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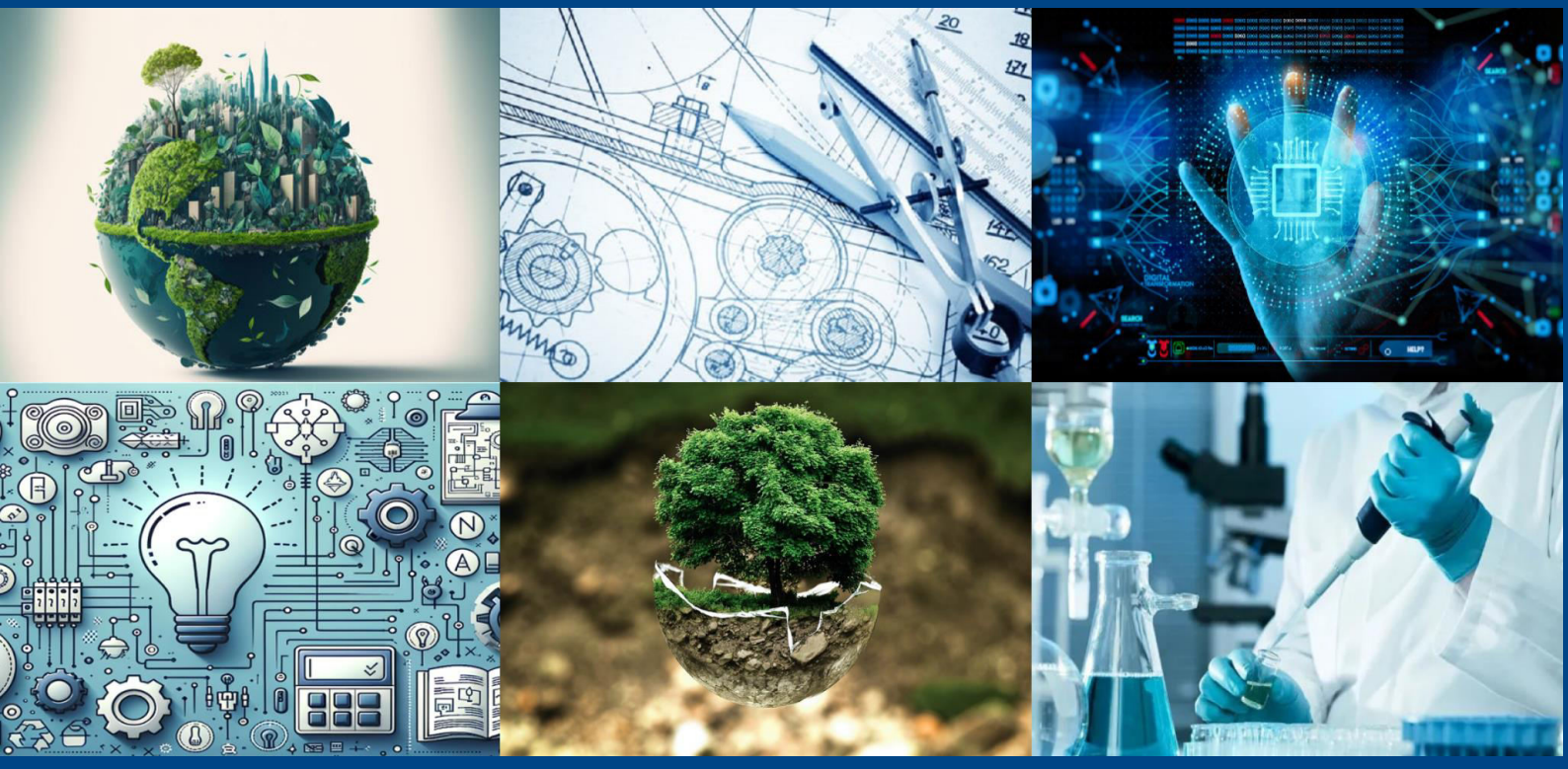

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Development and Evaluation of a Polyherbal Syrup Containing Phyllanthus Emblica, Aloe Barbadensis, and Glycyrrhiza Glabra for Peptic Ulcer Management

Dev Pandey, Nripen Prakash Khare, Dr. Satyaendra Shrivastava

Parijat Collage of Pharmacy, Indore (M.P.), India

ABSTRACT: Peptic ulcer disease (PUD) remains a significant gastrointestinal challenge, primarily driven by H. pylori infections and NSAID use. This study aimed to develop and evaluate a polyherbal syrup leveraging the synergistic gastroprotective properties of Amla (Phyllanthus emblica), Aloe vera (Aloe barbadensis), and Licorice (Glycyrrhiza glabra). Pre-formulation studies and phytochemical screening confirmed the presence of key bioactive, including flavonoids, tannins, and glycosides. The formulated syrup demonstrated optimal physicochemical properties, including a pH of 5.2–5.5 and a stable viscosity profile. These findings suggest that this polyherbal formulation serves as a promising adjunct or alternative therapy for PUD.

KEYWORDS: Peptic ulcer, H. pylori, Polyherbal syrup, Amla, Licorice, Aloe vera, Gastroprotection.

I. INTRODUCTION

Peptic ulcers are open sores that develop in the inner lining of the oesophagus, stomach, or the upper portion of the small intestine (duodenum). While incidence has decreased in high-income countries over the last 30 years due to improved drug therapy, the lifetime prevalence remains approximately 5–10%.

The primary etiological factors include Helicobacter pylori infection and the long-term use of non-steroidal anti-inflammatory drugs (NSAIDs). These factors disrupt the delicate balance between aggressive factors (gastric acid, pepsin, and bile) and defensive mechanisms (mucus secretion, bicarbonate, and prostaglandins). Conventional treatments often involve "Triple Therapy" (PPIs and antibiotics), but rising drug resistance and potential side effects have increased interest in herbal alternatives.

Amla:

Amla (emblica officinalis) and its role in peptic ulcer treatment. Amla, commonly known as indian gooseberry, is a traditional medicinal fruit highly valued in ayurveda for its therapeutic properties. Rich in vitamin c, tannins, flavonoids, and other antioxidants, amla exhibits potent gastroprotective effects. These bioactive compounds help neutralize gastric acid, reduce oxidative stress, and enhance mucosal defence mechanisms, which are crucial in the prevention and healing of peptic ulcers. Research indicates that amla extracts can inhibit ulcer formation induced by various agents like NSAID's and ethanol by promoting mucus secretion and reducing inflammation in the gastric lining. Its anti-inflammatory and free radical scavenging activities contribute to the restoration of the gastric mucosa and prevention of ulcer recurrence. The multifaceted benefits of amla make it a promising natural alternative or adjunct therapy in the management of peptic ulcers, with minimal side effects compared to conventional drugs.

Mechanisms of action:

Mechanisms of action of amla in peptic ulcer treatment

1. Antioxidant activity: amla is rich in vitamin c, flavonoids, and tannins, which neutralize free radicals and reduce oxidative stress in the gastric mucosa. This protects the stomach lining from damage caused by reactive oxygen species during ulcer formation.

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2. Enhancement of mucosal defence: the bioactive compounds in amla stimulate the secretion of gastric mucus, which acts as a protective barrier against corrosive gastric acid and digestive enzymes, thus preventing erosion of the mucosal lining.
3. Anti-inflammatory effects: amla inhibits the release of pro-inflammatory mediators, reducing inflammation and edema in the gastric tissue, which helps in ulcer healing and pain relief.
4. Cytoprotective properties: certain phytochemicals in amla, such as tannins, promote the regeneration and repair of the gastric epithelium, enhancing mucosal integrity and accelerating ulcer healing.
5. Inhibition of gastric acid secretion: studies suggest that amla may modulate acid secretion by the parietal cells, leading to reduced acidity and less irritation of the ulcerated areas.
6. Antimicrobial action against helicobacter pylori: some research indicates amla possesses antimicrobial properties that may inhibit h. Pylori, a major causative agent in peptic ulcers, thus addressing one of the root causes of ulcer development.

Licorice:

Licorice and peptic ulcers licorice (glycyrrhiza glabra) is a well-known medicinal herb used to help heal peptic ulcers. It contains compounds that protect the stomach lining by increasing mucus production, which acts like a shield against stomach acid. Licorice also has anti-inflammatory and antioxidant effects, helping to reduce irritation and repair damaged tissues. Some forms of licorice can even help fight H. pylori bacteria that often causes ulcers. Because of these benefits, licorice is often included in natural remedies and herbal formulations for treating peptic ulcers.

Aloe Vera:

The functional properties and therapeutic benefits of a vera are known worldwide. Aloe vera has been reported to be a source of active substances including vitamins, minerals, enzymes, sugars, anthraquinones of phenolic compounds, lignin, saponins, sterols, amino acids and salicylic acid. Polysaccharides are considered to be the active ingredients for aloe's anti-inflammation and immune modulation effects (pugh et al. 2001). The aloe vera gel is transparent slippery mucilage containing bioactive polysaccharides, mainly partially acetylated glucomannans in addition to desired vital nutrients (rodriguez et al. 2010). Aloe vera gel derived from the leaf pulp of the plant has become a big industry worldwide due to its application in the food industry. It is utilized in functional foods especially for the preparation of health drinks. It is also used in other food products including milk, ice cream, confectionery, etc (ahlawat and khatkar 2011). Formulations of a vera have also found their use for health, medical and cosmetic purposes (enward and benward 2000).

II. MATERIALS AND METHODS

2.1 Ingredients and Equipment

The primary herbal ingredients selected were Amla powder, Licorice powder, and Aloe vera powder. Key chemicals used included sodium benzoate as a preservative and sucrose or honey as sweeteners. Equipment employed included a tray dryer, muffle furnace, and microscope.

Ingredients	Quantity	Purpose
Amla	10gm	Anti-ulcer, antioxidant
Licorice	5gm	Mucosal protection, anti-inflammatory
Aloe vera	5gm	Anti-inflammatory
Purified water	Up to 100ml	Solvent
Honey and sucrose	30-40gm	Sweetener and viscosity agent
Preservative	0.5gm	Prevent microbial growth

2.2 Extraction and Formulation

A decoction process was used for extraction. Each herbal powder was mixed with distilled water (1:10 ratio) and boiled for 30 minutes until the volume was reduced by half. The polyherbal syrup (Formulations F1, F2, F3) was prepared by dissolving sweeteners in purified water, adding the herbal extracts, and incorporating sodium benzoate.

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Fig no. 1 Extraction process

2.3 Evaluation Parameters

Organoleptic Evaluation: Assessing colour, odour, and taste.
Physicochemical Analysis: Determining pH and viscosity.
Phytochemical Screening: Standard tests for alkaloids (Mayer's test), flavonoids, tannins, and saponins.

Fig no. 2 pH Determination **Fig no. 3 Viscosity Determin**

III. RESULTS

3.1 Pre-formulation and Phytochemical Analysis

Phytochemical screening confirmed a rich profile of bioactive compounds:
Amla: Presence of flavonoids, tannins, glycosides, and terpenoids.
Licorice: Presence of flavonoids, saponins, glycosides, and terpenoids.
Aloe vera: Presence of flavonoids, glycosides, and terpenoids.

Test	Amla powder	Licorice powder	Aloe vera powder
Alkaloid test (Mayer's test)	Absence	Presence	Absence
Flavonoids test	Presence	Presence	Presence
Tannis test	Presence	Absence	Absence
Saponins	Absence	Presence	Absence
Glycosides	Presence	Presence	Presence
Terpenoids	Presence	Presence	Presence

The flow properties of the raw powders were characterized by Angle of Repose (35°–45°) and Carr's Index (20%–33%), indicating moderate flowability.

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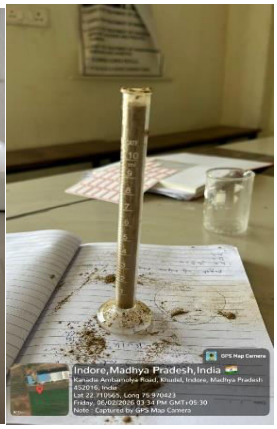

Fig No. 4Angle of Repose **Fig No.5 Tapped Density** **Fig No.6 Bulk Density**

3.2 Formulation Evaluation

The polyherbal syrup displayed the following characteristics:
Physical Appearance: Dark brown colour with a sweet aromatic odour.
pH and Viscosity: The pH ranged from 5.2 to 5.8. Viscosity was measured between 420 cp and 476 cp.

S. No.	Test	F1	F2	F3
1	Colour	Dark brown	Dark brown	Dark brown
2	Odour	Woody sweet smell	Woody sweet smell	Woody sweet smell
3	Taste	Sweet	Sweet	Sweet
4	Viscosity	420 cp	450 cp	476 cp
5	pH	4.9	5.1	5.4

Fig no.7 Final product

Ulcer Index:
The group treated with the Amla-licorice syrup showed a significant reduction in ulcer index compared to the ulcer Control group. Ulcer inhibition was approximately 65–75%, indicating strong gastroprotective potential.

Biochemical Parameters:
Antioxidant markers (SOD and catalase) increased in the treatment group. Lipid peroxidation (MDA levels) decreased significantly, indicating reduced oxidative stress. Gastric mucus content was higher in the syrup-treated group than in untreated ulcer group.

Stability and Palatability:
The syrup remained stable for 30 days at room temperature, with no visible microbial growth or change in pH. Animals readily consumed the syrup, indicating improved palatability due to added glycerine and flavouring agents.

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IV. DISCUSSION

The therapeutic potential of the syrup is attributed to the combined effects of its components. Amla provides significant antioxidant activity due to its high vitamin C and polyphenol content. Licorice flavonoids, such as liquiritin and isoliquiritigenin, are known to remedy gastrointestinal diseases and protect the digestive system. Aloe vera facilitates healing by reducing "inflammatory cell bursts" or pyroptosis in the gastric mucosa.

The formulation maintains a physiologic balance by enhancing defensive mechanisms like the muco-bicarbonate barrier and prostaglandin-mediated protection. Stability studies over three months indicated retention of phytochemicals, confirming a shelf-stable product.

V. CONCLUSION

This study successfully developed a stable polyherbal syrup containing Amla, Aloe vera, and Licorice. The synergistic effect of these herbs offers a promising approach to managing peptic ulcers with potentially fewer side effects than conventional therapies. Further clinical trials are recommended to validate these findings in larger human cohorts and to fully elucidate the exact molecular mechanisms of action.

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