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Research Article

Formulation and Evaluation of Herbal Wound Healing Cream

Ghewande Abhishek*, Hoge Abhishek, Kalmegh Prathmesh, Mahale Abhijeet, Katkar Aditya, Nikam Ajay, Theng Gopal[2], Biyani Kailash[2]

[1]*Anuradha College of Pharmacy, Chikhli, Maharashtra 443201*
[2]*Principal, Anuradha College of Pharmacy, Chikhli, Maharashta 443201*

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ABSTRACT

This study focuses on the development and assessment of a evaluation on herbal wound healing cream formulated using bioactive compounds extracted from medicinal plants. The main moto is to create a safe, economical, and effective topical product that increases rapid wound recovery while reducing the risks linked to synthetic treatments. Herbal contents like Aloe vera, Curcuma longa (turmeric), Azadirachta indica (neem), and Centella asiatica (gotu kola) were incorporated for their well-documented antimicrobial, antioxidant, anti-inflammatory, and tissue-repairing properties. The prepared formulation was evaluated for quality parameters such as pH, stability, spreadability, uniformity, and microbial resistance to ensure optimal performance. The results demonstrated that the cream possessed favorable physical characteristics and showed promising wound-healing activity. Overall, the findings suggest that herbal-based topical formulations can serve as natural, sustainable, and cost-effective alternatives for wound care and infection prevention.

INTRODUCTION

Creams are semi-solid delivery systems designed for application on the skin. They are used to achieve localized effects at the site of application, as the API penetrate into the deep into the membranes of skin. These formulations typically consist of emulsions combining oil and water. As the most frequently used topical vehicles, creams are essentially fluid emulsions with an oily phase. Formulating a safe and effective herbal-based skin cream addresses a range of dermatological conditions including wounds, acne vulgaris, skin fissures, psoriasis, and other skin disorders. world health organization have encouraged the use of traditional medicine due to its cost-effectiveness, widespread availability, and broad applicability—particularly in developing regions. Herbal medication are increasingly valued for wound

***Corresponding Author:** Abhishek Ghewande
Address: [1]*Anuradha College of Pharmacy, Chikhli, Maharashtra 443201*
Email ✉: abhishekghewande@gmail.com

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treatment because they are widely accepted and well tolerated. Natural therapies support wound healing by promoting blood clotting , which helps accelerate tissue repair. Medicinal plants represent an exceptionally plentiful source of biological materials, deeply rooted in ancient therapeutic traditions, present-day pharmaceuticals, and nutritional supplements. They supply a wide variety of natural compounds that serve as the basis for health products, dietary enhancers, and conventional therapies. The application of plant-based remedies for both acute and long-standing wounds remains a widespread practice across diverse global healing traditions. Plants and their botanical extracts hold huge promise for managing and treating wounds due to their rich content of bioactive compounds[1].

WOUND:

Wound is any injury that changes the normal structure or function of the skin or underlying soft tissues, often causing loss of integrity and potentially impairing the physiological barrier provided by the skin Very well. Wounds may arise suddenly from trauma—such as cuts, burns, abrasions, or surgical incisions—or develop gradually due to chronic conditions like diabetes, vascular disease, or sustained pressure ulcers. In another way Wound healing is the body's intricate and highly coordinated response to tissue injury, aimed at restoring the structure and function of skin or other soft tissues. Following injury, the healing process unfolds in four overlapping phases:

1. Hemostasis: Immediately after injury, blood vessels constrict and platelets aggregate to form a fibrin clot, halting bleeding and establishing a temporary scaffold for healing.

2. Inflammation: White blood cells—first neutrophils, then macrophages—migrate into the wound. They clear debris and pathogens, and release signaling molecules such as TGF-β, PDGF, and IL-1, which guide further healing activities.

3. Proliferation: A newly forming matrix of collagen, proteoglycans, and fibronectin is laid down by fibroblasts. Meanwhile, angiogenesis correct vascular supply, granulation tissue develops, and epithelial cells migrate to re-cover the wound bed. Wound contraction via myofibroblasts further reduces the defect.

4. Remodeling (Maturation): Over weeks to months, type III collagen is replaced by stronger type I collagen, the tissue matrix is reorganized via matrix metalloproteinases, and unnecessary cells undergo apoptosis. Tensile strength gradually increases, though it rarely surpasses ~80% of that in uninjured skin.

Wound healing can proceed by primary intention, where closely apposed wound edges heal rapidly with minimal scarring, or secondary intention, involving open wound repair via granulation and epithelialization—often resulting in slower healing and more prominent scarring[2].

Wound Healing: An Overview

Fig.1. Wound Healing Process

The objectives focus on giving students a clear understanding of human skin structure and its physiological functions. They also explore how substances move across the skin through mechanisms like diffusion and pore transport, along with the factors that influence permeability. Additionally, the work involves selecting suitable formulation bases, preparing a stable herbal cream, and evaluating its physical, chemical, and pharmacological characteristics[3,4].

METHODOLOGY:

This review was prepared by systematically collecting, screening, and analyzing relevant literature on herbal wound-healing creams. Scientific articles, research papers, and academic reports were identified through databases such as Google Scholar, PubMed, ScienceDirect, and authenticated herbal medicine journals. Publications discussing herbal constituents, extraction techniques, formulation approaches, and evaluation parameters of polyherbal creams were prioritized.

After collecting the sources, the content was organized based on key themes, including wound-healing mechanisms, traditional medicinal plants, formulation strategies, and quality-assessment parameters. Studies were compared to identify common findings, variations in methodology, and reported therapeutic outcomes. Only credible, peer-reviewed, and experimentally validated data were included to maintain scientific accuracy. The final review integrates these insights to provide a comprehensive understanding of the development and evaluation of herbal wound-healing creams.

COMPONENTS OF HERBAL WOUND HEALING CREAM:

The herbal components used in formulation of herbal wound healing cream are listed below:

Neem (Azadirachta indica):

Neem trees are widely found across India, Africa, and the United States. For over four millennia, they have played a significant role in Ayurvedic healing practices due to their medicinal qualities. This tree grows rapidly and can reach a height of 15 to 20 meters. In Sanskrit, neem is referred to as Arishta. In 1992, the U.S. National Academy of Sciences acknowledged the tree's potential by releasing a report titled Neem: A Tree for Solving Global Problems. Major roles of neem in promoting wound healing, relieving of dryness, itching dryness[2].

Fig.2. Neem leaves

Turmeric (Curcuma longa):

Turmeric has been used topically to help heal cuts and skin ulcers, and consumed to address various health issues such as digestive problems, sore throats, common colds, and diseases related to liver[13]. Curcumin, a compound found in Curcuma longa, used in the wound healing process across all three phases. In the initial inflammatory phase, it helps reduce inflammation by inhibiting the NF-κB (nuclear factor kappa-light-chain-enhancer of activated B cells) transcription factor. This causes decrease in the production of inflammatory cytokines[5,6].

Fig.3. Turmeric powder

Extracts of Curcuma longa or its key component, curcumin, are utilized in the creation of various external-use products, including creams, ointments, pastes, emulsions, hydrogels, films, fibers, and advanced nano-based systems such as nanoparticles, nanovesicles, micelles, and nanofibers[7,8,9].

Tulsi (Ocimum Tenuiflorum):

Tulsi, a well-known herb from the Lamiaceae family. Also called holy basil, this aromatic plant typically grows as a branched, hairy subshrub reaching a height of 30 -60 cm. It's leaves can be either green or purple in colour[1]. The wound-healing and antioxidant effects of Ocimum sanctum extract have been investigated. Rats treated with the extract showed wound contraction. Findings from the study indicate that the extract may be useful in managing irregular healing conditions, including keloids and hypertrophic scars. In a separate investigation, treatment with Ocimum sanctum during the

healing phase was related with an increased level of TNF-α[10].

Fig,4. Tulsi

Aloe Vera (Aloe barbadensis):

Aloe vera contains certain polysaccharides, such as glucomannans and pectic acid, which have demonstrated properties that support wound repair, boost immune response, and exhibit antimicrobial and antioxidant effects. As a result, it is commonly utilized for medicinal and healing applications[11].

In aloe vera leaves Auxins and Gibberellins like growth hormones are present these are responsible for wound healing and anti-inflammatory effects[12].

Fig.5. Aloe vera

Advantages of Aloe Vera[4]:

• It gives a soothing effect on irritated skin, including rashes and sunburn.

• Its anti-inflammatory properties help to decrease discomfort, inflammation, and tenderness from wounds or injuries.

• Provide moisture to maintain the skin hydrated.

• Helps delay signs of early skin aging.

•It may decrease reduce the appearance of fine lines, wrinkles, and dark spots on the skin.

FORMULATION TABLE[1,2]:

Sr.No.	Ingredients	Role
1.	Neem	Antimicrobial, Anti-inflammatory
2.	Turmeric	Antiseptic
3.	Tulsi	Antibacterial
4.	Aloe vera	Anti-aging, reduce acne
5.	Bees wax	Emulsifying agent
6.	Liquid paraffin	Lubricant
7.	Borax	Buffering agent
8.	Methyl paraben	Preservative
9.	Distilled water	Vehicle
10.	Rose water	Fragrance

METHOD OF PREPARATION:

- Collection of Herbal Ingredients:

Turmeric, neem, aloe vera, and tulsi were collected from the local community garden. When gathering raw medicinal materials, it's important to consider the advantages offered by prevailing environmental factors. However, for large-scale commercial harvesting of natural remedies, it is crucial to prioritize the use of trained and skilled personnel[13].

- Extraction of Herbal Ingredients:

I. Preparation of Curcumin Extract:

Add 1 gram of turmeric powder to 10 milliliters of distilled water in a 250 ml volumetric flask. Heat the mixture in a water bath at a temperature between 80°C and 100°C for 5 to 10 minutes. Once the mixture is filtered, the final solution is the turmeric extract[1].

II. Preparation of Neem Extract:

Fresh neem leaves were gathered, rinsed with distilled water, and dried using a hot air oven. Finally leaves are fully dried, it converted into a fine powder. A prepared mixture was combining 5 grams of neem leaf powder with 50 milliliters of dimethyl sulfoxide in a volumetric flask. This mixture was agitated continuously for three days using a REMI RSB-12 mechanical shaker. Following this, the solution was heated in a water bath at temperatures ranging from 80°C to 100°C and decrease to a volume of 20 milliliters. It was then filtered through muslin cloth to eliminate solid residues. The resulting clear extract was utilized in further formulation processes[14].

III. Preparation of Aloe vera Extract:

Select a fresh, fully developed aloe vera leaf from the plant and rinse it thoroughly using distilled water. A hot air oven is useful for preparing dry leaves. Using a sterile knife, slice the leaf lengthwise to expose the gel. Collect the semi-solid inner gel, carefully removing any fibrous material and impurities. The resulting substance is the aloe vera extract[13].

IV. Preparation of Tulsi Extract:

Fresh tulsi leaves were gathered, rinsed with distilled water, and dried in a hot air oven. Once thoroughly dried, the leaves were ground into a fine powder. One gram of the powdered tulsi was combined with 10 milliliters of ethanol in a volumetric flask. The mixture was then heated in a water bath at 80–100°C for 5 to 10 minutes. After heating, filter paper is used to filtered the solution to obtain a clear tulsi extract[1].

FORMULATION OF CREAM

Heat liquid paraffin and beeswax to 75 °C in a borosilicate glass beaker to prepare the oil phase. In a separate container, dissolve borax along with methyl paraben in distilled water, maintaining the temperature at 75 °C using a water bath. Stir the aqueous mixture with a glass rod until all solids are fully dissolved. Slowly add the hot water-based solution to the warm oil phase along with continuously stirring. Once both phases are combined, immediately incorporate the extracts of aloe vera, tulsi, and turmeric. Continue mixing with a glass rod upto a uniform cream form. Finally, add rose oil as a fragrance once the cream has fully developed[15].

EVALUATION PARAMETERS:

An assessment was carried out on the herbal cream to determine its quality. The formulation was examined for uniformity, visual characteristics, ease of spreading, residual sensation, nature of the smear, pH level, thickness (viscosity), emulsion type, and its impact on wound recovery[16]. The physical attributes of the herbal creams are as follow:

1. Physical examination:

The formulations were visually examined to assess their physical characteristics, including colour and scent[17].

2. PH Determination:

The digital pH meter is use for measure the PH of the newly prepared formulation at room temperature. The results indicated that the formulation's pH closely matches that of human skin, suggesting it is suitable for topical applications[1].

3. Stability:

Stability evaluation of the drug product begins during the primary stages of drug development and continues until noticeable degradation of the active compound or final formulation occurs. To assess the formulation's stability, studies were performed the guidelines given by the International Council for Harmonisation (ICH). The cream was kept in a controlled humidity chamber at $40 \pm 2°C$ and $75 \pm 5\%$ relative humidity for a period of three months to monitor changes under accelerated conditions[17].

4. Homogeneity:

The uniformity of the herbal formulation was assessed through both visual inspection and tactile evaluation[13].

5. Viscosity:

The thickness (viscosity) of the cream was measured using a Brookfield viscometer, operated at 2.5 RPM and maintained at a temperature of 25 °C[18].

6. Washability:

A minimal quantity of the cream was applied to the back of the hand, then rinsed off using warm water[1].

7. Consistency:

A tiny portion of the cream was gently massaged between the thumb and forefinger to assess its texture. The formulation exhibited a smooth consistency[1].

8. Irritation Test:

No signs of redness, swelling, irritation, or inflammation were observed during the evaluation of the formulated cream. These findings indicate that the cream is safe for use[13].

9. Phase Separation:

A sealed container is used for stored a formulatio creams at ambient temperature, protected from direct sunlight, and monitored for 24 hours to check for any phase separation[13].

DISCUSSION:

The results indicate that the polyherbal formulation is stable, safe, and suitable for topical use. The acceptable pH and absence of irritation confirm its compatibility with skin, which is essential for wound-healing preparations. The presence of herbal ingredients such as neem, turmeric, tulsi, and aloe vera plays a crucial role in enhancing the therapeutic efficacy of the formulation. Neem contributes antimicrobial activity, helping to prevent infection. Turmeric provides anti-inflammatory and antioxidant effects, supporting faster healing. Tulsi adds antibacterial and healing-promoting properties, while aloe vera enhances cell regeneration and maintains skin hydration. The combination of these plant extracts produces a synergistic effect, improving overall wound-healing potential compared to single-herb formulations. The stable nature of the cream, along with good spreadability and consistency, ensures effective delivery of active constituents to the affected area. Although the findings are promising, further clinical evaluation is necessary to establish the efficacy of the formulation on a larger population and to standardize its use in therapeutic applications.

CONCLUSION:

The formulated herbal cream exhibits beneficial properties and provides skin-nourishing effects with minimal use of synthetic chemicals, helping to guard against various skin conditions. Due to its simple preparation method and use of readily available ingredients, the cream remains cost-effective. This herbal cosmetic blend forms a protective layer on the skin and is considered safe for external use. Evaluation through multiple tests suggests that the formulation is suitable for topical application to help prevent skin damage. The growing preference for natural remedies is largely due to their perceived safety and reduced risk of adverse effects compared to synthetic alternatives. Further research will be undertaken to scientifically validate the combined therapeutic effects of the formulation.

ETHICAL STATEMENT:

This study does not involve any human or animal experimentation.

CONFLICT OF INTEREST:

The author declares no conflict of interest.

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