Formulation And Evaluation of Polyherbal Ficus Religiosa Gel in Treatment of Wound Healing

Akanksha Shingote[1], Pradeep Kale, *2, Asha Shinde[3], Dr. Kiran. Shinde[4]

Assistant Professor[1], Department of Pharmaceutics, Vidya Niketan Institute of Pharmacy and Research Center, Bota.

Research scholar[*2, 3], Vidya Niketan Institute of Pharmacy and Research Center, Bota.

Corresponding author

Pradeep B. Kale (Research Scholar)

Department of Pharmaceutics, Vidya Niketan Institute of Pharmacy and Research Center, Bota

ABSTRACT:

Wound healing is a complex process that requires proper treatment to prevent infection and promote tissue repair. Herbal formulations are widely preferred because they are safer and produce fewer side effects compared to synthetic products. In the present study, a polyherbal wound healing gel containing Ficus religiosa and Aloe vera extracts was formulated using Carbopol 940 as the gelling agent. The prepared gel was evaluated for pH, viscosity, spreadability, extrudability, homogeneity, skin irritation, and stability. The formulation showed good consistency, suitable pH, excellent spreadability, easy extrudability, and no skin irritation. Stability studies indicated that the gel remained stable during storage. The results suggest that the formulated polyherbal gel can be used as a safe and effective herbal preparation for wound healing applications.

Keywords:- Ficus religiosa, Aloe vera, Wound healing gel, Polyherbal formulation.

1. INTRODUCTION

Chronic wounds are a major healthcare concern worldwide, particularly in developing countries, where approximately 1–2% of the population is affected. These wounds require an extended period for healing and often lead to complications that negatively influence the patient's quality of life. A wound is defined as the disruption or damage of the normal anatomical structure and function of skin tissues caused by physical injury, burns, cuts, or infections. Delayed healing, prolonged hospitalization, and expensive treatment procedures increase both physical and economic burdens on patients. Although conventional therapeutic approaches are commonly used for wound management, limitations such as poor cellular interaction, delayed tissue regeneration, and adverse reactions remain significant challenges[1].

Wound healing is a complex biological process that occurs through four overlapping stages: hemostasis, inflammation, proliferation, and remodeling. Hemostasis is the initial stage in which platelets initiate vasoconstriction and clot formation to prevent excessive blood loss from damaged blood vessels[1]. During this phase, adenosine diphosphate (ADP) and type I collagen activate adhesive glycoproteins that support platelet aggregation and blood coagulation. Platelets also release thrombin, which converts fibrinogen into fibrin and activates the intrinsic clotting cascade responsible for stabilizing the clot[2].

The inflammatory phase follows hemostasis and is characterized by redness, swelling, warmth, and removal of damaged tissue debris. Neutrophils act as the primary defense cells by phagocytosing microorganisms and necrotic tissues while releasing intracellular enzymes that protect the wound from infection[2]. Fibroblasts and fibrin components further contribute to tissue cleanup and initiate the repair process. Cytokines and growth factors released by various cells play an essential role in cellular communication during wound healing, stimulating cell migration, proliferation, and extracellular matrix formation[3]. The extracellular matrix supports the synthesis of collagen required for tissue reconstruction. Macrophages serve as the secondary line of defense after neutrophils and release matrix metalloproteinases (MMPs), which assist in tissue remodeling and wound repair[3]. Proper wound care is essential for preventing microbial contamination, reducing inflammation, relieving pain, and accelerating tissue

regeneration. Synthetic wound healing agents are effective; however, prolonged use may result in allergic reactions, higher treatment costs, and undesirable side effects. Consequently, herbal formulations have attracted considerable attention due to their therapeutic effectiveness, safety, affordability, biocompatibility, and reduced adverse effects[4].

Fig.1 wound healing [5]

Medicinal plants have been utilized since ancient times for the treatment of wounds, infections, and various skin disorders. Among these medicinal plants, Ficus religiosa (Peepal tree), belonging to the family Moraceae, is considered one of the most valuable therapeutic plants in traditional medicine. The plant is widely distributed throughout India and has been extensively used in Ayurvedic systems for the management of wounds, inflammation, ulcers, diabetes, microbial infections, and dermatological disorders. Various parts of the plant, including leaves, bark, roots, and fruits, possess significant medicinal properties. The leaves of Ficus religiosa contain important phytoconstituents such as flavonoids, tannins, alkaloids, glycosides, saponins, and phenolic compounds. These bioactive constituents are reported to exhibit antimicrobial, antioxidant, anti-inflammatory, and wound healing activities, which contribute to faster tissue regeneration and repair[5]. The final phase of wound healing is the remodeling stage, in which collagen fibers synthesized during the proliferative phase undergo reorganization and maturation. Fibroblasts continuously produce collagen, which is initially arranged in an irregular manner and later reorganized into parallel bundles that enhance wound contraction and

tensile strength. Any disturbance in the sequential stages of wound healing may result in the development of chronic wounds. Excessive activity of matrix metalloproteinases (MMPs) during the proliferative stage can degrade extracellular matrix components and negatively affect the normal healing process[6].

Herbal medicines have gained considerable importance in modern pharmaceutical research due to their therapeutic effectiveness and lower incidence of adverse effects when compared with synthetic drugs. According to the World Health Organization (WHO), nearly 80% of the global population relies on plant-derived medicines for primary healthcare needs. Plant extracts are widely investigated for their applications in infection control, cosmetics, and healthcare products. Numerous scientific studies have focused on the medicinal value and ethnopharmacological importance of traditional medicinal plants used in India[7]. Among these plants, Ficus religiosa has been recognized for its broad spectrum of pharmacological activities and its traditional use in healthcare practices since ancient times. Phytochemical investigations have demonstrated the presence of naturally occurring compounds that contribute to its therapeutic potential in wound healing and other disease conditions[8].

Traditional Uses of Ficus religiosa

1. Healing and Curative Properties: Leaves of Ficus religiosa are traditionally used as a tonic and mild laxative. They are also administered for relief from fever and cold conditions. Leaf juice and powdered leaves are commonly used to control bleeding and support wound healing. Approximately 50 ml of leaf juice or one teaspoonful of leaf powder mixed with water is traditionally recommended for healing purposes[9].

2. Heart Diseases: Peepal leaves are traditionally believed to support cardiovascular health. In traditional practice, leaves are soaked overnight in water, and the filtrate obtained the following morning is consumed in small doses. This preparation is considered useful in managing cardiac weakness and heart palpitations[10].

3. Mumps and Boils: Leaves smeared with ghee and mildly heated are traditionally applied as bandages for the treatment of mumps, boils, and localized infections[11].

4. Fever and Joint Pain: Ficus religiosa is also used traditionally for managing fever because of its cooling properties. Bark ash and bark decoctions are commonly employed in traditional remedies for fever and joint pain. Decoctions prepared from the bark are often

mixed with honey before administration[9].

5. Skin Disorders: A decoction prepared from Peepal bark is traditionally recommended for skin conditions such as itching and eczema. Bark paste prepared with water is applied externally to eruptions and inflammatory skin conditions. The addition of honey to bark powder paste is believed to improve skin freshness and appearance[10].

Pharmacological Activities of Ficus religiosa

1. Antibacterial Activity: Aqueous extracts of Ficus religiosa leaves have demonstrated antibacterial activity against several pathogenic microorganisms including Salmonella typhi, Shigella dysenteriae, Pseudomonas aeruginosa, Escherichia coli, Bacillus subtilis, and Staphylococcus aureus[9].

2. Anthelmintic Activity: Methanolic bark extracts of Ficus religiosa have shown significant anthelmintic activity against worms such as Haemonchus contortus and Ascaridia galli in experimental studies[9].

3. Antioxidant Activity: The aqueous extract of Ficus religiosa possesses antioxidant properties and has demonstrated beneficial effects in streptozotocin-induced diabetic animal models. Oxidative stress plays an important role in the progression of type 2 diabetes, and antioxidant activity may contribute to therapeutic benefits.

4. Wound Healing Activity: The wound healing potential of Ficus religiosa has been evaluated using incision and excision wound models in Wistar albino rats. Topical application of formulations containing leaf extracts showed enhanced wound contraction, improved epithelialization, and greater skin breaking strength compared to untreated control groups[12].

2.PLANT PROFILE

i. Ficus Religiosa[14]

Kingdom: Plantae

Division:

Magnoliophyta

Class:

Magnoliopsida

Order: Urticales /

Rosales **Family:**

Moraceae **Genus:**

Ficus

Species: Ficus

religiosa

Botanical name: Ficus religiosa Linn.

Fig .2 Ficus Religiosa

- **Phytochemical Composition**:

Ficus religiosa (Peepal) contains several important bioactive phytochemical compounds in its leaves, bark, fruits, roots, and seeds. These compounds are mainly responsible for its wound-healing, antimicrobial, anti-inflammatory, and antioxidant activities[13].

i. **Phytochemical groups:** Along with specific compounds, it also contains: Flavonoids, Tannins, Phenolic compounds[14].

Medicinal importance: wound healing, anti-inflammatory activity, antimicrobial activity

ii.Aloe Vera[18]

Scientific name: Aloe barbadensis miller

Family: Asphodelaceae

Common name: Aloe, Ghritkumari (Hindi)

Part used: Leaf (especially the inner gel)

Fig . 3 Aloe Vera

Aloe vera is a succulent plant native to arid regions of North Africa but now cultivated worldwide. Its thick, fleshy leaves contain a gel-like substance that has been used for centuries in traditional medicine and skincare due to its healing, soothing, and hydrating properties[19].

- **Phytochemical Composition[18]**

Aloe vera gel is composed of over 75 active constituents, including: **Vitamins:** A (beta-carotene), C, E, B1, B2, B3, B6, and B12 **Minerals:** Calcium, magnesium, zinc, selenium, and potassium **Enzymes:** Amylase, lipase, catalase help reduce inflammation.

Amino acids: Contains 20 of the 22 essential amino acids

Polysaccharides: Acemannan, glucomannans provide hydration and immune support

Saponins: Possess cleansing and antimicrobial properties

Anthraquinones: Like aloin natural laxatives, but also have analgesic and antibacterial effects (typically removed in topical applications)

- **Benefits of Aloe vera in Skin Care[19]**

1. Soothing and Cooling

- Relieves sunburns, rashes, and insect bites
- Calms redness, irritation, and itching

2. Moisturizing Without Greasiness

- Deeply hydrates skin without clogging pores
- Ideal for oily and acne-prone skin

3. MATERIAL AND METHODS

Materials: Ficus Religiosa Extract , Aloe vera gel, Carbpol940, Methyl paraben, Propyl paraben , Propylene glycol , Triethanolamine.

- **Ingredients and their Role:**

Table. 1 List of ingredients

Sr. No	Ingredient	Quantity	Function
1	Ficus religiosa Extract	1.7 ml	Wound healing, Anti-inflammatory, antioxidant
2	Aloe vera gel	10g	Soothing, moisturizer, penetration enhancer
3	Carbopol 940	1 g	Gelling agent
4	Propylene Glycol	2.5ml	Penetration enhancer
5	Methyl paraben	0.1g	Preservative
6	Propylparaben	0.1g	Preservative
7	Triethanolamine (TEA)	q.s (to PH 6-7)	PH Adjuster
8	Distilled water	q.s upto 50gm	Solvent

Methods:[20]

Step 1

-Firstly collect all the ingredient and apparatus required for the formulation.

1.Collection and Cleaning

Collect fresh Ficus religiosa leaves.

Wash thoroughly with distilled water to remove dust and impurities.

2.Drying

Shade dry the leaves for 5–7 days until completely dry.

3.Powdering

Grind the dried leaves into coarse powder using a mortar and pestle. Powder is pass in 80 no sieve.

Step 2

1.Collection and weighing.

-Then weigh Ficus religiosa powder on weighing balance accurately 15gm.

2.**Extraction**

Take about 15 g of ficus religiosa powder. Add 50 ml distilled water.

3.Heating

Heat powder extract in 30 min by using heating metal.

4.Filtration

Prepare the setup of filtration with the beaker, funnel, conical flask, filter paper and Stand. After heating filter the extract by using filter paper. Collect the filtrate (plant extract).

- **Prepare Gel Base**

Disperse 1 gm Carbopol 940 in 50 ml dissolved in distilled water and stirring

Allow it to swell fo2 hours.

1.Add Aloe vera Gel

Add 10 g Aloe vera gel into the Carbopol solution.

1.Add Ficus religiosa Extract

Add 1.5 ml Ficus religiosa extract slowly with continuous stirring.

2.Add Humectant

Add 2.5 ml propylene glycol.

3.Add Preservatives

Add 0.1 g methyl paraben and 0.1 g propyl paraben.

4.pH Adjustment

Add triethanolamine dropwise until gel forms and pH becomes 6–7.

5.Homogenization

Stir continuously to obtain a smooth, uniform gel.

6.Storage

Transfer gel into airtight container. Store in a cool and dry place.

4.Test herbal wound healing gel[21,22]

1. Homogeneity Test

The homogeneity of the gel was examined to ensure uniform distribution and consistency

throughout the formulation. A small portion of the gel was taken and rubbed gently between the fingers to check for any gritty particles or lumps. In addition, the gel was visually inspected for any signs of phase separation or irregular texture. The formulation was found to be smooth, uniform, and free from any visible separation.

2. Colour and Odor Test

The physical appearance and sensory characteristics of the gel were evaluated through colour and odour testing. The colour of the gel was observed in brownish yellow to confirm its uniformity and visual appeal. The odour was assessed by smelling a small amount of the gel to ensure it had a sweet and grassy without any signs of spoilage or off-odours.

3. pH Determination

The pH of the gel was measured to verify its compatibility with skin and to ensure formulation stability. A small sample of the gel was tested using a calibrated pH meter. The pH was found to be within the acceptable range of 5.5 to 6.5, which is considered ideal for topical applications as it corresponds closely to the skin's natural pH.

4.Spreadability Test :

The spread ability test was conducted to evaluate the ease of spreading the gel on the skin. A pre-marked glass slide was placed on a flat surface, and 1 gram of the gel was placed at the center. Another glass slide was placed on top, and a weight of 500 g was applied for 1 minute. The upper slide was displaced, and the spread ability was calculated using the formula:

$S = M \times L / T$

Where ,

S is the spreadability

M is the applied weight (g)

L is the length moved by the glass slide

(cm) T is the time (sec).

The gel showed good spread ability, ensuring ease of application without excessive dripping. Volume used = 2gm

Weight applied =500g

Speed of daimeter after 1 minute = 5

cm Time = 60 second

5. Skin Irritation :

To check the irritation caused due to the gel on we perform the skin irritation test, gel on is applied on the back of the palm and wait upto complete absorption and check the irritation or redness or itching. But the herbal gel formulation does not causes and irritation to skin.

6.Stability Test :

The gel was subjected to stability studies by storing it at different temperatures (38°C, room temperature, and 40°C) for one month. Parameters such as physical appearance, pH, and spread ability were checked periodically. The formulation remained stable with no significant changes.

5.RESULT

The prepared polyherbal wound healing gel was evaluated for various physicochemical parameters and was found to meet the required standards. The formulation exhibited desirable properties such as a smooth texture, uniform spread ability, ease of application, and an acceptable pH suitable for topical use. The gel maintained stability throughout the study period, showing no signs of phase separation, colour change, or microbial growth. It was also found to be safe in preliminary skin irritation testing, with no evidence of redness, itching, or inflammation.

Table .4 Results

Sr. No	Evaluation Test	Results
1	Colour and Odor Test	Brownish yellow, sweet and grassy
2	pH	6
3	Homogeneity	Excellent
4	Spreadability	5 cm
5	Stability	Stable
6	Skin Irritation Test	No Reaction

6.CONCLUSION

The present study on the formulation and evaluation of herbal gel containing Ficus religiosa extract demonstrated that the prepared gel possesses satisfactory

physicochemical and therapeutic properties for wound healing application. The formulation showed good appearance, homogeneity, spreadability, viscosity, and pH suitable for topical use on the skin. The gel was found to be stable during the stability study without significant changes in color, consistency, or phase separation.

The herbal gel exhibited promising wound healing activity due to the presence of phytoconstituents such as flavonoids, tannins, phenolic compounds, and antioxidants present in Ficus religiosa. These constituents help in reducing inflammation, preventing microbial growth, promoting collagen formation, and accelerating tissue regeneration. The incorporation of aloe vera and suitable gelling agents further enhanced the soothing and moisturizing effect of the formulation.

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