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Pharmacological Investigation of *Ipomoea Reniformis* Chois from Convolvulaceae Family with Special Emphasis on Its Antiulcer Property

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KEYWORDS
Ulceration, Inflammation, Toxicity, *Ipomoea Reniformis,* Traditional Medicine

ABSTRACT:

The research article presented here explores the therapeutic potential of *Ipomoea reniformis*, particularly its antiulcer effects. The study employs a rigorous methodology, utilizing both the pyloric ligated ulcer and cold restraint stress-induced ulcer models to evaluate the efficacy of ethanolic leaf extracts at two dosage levels (200 and 400 mg/kg) in rats The findings reveal a significant dose-dependent reduction in gastric volume and ulcer index across both models, indicating that *Ipomoea reniformis* possesses substantial antiulcer activity.. The research works concludes that these pharmacological benefits likely stem from the compound's antisecretory and antioxidant properties, suggesting its potential as a natural therapeutic agent for gastric ulcers**.**

Introduction

The Convolvulaceae family, widely known for its diverse medicinal plants, has long been a focus in ethnopharmacology and modern pharmaceutical research. *Ipomoea reniformis* Chois, a perennial herb belonging to this family, is well-known in traditional medicine for its therapeutic properties[1]. The plant is native to various tropical and subtropical regions and has been utilized in folk medicine to treat ailments such as fever, inflammation, digestive disorders, and ulcers. In recent years, there has been a growing interest in investigating the pharmacological potential of traditional medicinal plants to understand their underlying mechanisms of action[2]. One significant area of focus has been the development of antiulcer therapies, as peptic ulcers and related gastrointestinal disorders remain prevalent worldwide, impacting millions of individuals. Modern treatment options, while effective, can be associated with side effects and high recurrence rates, driving the need for alternative, plant-based therapies[3].

Preliminary studies have shown that Ipomoea reniformis contains several bioactive secondary metabolites, including alkaloids, flavonoids, and phenolic compounds, known to exert anti-inflammatory, antioxidant, and gastroprotective effects[4]. These properties suggest that Ipomoea reniformis could be a promising candidate for antiulcer therapy, offering a potentially safer and more holistic approach compared to synthetic drugs. This study aims to explore the pharmacological profile of Ipomoea reniformis, with a particular emphasis on its antiulcer activity[5]. By evaluating its phytochemical composition and elucidating its potential mechanisms of action, this research seeks to contribute to the scientific understanding of Ipomoea reniformis as a viable therapeutic agent.

Material And Methods

Materials

Plant identification and authentication were performed by Dr. Praveen Kumar Joshi (HOD and Professor) of the Govt. Ayurvedic College Raipur, C.G. The sample was identified to be *Ipomoea reniformis* Chois and copy of specimen is deposited for future reference. All the solvents used for extraction and isolation were of Analytical Reagent grade. 1,1-Dipheny l, 2-picryl hydrazyl (DPPH) was obtained from Sigma Chemicals, USA. The adsorbent used for column chromatography was silica gel-60-120 (Merk).

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In vitro Evaluation

In vitro Antioxidant Activity

Antioxidant activity should not be reported based on a solo antioxidant test model. Many in vitro test procedures are carried out to estimate antioxidant activity. Another characteristic is that antioxidant test models vary in different respects[6]. Therefore, it is not practical to compare one method to another one. In general, in vitro antioxidant tests using free radical traps are relatively straight forward to perform[7]. Among free radical scavenging methods, 1, 1-diphenyl-2- picrylhydrazyl (DPPH) method is quick, simple, and cheap in comparison to superoxide radical scavenging activity and α-Amylase inhibitory activity.

DPPH Scavenging Activity:

The molecule 1, 1-diphenyl-2-picrylhydrazyl (α,α-diphenylβ-picrylhydrazyl; DPPH) is characterized by the delocalization of the spare electron over the molecule as a whole, so that the molecule does not dimerize. The delocalization of electron results in deep violet color, characterized by an absorption band in ethanol solution at about 517 nm[8]. When a solution of DPPH is mixed with that of a substrate that can donate a hydrogen atom, then this gives rise to the reduced form with the loss of this violet color. To assess the antioxidant potential by free radical scavenging of the test samples, the change in optical density of DPPH radicals is observed. The plant extracts and fractions in different concentration (0.2 ml) are diluted with methanol, and 2 ml of DPPH solution (0.5 mM) is added[9]. After 30 min, the absorbance is measured at 517 nm. The percentage of the DPPH radical scavenging is calculated using the equation as given below:

$$\text{DPPH radical scavenging Activity} = \frac{\text{Abs}_{\text{control}} - \text{Abs}_{\text{sample}} \times 100}{\text{Abs}_{\text{control}}}$$

Superoxide Radical Scavenging Activity Method

Superoxide radicals were generated in vitro by non-enzymatic system and determined spectrophotometrically (560 nm) by nitro blue tetrazolium (NBT) photo reduction method[10]. The assay mixture consists of 6.6 mM EDTA containing 3 µg of NaCN, 2 µM of riboflavin, 50 µM of NBT, crude extract, and 67 mM of phosphate buffer (pH 7.8) in a final volume of 3 mL. The optical density at 560 nm was measured before and after 15 min illumination[11]. The superoxide radical scavenging activity of the crude extracts was expressed in inhibitory concentration 50% (IC50) values.

In-vitro antimicrobial activity

Microbial strains

All the extracts of *Ipomoea reniformis* were tested against the following five microbial strains (Escherichia coli NCIM 2109; Staphylococcus aureus NCIM 2079, Pseudomonas aeruginosa NCIM 2036; Bacillus subtilis NCIM 2250 and Aspergillus niger NCIM 545).

Well Diffusion Method

The antibacterial activities of all the extracts and fractions were determined by well diffusion method. From the obtained results it was clear that the extracts posses good antimicrobial potential.

Microbiological media used for bacteria

For various bacterial strains the media used was Nutrient agar (Hi-media), Composition (G/Litre): Sodium chloride, 5.0; Beef extract 10.0; Peptone 10.0 (pH 7.2).

Microbiological media for fungi

The media used for fungal growth was Potato dextrose agar (Himedia), Composition (G/Litre): Potatoes infusion, 200.0 Dextrose 20.0 (pH 5.2). 100µl of each test bacterium was spread with the help of sterile spreader on a sterile Agar plate (Hi Media, Mumbai, India) so as to achieve a confluent growth and was incubated for 24 hours at 37 ± 0.1 °C[12]. Well diffusion method was employed.

Test samples of each extract (200 mg) were dissolved in respective solvents (1 ml). Hi-media antibiotics: Streptomycin (10 microgram), Amphotericin-B (100 units) were used as standard. The count of the bacterial strains and fungal strain was adjusted to yield 1 X 10^7 to 1 X 10^8 mL-1 and 1 X 10^5 to 1 X 10^6 mL^{-1} respectively[12]. The microbes (0.1 ml) were inoculated with a sterile spreader on the surface of solid nutrient agar medium in plates. The agar plates inoculated with test organism were incubated for one hour before placing the extract in the wells on the plates. The bacterial plates were incubated at 37 ± 0.1 °C for 24 hours in a BOD incubator[13]. After incubation all the

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plates were observed for zones of inhibition and the diameters of these zones were measured in millimeters by vernier calliper. All tests were performed under sterile conditions and in triplicate. Streptomycin (10µg/well) and Amphotericin B (100 unit/well) were used as positive controls.

In- vivo pharmacological screening of various extracts

Male Wistar Albino rats weighing between 150-160g were used for the study. The animals were obtained from animal house of Gupta Suppliers and breeders,Kolkata, India. On arrival, the animals were placed at random and allocated to treatment groups in polypropylene cages with paddy husk as bedding[14]. Animals were housed at a temperature of 24±2°C and relative humidity of 30-70%. A 12:12 light: dark cycle was followed. All animals were allowed free access to water and fed with standard commercial pelleted rat chaw (Hindustan Lever Ltd, Mumbai). All the experimental procedures and protocols used in this study were in accordance with the guidelines of the IAEC.

Acute Oral Toxicity Study

The acute oral toxicity study was conducted according to the OECD 423 guidelines. The animals were acclimatized to laboratory conditions 1 week before starting the experiment. The animals were kept in standard laboratory conditions at a temperature of 20 ± 2°C, relative humidity of 50 ± 10%, and 12 h of dark and light cycles[15]. The animals were provided food and water *ad libitum*. All experiments and procedures were performed according to the Institutional Animal Ethics Committee (IAEC) formed under the supervision of CPCSEA under the Ministry of Animal Welfare Division of the Government of India, New Delhi.

Screening of antiulcer activity Pyloric ligation induced gastric ulceration

Male Wistar albino rats were used in the study. The animals were divided into 4 groups of six animals each. Animals were fasted for 24 hour before the study, but had free access to water[16]. Group I treated as control, received 0.1% Carboxy Methyl Cellulose (CMC); group II and III treated as treatment groups, received 200 and 400 mg/kg of chloroform extract, ethyl acetate extract and ethanolic extract of *Ipomoea reniformis* for 7 days and group IV as standard group, received Omeprazole (10 mg/kg). All the test drugs were administered by suspending in CMC, once daily for 7 days, through oral route using gastric intubation tubes. On day 7 after the last dose of test drugs, the rats were kept for 18 h fasting and care was taken to avoid coprophagy.

Then the pre-treated animals were anaesthetized by pentobarbitone sodium (45mg/kg). The abdomen was opened by a small midline incision below the xiphoid process[17]. The pyloric portion of the stomach was ligated without causing any damage to its blood vessels. The stomach was isolated carefully and the abdominal wall was sealed by interrupted sutures. The animals were deprived of water during the postoperative period. 4hrs after pyloric ligation, the animals were sacrificed with excess pentobarbitone sodium and the stomach was dissected out[18]. The gastric contents were collected in tubes and volume was measured. The stomach was then incised along the greater curvature and examined for lesions in the fore stomach portion then indexed according to severity. The percentage inhibition of ulceration was calculated and compared with control.

Aspirin induced gastric ulceration

Albino Wistar rats of either sex were divided into five groups with six animals in each group as follows:

Group I: Control (untreated) group

Group II: Toxicant group (aspirin 200 mg/kg)

Group III: Standard treatment group (omeprazole 20 mg/kg)

Group IV: Test treatment group (CE 400 mg/kg)

Group V: Test treatment group (EE 400 mg/kg)

Group VI: Test treatment group (EA 400 mg/kg)

All rats were fasted for 24 hours but excess water was allowed. The standard drug (omeprazole 20 mg/kg) and the test drugs (TE 400 mg/kg) were administered orally to the respective groups[19]. One hour after their pretreatment, all animals were gavaged with aspirin (200 mg/kg). After 4 hours, they were humanely sacrificed by using diethyl ether. The numbers of ulcer spots in the glandular portion of the stomach were counted in both normal control and drug treated animals and the ulcer index was calculated. The stomach was further tested for LPO, GSH, SOD, CAT, GPx and GR.

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Estimation of antioxidants and protein content in gastric tissue

The GSH level in the stomach tissue was determined according to the method of Ellman. Gastric SOD activity was estimated by the method of Sun and Zigman. CAT activity was estimated by the Clairborne et al method. GPx estimation was carried out using the method of Rotruck et al . GR activity was determined by using the method of Mohandas et al. The protein content of the gastric tissue was determined by the Folin Lowry Method using bovine serum albumin as standard. Estimation of thiobarbituric acid reactive substances (TBARS) in gastric tissue [LPO]: The quantitative estimation of LPO was done by determining the concentration of Thiobarbituric Acid Reactive Substances (TBARS) in gastric tissue using the method of Ohkawa & Yagi. The amount of malondialdehyde (MDA) formed was quantified by reaction with TBA and used as an index of lipid peroxidation. The results were expressed as nmol of MDA/mg protein using molar extinction coefficient of the chromophore (1.56 × 10-5/M/cm) and 1,1,3,3- tetraethoxypropane as standard.

***Statistical analysis*:** The results of anti-ulcer activity are expressed as mean ± SEM. Results were statistically analyzed using one-way ANOVA, followed by the Tukey–Kramer post-test for individual comparisons. P

Result And Disscusion

Antioxidant activity

According to the study it was proven that, *I. reniformis* has antioxidant action. It could be considered from the results that the antioxidant activity of any extract may be influenced by the phenolic and flavonoid concentration. The primary chemical from this plant that is responsible for the aforementioned activities may be investigated further.

DPPH Scavenging Activity

All the extracts of Ipomoea reniformis have significantly reduced the DPPH radicals in a concentration dependent manner. After the study, it was found that ethanolic extract showed potent antioxidant activity with IC50 value of 52.24 µg/ml, and the highest antioxidant activity i.e., 94.84 ± 1.56 % at 1000 µg/ml as compared with other extracts. IC50 value of chloroform, ethyl acetate and hydroalcoholic extract was found to be 595µg/ml, 91.92 µg/ml, and 57.89 µg/ml respectively as shown in figure.

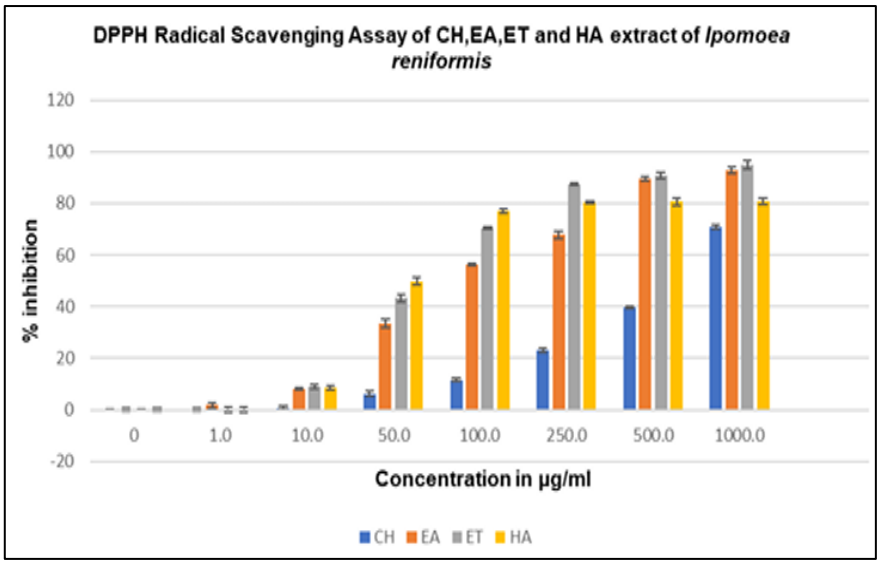

Figure 3.1. Figure Showing Percent inhibition concentration (50%) of various extracts when treated with DPPH reagent The SM obtained from *Ipomoea reniformis* have reduced the DPPH radicals in a concentration dependent manner as shown in figure below.

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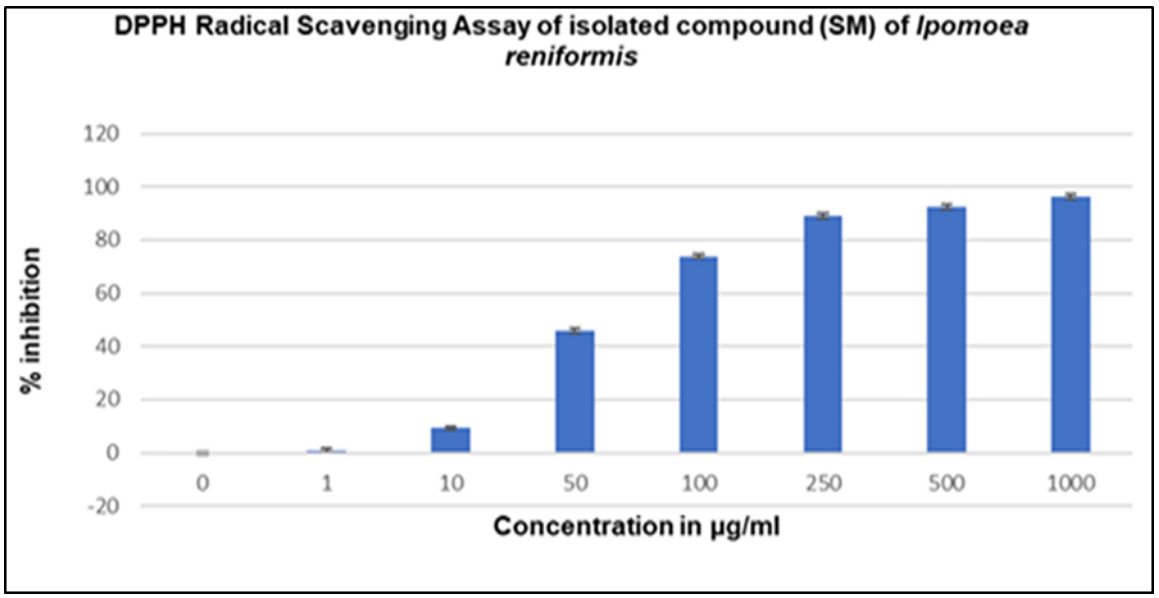

Figure 3.2. Figure Showing Percent inhibition concentration (50%) of isolated compound-I when treated with DPPH reagent.

Superoxide Radical Scavenging Activity

Vitamin C exhibited better results with lower IC50 values. In the superoxide radical scavenging method, the ethanolic extract again showed the highest activity 96.66 µg/mL−1 among all the samples used followed by ethyl acetate extract with a value of 87.42 µg/mL−1. Hence for further animal studies only three fractions i.e chlrofoem extract, ethanolic extract and ethylacetate extract were taken into account.

Table. 3.1.

S.No.	Extracts	IC50 ±SEM* (µg/mL−1) Superoxide radical scavenging
1.	Chloroform	54.01±0.59
2.	Hydroalcoholic	47.12±1.23*
3.	Ethanolic	96.66±1.41
4.	Ethyl Acetate	87.42±0.89**
5.	Vitamin C	165±1.02

Determination of Minimum Inhibitory Concentration (MIC)

Serial dilutions of concentrations ranging from 0.01 to 200 mg/ml were prepared as follows: DMSO (2 ml in the first tube and 1 ml in the rest tubes) was filled in tubes. 400 mg of extract was added to the first tube and vortexed to prepare 200 mg/ml test extract solution. 1 ml of this solution was transferred in to other tube containing 1 ml DMSO to prepare the next dilution (100 mg/ml). Similarly, 1 ml of the second dilution was transferred in to the third tubes to prepare the third dilution (50 mg/ml) and the procedure was continued until the last dilution MIC determination was performed using the above serially diluted plant extracts in 96-well micro plates. 25µl of the test extract dilution were transferred from each test tube to wells of 96-well plates. Each well of the plate was loaded with 25 µl of bacterial suspension (adjusted to 0.5 McFarland standards) and 200 µl of broth except wells left for checking sterility.

Chloramphenicol was used as a positive control, inoculated wells of antibiotic free broth were used as negative control and un-inoculated wells of antibiotic free broth were used to check sterility. Then the plates were covered with plate sealing tape and incubated at 37°C for 20 hours. Finally, the lowest concentration of the plant extract that showed no visible growth was taken as minimum inhibitory concentration. From the obtained results it was clear that ethyl acetate extract was having least MIC values[Table No. 6]. The same procedure was carried out for various fractions obtained from ethyl acetate extract.

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MIC Study: It was clear from the antimicrobial study that ethyl acetate extract has shown most of the activity so it was carried further for fractions. The MIC study of all fractions as shown in table 6 exhibited that ethyl acetate fraction is most potent among all the fractions.

Table No. 3.2.: Antimicrobial activity of *Ipomoea reniformis* extracts.

Plant extracts/ Standards	**Zone of inhibition (mm)**				
	Gram Negative bacteria		**Gram positive bacteria**		**Fungi**
	E.coli	*P. aeruginosa*	*S. aureus*	*B. Subtilis*	*A. niger*
Chloroform	-	-	-	-	9.15
Ethyl acetate	8.13	6.53	9.12	9.15	-
Ethanolic	7.89	6.00	7.97	7.58	9.27
Hydroalcoholic	-	-	9.15	-	-
Streptomycin(10 µg)	15.11	11.23	16.23	15.78	NA
Amphotericin- B	NA	NA	NA	NA	10.11

Diameter in mm calculated by Vernier Caliper; '-' means no zone of inhibition, NA: Not applicable.

* Readings below 5 mm were not considered.

Table 3.3. : Antimicrobial activity of *Ipomoea reniformis* Fractions.

Fractions / Standards	**Zone of inhibition (mm)**				
	Gram Negative bacteria		**Gram positive bacteria**		**Fungi**
	E.coli	*P. aeruginosa*	*S. aureus*	*B. Subtilis*	*A. niger*
Chloroform (IPR 1)	6.04	5.21	5.63	6.14	8.03
Ethyl acetate (IPR 2)	9.57	8.40	11.02	11.27	-
Ethanolic (IPR 3)	6.31	6.58	6.97	6.41	8.21
Hydroalcoholic(IPR 4)	5.14	5.76	8.74	8.19	-
Streptomycin (10 µg)	15.11	11.23	16.23	15.78	NA
Amphotericin- B	NA	NA	NA	NA	10.11

Diameter in mm calculated by Vernier Caliper; '-' means no zone of inhibition, NA: Not applicable. * Readings below 5 mm were not considered.

Table: 3.4. . MIC studies of various Extracts of *Ipomoea reniformis.*

Extracts	***MIC values (in mg/ml) against***				
	S. aureus	***E. coli***	***P. Aeruginosa***	***B. subtilis***	***A. niger***
Chloroform	0.78	1.56	3.12	0.39	NA
Ethyl acetate	0.10	0.20	0.39	0.10	NA
Ethanolic	0.39	0.39	1.56	0.20	NA
Hydroalcoholic	1.56	1.56	3.12	0.39	NA

Minimum Inhibitory Concentration (rounded to two decimal place) of *I. reniformis* solvent Extracts against the tested microbes., Key: NA = No activity.

Table: 3.5. . MIC studies of various fractions of *Ipomoea reniformis.*

Fractions	***MIC values (in mg/ml) against***				
	S. aureus	***E. coli***	***P. Aeruginosa***	***B. subtilis***	***A. niger***

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Chloroform (IPR 1)	0.39	0.39	0.78	0.10	NA
Ethyl acetate (IPR 2)	0.02	0.05	0.20	0.02	12.50
Ethanolic (IPR 3)	0.20	0.10	0.39	0.05	NA
Hydroalcoholic (IPR 4)	0.20	0.39	0.78	0.10	NA

Minimum Inhibitory Concentration (rounded to two decimal place) of *I. reniformis* solvent fractions against the tested microbes. Key: NA = No activity.

Screening of antiulcer activity Pyloric ligation induced gastric ulceration

Ipomoea reniformis leaf extract was studied for its antiulcer activity against pyloric ligation induced ulcer in rats and the results were shown in Table 1. The gastric volume accumulated in the control groups was 10.65±0.90 ml of pyloric ligated rats. The reference control Omeprazole significantly ($P<0.001$) decreased the gastric volume to 3.48±0.16 ml compared to control groups. The ethanolic extract of *Ipomoea reniformis* 400mg/kg ($P<0.05$) significantly decreased the gastric volume to 5.88±0.45 and 4.95±0.26 ml respectively, compared chloroform extract and ethyl acetate extracts in comparison to control. *Ipomoea reniformis* extract showed dose dependent reduction in the gastric volume.

Table. 3.6. Table Showing: The effect of *Ipomoea reniformis* extracts on gastric volume and ulcer index of pyloric ligation induced ulcer in rats.

Groups	Drug treatment	Gastric volume (ml)	Ulcer index	Protection
I	Control-0.1% CMC (1ml/kg)	10.65±0.90	18.22±1.06	
II	Ipomoea reniformis (CE) (400mg/kg)	11.93±0.23*	20.43±0.22**	66.9
III	Ipomoea reniformis (EA) (400mg/kg)	5.88±0.45*	8.73±0.74**	52.08
IV	Ipomoea reniformis (EE) (400mg/kg)	4.95±0.26**	4.93±0.19***	72.94
IV	Reference control omeprazole (10mg/kg)	3.48±0.16***	3.52±0.01***	80.68

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Table 3.7. able Showing the effect of ethanolic leaf extract of *Ipomoea reniformis* on ulcer index and antioxidant parameters (LPO, SOD and CAT) in cold restraint stress induced ulcer in rats.

Groups	Drug treatment	Ulcer index	%Protection	LPO (nmols of MDA/mg of protein)	SOD (U/mg of protein)	CAT (U/mg of protein)
I	Normal Control			133.25±6.72***	93.22±5.65**	54.03±4.80***
II	Stress control 0.1% CMC (1ml/kg)	18.66±5.82		239.64±6.55	146.33±5.42	21.38±1.56
III	Ipomoea reniformis (CE) (400mg/kg)	20.43±0.22**	66.9	212.76±1.44	129.18±4.59	20.73±1.26
IV	Ipomoea reniformis (EA) (400mg/kg)	9.62±2.48"	48.45	184.92±7.95"	120.88±5.20**	31.72±2.05
V	Ipomoea reniformis (EE) (400mg/kg)	6.74±0.64***	63.87	162.30±6.74***	105.77±4.66***	38.54±2.92**
VI	Reference control Omeprazole (10mg/kg)	3.86±0.45	79.31	144.72±5.58***	114.34±5.09***	47.32±3.42***

The rats treated with reference standard Omeprazole showed significant decrease in ulcer index and enhanced the percentage of ulcer protection. The rats treated with *Ipomoea reniformis* extract (400mg/kg) also significantly (P<0.001 and P<0.01, respectively) decreased the intensity of gastric mucosal damage. The ulcer index and % protection of gastric lesion was 8.73±0.74 and 52.08% respectively, in the groups of animals received Ipomoea reniformis leaf extract (200mg/kg) as compare control. The ulcer index and % protection of gastric lesion was 4.93±0.19 and 72.94% respectively, in the groups of animals received *Ipomoea reniformis* leaf extract (400mg/kg) as compare control and the effect was equipotent with reference control Omeprazole. The ulcer index and % protection of gastric lesion was 3.52±0.01 and 80.68% respectively, in the groups of animals received Omeprazole. Rats under pyloric ligation were used to test the antiulcer properties of an ethanolic leaf extract of *Ipomoea reniformis*. From the data, it was determined that the *Ipomoea reniformis* extract displayed antiulcer action in both the tested animals. *Ipomoea reniformis* may have demonstrated the aforementioned action as a result of its antioxidant and antisecretary qualities. It may be possible to develop a safe and effective herbal antiulcer agent for use by humanity by doing more research to identify the active ingredient.

Aspirin induced gastric ulceration

The study of aspirin-induced gastric ulceration often investigates how certain substances can either prevent or exacerbate gastric damage caused by aspirin, a common nonsteroidal anti-inflammatory drug (NSAID). Aspirin's ulcerogenic effect is primarily due to its inhibition of prostaglandin synthesis, which compromises the gastric mucosal barrier, leading to ulcers. *Ipomoea reniformis*, a plant belonging to the Convolvulaceae family, has been investigated for its potential gastroprotective properties. The plant is traditionally used in folk medicine for various therapeutic applications, including treating ulcers, due to its anti-inflammatory, antioxidant, and wound-healing properties.

***(**Fraction 1(EE), Fraction 2(CE), and Fraction 3(EA).

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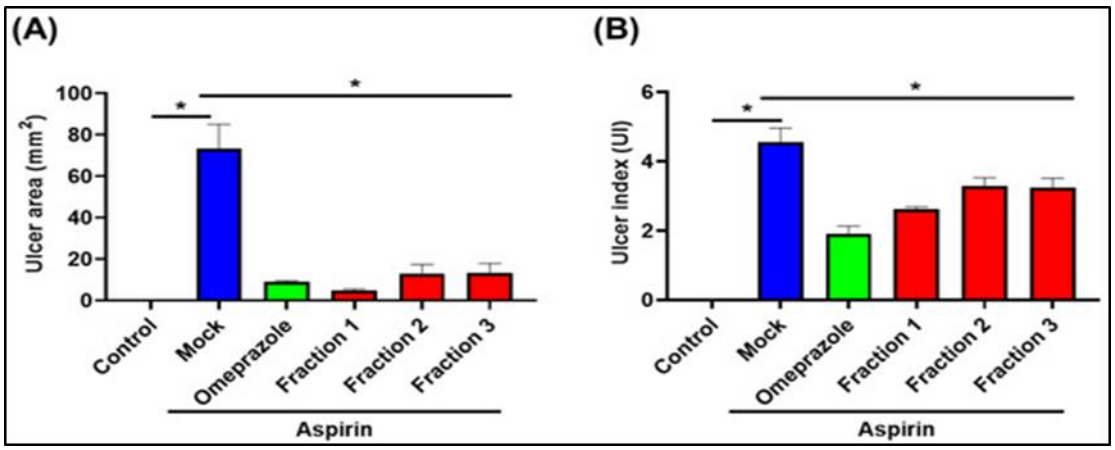

Figure3.3 . *I.reniformis* fractions alleviate aspirin-induced gastric ulcer in mice. Mice were randomly divided into 6 groups (6 mice each group) and administrated mock control (PBS), aspirin (500 mg/kg), followed by treatment with omeprazole (10 mg/kg) and each *I. reniformis* fractions (400 mg/kg). (A) Ulcer area (mm^2) and (B) ulcer index were assessed. *, $p < 0.05$ compared with aspirin treatment group.

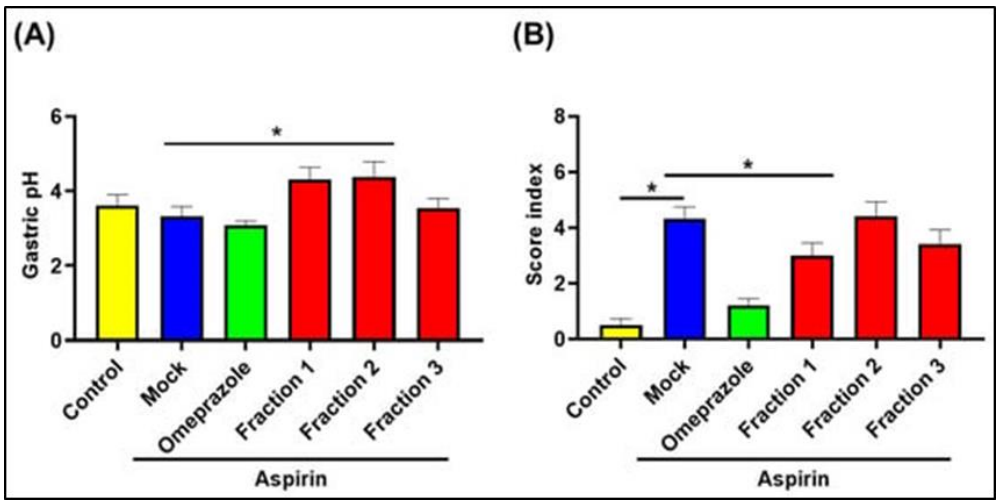

Figure 3.4. Figure Showing *I.reniformis* fractions improve aspirin-induced gastric inflammation in mice. (A) Gastric pH and (B) inflammatory score index of stomach were evaluated, as described in Materials and Methods section. *, $p < 0.05$ compared with aspirin treatment group.

Histopathological Analysis

Mouse gastric tissues were prepared for hematoxylin-eosin (H&E) and immunohistochemistry (IHC) staining as described previously. H&E staining was conducted to evaluate the mucosal and inflammatory cell infiltration of the gastric cells. The histopathologic grades were classified based on the severity of inflammatory cell infiltration: level 0 (no inflammatory cells), level 1 (minimal), 2 (mild), 3 (moderate), 4 (marked), and 5 (severe), as described previously. IHC staining was performed by using antibodies against COX-2 (PA5-88606, Thermo Fisher Scientific, Waltham, MA, USA) and iNOS (ab115819, Abcam, Boston, MA, USA), respectively. The tissue sections were then incubated with Imm PRESSHRP Universal Antibody (MP-7500, Vector Laboratories, Newark, CA, USA), and finally developed with an ABC kit (ImmPACT DAB SK-4105, Vector Laboratories). The stained tissues were then analyzed using a microscope (Labomed, Germany).

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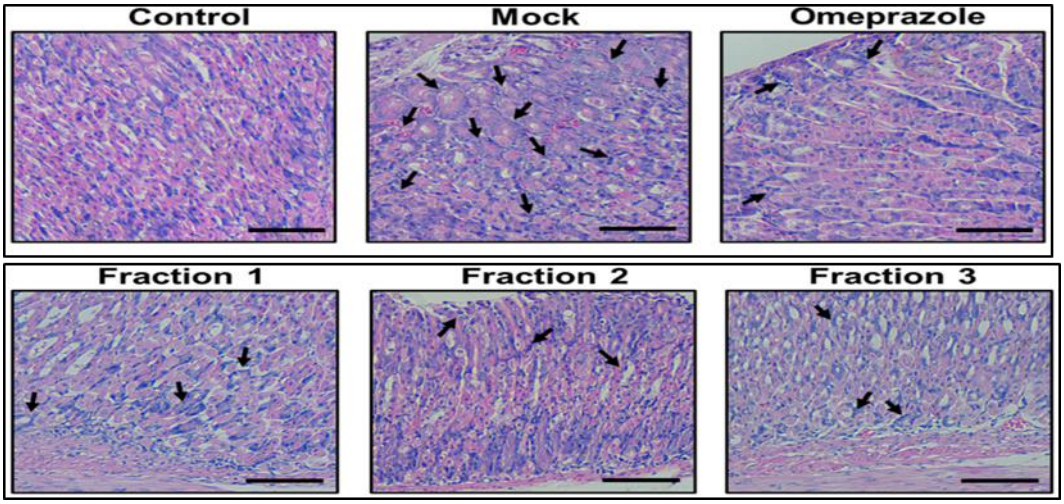

Figure 3.5. Figure Showing *: Ipomoea reniformis* fractions protect aspirin-induced gastric injury in mice. Macroscopic image of stomach in mice treated with (A) control (PBS), (B) aspirin, followed by treatment with (C) omeprazole, *Ipomoea reniformis* (D) Fraction 1(EE), (E) Fraction 2(CE), and (F) Fraction 3(EA). White arrows indicated severe mucosal lesions of the stomach. The magnified images of ulcer area were shown in the lower left corner. The stomachs were prepared and subjected to H&E staining. Black arrows indicated the inflammatory cell infiltration around gastric glands. Scale bars, 100 µm

The extract of *Ipomoea reniformis* is typically found to reduce ulcer formation, demonstrating its potential protective effect on the gastric mucosa. The gastroprotective effect is often attributed to its antioxidant and anti-inflammatory properties, as well as its ability to enhance mucus secretion and improve the mucosal defense mechanisms, which are impaired by aspirin. The study might conclude that Ipomoea reniformis offers significant protection against aspirin-induced gastric ulceration, highlighting its potential as a herbal therapeutic agent for preventing NSAID-induced gastric damage.

Through the present research work an attempt has been made
to show that *Ipomea reniformis* have potential therapeutic benefits for a number of health conditions. For example, studies have suggested that the plant may have anti-inflammatory effects that could help alleviate symptoms of arthritis and other inflammatory conditions. Additionally, the plant's antioxidant properties may help protect cells from damage caused by free radicals, which could potentially reduce the risk of chronic diseases such as cancer and heart disease. In conclusion, pharmacognostical and pharmacological evaluation of Ipomea reniformis is important in order to understand the medicinal properties of this plant. Research suggests that the plant may have potential therapeutic benefits for a number of health conditions, making it a promising candidate for further study and development as a natural medicine.

Conclusion

The present pharmacological investigation of *Ipomoea reniformis* Chois, from the Convolvulaceae family, highlights its significant medicinal potential, particularly in the treatment of ulcers. *Ipomoea reniformis*, are known for their diverse pharmacological activities, including antioxidant, anti-inflammatory, and cytoprotective properties, which contribute to the plant's antiulcer activity.

The antiulcer property of *Ipomoea reniformis* is attributed to its ability to enhance the defensive mechanisms of the gastric mucosa, such as increasing mucus production, scavenging free radicals, and reducing gastric acid secretion. The plant's ability to mitigate oxidative stress and inflammation plays a crucial role in its effectiveness in preventing and healing ulcers. Preclinical studies conducted on various ulcer models (such as ethanol-induced and aspirin-induced gastric ulcer models) have demonstrated a notable reduction in ulcer formation, confirming the plant's gastroprotective action.

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Moreover, *Ipomoea reniformis* has shown a high safety profile in the tested doses, with no significant toxicological concerns, making it a promising candidate for future development as a natural antiulcer agent. However, further studies, including clinical trials and mechanistic studies, are required to fully elucidate the underlying mechanisms and to validate its efficacy and safety in humans.

In conclusion, the findings of this study underscore the therapeutic potential of *Ipomoea reniformis* as an antiulcer agent. Its rich pharmacological profile, , opens up new avenues for its application in the management of peptic ulcers, particularly as a natural alternative to synthetic drugs with fewer side effects.

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