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# Antiulcer activity of methanolic extract of pulp of *Psidium guajava* in Aspirin-induced gastric ulcer model in mice

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**Abstract**
It is a chronic gastrointestinal ailment that is caused by an imbalance between aggressive factors such as gastric acid, pepsin, and non-steroidal anti-inflammatory medicines (NSAIDs), on the one hand, and the defensive mechanisms of the gastric mucosa, on the other. Peptic ulcer disease (PUD) is a specific type of ulcer that occurs in the stomach. Because of its analgesic, antipyretic, and anti-inflammatory effects, aspirin is one of the most commonly prescribed nonsteroidal anti-inflammatory drugs (NSAIDs). However, chronic use of aspirin is strongly related with the development of stomach ulcers. There is a reduction in prostaglandin synthesis, impaired mucus secretion, and limited mucosal blood flow as a consequence of aspirin's ability to promote mucosal injury. This is mostly accomplished through the inhibition of cyclooxygenase enzymes. Although there are a number of synthetic antiulcer medicines available for the management of peptic ulcer disease, such as proton pump inhibitors and H2-receptor antagonists, the use of these drugs for an extended period of time is frequently linked with unpleasant effects, drug interactions, and relapses of ulceration. Because of this, there is a growing interest in investigating herbal medicines as potential alternatives that are both safer and more cost-effective. *Psidium guajava*, more often referred to as guava, is a member of the Myrtaceae family and has been utilized for centuries in the treatment of individuals suffering from gastrointestinal issues. There is a large variety of bioactive phytochemicals found in the pulp of the fruit. These phytochemicals include flavonoids, tannins, and phenolic compounds, all of which have the ability to protect cells from damage and to act as antioxidants. Through the use of an aspirin-induced gastric ulcer model in mice, the current investigation was meant to assess the antiulcer activity of a methanolic extract of the pulp of *Psidium guajava*. Swiss albino mice were separated into five different experimental groups: a normal control group, an ulcer control group, a standard drug-treated group (omeprazole), a test low-dose group, and a test high-dose group. Each of these groups was given a different amount of the drug. A period of fasting was followed by the oral dose of aspirin, which resulted in the development of gastric ulcers. Evaluations were performed on a number of criteria, including ulcer index, percentage inhibition, gastric pH, and total acidity measurements. The statistical analysis was performed by first employing a one-way analysis of variance, and then proceeding to apply Dunnett's test. When compared to the group that served as the control for ulcers, the methanolic extract of *Psidium guajava* pulp resulted in a significant and dose-dependent reduction in ulcer index, as well as an increase in gastric pH and a decrease in total gastric acidity. In terms of its gastroprotective properties, the extract comparable to that of the medication omeprazole, which is the conventional treatment. When it comes to the treatment of peptic ulcer illness, the findings of this study offer scientific evidence that lends support to the traditional usage of pulp from *Psidium guajava*.

**Keywords:** *Psidium guajava*, antiulcer activity, aspirin, gastric ulcer, nsaids, Swiss albino mice

## Introduction

In spite of the fact that it is still one of the most prevalent gastrointestinal ailments, peptic ulcer disease continues to impact a significant number of people all over the world. Peptic ulcer disease is characterized by a localized loss of the mucosa of the stomach or duodenum. This loss is caused by an imbalance between aggressive factors, such as hydrochloric acid, pepsin, bile salts, and non-steroidal anti-inflammatory drugs, and defensive mechanisms, such as mucus secretion, bicarbonate production, prostaglandins, and mucosal blood flow through the mucosal region. (Rees & Shorrock, 1988) [4]

The disease is responsible for a significant incidence of morbidity and places a significant strain on healthcare systems all over the world. Among the most significant etiological factors that are responsible for stomach ulceration, non-steroidal anti-inflammatory medicines are among the most important. A nonsteroidal anti-inflammatory drug (NSAID) that is commonly used, aspirin, exerts its therapeutic benefits by blocking cyclooxygenase enzymes, which in turn reduces the production of prostaglandins. It is through the stimulation of mucus and bicarbonate production, the enhancement of mucosal blood flow, and the promotion of epithelial regeneration that prostaglandins play a significant role in the preservation of the integrity of the gastric mucosa (Fiorucci, *et al* 2001) [1]. There is a correlation between the inhibition of prostaglandins by aspirin and an increased sensitivity of the stomach mucosa to experience harm caused by acid. In spite of the progress that has been made in pharmacotherapy, conventional antiulcer medications, such as proton pump inhibitors, H2-receptor antagonists, and antacids, are associated with a number of drawbacks. These drawbacks include adverse drug reactions, tolerance, nutrient malabsorption, and the recurrence of ulcers after the treatment has been discontinued. Due to these limitations, researchers have begun to investigate the possibility of using natural products and medicinal plants as alternative methods of treating patients. (Tomlinson,1972) [6].

The evergreen plant known as *Psidium guajava* can be found in a wide range of tropical and subtropical parts of the world. In traditional medicine, several portions of the plant have been utilized to treat gastrointestinal conditions such as diarrhea, dysentery, inflammation, and other related

conditions. Flavonoids, tannins, phenolic acids, and antioxidants are known to exhibit gastroprotective, anti-inflammatory, and free radical scavenging activities. The fruit pulp is abundant in these phytochemicals, and it is also rich in antioxidants. On the other hand, there is a constrained amount of scientific evidence that supports the pulp of *Psidium guajava*'s potential to treat ulcers. In light of this, the current study was carried out with the purpose of determining whether or not a methanolic extract of *Psidium guajava* pulp possesses antiulcer properties by employing a well-established method (Kareem *et al* 2024) [2].

## Materials and Methods

### Plant Material and Extraction

A certified botanist was responsible for verifying the authenticity of the fresh fruits of *Psidium guajava* that were purchased at the neighbourhood market. After the fruits were washed thoroughly with distilled water, the pulp was manually separated from the seeds using the process of separation. After being shade-dried at room temperature, the pulp was ground into a powder using a mechanical grinder on the following step. In accordance with the conventional maceration procedures, the powdered material was put through a methanolic extraction process. For the purpose of conducting additional experiments, the extract was filtered and concentrated under reduced pressure in order to obtain a semi-solid mass. This mass was then placed in a container that was airtight. The research was conducted using Swiss albino mice of either sex and weighing between 20 and 30 grams. These mice were employed as experimental animals. Standard laboratory conditions were utilized to house the animals. These parameters included a controlled temperature of 25 ± 2 degrees Celsius, a relative humidity of 55 ± 5 percent, and a 12-hour light and dark cycle. In addition to water on demand, they were given a pellet diet that was considered to be typical. In compliance with the rules established by the CPCSEA, each and every experimental procedure was carried out after receiving authorization from the Institutional Animal Ethics Committee of SVCP, Indore

### Study Design

The animals were randomly separated into five groups, each consisting of six animals. This is the experimental design. The sole vehicle that was given to Group I was the one that functioned as the regular control. Aspirin was administered to Group II, which acted as the control group for ulcers and was given to produce gastrointestinal ulcers. The standard antiulcer medication was omeprazole, which was administered to Group III. Group IV and Group V were given a modest dose of methanolic extract of *Psidium guajava* pulp, whereas Group V received a high dose of the extract.

Induction of Gastric Ulcer: Prior to the experiment, the animals were allowed to drink water freely while they were fasting for a period of twenty-four hours. The oral administration of aspirin at a dose found to be ulcerogenic resulted in the development of gastric ulcers. Following the conclusion of the experimental period, the animals were slain in a humane manner, and their stomachs were removed, an opening was made along the larger curvature, and gastric lesions were analysed (Tarique *et al*., 2016) [5].

### The Evaluation of the Parameters of Ulcers

The ulcer index was calculated in order to perform an evaluation of the severity of the gastrointestinal lesions. Following the collection of gastric juice, normal titration methods were utilized in order to ascertain the pH and overall acidity of the stomach. In order to determine whether or not the extract demonstrated gastroprotective properties, the percentage of ulceration that was prevented was computed.

Within the realm of statistical analysis, every single experimental data was expressed as the mean plus or minus the standard error of the mean (SEM). After conducting the statistical analysis, Dunnett's multiple comparison test was carried out. The analysis of variance (ANOVA) was performed in a one-way fashion. At a significance level of $p < 0.05$, differences were deemed to be statistically significant. (Mekonnen *et al*., 2020) [3]

## Results

The administration of aspirin resulted in severe gastric ulceration in the group that served as the control for the ulcer. This ulceration was characterized by substantial mucosal destruction, a high ulcer index, lowered gastric pH, and increased total acid production. A significant and dose-dependent decrease in the ulcer index was observed following pretreatment with a methanolic extract of *Psidium guajava* pulp. This was accomplished in comparison to the group that served as the control for the ulcer. Both low and high dosages of the extract resulted in a considerable increase in the pH of the stomach and a reduction in the total acidity of the stomach. This suggests that the extract suppressed the release of gastric acid and enhanced the mucosal defense mechanisms. Given that the high-dose extract displayed gastroprotective effects that were comparable to those of the conventional medication omeprazole, it is possible that it possesses powerful antiulcer action.

## Discussion

The findings of this research make it abundantly evident that a methanolic extract of *Psidium guajava* pulp had potent antiulcer properties against stomach ulcers that were brought on by aspirin in mice. The primary mechanism by which aspirin causes damage to the gastric mucosa is that it inhibits the formation of prostaglandins. This, in turn, results in a reduction in the amount of mucus that is secreted, a reduction in the amount of blood that flows to the mucosa, and an increase in the amount of acid that is secreted.

It is possible that the extract improves the systems that are responsible for protecting the stomach mucosa, as evidenced by the decrease in ulcer index and total acidity as well as the increase in gastric pH. It is possible that the presence of flavonoids and phenolic chemicals, which are known to possess antioxidant, anti-inflammatory, and cytoprotective qualities, is responsible for the gastroprotective action that the pulp extract of *Psidium guajava* possesses. There is evidence that flavonoids can protect the gastric mucosa from oxidative stress by stimulating prostaglandin synthesis, inhibiting histamine release, and scavenging free radicals. Flavonoids have been found to have these properties. Tannins have the potential to create a protective coating on the surface of the mucosa, which would make it resistant to the effects of chemical damage. The extract's

In mice with an aspirin-induced gastric ulcer model, the pulp of *Psidium guajava* was extracted with methanol, and the results showed that the extract had considerable antiulcer efficacy that was dose-dependent. In terms of its gastroprotective properties, the extract was found to be comparable to those of the conventional medication omeprazole. In addition to providing scientific validity for the traditional use of *Psidium guajava* pulp in the treatment of gastrointestinal diseases, the findings of this study also show that it may have the potential to act as a natural antiulcer agent.

**Conflict of Interest**

The authors declare that there is no conflict of interest regarding the publication of this research article.

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