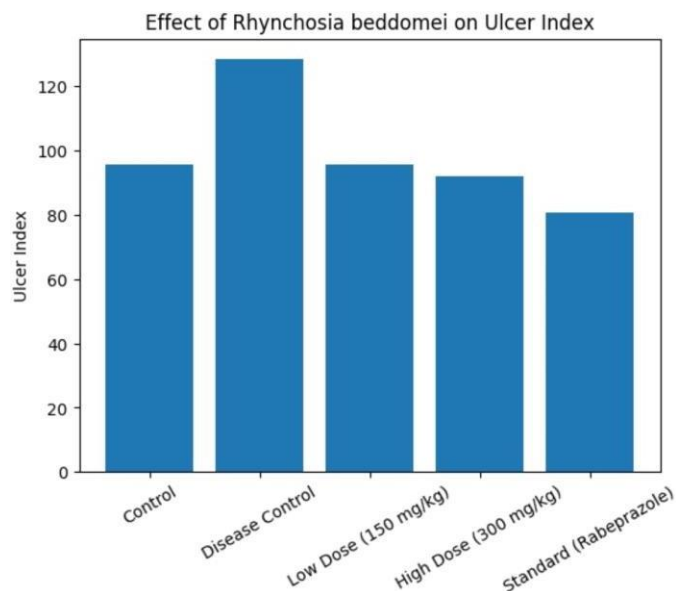


Figure 4: Effect of *Rhynchosia beddomei* extract on ulcer index

DISCUSSION:

Stress-induced gastric ulcers are known to develop due to excessive physiological stress, which leads to increased gastric acid secretion, reduced gastric mucosal blood flow, and impaired mucosal defense mechanisms. Cold water immersion stress is a well-established experimental model that produces gastric lesions through hypersecretion of acid, oxidative stress, and damage to the gastric mucosal barrier.

In the present study, the stress-induced ulcer control group showed a significant decrease in gastric pH along with a marked increase in free acidity and total acidity when compared to the normal control group. These findings confirm the successful induction of gastric ulcers and are consistent with earlier reports indicating that stress enhances gastric acid secretion and disrupts mucosal integrity.

Pretreatment with *Rhynchosia beddomei* extract produced a dose-dependent protective effect against stress-induced gastric damage. The low dose (150 mg/kg) showed a moderate reduction in gastric acidity and a corresponding increase in gastric pH, suggesting partial protection of the gastric mucosa. The high dose (300 mg/kg) exhibited a more pronounced reduction in free and total acidity with a significant restoration of gastric pH towards normal values, indicating enhanced gastroprotective activity.

The reduction in gastric acidity observed with *Rhynchosia beddomei* may be attributed to its phytochemical constituents such as flavonoids, phenolic compounds, and tannins, which are known to possess antioxidant, cytoprotective, and antisecretory properties. These compounds help in scavenging free radicals generated during stress and strengthening the gastric mucosal barrier, thereby preventing acid-induced damage.

The standard drug rabeprazole showed significant gastroprotection by reducing gastric acidity and increasing gastric pH, which validates the experimental model. The protective effects of the high-dose *Rhynchosia beddomei* extract were found to be comparable to the standard drug, indicating its potential as a natural antiulcer agent.

Overall, the findings of the present study suggest that *Rhynchosia beddomei* exerts significant antiulcer activity against stress-induced gastric ulcers, possibly through antisecretory and mucosal protective mechanisms.

CONCLUSION:

The present study concludes that *Rhynchosia beddomei* possesses significant antiulcer activity against cold water immersion stress-induced gastric ulcers in Wistar albino male rats. The extract effectively reduced gastric juice volume, free acidity, and total acidity, while increasing gastric pH in a dose-dependent manner.

The gastroprotective effect of *Rhynchosia beddomei* may be attributed to its antioxidant, cytoprotective, and antisecretory properties. The higher dose of the extract exhibited effects comparable to the standard antiulcer drug rabeprazole.

These findings support the traditional use of *Rhynchosia beddomei* in the management of gastric disorders and suggest that the plant may serve as a potential source for the development of safer and effective antiulcer agents. Further studies are required to isolate the active constituents and elucidate the exact mechanism of action.

SUMMARY:

The present study was designed to evaluate the antiulcer potential of *Rhynchosia beddomei* using a cold-water immersion stress-induced ulcer model in Wistar albino rats. Stress-induced gastric ulcers are a common experimental model to assess gastric mucosal damage caused by excessive acid secretion, oxidative stress, and impairment of mucosal defense mechanisms.

The ethanolic extract of *Rhynchosia beddomei* was prepared using the Soxhlet extraction method and administered orally at two dose levels (150 mg/kg and 300 mg/kg). Rabeprazole (10 mg/kg) was used as the standard reference drug. Various gastric parameters including gastric juice volume, pH, total acidity,

and total ulcer index were evaluated to assess the gastroprotective activity of the extract.

The disease control group showed a significant increase in total acidity and ulcer index along with a marked decrease in gastric pH, confirming successful induction of gastric ulcers. Treatment with *Rhynchosia beddomei* extract produced a dose-dependent improvement in all gastric parameters. The higher dose (300 mg/kg) exhibited significant restoration of gastric pH, reduction in total acidity, and decrease in ulcer index, comparable to the standard drug rabeprazole.

The observed antiulcer activity of *Rhynchosia beddomei* may be attributed to the presence of bioactive phytoconstituents such as flavonoids, phenolic compounds, and alkaloids, which are known to possess antioxidant, cytoprotective, and anti-secretory properties. Statistical analysis using one-way ANOVA followed by post-hoc tests confirmed the significance of the results ($p < 0.05$).

In conclusion, the results of the study scientifically validate the gastroprotective and antiulcer potential of *Rhynchosia beddomei*. The plant extract demonstrated significant protection against stress-induced gastric ulcers, supporting its traditional use and suggesting its potential as a natural antiulcer agent.

REFERENCES:

1. Javed S. M., Ahmad M. I. Comparison of Ulcer Healing Property of Lansoprazole and Rabeprazole in Albino Rats. *Journal of Medical Science and Clinical Research* . 2017;5
2. Daniel V. T. Predictors of mortality in the elderly after open repair for perforated peptic ulcer disease. *Journal of Surgical Research* . 2017;215:108–113. doi: 10.1016/j.jss.2017.03.052.
3. Sung J., Kuipers E., El-Serag H. Systematic review: the global incidence and prevalence of peptic ulcer disease. *Alimentary pharmacology & therapeutics* . 2009;29(9):938–946.
4. Zatorski H. Introduction to Gastrointestinal Diseases space , Vol. 2. Springer; 2017. Pathophysiology and risk factors in peptic ulcer disease; pp. 7–20.
5. Kang Y. M. Traditional Indian medicine (TIM) and traditional Korean medicine (TKM): a constitutional-based concept and comparison. *Integrative medicine research* . 2017;6(2):105–113.
6. Kim H.-S. Do not put too much value on conventional medicines. *Journal of Ethnopharmacology* 2005;100(1-2):37–39.
7. Kumar M. R. A review on medicinal plants for peptic ulcer. *Der Pharmacia Lettre* . 2011;3(2):180–186.
8. Kaur A., Kumar S., Sharma R. Assessment of anti-ulcer activity of *Rheum emodii* rhizomes extract. *Indo Global Journal of Pharmaceutical Sciences* . 2012;2(3):333–341.
9. Nair MP, Sastry ARK. 1998. *Red Data Book of Indian Plants*, Calutta: Botanical Survey of India.
10. Rama Rao N, Henry AN. 1996. *The Ethnobotany of Eastern Ghats of Andhra Pradesh, India*, Botanical Survey of India, Calcutta.
11. Gunasekar D. 1984. Ph. D. Thesis, Sri Venkateswara University, Tirupathi.
12. Bakshu L Md, Venkata Raju, RR. 2001. Antimicrobial activity of *Rhynchosia beddomei*. *Fitoterapia* 72:579-582.