



Research Article

Evaluation of Fruit Extract of *Solanum Lycopersicum* for Gastroprotective Effect

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This study investigates the gastro protective potential of the methanolic extract of *Solanum lycopersicum* fruit waste against aspirin-induced gastric ulcers in mice. The extract was evaluated at doses of 250 mg/kg and 500 mg/kg and compared with a standard drug (Omeprazole, 20 mg/kg). The results demonstrated a significant reduction in ulcer index, with a dose-dependent response. Phytochemical screening revealed the presence of phenolic compounds, flavonoids, tannins, and other secondary metabolites likely responsible for the observed anti-ulcer activity. The findings suggest the potential of *Solanum lycopersicum* fruit extract as a natural therapeutic agent for gastric ulcers.

Keywords: *Solanum lycopersicum*, anti-ulcer, aspirin-induced ulcer, gastric mucosa, phytochemicals, omeprazole.

INTRODUCTION

Peptic ulcer is a prevalent and recurring gastrointestinal disorder characterized by mucosal erosions in the stomach or duodenum, primarily caused by an imbalance between aggressive factors such as hydrochloric acid, pepsin, and bile salts, and protective mechanisms including mucus secretion, bicarbonate production, prostaglandins, and mucosal blood flow. This imbalance can lead to mucosal injury and ulceration, particularly when exacerbated by contributing factors such as stress, *Helicobacter pylori* infection, lifestyle habits, and certain medications (Laine et al., 2008; Sung et al., 2009). Among the most significant drug-related causes are non-steroidal anti-inflammatory drugs (NSAIDs), such as aspirin, which exert their ulcerogenic effects by inhibiting cyclooxygenase (COX) enzymes, thereby decreasing prostaglandin synthesis. Prostaglandins play a crucial role in maintaining gastric mucosal integrity by stimulating mucus and bicarbonate secretion and enhancing mucosal blood flow. Their suppression weakens mucosal defenses, allowing for increased vulnerability to acid-induced injury. Long-term or high-dose usage of NSAIDs is especially associated

with the development of gastric lesions, leading to pain, bleeding, and potential complications such as perforation (Takeuchi et al., 2011). In response to these concerns, attention has increasingly turned to natural remedies and dietary supplements as alternative therapeutic strategies for managing gastrointestinal disorders, including peptic ulcers. Plant-based phytochemicals and antioxidants are being extensively investigated for their protective roles due to their relatively low toxicity, affordability, and broad-spectrum biological activities. These compounds may help restore the mucosal balance by neutralizing reactive oxygen species (ROS), modulating inflammatory pathways, and promoting mucosal regeneration (Fashner & Gitu, 2015). *Solanum lycopersicum*, commonly known as tomato, is one such plant that holds promise for its medicinal value. Widely consumed around the world, tomatoes are rich in health-promoting phytoconstituents, including phenolics, flavonoids, carotenoids (notably lycopene), tannins, and essential vitamins. These constituents have been linked to a wide array of pharmacological effects, such as antioxidant, anti-inflammatory, antiplatelet, and anticancer properties (Raiola et al., 2014). The antioxidant potential of

tomato constituents, particularly lycopene and flavonoids, plays a significant role in scavenging free radicals and reducing oxidative stress, a known contributor to ulcer pathogenesis (Del Valle et al., 2006; Sahin et al., 2021). Previous research has demonstrated that polyphenolic compounds, tannins, and flavonoid can offer gastroprotective effects through various mechanisms, including strengthening the gastric mucosal barrier, inhibiting gastric acid secretion, promoting mucus production, and exerting antimicrobial effects against ulcerogenic bacteria such as *Helicobacter pylori*. Given the prevalence of these bioactive compounds in tomatoes, it is plausible that tomato extracts may serve as effective agents in the prevention and management of peptic ulcers (Vuong et al., 2014) This study was undertaken to evaluate the potential anti-ulcer effects of methanolic extract derived from *Solanum lycopersicum* fruit waste in a murine model of aspirin-induced gastric ulceration. By comparing the extract's effects at two different doses with a standard anti-ulcer drug, omeprazole, we aimed to determine its efficacy in reducing ulcer index and enhancing gastric mucosal protection. The findings from this study may provide a scientific basis for the therapeutic application of tomato-based phytomedicine in managing peptic ulcer disease.

MATERIALS AND METHODS:

2.1 Collection and Authentication of Plant Material:

Fresh and ripe tomato fruits (*Solanum lycopersicum*) were carefully sourced from a local vegetable market located in Indore, Madhya Pradesh, India. To ensure the botanical identity and authenticity of the plant material, it was submitted for verification and formally authenticated by Dr. S.N. Dwivedi, a respected taxonomist from the Department of Botany at Janata Postgraduate College. This institution is affiliated with Awadhesh Pratap Singh (A.P.S.) University, situated in Rewa, Madhya Pradesh. As part of standard scientific documentation, a voucher specimen was prepared and deposited for future reference. The specimen was assigned the reference number J/Bot/SLF-033 and was officially recorded in the herbarium collection on December 5, 2022.

2.2 Preparation of Extract:

A total of 900 g of fresh tomato fruit was weighed and placed in a beaker with 400 mL of methanol. The mixture was subjected to ultrasonic-assisted extraction in an ultrasonic bath for 6 hours. The extract was subsequently filtered using multiple layers of filter paper and concentrated on a water bath maintained at 80–100°C. It was then dried under reduced pressure, resulting in a dark brown residue weighing 62.06 g, corresponding to a yield of 6.89%.



Figure1: -Ultrasonic Bath



Figure2: -Fruit Extract

2.3 Preliminary Phytochemical Screening:

The methanolic extract was subjected to standard qualitative phytochemical tests for the identification of various classes of secondary metabolites, which are known to contribute significantly to the therapeutic efficacy and pharmacological properties of medicinal plants. These bioactive constituents included alkaloids, carbohydrates, glycosides, tannins, flavonoids, resins, steroids, proteins, amino acids, fats and oils, volatile oils, and phenolic compounds.

A summary of the phytochemical tests and their results is presented in Table 1:

Table1: Qualitative Analyse is of Methanolic Extract of Solanum lycopersicum

S. No	Phyto chemical Class	Test	Result
1	Carbohydrates	Molisch's, Fehling's, Benedict's	+
2	Proteins	Biuret, Xanthoproteic	+
3	Amino Acids	Ninhydrin	+
4	Fats and Oils	Filter paper test	+
5	Steroids	Salkowski, Libermann-Burchard	+
6	Glycosides (Keller Killani)	Legal's, Modified Borntrager's	+
7	Flavonoids	Shinoda test	+
8	Alkaloids	Mayer's, Dragendorff's, Wagner's	+
9	Phenolic Compounds	FeCl ₃ test, Lead acetate	+
10	Volatile Oil	Sudan red	-
11	Tannins	Vanillin-HCl, Gelatintest	+
12	Resins	FeCl ₃ , Turbidity test	+

2.4 Experimental Design and Animals:

Healthy adult albino mice of either sex, weighing between 18 to 20 grams, were selected for the study. Prior to the commencement of the experimental procedures, all animals were housed under standard laboratory conditions to ensure their well-being and acclimatization. The acclimatization period lasted for 10 days, during which the mice were maintained at a controlled room temperature of 25°C with a 12- hour light and 12-hour dark cycle to mimic natural circadian rhythms.

2.5 Grouping and Treatment:

The animals were divided into five groups(n=6):

- Group1(Control): Normal saline (10 ml/kg)
- Group2(Untreated): Aspirin(350mg/kg)
- Group3(Standard): Omeprazole (20 mg/kg)
- Group4(Test): Extract (250mg/kg)
- Group5(Test): Extract (500mg/kg)

All treatments were administered orally once daily for 7 days.

2.6 Ulcer Induction and Sample Collection:

Ulcers were induced using aspirin (350 mg/kg) for seven consecutive days. On the last day, animals were sacrificed by cervical dislocation. Stomachs were excised, opened along the greater curvature, and gastric contents collected for biochemical analysis. Tissues were preserved in 0.1 M phosphate buffer (pH 7.4) for histological assessment.



Figure3: -Inducing of Ulcer

2.7 Ulcer Index and Inhibition: Ulcer areas were quantified under a dissecting microscope using a 0-5 scale. The ulcer index (UI) and % ulcer inhibition were calculated:

- Ulcer Index (UI)= (Ulcerated Area/Total Stomach Area) ×100
- %Ulcer Inhibition= [(UI control– UItest) / UI control] ×100

2.8 Ulcer Images:



Figure4: -Control group (Normal saline10ml/kg)



Figure 5: -Untreated group (Aspirin350mg/kg)



Figure 7: -Solanum extract(250mg/kg)



Figure 6: -Standard group (Omeprazole20mg/kg)



Figure 8: -Solanum extract(500mg/kg)

RESULTS:

Phytochemical screening showed the presence of carbohydrates, alkaloids, phenolic compounds, steroids, flavonoids, tannins, and glycosides. Table 2 summarizes the effects of treatments:

Table2: Effect of Solanum Extraction Ulcer Index

S. No.	Group	Ulcer Index (UI)
1.	Control	8.36±0.35
2.	Omeprazole(20mg/kg)	2.21±0.36
3.	Extract (250 mg/kg)	4.55±0.39
4.	Extract (500mg/kg)	3.28±0.38

Statistical analysis showed significant ($p < 0.05$) to highly significant ($p < 0.01$) reduction in ulcer index with both extract doses, especially 500 mg/kg.

DISCUSSION:

The study confirms that *Solanum lycopersicum* extract exhibits significant gastroprotective activity in aspirin-induced gastric ulcer in mice. The anti-ulcer effect is likely due to its phenolic, flavonoid, and tannin content. These phytochemicals exhibit antioxidant, anti-inflammatory, and cytoprotective

effects. Prostaglandins play a protective role in gastric mucosa by stimulating mucus and bicarbonate secretion; aspirin inhibits prostaglandin synthesis, leading to mucosal damage. Polyphenols, flavonoids, and tannins are known to stabilize gastric mucus, scavenge reactive oxygen species, and reduce inflammation. Tannins form a protective layer on the ulcer site. Flavonoids enhance mucosal defense, inhibit acid secretion, and possess antimicrobial properties. Omeprazole, a proton pump inhibitor, reduced ulcer index significantly, corroborating the model.

CONCLUSION:

Solanum lycopersicum fruit extract demonstrates dose-dependent anti-ulcer activity. Its efficacy is attributed to antioxidant and cytoprotective phytoconstituents, especially polyphenols and flavonoids. This study suggests the potential of tomato fruit extract as a natural remedy for ulcer management. Further investigations are needed to isolate the active compounds and elucidate their precise mechanisms of action.

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