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Herbal Wound Healing Cream: Formulation, Evaluation and Pharmacological Activities

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Abstract : *Herbal wound-healing creams have gained attention because selected medicinal plants contain bioactive compounds that may support skin repair and may show anti-inflammatory, antioxidant, or antimicrobial activity. This narrative review discusses a potential topical cream containing extracts from Frangipani (Plumeria species), Aloe vera, Turmeric (Curcuma longa), and Neem (Azadirachta indica). Key formulation and evaluation considerations include physical appearance, odour, pH, consistency, homogeneity, spreadability, extrudability, and stability. Possible pharmacological activities are considered in light of available literature. However, the strength of evidence differs between plants and studies, and laboratory findings do not necessarily establish clinical benefit. A finished formulation must be tested for quality, safety, stability, and efficacy before it can be recommended for wound care..*

Keywords: Herbal cream, wound healing, *Plumeria*, *Aloe vera*, *Curcuma longa*, *Azadirachta indica*.

I. INTRODUCTION

Wound healing is the natural process by which the body repairs damaged skin and underlying tissues. Wounds can result from cuts, burns, injuries, accidents, or some medical conditions. Proper wound care helps protect the wound, supports repair, and reduces the risk of complications.[1,2]

Medicinal plants have been used traditionally in skin care and wound management. They contain natural compounds, including flavonoids, tannins, alkaloids, and phenolic compounds. Some are being studied for antioxidant, anti-inflammatory, or antimicrobial effects.[2,3] Traditional use alone, however, does not prove that a preparation is safe or effective.

A herbal wound-healing cream is a topical preparation made by incorporating plant-derived ingredients into a suitable cream base.[4] Frangipani (*Plumeria* species), *Aloe vera*, Turmeric (*Curcuma longa*), and Neem (*Azadirachta indica*) are examples of plants investigated for potential skin-related applications (Fig. 1). Their effects may depend on the exact species, plant part, extraction method, concentration, and final formulation.

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Fig. 1. Frangipani (Plumeria) flowers

This review describes the wound-healing process, selected medicinal plants, possible mechanisms, formulation factors, and tests used to evaluate a topical herbal cream. It does not report a newly prepared or clinically tested product.

II. AIM AND OBJECTIVES

Aim: To review the formulation and evaluation of a herbal wound-healing cream made with selected medicinal plant extracts and to discuss its potential pharmacological activities.

Objectives:

- To identify medicinal plants investigated for potential wound-healing properties.
- To describe suitable considerations for obtaining and standardising plant extracts.
- To outline the main steps involved in incorporating extracts into a topical cream base.
- To describe physical and physicochemical tests used to evaluate a cream.
- To discuss potential antimicrobial, antioxidant, and anti-inflammatory activities of selected ingredients.
- To highlight the need for quality control, safety assessment, and further efficacy studies.

III. REVIEW METHODOLOGY

This article is a narrative review and is not a registered systematic review. Literature was identified from PubMed-indexed articles and accessible review papers concerning wound healing, medicinal plants, herbal formulations, and topical creams.[2,3,4,5] Search concepts included "herbal wound healing," "medicinal plants and wound repair," "herbal cream formulation and evaluation," and "clinical studies of herbal wound formulations." Review articles and selected clinical or preclinical literature were used to describe broad themes. No new experiments were performed, and no pooled effect estimate was calculated. Because formulations, plant species, doses, and study designs differ, findings should be interpreted according to the type and quality of evidence available.

IV. PHYSIOLOGY OF WOUND HEALING

4.1 Haemostasis

Haemostasis begins immediately after an injury. Blood vessels constrict, platelets gather at the damaged site, and a fibrin-rich clot forms. The clot limits blood loss and provides a temporary structure for cells involved in repair.[6]

4.2 Inflammation

Inflammatory cells, including neutrophils and macrophages, help remove microorganisms and damaged tissue. Inflammation is necessary in early healing, but prolonged or excessive inflammation can delay repair.[6]

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4.3 Proliferation

During proliferation, fibroblasts produce extracellular-matrix components, new blood vessels develop, and epithelial cells move across the wound surface. Granulation tissue forms and the wound gradually contracts.[6]

4.4 Remodelling

During remodelling, collagen is reorganised and tissue strength gradually increases. Healed tissue may not regain the full strength or appearance of uninjured skin. These phases overlap rather than occurring as completely separate events.[6]

V. SELECTED MEDICINAL PLANTS INVESTIGATED IN WOUND CARE

5.1 Frangipani (*Plumeria* species)

Frangipani is used traditionally in some systems of herbal medicine. Different plant parts contain compounds being studied for possible antioxidant, anti-inflammatory, and antimicrobial properties (Fig. 2).[7] Evidence specifically supporting wound healing in humans remains limited, and findings from one *Plumeria* species or extract should not automatically be applied to another.



Fig. 2. Frangipani (Plumeria species)

5.2 *Aloe vera*

Aloe vera gel is widely used in skin-care products (Fig. 3). It contains water, polysaccharides, and other constituents that may help maintain moisture and are studied for their possible role in skin repair.[3] Results can vary by preparation and wound type, so a particular product requires its own safety and efficacy evaluation.

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Fig. 3. Aloe vera

5.3 Turmeric (*Curcuma longa*)

Turmeric contains curcuminoids, including curcumin, which have been studied for antioxidant and anti-inflammatory effects (Fig. 4).[8] Researchers investigate whether these properties may support wound repair. Formulation, solubility, stability, and the amount delivered to the skin can influence performance.



Fig. 4. Turmeric (Curcuma longa)

5.4 Neem (*Azadirachta indica*)

Neem leaves and other plant parts contain diverse bioactive compounds that have been studied for antimicrobial and anti-inflammatory effects (Fig. 5).[9,10] Laboratory activity does not necessarily mean that a neem cream will prevent infection or improve healing in people. Concentration, purity, and skin tolerability must be assessed.

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Fig. 5. Neem (Azadirachta indica)

VI. POSSIBLE MECHANISMS OF ACTION OF A HERBAL WOUND-HEALING CREAM

The possible effects of a herbal cream depend on its ingredients, concentrations, and quality. The mechanisms below are proposed from the wider literature and should not be interpreted as proof that a specific combined formulation works.[6]

6.1 Anti-inflammatory activity

Some constituents of turmeric and *Aloe vera* are investigated for their effects on inflammatory pathways.[6] If a preparation reduces excessive inflammation without interfering with normal repair, it may support the healing environment. This effect must be confirmed for the finished formulation.

6.2 Antioxidant activity

Plant phenolics and flavonoids may neutralise certain free radicals in laboratory tests (Fig. 6). Reducing excessive oxidative stress could help protect cells involved in repair, but results from chemical antioxidant assays do not directly predict clinical wound-healing outcomes.

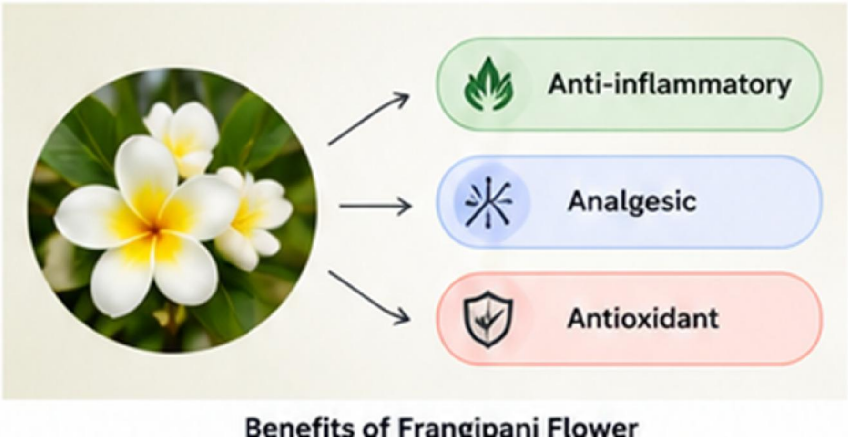

Fig. 6. Potential biological activities under investigation; not proof of clinical effect

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6.3 Antimicrobial activity

Some extracts of neem and *Plumeria* have shown activity against selected microorganisms in laboratory studies.[7,9] Such findings do not establish that a cream can treat a wound infection. Suspected infected wounds require appropriate medical assessment.

6.4 Collagen formation and tissue repair

Collagen provides structural support to repairing tissue. Some plant compounds are studied for possible effects on fibroblasts, collagen deposition, and tissue remodelling.[6] These effects depend on dose and formulation and must be evaluated using suitable models.

6.5 Epithelialisation and moisture

Epithelialisation is the movement and growth of skin cells across the wound surface. A suitable moist environment can support this process. Ingredients such as *Aloe vera* are studied for their potential contribution, but product safety and clinical benefit must be established.[3]

VII. FORMULATION CONSIDERATIONS FOR A HERBAL CREAM

7.1 Selection and authentication of ingredients

Plant species and plant parts should be correctly identified. Raw materials should be checked for identity, purity, contaminants, and consistency. A documented source and suitable quality-control process help reduce batch-to-batch variation.[4]

7.2 Extraction method

The extraction method should be appropriate for the plant material and the compounds of interest. Solvent, temperature, extraction time, and drying conditions can affect the extract. Residual solvent and microbial quality should be considered where relevant.

7.3 Cream base and compatibility

The base should be selected according to the intended use and compatibility with the extracts. Ingredients may affect texture, colour, odour, pH, preservative performance, or emulsion stability. Compatibility testing is important before finalising the formula.[4]

7.4 pH and skin compatibility

The pH should be measured using a suitable method and assessed in relation to skin compatibility, ingredient stability, and preservative performance. A pH value alone does not prove that a product is non-irritating.

7.5 Mixing and preparation

The ingredients should be incorporated using a controlled procedure to obtain a uniform preparation. Appropriate mixing, temperature control, hygienic handling, and documentation help improve consistency and reduce separation or contamination.

7.6 Packaging and storage

Packaging should protect the cream from contamination and, where needed, light, air, and moisture. Storage conditions and shelf life should be supported by stability data rather than assumptions.

VIII. EVALUATION OF HERBAL WOUND-HEALING CREAM

8.1 Physical appearance

The cream is observed for colour, odour, texture, visible lumps, and general appearance. Any change during storage should be documented.

8.2 Homogeneity

Homogeneity checks whether the preparation is uniform and whether visible particles or separation are present. A suitable method should be specified and applied consistently.

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8.3 pH

The pH can be measured using a calibrated pH meter or an appropriate validated method. The target range should be justified for the formulation and intended use.

8.4 Spreadability

Spreadability describes how readily the cream spreads over a surface under defined conditions. A consistent test procedure is needed to compare batches or formulations.

8.5 Viscosity and consistency

Viscosity indicates resistance to flow. Suitable viscosity helps the cream remain at the application site while still being easy to spread. Measurement conditions and equipment should be reported.

8.6 Extrudability

Extrudability measures how easily the cream is dispensed from its container, such as a tube. The test method, container, and applied force should be specified.

8.7 Stability

Stability studies assess changes in appearance, odour, pH, viscosity, phase separation, and relevant microbiological or chemical quality over time under defined conditions. Shelf life should only be assigned from appropriate data.

8.8 Antioxidant and antimicrobial testing

Methods such as the DPPH (2,2-diphenyl-1-picrylhydrazyl) assay may be used to estimate antioxidant activity in vitro. Antimicrobial activity may be assessed with suitable validated microbiological methods and controls. These tests provide preliminary laboratory evidence and do not, by themselves, prove clinical effectiveness.

8.9 Skin irritation and safety

Safety evaluation should follow relevant ethical and regulatory guidance. Testing should use appropriate validated approaches and avoid unnecessary harm to people or animals. A product intended for broken skin needs particular attention to irritation, sensitisation, contamination, and other risks.

IX. EVIDENCE AND INTERPRETATION

Published research suggests that some medicinal plant extracts contain compounds with biological activities relevant to wound repair, including antioxidant, anti-inflammatory, and antimicrobial effects.[5,11] However, evidence varies considerably by plant, extract, concentration, formulation, and study design. A positive result in a test tube or animal model does not guarantee a similar benefit in humans. For a combined cream containing *Plumeria*, *Aloe vera*, turmeric, and neem, the final product cannot be assumed to have the same activity as each ingredient tested separately. Interactions between ingredients and the cream base may change stability, availability, and skin tolerability. Claims about healing, infection prevention, or faster recovery should be supported by product-specific data.

A stronger evidence package would include authenticated plant material, standardised extracts, reproducible formulation methods, physicochemical and microbiological quality testing, stability studies, appropriate safety assessment, and well-designed efficacy studies. Until such evidence is available, the formulation should be described as a potential research candidate rather than a proven treatment.

X. ADVANTAGES AND LIMITATIONS

10.1 Potential advantages

- Plant extracts provide a source of compounds for research into topical wound-care products.
- Some ingredients have reported antioxidant, anti-inflammatory, or antimicrobial activity in laboratory studies.
- A cream can be convenient to apply and may help maintain a suitable level of moisture, depending on its base.
- Locally available plants may offer opportunities for economical product development, provided quality is maintained.
- Research may help identify safe and effective formulations for specific wound-care needs.

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10.2 Limitations

- Plant composition varies with species, plant part, season, growing conditions, and extraction method.
- Clinical evidence for some ingredients and combinations is limited or inconsistent.
- Plant extracts may cause irritation, sensitivity, or allergic reactions.
- Light, heat, air, and unsuitable storage can affect extract stability.
- Poor-quality raw materials or preparation may introduce microbial or chemical contamination.
- Extracts may alter the cream's pH, texture, preservative performance, or stability.
- Standardising active constituents and ensuring batch-to-batch consistency can be difficult.
- Safety, suitable use, and efficacy of the finished product require appropriate testing.

Safety note: A herbal product should not replace medical care for deep, large, heavily bleeding, infected, or non-healing wounds, or for serious burns. Seek appropriate medical advice for these conditions.

XI. CONCLUSION

Herbal wound-healing creams are an area of research because selected medicinal plants contain bioactive compounds that may be relevant to skin repair. Frangipani (*Plumeria* species), *Aloe vera*, Turmeric (*Curcuma longa*), and Neem (*Azadirachta indica*) have been investigated for different biological activities, but the amount and quality of evidence differ between ingredients.

Developing a topical herbal cream requires correct plant identification, suitable extraction, a compatible cream base, controlled preparation, and evaluation of appearance, homogeneity, pH, spreadability, viscosity, extrudability, microbiological quality, and stability. These tests help assess product quality but do not alone establish clinical benefit.

A herbal cream may offer a useful direction for further research, but its safety and effectiveness cannot be assumed from the natural origin of its ingredients. Further product-specific laboratory and clinical studies are needed before claims about wound healing can be confirmed.

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