Formulation and Evaluation of Ficus Benghalensis Leaf Gel: for Mouth Ulcer Treatment

Anushka A. Ghubde[1] ,
Shri Chhatrapati Shahu Maharaj Shikshan Sanstha Institute of Pharmacy, Maregaon.
Anushkaghubde02@gmail.com

Aarti S. Harijan [2],
Shri Chhatrapati Shahu Maharaj Shikshan Sanstha Institute of Pharmacy, Maregaon

Mrs. Mohini S. Kale[3],
Shri Chhatrapati Shahu Maharaj Shikshan Sanstha Institute of Pharmacy, Maregaon

Dr. Nilesh O. Chachda[4],
Shri Chhatrapati Shahu Maharaj Shikshan Sanstha Institute of Pharmacy, Maregaon.

Abstract:
This research investigates the formulation and evaluation of an herbal gel incorporating Ficus benghalensis leaf extract for the treatment of mouth ulcers. Owing to its well-documented anti-inflammatory, antimicrobial, and wound healing properties, Ficus benghalensis was selected as the active phototherapeutic agent. The extract was obtained via maceration and formulated into gel using Carbopol 934 along with appropriate excipients, including clove oil and peppermint oil. Three formulations were developed and assessed for organoleptic properties, pH, viscosity, spreadbility, homogeneity, and microbial safety. Among these, Batch F3 demonstrated optimal characteristics, including a stable pH (6.2), good spreadbility, acceptable viscosity, and no microbial contamination. These results affirm the potential of Ficus benghalensis-based gel as a safe and effective natural alternative for the management of mouth ulcers.

Keyword: Ficus benghalensis, Herbal Gel, Mouth Ulcers, Phytoconstituents, Anti-inflammatory, Antimicrobial, Gel Formulation, Natural Medicine, Wound Healing.

Introduction

The growing concern over the adverse effects associated with synthetic drugs has led to an increased reliance on plant-based therapies for disease management and health promotion. Since ancient times, people have used medicinal plants to cure a variety of illnesses; this method, known as phytotherapy, is still very important in contemporary healthcare. These plants' secondary metabolites, also known as phytochemicals, are naturally occurring substances with a variety of pharmacological actions that are largely responsible for their medicinal potential. The seeds, bark, roots, leaves, and fruits of medicinal plants are the main sources of these bioactive substance. One of these species, Ficus benghalensis, has become well-known for its potent antibacterial, anti-inflammatory, and wound-healing properties. An herbal gel was developed for the current study in order to evaluate the efficacy of Ficus benghalensis leaf extract in the treatment of mouth ulcers.

Mouth ulcer

Infections, stress, mechanical damage, and nutritional deficits are some of the causes of mouth ulcers, which are painful sores. Even though they frequently go away on their own, severe or chronic ulcers need to be treated. Traditional treatments, such antis The term "mouth ulcer" describes the disturbance of the oral mucosa, which can be brought on by a number of things, including trauma, dentures, dehydration, viral infections, or autoimmune diseases.



Fig no.1: Mouth ulcer

Types of Mouth ulcer

1. Minor aphthous ulcer
2. Major aphthous ulcer
3. Herpetiform ulcer
4. Traumatic ulcer
5. Herpetic ulcer
6. Ulcers from systemic diseases
7. Drug-induced ulcers
8. Infectious ulcers

Mouth Ulcers symptoms are:

1. **Pain**: Mouth ulcers can be painful, especially when eating, drinking, or speaking.
2. **Redness and swelling**: The area around the ulcer may become red, swollen, and inflamed.
3. **Open sore**: A mouth ulcer appears as an open sore or lesion in the mouth, which can be yellow or white in colour
   bleeding: Mouth ulcers can bleed, especially if they are irritated or injured.
4. **Discomfort:** Mouth ulcers can cause discomfort or tenderness in the mouth, especially when eating or drinking.
5. **Difficulty speaking or eating:** Ulcer causing difficulty chewing food and eating become painful.

Gel-Based Formulations: An Overview



Fig no.2: Gel

The term "gel" refers to semi-rigid systems where the movement of a dispersing medium is constrained by a 3D network of interlacing polymers, Because of their great biocompatibility, convenience of use, and controlled drug release capabilities, they have become extremely popular in pharmaceutical and cosmetic applications.

Types of Gels

1. Hydrogels
2. Organogels
3. Emulgels
4. In-situ Gels

Why Are Plant-Based Gel Formulations Used?

Plant-based gel formulations are developed to enhance drug delivery, improve stability, and provide a natural, safe, and effective alternative to synthetic treatments. They offer prolonged contact time, controlled release, and better absorption, making them ideal for treating wounds, skin conditions, and oral ulcers.

Drug profile

Ficus benghalensis leaf



Fig no :3 leaves

Scientific Classification

1. Botanical Name: Ficus bengalensis
2. Kingdom: Plantae;
3. Division: Magnoliophyte;
4. Class: Magnoliopsida;
5. Order: Urticales;
6. Family: Moraceae
7. Genus: Bengalensis

Leaves

Coraceous, green, oppositely arranged, ovate to elliptic (lanceolate) in shape, with a reticulately pinnate venation and an obtuse apex, the leaves have a slightly bitter flavour. The leaf powder has a somewhat bitter flavour, is oduorless, and is pale green in colour. Under a microscope, one may see trichomes, fibers, spiral thickenings, calcium oxalate crystals, and epidermal cells with anticlinal walls.

Traditional Used :

The leaves are beneficial for abscesses, burning sensations, skin allergies, ulcers, and leprosy. When it comes to diarrhea and dysentery, the buds are helpful. The fruits are helpful in pitta vitiation and are tonic and refrigerant. Neuralgia, rheumatism, lumbago, The latex can help with a variety of skin disorders, including bruises, nasitis, ulorrhagia, ulitis, odontopathy hemorrhoids, gonorrhea, inflammations, and sole cracks.

Phytochemical Constituents of Ficus benghalensis Leaves

Flavonoids: Antioxidant, anti-inflammatory, and wound healing properties.
Tannins: Astringent effect, promote tissue repair, and possess antimicrobial activity.
Saponins: Antimicrobial enhance absorption, and provide emulsifying properties.
Alkaloids: Analgesic and anti-inflammatory effects.

Phenolic compounds: exhibit antioxidant activity and help in reducing oxidative stress.
Glycosides: Antioxidant activity and contribute to reducing oxidative stress.

Pharmacological Action

1. Wound Healing

Healing of wounds The capacity of the majority of these plants is still unknown, however some have undergone scientific screening to assess their ability to heal wounds in various pharmacological models and people. Active chemical components were found in a small number of instances. Experimental models have demonstrated the effectiveness of several Ayurvedic medicinal plants, including Ficus racemosa, Glycyrrhiza glabra, Berberis aristata, Curcuma longa, Centella asiatica, Euphorbia nerifolia, Rubia cordifolia, Pterocarpus santalinus, Ficus bengalensis ynodont, dactylon, and Aloe vera.

2. Antinflammation:

Reduced Inflammation In response to pathogens, damaged or injured cells, radiation, or toxic substances, inflammation is a defined mechanism that starts the healing process. Through a variety of pathways, inflammation is frequently linked to serious illnesses like diabetes, cancer, heart disease, etc. Numerous phytoconstituents may disrupt the processes and fight a number of inflammatory conditions. Damage to the skin and other soft tissues, as well as the healing process of wounds, are among the mechanisms that involve inflammation.

3. Antistress and Antiallergic:

Several extracts of Ficus bengalensis bark were tested for their antiallergic and antistress properties in asthma using milk-induced leucocytosis and milk-induced eosinophilia. Aqueous, ethanol, and ethyl acetate extracts dramatically decreased leucocytes and eosinophils in the order shown, although petroleum ether and chloroform extracts were inactive. This illustrates the potential of polar components of F. bengalensis bark as anti-allergic and anti-stress drugs for asthma.

4.Antifungal Activity:

Ficus benghalensis leaf tissues and aerial roots were used to isolate endophytes, including mitosporic fungus and a number of sterile varieties. Even though the lamina and petiole had a comparable number of endophyte species, the petiole was more heavily colonized by endophytic fungus. There was minimal overlap between the endophyte assemblages of the aerial root leaf developing in soil and air, indicating that the endophyte composition of a host is determined by both the environment and the kind of host tissue.

Material and methods

Material:

The raw material of dry leaves of *Ficus benghalensis* were collected from the campus of Institute of Pharmacy (Maregaon) All Were **authenticated by** medicinal garden and authenticate from department of Botany, Arts, commerce and Science college Maregaon.

Sr no	Ingredients	Role
1.	Carbopol 934	Gelling agent providing viscosity
2.	Ficus benghalensis leaves extract	Active healing component
3.	Distilled water	Solvent for preparation
4.	Sodium hydroxide	Ph adjuster
5.	Methyl paraben	Enhance product stability
6.	Propyl paraben	Preservative
7.	Clove oil	Analgesic

8.	Peppermint oil	Flavouring and mild Analgesic
9.	Glycerine	Humectant and base modifier

Table no 1: Ingredient used in formulation

2.Method:

Ficus benghalensis leaf gel formulation Gel preparation with Carbopol 934: 50 milliliters of purified water were used to dissolve precisely weighed Carbopol 934 in a beaker. Set the beaker aside to let the carbopol to swell for 30 minutes. After that, mix it thoroughly with a mechanical or lab stirrer set to 1200 rpm for 30 minutes. Weigh out the propyl and methyl parabens.
Following the dispersion of carbopol, 1 gram of extract and preservative solutions were added while being continuously stirred. In order to correct the skin pH (6.8–7) and get the desired gel consistency, clove oil and peppermint oil were added dropwise to the formulations until the volume reached 100 ml using the remaining distilled water.

Chemical tests:

Mayer'sTest:

To 2-3 mL of filtrate, 2-3 drops of Mayer's reagent were added. The appearance of precipitate indicated the **presence of alkaloids.**

Wagner's Test:

Wagner's (three to five drops) reagent was added to two to three mililiters of filtrate. Alkaloids were present because a reddish-brown precipitate formed.

Hager's Test:

Four to five drops of Hager's reagent were applied to two to three mililiters of filtrate. Alkaloids were present because of the yellow precipitate that formed.

DragendorffsTest:

To 2-3 ml. of filtrate, 4-5 drops of Dragendorff's reagent were added. The appearance of an *orange*-brown precipitate indicated the presence of alkaloids.

Evaluation Test:

1. Appearance

Colour, clarity, texture, transparency, and the presence of any gritty particles were all evaluated in the created gels.

2. pH measurement

A digital pH meter was used to measure the herbal gel compositions' pH Ten milliliters of distilled water were used to dissolve one gram of gel, which was then left for two hours. Three measurements of the formulation's pH were made, and the average results are given. It stated the gel formulation's ph.

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3. Homogeneity

Following the gels' placement in the container, a visual inspection was used to verify the homogeneity of each generated gel composition. They were examined to determine whether any aggregates were present and how they looked.

4. Spreadability

The duration in seconds it takes for two slides to separate from gel positioned between them when subjected to a specific stress is known as spreadability. The spreadability is improved if it takes less time to separate two slides. The following formula is used to calculate spreadability:

$$S = M \times L/T$$

5. Microbial test

To assess the microbiological purity of the Ficus benghalensis leaf gel, microbial testing was carried out using the Cup Plate Method. Since the goal of the procedure was to evaluate any intrinsic contamination in the formulation, no exogenous

microbes were added. No microbial growth was seen following incubation, suggesting that there was no bacterial contamination. These outcomes attest to the gel's microbiologic safety and suitability for therapeutic use.

RESULT AND DISCUSSION

- **Identification test and evaluation test**

Sr no	Test	Observation
1	Mayers test	Present
2	Alkaloids test	Present
3	Flavonoids test	Present
4	Reindorf's Test	Present



Fig no.5: mayers test



Fig no.6: Alkaloids test



Fig no.7: Flavonoids test



Fig no.8: Dragendorffs test

- **Evaluation test Organoleptic Evaluation**

SR. NO	Parameter	Observation
1.	Colour	Greenish
2.	Odour	Moderate
3.	Appearance	Homogeneous

Table No: 6 Organoleptic Evaluation

- **Determination of pH:**

Sr no	Batches	pH
1.	F1	6
2.	F2	6.1
3.	F3	6.2

Table 7: Determination of the pH



Fig 9: pH meter

- **Spreadbility:**

Sr no	**Batches**	**Spredability Result**
1.	F1	Not applicable gel
2.	F2	Spreadable
3.	F3	Spreadable

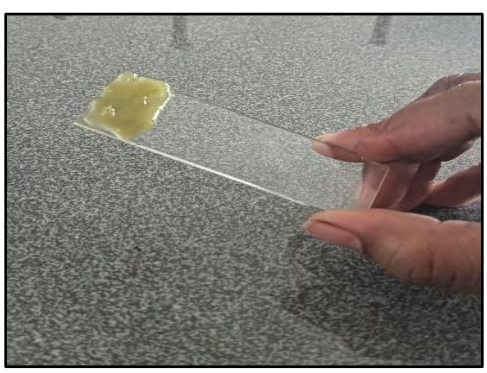


Fig 10: Spreadbility

- **Viscosity:**

Batch	Flow time (sec)	Viscosity	Remarks
Batch 1	120	134.5	Acceptable gel viscosity
Batch 2	Not measured	Not applicable	Gel not formed
Batch 3	110	123.5	Stable gel

Table 9: Viscosity

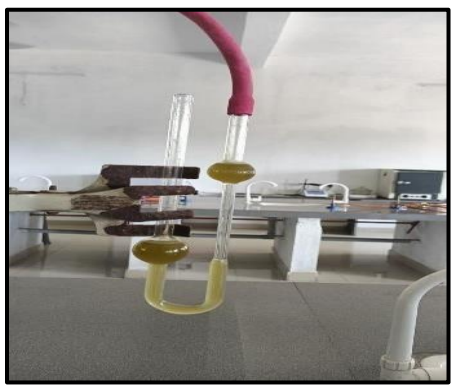


Fig no.11: Ostwald viscometer

- **Microbial test:**



Fig no.12: Microbial

Conclusion:

Ficus benghalensis (banyan tree) is a culturally significant plant known for its medicinal properties due to the presence of bioactive compounds like flavonoids, tannins, and saponins. These contribute to its anti-inflammatory, antimicrobial, and wound-healing effects. An herbal gel was formulated using its leaf extract for the treatment of mouth ulcers. Among three tested formulations, Batch F1 had acceptable pH and viscosity but poor spreadbility, while Batch F2 showed poor consistency and failed to form a proper gel. Batch F3 demonstrated optimal pH (6.2), good spreadbility, viscosity, and microbial safety. It was found to be the most effective and stable, making it a promising plant-based alternative for managing mouth ulcers.

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