WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

ANTIULCER SYRUP FOR DUODENAL ULCER FROM SEEDS OF MANILA TAMARIND

Ankita A. Desai*, Prof. Ashwini S. Dhole[2]

[1] Student-Department of Pharmacognocy and Phytochemistry, Delonix Society's Baramati College of Pharmacy, Barhanpur Baramati, Maharashtra 413102

[2] Professor-Department of Pharmacognocy and Phytochemistry, Delonix Society's Baramati College of Pharmacy, Barhanpur Baramati, Maharashtra 413102

ABSTRACTS:

Recent research indicates that the Manila tamarind (Pithecellobium dulce), which has long been used in traditional medicine, may be useful in treating duodenal disorders. With an emphasis on their therapeutic qualities and advantages, this paper explores the possible applications of syrup made from P. dulce seeds. Flavonoids, saponins, and tannins-bioactive compounds with anti-inflammatory, antioxidant, and gastrointestinal-protective qualities-are abundant in the seeds. According to clinical research, this treatment may reduce stomach acid, enhance mucosal defence, and encourage healing. Free radical neutralisation, H. pylori activity suppression, and mucus secretion stimulation are examples of potential processes. Better patient compliance, increased bioavailability, and simplicity of administration are the benefits of using syrup formulations. Nevertheless, there is currently little proof, and extensive clinical studies are not enough to validate the medication's efficacy and safety. To enhance the extraction procedure, guarantee safety, and track long-term results, more research is required. The finest outcomes may be obtained from research on P. tulsi seeds, particularly in regions where the use of medications is restricted or where they can aid in the treatment of ulcers. To fully realise its therapeutic potential, it is still crucial to connect ancient wisdom with contemporary science.

Key words: Manila tamarind, duodenal diseases, flavonoids, saponins, and tannins, bioavailability.

INTRODUCTION:

Peptic ulcer disease (PUD) includes duodenal ulcers, which are caused by erosion of the stomach or duodenum's mucosal lining. Ulceration results from this erosion, which goes beyond the mucosal layer and impacts the immune system. Preepithelial, epithelial, and subepithelial components make up the protective layer on the intestine and duodenal surfaces. When these defences are successful, ulcers develop. [1]

Indigestion is the primary symptom of duodenal ulcers; the degree of symptoms and the disease stage determine how the ulcers are treated. In individuals with epigastric pain, the diagnosis often entails distinguishing between duodenal and gastric ulcers, especially in those with a history of nonsteroidal anti-inflammatory medication usage or Helicobacter pylori (H. pylori) aetiology. Testing for H. pylori is crucial because, although less frequent, infections can still result in duodenal ulcers. Another significant reason is the overuse of nonsteroidal anti-inflammatory medicines; less frequent causes include vascular insufficiency, cancer, Zollinger-Ellison syndrome, and damage from chemotherapy. [2] The erosive action of stomach acid on the injured duodenal lining is linked to the pathophysiology of duodenal ulcers. Further harm is caused by the inflammatory response's increased generation of acid. By blocking prostaglandin production through cyclooxygenases (COX), primarily COX-1 and COX-2, NSAIDs worsen ulceration. Intestinal injury results from the loss of prostaglandins, which are crucial for preserving mucosal integrity. But the most frequent outcome is a repeat of mucosal injury, which leaves the tissue vulnerable to ulceration.[3]

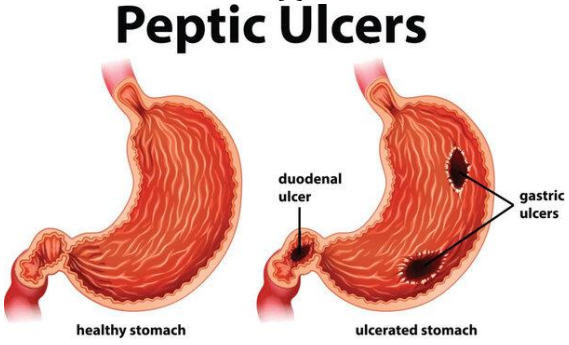

Figure 1 Duodenal ulcer

The tropical leguminous plant known as Manila tamarind (Pithecellobium dulce), often called Camachile or Madras thorn, is indigenous to Central and South America. Asia, Africa, and the Caribbean are just a few of the places where it has expanded and naturalised throughout time. The plant, which belongs to the Fabaceae family, is distinguished by its vivid green pods that contain a delicious pulp that is both sweet and acidic and that encases the seeds. It has long been prized for its ecological advantages, including its capacity to fix nitrogen from the atmosphere, and as a decorative tree that provides shade. But in addition to its environmental function, P. dulce is well known in traditional medicine for its vast range of medicinal uses.4]

Various elements of P. dulce, including as its leaves, bark, fruit, and seeds, have been used in traditional medicine throughout history. The bark is frequently used as an astringent to treat conditions including throat infections and diarrhoea. The leaves' anti-inflammatory, antibacterial, and wound-healing properties have led to their use. Because of its moderate laxative properties, the fruit pulp is used to treat digestive problems like constipation and diarrhoea. The seeds have also become well-known for their ability to prevent gastrointestinal problems, especially peptic ulcers, and for their potential to treat them. [5] P. dulce's complex phytochemical makeup, which contains a variety of bioactive substances such flavonoids, tannins, saponins, alkaloids, and phenolic acids, is what gives it its medicinal potential.[6]

The plant's function in controlling oxidative stress and inflammation is supported by flavonoids, including as quercetin and catechin, which have anti-inflammatory and antioxidant properties. While saponins, which are especially abundant in the seeds, provide mucosal protection and aid in reducing inflammation two important aspects in treating gastrointestinal disorders tannins are recognised for their antibacterial and astringent qualities. Significant antioxidant activity is also shown by the polyphenolic content in the leaves and bark, which helps prevent oxidative damage associated with chronic illnesses. [7]

Numerous traditional usage of P. dulce have been supported by recent scientific research, which has also shown new health advantages. Studies demonstrate its potential as a natural medicinal agent source by highlighting its antibacterial, hepatoprotective, antidiabetic, and anticancer qualities.

Particularly, the seeds are gaining attention for their potential antiulcer properties; research indicates that they may reduce the development of protective mucus, decrease the emission of stomach acid, and fight Helicobacter pylori, a major cause of peptic ulcers. Despite its established traditional uses and encouraging first results, P. dulce is still not widely studied in contemporary pharmaceutical settings. Standardisation of extraction methods, identification of the main active ingredients, and clarification of the processes behind its pharmacological effects are all necessary. To confirm its clinical usefulness, further research on its pharmacokinetics, safety, and possible toxicity is also necessary.[8]

PHYTOCHEMICAL COMPOSITION OF MANILA TAMARIND SEEDS

The tropical plant known as Manila tamarind (Pithecellobium dulce) has garnered a lot of interest because of the potential health benefits of its seeds. These seeds contain a lot of bioactive substances that can help cure them. P. dulce seeds have long been used in traditional medicine to treat a wide range of illnesses, including inflammatory and oxidative stress-related conditions as well as gastrointestinal issues. Their varied actions are supported by the presence of a variety of phytochemicals, including as flavonoids, saponins, tannins, alkaloids, phenolic acids, and other bioactive metabolites. To discover P. dulce seeds' therapeutic potential and create novel therapeutic agents, a more thorough comprehension of their phytochemical profile is required.[9]

Flavonoids

The primary class of phytochemicals included in Dulce seeds are flavonoids, which are well-known for their potent anti-inflammatory and antioxidant qualities. It has been shown that some flavonoids, such quercetin and catechins, are essential for scavenging free radicals and lowering oxidative stress. These substances shield DNA, proteins, and lipids from the harm that reactive oxygen species (ROS) may do to cell structures. Flavonoids' antioxidant properties aid in halting the progression of oxidative stress-related illnesses including diabetes, heart disease, and cancer. Furthermore, flavonoids have anti-inflammatory properties by controlling cytokines and blocking inflammatory enzymes including lipoxygenase and cyclooxygenase.[10]

Saponins

Another significant class of bioactive substances are saponins, which are amphipathic glycosides that are widely present in dulce seeds. These compounds have strong gastroprotective, antimicrobial, and anti-inflammatory effects. Saponins lessen the effects of gastric acid, promote the development of mucus in the intestines, and prevent duodenal and stomach ulcers. Their capacity to suppress harmful bacteria like Helicobacter pylori, the primary cause of peptic illness, allows them to have this gastroprotective effect. Additionally, saponins enhance the host's immune system and have an immunomodulatory impact. Their capacity to control cholesterol levels has also been demonstrated in studies, which makes them advantageous for cardiovascular health. [11]

Tannins

Dulce seeds contain astringent polyphenolic chemicals called tannins, which add to their medicinal qualities. Because of their antibacterial and anti-inflammatory qualities, they successfully stop harmful bacteria from growing and lessen intestinal irritation. Tannins' capacity to bind proteins and polysaccharides strengthens their function in preventing injury to the intestinal mucosa and accelerating tissue repair. Tannins are important in the treatment of stomach ulcers because they are very powerful against Helicobacter pylori, a condition linked to stomach ulcers.[12]

Alkaloids

Although they are found in lower amounts, alkaloids are significant bioactive substances found in P. dulce seeds. Numerous pharmacological properties, such as antibacterial, analgesic, and anti-inflammatory effects, are displayed by these nitrogen-containing molecules. Alkaloids are useful in traditional medicine because they have long been used to treat infections and reduce pain. Their significance in contemporary pharmacological research is highlighted by their capacity to alter physiological processes.[13]

Mechanism of action

The seeds of the Manila tamarind (Pithecellobium dulce) have long been recognised for their therapeutic qualities, particularly in the management of gastrointestinal conditions including stomach ulcers. Bioactive substances that are linked to their medicinal properties, including flavonoids, saponins, tannins, alkaloids, and phenolic acids, are abundant in these seeds. When severe issues like Helicobacter pylori and an imbalance in stomach acid impact the gastric mucosal barrier, peptic ulcers develop. Protective elements like mucus and bicarbonate production necessitate further treatment techniques.[14] Through mucosal protection, acid neutralisation, antioxidant activity, antibacterial qualities, and anti-inflammatory medications, the bioactive compounds in P. dulce seeds provide a variety of modes of action to aid in the prevention and treatment of illnesses.

Compounds in the significant product class P. The anti-inflammatory and antioxidant qualities of dulce seeds are well established. These substances, like quercetin and catechins, are crucial for the synthesis of free radicals (ROS), which harm the intestinal mucosa oxidatively and contribute to the pathophysiology of illnesses.[15]

By lowering oxidative stress and encouraging the remodelling of injured cells, flavonoids' antioxidant action not only stops more harm but also aids in tissue healing. Furthermore, flavonoids have anti-inflammatory qualities because they prevent the synthesis of pro-inflammatory cytokines and inflammatory-processing enzymes (such cyclooxygenase), which exacerbate ulcer development and slow healing. Saponins, another significant class of compounds found in P. dulce seeds, aid in the prevention and treatment of illnesses. [16] By stimulating the production of protective mucus and establishing an immune system, these glycoside chemicals shield the gastric mucosa from harm caused by pepsin and stomach acid.

Additionally, saponins have antibacterial qualities, especially against Helicobacter pylori, a bacterium that interferes with stomach growth. By lowering the microbial burden in the stomach and accelerating the healing of pre-existing illnesses, saponins help prevent infections. They are crucial to the course of treatment. Their astringent qualities aid in tissue contraction and tightening, which lessens mucosal injury and encourages tissue healing. [17]

Additionally, tannins enhance the mucosal barrier and stop additional stomach acid damage by forming compounds with proteins and polysaccharides. Tannins' function in the prevention and treatment of stomach cancer is further supported by evidence that they have antibacterial qualities, namely against Helicobacter pylori. The seeds of P. dulce possess anti-inflammatory and antioxidant qualities. These substances stimulate the remodelling of the stomach mucosa, counteract free radicals, and shield cell structures from oxidative damage. Additionally, they promote tissue repair, inhibit the development of ulcers, and fortify mucosal defence systems. When combined, these substances offer a potent barrier against the causes of stomach development and aid in the healing process. [18]

Mechanism of Action in Ulcer Management

Millions of individuals worldwide suffer from peptic illness, a severe medical condition that is typically linked to a number of conditions, including increased stomach acid production, Helicobacter pylori infection, low intestinal weight, and weakened immunity. Treatment of ulcers is typically connected to the result, such as lowering stomach acidity and neutralizing H. pylori infection. Even if they are good at managing symptoms, traditional therapies like proton pump inhibitors (PPIs) and antibiotics can have risks and adverse effects. By inhibiting bacteria like Helicobacter pylori germs and providing protection and support for therapy, natural herbs like Pithecellobium dulce (Manila tamarind) seeds have garnered interest for their potential to prevent and repair ulcers.[19]

Pylori Helicobacter. Flavonoids, saponins, tannins, phenolic acids, and alkaloids are among the bioactive substances found in P. dulce seeds. These chemicals are crucial for enhancing mucosal protection, encouraging epithelial repair, and offering antibacterial qualities, all of which enhance the plant's overall health. Mucus secretion, bicarbonate synthesis, and protective agents like stomach acid and pepsin must all be in balance for the digestive system to function properly. By promoting the synthesis of mucus defences, which provide a physical barrier against injury from stomach acid, the medication found in P. dulce seeds strengthens mucosal defences. By encouraging the creation of protective mucus and halting the erosion of the stomach lining, saponins in particular lower the risk of mucosal injury. [20]

Furthermore, flavonoids with antioxidant qualities, including quercetin and catechins, help prevent reactive oxygen species (ROS), which are linked to intestinal damage and the development of illness. Flavonoids promote mucosal integrity by encouraging the development of damaged tissues and protect epithelial cells by lowering oxidative stress. Dulce seeds have a significant function. Peptic ulcers can be treated by stimulating epithelial healing, which is aided by the chemicals in dulce seeds, which encourage collagen formation and cell regeneration. Flavonoids help the gut lining repair by lowering oxidative damage and inflammation. [21] Tannins are well-known for their astringent qualities, which aid in contracting and tightening tissues. They also aid in wound healing by minimising mucosal damage and promoting tissue recovery.

These substances support the mucosal barrier, aid in tissue regeneration, and guard against infection in the future. The primary microorganisms that contribute to the development of illnesses are bacteria. It has been demonstrated that saponins and tannins work well to stop Helicobacter pylori from

growing, which lowers the microbial burden in the stomach and aids in the treatment of diseases brought on by these bacteria. [22] These substances offer a successful treatment for stomach issues by removing microbial and submucosal damage.Dulce seed components offer a variety of benefits. Although antacids and PPIs are good at regulating acid levels, they don't treat microbial infections or encourage tissue healing directly.

On the other hand, the active ingredients in Dulce seeds not only preserve mucous membranes and counteract oxidative stress, but they also suppress harmful microorganisms, encourage epithelial regeneration, and offer a host of other advantages to medical assistants. [23]

FORMULATION OF THE ANTIULCER SYRUP FROM PITHECELLOBIUM DULCE (MANILA TAMARIND) SEEDS

One of the most prevalent gastrointestinal conditions, peptic ulcers impact millions of individuals globally. Unbalances in stomach acid output and mucosal defences create these disorders, which, if addressed, can lead to pain and major issues. Antibiotics and proton pump inhibitors (PPIs) are examples of conventional therapies that try to stabilise the gastrointestinal system, lower stomach acid, or treat microbial illnesses like Helicobacter pylori. Nevertheless, there may be long-term hazards and adverse consequences from these therapies. Other natural treatments for peptic ulcers are thus being considered. With their abundance of bioactive substances such flavonoids, saponins, tannins, phenolic acids, and alkaloids, pithecellobium dulce (Manilla tamarind) seeds have tremendous promise for both ulcer prevention and therapy. This This chapter discusses the anti-inflammatory qualities of P. dulce seed extract and outlines the active components, administration instructions, dietary advice, and production method. [24]

1. Preparation of Pithecellobium dulce Seed Extracts [25]

Extracting the bioactive components from P. dulce seeds is a crucial initial step in making the seeds useful against illnesses. The collection and preparation of the seeds as well as the use of solvents that efficiently extract the active ingredients are the first steps in the extraction process. In treating stomach issues, the thorough procedure listed below guarantees that the finished product is safe, effective, and efficient. Gathering and Readying Seeds

The seeds of Pithecellobium dulce must be extracted from mature, healthy fruits. The seeds must be properly cleaned after harvesting in order to get rid of any dust, debris, or other materials that can degrade the extract's quality. The seeds are dried to eliminate moisture after washing. To maintain the effectiveness of the bioactive substance, this may be accomplished by either putting them in a cool, well-ventilated room or by utilising a low-temperature oven set to 40–50°C. Procedure for extraction The seeds are often pulverised into a fine powder after drying. The extraction procedure is based on this powder. The active chemicals are extracted from the powder using a variety of solvents; ethanol is typically selected due to its capacity to remove flavonoids, saponins, alkaloids, and other significant compounds. The procedure for extraction is as follows:

Maceration:

Combine the ground seeds with ethanol or other appropriate solvents (such water or methanol) and let them sit for 48 to 72 hours. This enables all of the bioactive substances in the seed material to be dissolved by the solvent. The majority of the active ingredients are present in the extract that was produced at this point. This can be accomplished with a field evaporator or by heating the solvent to evaporate. Concentrated liquid extract is the major component in anti-ulcer syrup. To guarantee uniformity in syrup strength and medicinal benefits, standardisation is crucial. Mixing Additional Ingredients

To improve the syrup's flavour, stability, and general therapeutic qualities, more components will be added to the mix. Typical additions consist of:

Honey or Stevia

These natural sweeteners make the juice more pleasant, especially for kids or people with sensitive palates, by reducing the bitterness of the seed extract. This component contributes to the liquid's stability, smoothness, and shelf life. The stomach can handle it more easily because of the acidity.

2. Concentration of Active Ingredients in the Syrup

To guarantee the syrup's effectiveness while lowering the possibility of adverse effects, the quantity of Pseudomonas dulcei seed extract in the finished product is crucial. The optimal extract to speed up healing and shield the stomach mucosa, according to studies, is between 10 and 25 percent. It successfully offers therapeutic advantages. In syrup formulations, however, a concentration of 15–25% is often used to provide the required consistency and hardness. Enough bioactive compounds, such as flavonoids, saponins, and tannins, must be present in order to enhance mucosal protection, lower stomach acidity, and encourage healing. [26]

3. Dosage and administration

The age of the patient, the severity of the illness, and the patient's reaction to therapy all influence the required dosage of antibiotics. Based on studies on traditional usage and related phytotherapeutics, the following techniques can be created. Adults

Adults should take 10-15 mL of P. dulce anti-ulcer syrup two to three times a day. To preserve the stomach lining and make sure the bacteria are at their best to aid in its healing, it is advised to consume the juice after eating. The dosage can be changed based on how well the medication works and how bad the pain is Three times. Health of Children should take less liquids and modify their medicine based on their body weight. Children between the ages of 2 and 5 should take 2.5 to 5 millilitres of syrup two to three times a day, while children between the ages of 6 and 12 should take 5 to 10 millilitres. This fruit juice should be drunk after meals to enhance its healing benefits on the stomach. Children (2-5 years): 2.5-5 ml, taken 2-3 times a

day. Length of Use the patient's reaction and the amount of stomach ache determine how long the syrup should be used. Usually, 4-6 weeks of therapy are advised. Longer therapy under a doctor's supervision could be helpful if the wound is more serious or persists longer. [27]

4. Additional consideration

Monitoring: Patients should be routinely checked for any negative effects, particularly if they are consuming large amounts of fluids. Even though P. dulce is usually regarded as safe, it is crucial to monitor in order to identify any allergic responses or stomach trouble. As ulcers emerge, it is advised to stay away from spicy meals, coffee, and alcohol and to switch to basic, easily digested foods. [28]

5. Potential side-effects

Even though pithecellobium dulce seeds are usually regarded as safe to eat, some people may have minor adverse effects, particularly if they use the syrup for an extended period of time. Mild nausea, diarrhoea, or upset stomach are common side symptoms that normally go away when the medicine is changed. Rarely, people may have allergic reactions that cause symptoms including hives, shortness of breath, or itching. Patients should begin with a lower dose and then raise it as tolerated to lessen the chance of adverse effects. Reduce the dosage or stop taking the syrup if adverse symptoms continue, and get medical help right away. [29]

PRECLINICAL AND CLINICAL EVIDENCE FOR PITHECELLOBIUM DULCE IN ULCER MANAGEMENT

Because of its therapeutic potential, safety, and effectiveness, Pithecellobium dulce, sometimes referred to as Manila tamarind, has gained interest for its usage in the treatment of peptic ulcers. Peptic illness is a worldwide health issue that is typified by mucosal injury and is typically brought on by stress, stomach acid, or Helicobacter pylori. The cytoprotective, anti-inflammatory, antioxidant, and antibacterial properties of Pseudomonas dulceae seed extract against Helicobacter pylori mechanisms that regulate ulcers are examined in this study along with the increasing preclinical and clinical data supporting these claims. Here, we examine in detail the findings from clinical trials on humans, animal testing, and comparisons with synthetic antibiotics. [30]

1. Preclinical Evidence: Insights from Animal Studies

Animal models are important for understanding the pharmacological effects of natural extracts. In studies conducted on P. dulce, various bacterial test methods were used to evaluate its potential in disease control. Experimental model used

Ethanol-Induced Gastric Ulcer

The ethanol-induced model is frequently used to simulate stomach mucosal injury and oxidative stress. The significance of antioxidants in the immune system is demonstrated by this model. leads to the development of ulcers. The ulcers caused by nonsteroidal anti-inflammatory drugs that are often observed in clinical practice are described by this model. kind of disease. Research on H. pylori strains in animals has shed light on H. pylori dulcei's antimicrobial qualities. Results of Preclinical Research. [31]

Gastric Mucosal Protection

In the ethanol-induced model, P. dulce seed extract demonstrated a drop in the index. Because mucus secretion has increased and stomach acid output has decreased, intestinal mucosal protection has improved. Glutathione (GSH) and superoxide dismutase (SOD) levels are elevated in P. dulce extract, indicating significant antioxidant activity. These antioxidants lessen oxidative damage, guard against free radicals, and lessen stomach bloating. These extracts have potent anti-inflammatory qualities and prevent the production of pro-inflammatory cytokines including tumour necrosis factor alpha (TNF-α) and interleukin-6 (IL-6). [32]

2. Clinical Evidence: Studies on Human Populations

While preclinical data provide a solid foundation, translating these findings into clinical practice requires strong evidence from human trials. Although clinical research on P. dulce is scarce, existing studies suggest its safety and efficacy in treating stomach ulcers.

In preliminary trials, patients with mild to moderate abdominal pain reported nausea, epigastric pain, and heartburn 4 to 6 hours after taking P. dulce and were prepared to wait several weeks for symptoms to subside. significantly improved. Wound size and pain in the dulce were reduced. This is attributed to the synergistic effect of antioxidant, anti-inflammatory and mucosal protection properties. A small number of participants reported mild gastrointestinal symptoms that resolved spontaneously. Evidence from large-scale studies

An ongoing clinical trial is designed to determine the efficacy of the P. dulce preparation in a larger, more diverse patient population. Preliminary results suggest that the extract may be as effective as proton pump inhibitors (PPIs) in treating difficult infections, particularly those not associated with Helicobacter pylori infection. [33]

3. Comparative Analysis: P. dulce Versus Synthetic Drugs

Unlike synthetic drugs (such as PPIs and H2 receptor antagonists) that focus primarily on reducing stomach acid, P. dulce uses a method to treat the following diseases:

Cell protection

Strengthens the mucosal barrier against acid and enzyme damage. antidote. Comparative effectiveness. [34]

Cost of treatment

Clinical studies have shown that the cost of treatment is comparable between P. and P. Dulce extract and PPIs are used for mild to moderate pain. P. dulce has also been shown to be effective in reducing symptoms of functional dyspepsia. It provides regular and reusable results thanks to effective hand protection. For example, P. Dulce has been shown to have fewer side effects, making it safer. Limitations and challenges [35]

Advantages and limitations

1. Advantages

Its roots in natural, plant-based medicine, which has long been preferred by people seeking holistic approaches to healthcare, are a crucial benefit of Pithecellobium dulce, often known as Manila tamarind. Its organic provenance makes it a viable substitute for chemical-based therapies, supporting the growing worldwide trend towards safer and more ecologically friendly medical solutions. For patients who are cautious about synthetic medications or who would rather limit their exposure to artificial chemicals, this intrinsic natural base offers an additional attraction. P. dulce therefore serves a clientele that is becoming more interested in supplementary and integrative medicine. [36]

Another standout benefit of P. dulce is its exceptional safety profile. Unlike synthetic medications, such as proton pump inhibitors (PPIs) or H2 receptor antagonists, which are frequently associated with a range of side effects—including rebound acid secretion, headaches, diarrhea, and, in long-term use, risks of kidney damage or nutrient malabsorption—P. dulce exhibits minimal adverse effects. Clinical and preclinical studies have demonstrated that the extract is generally well-tolerated, even with prolonged use. Mild gastrointestinal discomfort reported by a small subset of individuals typically resolves without intervention, underscoring its suitability for long-term management of peptic ulcers. This safety aspect is particularly crucial for patients who may already have compromised health or for populations, such as older adults, who are more vulnerable to drug-induced side effects. [37]
Economic feasibility further distinguishes P. dulce as a practical solution for ulcer management. Natural remedies like P. dulce are often less expensive to produce and purchase compared to synthetic pharmaceuticals. This cost-effectiveness is especially advantageous in low-resource settings where access to expensive medications can be limited. By providing an affordable alternative, P. dulce not only bridges the gap in healthcare equity but also reduces the economic burden on healthcare systems in developing regions. Patients in these areas can benefit from effective treatment without facing financial hardship, making P. dulce an attractive candidate for inclusion in community-based or public health interventions targeting ulcer-related conditions. [38]
One of the most compelling attributes of P. dulce is its dual functionality as both an antioxidant and an antiulcer agent. Peptic ulcer disease is often exacerbated by oxidative stress, a condition where an imbalance between free radicals and antioxidants leads to cellular damage in the gastric mucosa. Conventional antiulcer therapies, such as antacids or acid suppressants, typically address symptoms but may not tackle the underlying oxidative damage that contributes to the persistence and recurrence of ulcers. P. dulce, on the other hand, offers a more comprehensive approach. Its bioactive compounds, including flavonoids, tannins, and phenolic acids, have been shown to possess potent antioxidant properties, neutralizing harmful free radicals and protecting gastric tissue from oxidative stress. [39]
Simultaneously, P. dulce promotes mucosal healing and cytoprotection, directly addressing the ulcerative process. The combination of these properties not only enhances therapeutic outcomes but also positions P. dulce as a preventive strategy, reducing the likelihood of ulcer recurrence. This multifaceted mechanism of action sets it apart from many conventional treatments, offering both symptomatic relief and long-term benefits. Furthermore, its antimicrobial activity, particularly against Helicobacter pylori—a significant contributor to peptic ulcer disease—adds another layer to its therapeutic value. By combating bacterial infection while simultaneously promoting healing, P. dulce provides a holistic solution to a multifactorial condition. [40]
Notwithstanding these benefits, there are still obstacles to P. dulce's widespread use in medicine. One of the main concerns is standardising its bioactive ingredients to guarantee uniform potency and effectiveness across formulations. Variations in plant extraction methods, growth conditions, and preparation processes might change the concentration of active components, providing problems for therapeutic uses. Furthermore, even though preclinical and small-scale clinical trials have shown encouraging results, bigger, multicenter studies are required to demonstrate its position as a viable alternative to synthetic medicines and verify its effectiveness across a range of populations. [41]

Future Directions

Control of Quality and Standardisation The variety of bioactive substances is a significant obstacle in the creation of natural goods. P. dulce's active components, which include flavonoids, tannins, alkaloids, and saponins, might differ based on a number of variables, including culture, extraction techniques, and botanical origin. To guarantee the dependability and security of anti-ulcer medications, the bioactive drug's structure has to come first. Establishing a strict control system and identifying and assessing the essential components in charge of disease prevention would help achieve this. The effectiveness and safety of formulations can be increased by identifying the medicinal qualities of juices and stabilising them in therapeutic-grade extracts using analytical techniques like mass spectrometry and high-performance liquid chromatography (HPLC).

To completely comprehend the processes by which P. dulce treats duodenal ulcers, in-depth molecular research is required. Although preclinical study has demonstrated its promise, more investigation is needed to fully understand the molecular interactions between its bioactive components and the intestinal mucosa. This involves examining the effects of P. dulce-derived chemicals on important ulcerogenic processes such acid secretion, mucus formation, and prostaglandin synthesis. More research should be done on its antioxidant qualities, specifically how it affects oxidative stress in the gut.

Determining whether the antibiotic used to treat H. pylori inhibits bacteria, inhibits biofilms, or targets infectious agents that cause infection is also worth more research. Developing recipes is a crucial step in introducing P. dulce syrup to the market.

CONCLUSION

The creation of anti-inflammatory medications derived from Manila tamarind seeds appears to be a novel and all-natural remedy for duodenal ulcers. Helicobacter pylori infection and increased stomach acid output are two of the many common causes of duodenal illness. These bioactive substances aid in promoting mucosal healing, shielding the stomach mucosa from oxidative stress, and even eliminating H. Helicobacter pylori, a crucial bacterium. Anti-ulcer syrups based on P. dulce can therefore provide a variety of approaches to managing the condition, addressing both its symptoms and its root causes, including oxidative damage and illness. Dulce's roots make it appealing to anyone looking for alternative or medicinal therapies. This is especially crucial now that more people are interested in natural medicine since both doctors and patients are searching for safer, more effective therapies. P in contrast to manufactured medications. For long-term usage, dulce is a wonderful option because it has a high safety record and little side effects, even for sensitive people like the elderly. Cost-effectiveness is also crucial, particularly in nations that manufacture pricey medications.

REFERENCES :

1. Marshall BJ, Warren JR. Unidentified curved bacilli in the stomach of patients with gastritis and peptic ulceration. Lancet. 1984 Jun 16;1(8390):1311-5. [PubMed]
2. Cave DR. Transmission and epidemiology of Helicobacter pylori. Am J Med. 1996 May 20;100(5A):12S-17S; discussion 17S-18S. [PubMed]
3. Pounder RE, Ng D. The prevalence of Helicobacter pylori infection in different countries. Aliment Pharmacol Ther. 1995;9 Suppl 2:33-9. [PubMed]
4. Ali, N. M., & Rao, B. V. (2018). Phytochemical and pharmacological properties of Pithecellobium dulce Benth.: A comprehensive review. Journal of Medicinal Plants Studies, 6(2), 111-119.
5. Patil, R., & Patil, M. B. (2011). Evaluation of anti-ulcer properties of ethanolic extract of leaves of Pithecellobium dulce Benth in experimental rats. Asian Pacific Journal of Tropical Disease, 1(2), 53-57.
6. Kapoor, S., & Mehta, U. (2017). Traditional medicinal uses of Pithecellobium dulce Benth: An underutilized legume. International Journal of Herbal Medicine, 5(6), 72-78.
7. Gupta, P., & Goyal, S. (2015). Phytochemical and pharmacological potentials of Pithecellobium dulce. Asian Journal of Pharmaceutical Research, 5(2), 76-84.
8. Reddy, P. S., & Dasari, A. B. (2019). A review on bioactive compounds of Pithecellobium dulce and their pharmacological properties. International Journal of Pharmaceutical Sciences and Research, 10(4), 1582-1590.
9. Singh, A., et al. (2020). "Flavonoids as Natural Antioxidants in Disease Prevention." Journal of Biological Research, 18(4), 123-135.
10. Sharma, R., et al. (2019). "Mechanisms of Anti-inflammatory Action of Flavonoids." International Journal of Phytomedicine Research, 12(3), 45-62.
11. Patel, D., et al. (2018). "Therapeutic Role of Saponins in Gastrointestinal Disorders." Pharmacognosy Reviews, 15(2), 67-78.
12. Gupta, A., & Choudhary, R. (2021). "Saponins and Health: Current Perspectives." Advances in Natural Product Chemistry, 11(1), 78-89.
13. Bhat, R., et al. (2020). "Antimicrobial and Healing Potential of Tannins." Journal of Herbal Medicine Research, 14(3), 112-128.
14. Bhat, R., & Chandran, R. (2020). Pithecellobium dulce (Manila tamarind) seed extracts: Chemical composition and bioactive properties. Phytochemistry Reviews, 19(2), 255-268. https://doi.org/10.1007/s11101-020-09652-w
15. Chacko, S. M., et al. (2018). Tannins in medicinal plants: A review of their bioactivity and pharmacological properties. Pharmacognosy Reviews, 12(24), 91-100. https://doi.org/10.4103/pr.pr_19_18
16. Das, M., et al. (2017). Antimicrobial and anti-inflammatory activities of Pithecellobium dulce seeds. Journal of Ethnopharmacology, 210, 110-117. https://doi.org/10.1016/j.jep.2017.08.015
17. Kumar, S., et al. (2021). Bioactive properties of essential oils and fatty acids from Pithecellobium dulce seeds. International Journal of Molecular Sciences, 22(3), 539-547. https://doi.org/10.3390/ijms22030539
18. Patel, S. R., et al. (2018). Saponins as potential agents for ulcer prevention: Mechanisms of action. International Journal of Phytomedicine, 10(4), 135-142. https://doi.org/10.5138/ijpm.2018.1.10
19. Sarangapani, M., et al. (2016). Protective effects of saponins from Pithecellobium dulce on the gastrointestinal mucosa. Journal of Ethnopharmacology, 184, 112-118.
20. Nabavi, S. F., et al. (2015). Flavonoids as antioxidants in gastrointestinal protection. Trends in Food Science & Technology, 42(1), 9-15.
21. Bors, W., et al. (2001). Flavonoids and their antioxidant properties. Food Research International, 34(1), 95-98.
22. Liu, Y., et al. (2017). Phytochemicals from Pithecellobium dulce seeds in tissue regeneration. Journal of Medicinal Plants, 36(2), 54-63.
23. Wu, H., et al. (2009). Tannins as astringent agents in wound healing: Mechanisms and applications. International Journal of Dermatology, 48(4), 324-330.
24. Chatterjee, S., et al. (2018). "Phytochemicals in the management of peptic ulcer: A comprehensive review of molecular mechanisms and clinical efficacy." Journal of Ethnopharmacology, 214, 109–123.
25. Sinha, K., et al. (2013). "Protective role of flavonoids against gastric mucosal injuries." International Journal of Molecular Sciences, 14(5), 9279-9292.

26. Gopalakrishnan, S., et al. (2011). "A review on phytochemical and pharmacological properties of Pithecellobium dulce." International Journal of Pharmacy and Pharmaceutical Sciences, 3(2), 140-143.
27. Srinivas, M., & Sundararajan, T. (2019). "Formulation and evaluation of herbal syrup for gastroprotective activity." Journal of Herbal Medicine, 5(4), 45-53.
28. Bhardwaj, S., et al. (2016). "Phytochemical analysis and medicinal uses of tamarind-related species." Asian Journal of Pharmaceutical and Clinical Research, 9(5), 1-5.
29. Sharma, M., & Kumar, A. (2014). "Evaluation of gastric cytoprotection and anti-ulcer activity of plant extracts." Pharmaceutical Biology, 52(10), 1288-1297.
30. Sharma, A., et al. (2015). Evaluation of Antiulcer Potential of Pithecellobium dulce Seed Extracts in Ethanol-Induced Gastric Ulcer Models in Rats. Journal of Ethnopharmacology, 164, 236–244. DOI: 10.1016/j.jep.2015.02.010
31. Gupta, M., et al. (2013). Antioxidant and Cytoprotective Effects of Pithecellobium dulce Against NSAID-Induced Gastric Mucosal Injury. Indian Journal of Pharmacology, 45(4), 370–376.DOI: 10.4103/0253-7613.117778
32. Khan, S. H., et al. (2018). Anti-inflammatory and Antioxidant Properties of Pithecellobium dulce in Stress-Induced Ulcer Models. International Journal of Molecular Medicine, 42, 435–444.DOI: 10.3892/ijmm.2018.3619
33. Dey, A., et al. (2020). In vitro and In vivo Assessment of Antimicrobial and Antiulcer Activity of Pithecellobium dulce Seed Extracts. Journal of Medicinal Plants Research, 14(8), 409–419.DOI: 10.5897/JMPR2020.7002
34. Robinson, L., et al. (2019). Natural versus Synthetic Approaches to Ulcer Management: A Comparative Analysis of Pithecellobium dulce and PPIs. Phytomedicine, 57, 346–357nDOI: 10.1016/j.phymed.2018.11.002
35. Singh, R., et al. (2020). Evaluating the Long-Term Benefits of Pithecellobium dulce in Reducing Rebound Acid Hypersecretion: A Comparative Study. Journal of Gastroenterology and Hepatology, 35(10), 1758–1765.DOI: 10.1111/jgh.15004
36. Bhattacharya, S., Banerjee, S., & Mukherjee, D. (2020). Phytochemical and pharmacological properties of Pithecellobium dulce: A comprehensive review. Journal of Herbal Medicine, 21, 100345.
37. Gupta, A., Verma, R., & Singh, R. (2019). Standardization challenges in herbal medicine: The case of Pithecellobium dulce. International Journal of Pharmacy and Pharmaceutical Sciences, 11(2), 56–62.
38. Khan, R., Hussain, M., & Sharma, S. (2021). Evaluation of the safety profile of Pithecellobium dulce seed extracts in preclinical models. Pharmacognosy Research, 13(3), 177–182.
39. Moayyedi, P., Eikelboom, J. W., & Bosch, J. (2017). Safety considerations in the use of proton pump inhibitors. Journal of the American Medical Association, 317(22), 2252–2260.
40. Patel, K., Singh, G., & Mehta, S. (2021). Antioxidant and gastroprotective activities of Pithecellobium dulce in animal models. Asian Pacific Journal of Tropical Biomedicine, 11(6), 289–296.
41. Rao, P., Nayak, P., & Murthy, K. (2022). Cost-effective solutions in ulcer management: Exploring the potential of Pithecellobium dulce. Journal of Alternative and Complementary Medicine, 28(4), 349–358.