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Anti-Ulcer Activity of Ficus Glomerata Extract on Pylorus Ligation-Induced Gastric Ulcer In Experimental Animals

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ABSTRACT

The phytochemical investigation and assessment of the anti-ulcer properties of a hydroalcoholic extract of Ficus glomerata leaves are the focus of this work. The hydroalcoholic extract of Ficus glomerata on gastric ulcer pyloric ligation in rats was also used to test the ulcerative index, stomach volume, pH, and total and free acidity. A one-way ANOVA and Tukey's multiple comparison tests were used for statistical evaluation, and the findings were presented as Mean ± S.E.M. Only the hydro alcohol extract contains glycosides, alkaloids, carbohydrates, terpenoids, and flavonoids. Thus, for its anti-ulcer properties, the hydroalcoholic extraction was employed. The current investigation was conducted in albino rats using a pylorus ligation-induced gastric ulcer model. The hydroalcoholic extracts of Ficus glomerata were tested orally at a dose level of 200 mg/kg body weight and compared to the standard of ranitidine (10 mg/kg). According to the findings, hydro alcohol leaf extracts of Ficus glomerata at a dose level of 200 mg/kg shown a noteworthy anti-ulcer effect in comparison to the usual medication.

Keywords: *Ficus glomerata, Medicinal plant, ulcer, phytochemical*

1. INTRODUCTION

PCOS is a known illness of the endocrine system, It primarily affects 4%–20% of women who are of reproductive age (1) causing oligo-ovulation, hyperandrogenism, and polycystic ovary morphology. Acid-related health issues are a substantial contributor to patient morbidity and mortality and primarily impact quality of life. The most prevalent gastrointestinal conditions include peptic ulcers, gastro-esophageal reflux disease, and heartburn. 10% of people will experience an ulcer at some point in their lives, making it one of the most prevalent gastrointestinal health problems in the world [1, 2]. Additionally,

it was mentioned that ulcers have a higher likelihood of relapsing or recurring. As a result, safe and effective medications must be able to regulate the production of gastric acid, postpone or prevent the likelihood of recurrence and pain problems, and promote the healing process [3]. There are numerous causes for the population's reliance on drugs that reduce acidity, including stress and drug use. However, it has already been noted that a major component in the development and repair of ulcers is mucosal strength rather than gastric acid secretion [4]. Acid-pepsin hypersecretion, Helicobacter pylori, and non-steroidal anti-inflammatory medications are the main causes that upset the balance between the defensive and aggressive components. Ulcers can also develop in situations when there is an excessive and unregulated generation of acid [5, 6]. The symptoms include bloating, heartburn, autoimmune diseases, digestive disorders include gastrointestinal inflammation, burning in the abdomen, nausea, vomiting, chest discomfort, and unexplained weight loss. Age above 60 was one of the independent factors linked to a higher risk of long-term mortality rate [7]. Proton pump inhibitors, H2 receptors, cytoprotectants, demulcents, anticholinergic, antacids, and prosta-glandin analogues are examples of synthetic medications used to treat ulcers; nevertheless, these medications have a number of adverse effects. Therefore, herbal medications are thought to be superior substitutes for treating peptic ulcers [8, 9].

The plant species Ficus glomerata Roxb. (also known as Ficus racemosa) belongs to the Moraceae family. Throughout the majority of India, this evergreen, moderate- to large-sized deciduous tree is frequently grown in villages for its edible fruit. It is typically cultivated near temples and is considered to be one of the "ksirivrkas," or plants that are good for human health. Common names for it include Goolar (Gular), Indian Fig Tree, and Cluster Fig Tree. [10, 11] Because of its many therapeutic qualities, F. glomerata is prized in the Ayurvedic and Unani medical systems and is frequently used in traditional medicine to treat a wide range of illnesses. On the plant's leaves, petioles, and branches, the bug Pauropsylla depressa (Homoptera) produces gall-like excrescences. [12, 13] In Ayurveda and Indian traditional medicine, these galls—known in Sanskrit as Karkatshringi—are widely employed. In the traditional medical systems of Ayurveda, Unani, and Siddha, Karkatshringi is utilised as a treatment for liver problems, fever, cough, and asthma. [14–17] Additionally, Karkatshringi is used to cure ear infections in youngsters, slow down gum bleeding, and stop nose bleeding.[18–20] Therefore, in an effort to improve gastroprotective activity and lower the rate of recurrence in chronic ulcers, the quest for the perfect anti-ulcer medication has been expanded to the conventional medical system. This study used a hydroalcoholic extract of Ficus glomerata to test the anti-ulcer efficacy in rats utilising pyloric ligation models.

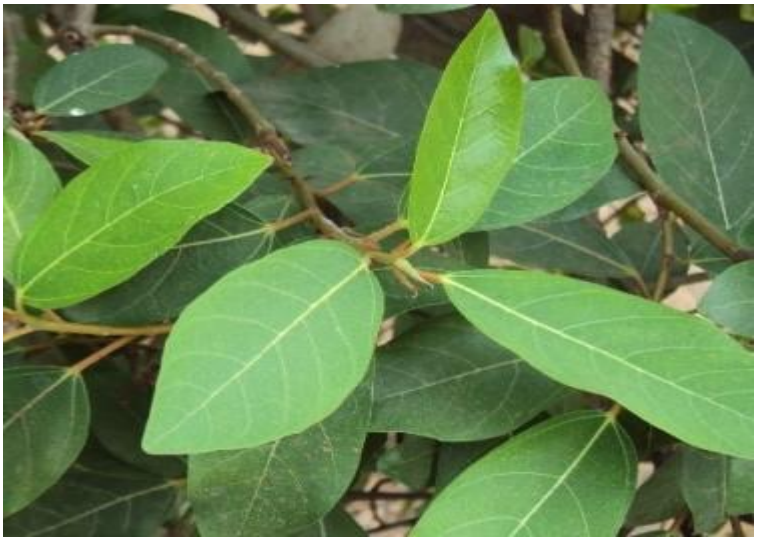

Figure 1: Ficus glomerata leaves

2. MATERIALS AND METHODS

Collection: Both distilled water and running tap water were used to wash the gathered plant leaves. The cleaned leaves were milled into a fine powder after being shade-dried for three to five days at room temperature. They were used to extract solvents after being stored in an airtight container. Using hexane, chloroform, and hydroalcoholic solvents, powdered leaves were extracted. [21]

Preparation of Hydroalcohol Extraction: After mixing about 25 g of powdered dried leaves with 100 ml of ethanol (7:3) and adding distilled water, the mixture was incubated for 72 hours at 40 oC. After passing through Whatmann no. 1 filter paper, the filtrate was gathered and utilised for the phytochemical group's initial chemical colour reactions. [22]

Preparation of Hexane and Chloroform Extraction: Using 100 ml of hexane solvent at 40 oC for 72 hours, 25 g of powdered dried leaves and 100% hexane solvent were extracted. 25 g of dry powder and 100% chloroform solvent were combined and allowed to sit at 40 oC for 72 hours to create the chloroform extract. Following air drying, the extracts were

concentrated using an evaporation technique. The refrigerator was used to store the samples. In order to analyse distinct phytochemical groups, these extracts were utilised for initial screening of different phytochemicals.[23, 24]

Preliminary Qualitative Analysis: All extracts were qualitatively examined for alkaloids, amino acids, carbohydrates, glycosides, phenolic compounds, protein, saponins, flavonoids, tannins, and terpenoids. [24, 25]

In-vivo Activity: The albino rats used in this investigation were of either sex and weighed between 150 and 200 grammes. They were purchased from the animal house. They were kept at usual temperatures (24–28 °C), fed a typical rat diet, and given water. The Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), Ministry of Environment and Forest, Government of India, provided recommendations for the care of the animals. [26]

Acute Oral Toxicity Study: The OECD 423 toxic class method guideline was used to determine the acute oral toxicity research. Considering the available data on mortality is improbable at the maximum beginning dose level, three healthy female Wistar rats were given Ficus glomerata extract orally at a dose of 2000 mg/kg in accordance with the previously described guideline. For the first four hours after the medicine was administered, and then twice a day for the next fourteen days, the animals were observed for changes in body weight, clinical signs, and mortality. [27]

Anti-ulcer Activity: The albino rats were divided into three groups, each with six animals.

- Group- I received distilled water orally (1 ml/kg, p.o) act as a control.
- Group- II received Ranitidine (10 mg/kg, p.o) act as a standard.
- Group- III received hydroalcoholic extract of Ficus glomerata (200 mg/kg, p.o).

Drugs: Gastric antacid (dosage 10 mg/kg, IP; NaOH 0.01N), Topfer's chemical agent, collodion, or 200 mg of hydroalcoholic Ficus glomerata extract are examples of anaesthetics. [28]

Surgical Procedure: The rat who was fasting for the entire night was given an anaesthetic. On the operating group, the rat has been restrained. The stomach was made visible by a 1 cm long incision made in the abdomen, directly behind the sternum. After that, a tight not was applied after the thread was passed around the pylori sphincter. Care should be used when tying the knot to ensure that no blood vessels are bound along it. [29, 30]

The sutures were used to seal the abdominal wall. Bloodstains and bleeding were removed from the skin. The wounds were covered with collodion. To give them time to recuperate, the rats were housed in a different cage. Rats were given injections of the herbal medication Ficus glomerata hydroalcoholic extract (200 mg/kg, ip) and the standard medication Ranitidine (10 mg/kg, ip) following a 30-minute pyloric ligation interval. Following a four-hour pyloric ligation procedure, both animals were killed by ether overdose. When the abdomen was opened, the esophageal end was tied to the stomach's cardiac end. The entire stomach was cut out of the animal's body, and the ulcers were scored. Studies on gastric secretion and gastric juice were conducted. [31, 32]

Estimation of Gastric Volume, Total and Free Acidity:

Collection of Gastric Juice: It is recommended that the subject abstain from all food and liquids for 12 hours before to the test. Up to the double mark on the tube, Ryle's tube, which has been greased with a small amount of paraffin, is fed to the stomach via the mouth or nose. It is not advisable to consume saliva afterwards. A 50 ml syringe is used to extract the resting juice. The contents are retained for additional analysis, and the volume is indicated. We refer to this as "zero samples." A pint of muesli is offered to the rat. The time is noted. For two and a half hours, roughly 10 millilitres of the stomach contents are transferred into test tubes numbered 1 through 10 every fifteen minutes. The stomach is fully drained at the conclusion of this time, and the volume of any leftover contents is measured. After that, the tube is carefully removed. Following centrifugation of the gastric juice, the total and free acidity of the clear supernatant were measured. [33, 34]

Acid Titration:

Free Acid: The pipette Fill a little beaker with 1 millilitre of the filtered stomach contents. After adding two to three millilitres of distilled water, add a drop of Topfer's indicator. When free HCL is present, it will turn pink. Use N/100 NaOH to titrate it until the pink hue goes away and it turns yellowish orange (pH 4.0). All free HCl is titrated at this pH. Take a reading from the burette. The amount of alkali needed for titration is equivalent to the amount of free HCl (N/10 acid) in 100 millilitres of gastric juice. [35]

Total Acid: Continue titrating with the alkali until a distinct red colour returns (pH 8.5) after adding a drop of phenolphthalein to the liquid. The burette's second reading was recorded. The entire amount of acid in one millilitre of stomach contents is represented by the difference between this reading and the original reading. [36]

Measurement of Ulcerative Index: The stomach was opened, cleaned with running water, and then placed on a flat glass plate to be examined at 10X magnification for ulcers in order to measure the ulcerative index. [37, 38] The ulcer will be scored in the manner described below:

Normal stomach……. (0)

Red colouration……. (0.5)

Spot ulcer …… (1)

Hemorrhagic streak… (1.5)

Ulcers…….. (2)

Each animal's mean ulcer sore will be represented by an ulcer index. [39] The following percentage represents the ulcer prevention.

Protective = Control mean ulcer index – Test mean ulcer index / Control mean ulcer index × 100

Determination of Acidity: [40]

Acidity = Volume of NaoH × 100 / 0.1 × mEq / LZ

Statistical Analysis: Graph pad software was used to analyse the statistical significance between the treated and control groups. The values are shown as mean ± standard error. [41]

RESULTS AND DISCUSSION

Phytochemical Analysis: Significant phytochemical analysis of Ficus glomerata hydroalcoholic, chloroform, and hexane is observed in this work. Table 1 shows the results of phytochemical screening of extracts from Ficus glomerata leaves.

Table 1: Phytochemical Screening of Ficus glomerata

Phytochemicals test	Hydroalcohol	Chloroform	Hexane
Alkaloids	+	+	+
Carbohydrate	+	+	+
Phenolic compound	+	+	+
Flavonoids	+	+	+
Protein &Amino acid	+	-	+
Glycosides	+	+	-
Gums & mucilage’s	-	-	-
Terpenoids	+	-	-
Saponins	-	+	-

(+) Positive; (-) Negative

Ficus glomerata leaf hydroalcoholic extract was found to include phenolic substance, alkaloids, flavonoids, carbohydrates, glycosides, saponins, protein, amino acids, and terpenoids. When compared to hydroalcoholic extract, chloroform and hexane extracts reveal the presence of only a few components. Ficus glomerata chloroform extract contains phenolic chemicals, alkaloids, flavonoids, glycosides, polysaccharides, and saponins. Our plant's chloroform extract lacks terpenoids, protein and amino acids, and gum and mucilage. Ficus glomerata hexane extract contained phenolic compounds, alkaloids, flavonoids, and carbohydrates. Among the cytoprotective substances whose anti-ulcerogenic effectiveness has been thoroughly established are flavonoids. It is hypothesised that these active substances could counteract in the gastrointestinal lumen and increase the secretion of mucus, bicarbonate, and prostaglandins. Therefore, the flavonoid concentration of Ficus glomerata may be responsible for its antiulcer effect.

Acute Toxicity Study: According to the acute oral toxicity research, animals did not die from Ficus glomerata up to a level of 2000 mg/kg. The experimental animals showed no signs of behavioural or physical abnormalities.

Anti-ulcer activity: Numerous natural compounds with a range of biological activities, including antiulcerogenic properties, are found in plants. In this study, we investigated the anti-ulcer properties of a hydro-alcohol extract of Ficus glomerata in a model generated by pyloric ligation, as shown in Table 2, 3, and Fig. 2.

Table 2: Effects of Hydroalcohol Extract in Ficus glomerata on Gastric Ulcer Pyloric Ligation in Rat

S. no.	Group	Volume of gastric juice	pH	Acidity	
				Free	Total
1	Control	5.42 ± 1.38	4.2 ± 1.21	117.25 ± 1.97	124 ± 0.31
2	Ranitidine 10 mg/kg p.o	4.17 ± 0.68 5	.32 ± 0.46	53 ± 2.54	64 ± 1.46
3	Hydroalcohol 200 mg/kg p.o	4.72 ± 0.75	4.65 ± 0.75	60 ± 2.66	74.25 ± 5.48

Table 3: Effects of Hydroalcohol Extract in Ficus glomerata on Gastric Ulcer Pyloric Ligation in Rat

Group	Ulcer index	% of inhibition of ulcer
Control	7.24 ± 3.23	-
Ranitidine 10 mg/kg p.o	1.35 ± 0.40	81.35%
Hydroalcohol 200 mg/kg p.o	2.34 ± 0.54	68%

Group I **Group II** **Group – III**

Fig. 2: Anti-Ulcer Activity Of Ficus glomerata Hydroalcohol Extract

Three groups of animals weighing between 150 and 200 grammes were created: Group I was the normal control, Group II was the positive control and was given ranitidine (10 mg/kg p.o.), and Group III was a sample and was given hydroalcoholic extract (200 mg/kg p.o.).The ulcer index value in hydroalcoholic extract was marginally lower than that of the standard (ranitidine) group and lower than that of the control group. Pyloric ligation causes the control group's stomach acidity and gastric juice volume to rise. The gastric acidity and gastric juice volume are moderately decreased by the hydroalcoholic extract of Ficus glomerata 200 mg/kg when compared to the standard (ranitidine), and the value is also decreased when compared to the control. Tables 2 and 3 demonstrated the hydroalcoholic extract of Ficus glomerata's strong anti-ulcer properties. Ranitidine has an ulcer-inhibiting percentage of 81.35%, while Ficus glomerata hydroalcoholic extract has an ulcer-inhibiting rate of 68%. Thus, it was nearly identical to that of a typical medication. Our findings showed a significant decrease in gastric volume, total acidity, free acidity, ulcer index, and an elevation in the pH of gastric juice, which is comparable to the antiulcer effect of B. oleracea methanol extract in the pylorus ligation model. There was a decrease in aggressive factors, primarily acid and pepsin, and an increase in mucosal resistance due to the excess stomach production of prostaglandin. One of the main pathogenic causes for the development of gastric ulcers is excessive stomach acid secretion. Phytoconstituents such as flavonoids, tannins, terpenoids, and saponins were found to be the cause of gastroprotective agents in a number of research investigations. Tannins have astringent properties that cause skin and mucosal membrane proteins to precipitate. Certain tannins have a local impact of protecting the gastric mucosa by suppressing gastric secretion and improving the mucus layer.

3. CONCLUSION

It was determined that the test formulation was safe up to 2000 mg/kg body weight. The current study's findings demonstrate that Ficus glomerata has the ability to heal ulcers. When compared to a standard medication, Ficus glomerata leaf extracts significantly reduce gastric volume, free acidity, total acidity, ulcer sore, and pH, demonstrating its anti-gastric ulcer action in the pylorus ligation model. At 200 mg/kg, the 100% hydro-alcohol extract's anti-gastric ulcer efficacy shown superior outcomes. These extracts' potential as an anti-ulcerogenic agent has also been scientifically demonstrated. This kind of research offers cost-effective health applications. More investigation is required to determine whether phytochemicals may be used to treat other terrible illnesses. To isolate, identify, characterise, and clarify the structure of these bioactive chemicals, further research is being done on these plants.

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