

DEVELOPMENT AND EVALUATION OF HERBAL SKIN CREAMS FOR ENHANCED WOUND HEALING

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ABSTRACT

With the development of medical science, wound care is continually changing. Professionals in wound care are still searching for the ideal dressing material since they are up against a number of obstacles. In order to control wounds, wound care experts have turned back to the old healing techniques by adopting traditional and alternative medicine due to the advent of multi-resistant organisms and a decline in modern antibiotics. It is really gratifying to see how traditional medicine is being perceived by the public. In this study, creams were created based on an analysis of the effectiveness of plant extracts in treating wounds. Acacia auriculiformis, Turmeric, Tulsi, and Aloe vera were chosen as herbal plants. Alcohol is used to remove certain dried plant components. Utilizing various evaluation techniques, the product's quality was evaluated. The physical characteristics remained unchanged, and the pH was within acceptable limits (about pH 7). During this study period, the formulations demonstrated good

consistency, no sign of phase separation, and good spreadability. The viscosity of creams was discovered to be inversely proportional to the rate of shear (rpm), increasing when the rate of shear was decreased. During a stability study conducted for three months at (40) and 75 5%

RH) in accordance with ICH guidelines, the creams were found to be stable. From the current study, it can be inferred that creams containing herbal extracts with wound-healing properties can be created and used to provide a skin barrier.

KEYWORDS: Wound healing, *Acacia auriculiformis*, Turmeric, Aloe vera, Tulsi.

INTRODUCTION

Creams are semisolid dosage forms that are meant to be applied topically to the skin, on the eye's surface, or utilised nasally, vaginally, or rectally for medicinal or protective action. They can also serve an aesthetic purpose. These preparations are utilised for the localised effects that the drug's penetration into the skin's or mucous membrane's underlying layer produces at the application location. The skin is the intended organ for these devices' medication delivery systems, which are intended to treat cutaneous ailments.^[1]



Fig. 1: Formulation of herbal cream.

Oil-in-water (o/w) or water-in-oil (w/o) type semisolid emulsions that are meant for exterior applications are referred to as cream. Creams frequently have two phases to them. Water-in-oil (w/o) emulsions are emollient and cleaning agents, whereas oil-in-water (o/w) emulsions are most helpful as water-washable bases. To disperse the aqueous phase in the oily phase or vice versa, an emulsifying agent is employed.^[2-3]

Traditional medicines are less expensive, easily accessible, and comprehensive, especially in developing nations, according to the World Health Organisation (WHO) and our nation.^[4]

Wound and Wound Healing Process

A loss or interruption of the cellular, anatomical, or functional continuity of the deep skin tissue or the living tissues may be referred to as a wound. Physical, chemical, thermal, viral, microbial, or immunological stress to the skin's surface can all result in wounds. In addition to having a negative impact on the patient's bodily and mental health, wounds can also be very expensive and leave long-lasting scars. Generally speaking, a wound is a physical injury that opens up or breaks the skin.^[5]

The following are a few illustrations of plants that can treat wounds:

Aloe vera

The plant species aloe vera belongs to the genus aloe. It is used for agricultural and therapeutic purposes and grows naturally in tropical areas all over the world. Aloe grows nicely indoors in pots and is utilised for ornamental purposes as well. A significant medicinal plant for treating and defending the skin is aloe vera. It is incredibly beneficial and protective and works wonders on burns, sunburns, and a range of skin conditions (eczema, pruritus, psoriasis, acne). Aloe vera is helpful for skin that is irritated or swollen. Aloe vera aids in the restoration of even the most delicate skin injuries. Burns and other wounds can heal faster thanks to aloe vera. Your skin will be moisturised, renewed, and toned by aloe vera. Your skin is moisturised and made softer with Aloe vera.

Curcuma longa

A perennial herbaceous plant with rhizomes, turmeric (*Curcuma longa*) is a member of the ginger family (Zingiberaceae). It is indigenous to southern Asia and needs between 20 and 30 °C (68 and 86 °F) of temperature as well as a sizable amount of annual rainfall to survive. Each year, plants are harvested for their rhizomes, and the next season, some of those rhizomes are used to establish new plants. A perennial herbaceous plant, turmeric can grow as tall as 1 m (3 ft 3 in). There are highly branching, cylinder, scented, yellow to orange rhizomes. The leaves are placed in two rows and are alternated. Leaf sheath, petiole, and leaf blade are the three categories. A fake stem is created from the sheaths of the leaves. 50 to 115 cm (20 to 45 in) is the length of the petiole. Simple leaf blades typically range in length from 76 to 115 cm (30 to 45 in) and seldom reach 230 cm (91 in). They are oblong to elliptic in shape and range in breadth from 38 to 45 cm (15 to 18 in), narrowing near the tip.

Turmeric has been applied physically to heal wounds and treat skin sores as well as internally to treat a number of illnesses, including indigestion, throat infections, colds, or liver diseases.^[7]

Tulsi

Tulsi is frequently used as a natural therapy for injuries, hepatic and respiratory problems, viral infections, earaches, back pain, hiccups, and inflammation of the conjunctiva in newborns. Additionally, it has ambrosial, appetising, flatulence-relieving, mucus-irritation-curing, sweat-inducing, diuretic, expectorating, alexiteric, anthelmintic, and antipyretic qualities. Tulsi, often referred to as *Ocimum sanctum* Linn., is a tree in the Labiatae family. The antimicrobial, antifungal, antibacterial, and antioxidant properties of the upright, herbaceous, numerous-branched, softly hairy, biennial or triennial plant, tulsi, were first brought to the attention of chemists by Ayurveda. The majority of species have green pinnate leaves. Tulsi is renowned, and a recent study is confirming its positive effects. There is growing proof that tulsi uses a unique combination of pharmacological activities to relieve physical, physiological, metabolic, and psychological stress. Tulsi has also been demonstrated to reduce psychological stress by improving memory and cognitive function, as well as metabolic stress by bringing blood sugar levels back to normal, regulating lipid levels, and regulating vital signs.

Acacia auriculiformis

One such priceless species is *Acacia auriculiformis* A. Cunn. ex. Benth, from which numerous therapeutically effective components have been extracted. It is a leguminous tree with multiple uses that is significant for forestry and medicine. In urban areas, where its hardiness, dense foliage, and vivid yellow blooms are advantages, this species is employed for shade and decorative purposes.

It has been used traditionally to treat a variety of medical issues, including allergies, rheumatism, sore eyes, pains, and rashes. Besides, *Acacia auriculiformis* has been proven for many pharmacological activities like central nervous system depressant activity, antioxidant, antimicrobial, antimalarial, anti-filarial, cestocidal, antimutagenic, chemopreventive, spermicidal, wound healing, hepatoprotective and antidiabetic activity due to its low toxicity (LD₅₀ = 3 741.7 mg/kg) and high efficacy. The presence of the main components flavonoids (Auriculoside) and triterpenoid saponin glycosides (acaciasides- acaciaside A & B) in various portions of this plant is also demonstrated by numerous phytochemical analyses.^[9]

Physiology of Human Skin Epidermis

The thickness of the stratified, keratinized squamous epithelium that makes up the epidermis, the skin's outermost layer, varies depending on where on the body it is located. The palms of the hands and the bottoms of the feet have the thickest layer. The deeper layers of the epidermis

are bathed in interstitial fluid from the dermis, which supplies oxygen and nutrients and drains away as lymph. The epidermis does not contain blood vessels or nerve endings.

Dermis

The dermis is elastic and resilient. It is made of connective tissue, and the matrix contains elastic and collagen fibres woven together. Stretch marks, also known as permanent striae, are a result of the skin's elastic fibres rupturing when it is overstretched during pregnancy and obesity. Water is held together by collagen fibres, which also give the skin its tensile strength. As collagen fibres age, wrinkles start to appear. The primary cells present in the dermis are mast cells, macrophages, and fibroblasts.

Subcutaneous gland

These are made up of cells that secrete substances and are derived from the same tissue as hair follicles. All regions of the body's skin, with the exception of the palms of the hands and soles of the feet, contain sebum, an oily material that they inject into the hair follicles. The skin of the scalp, face, axillae, and groynes contains the most of them.^[10]

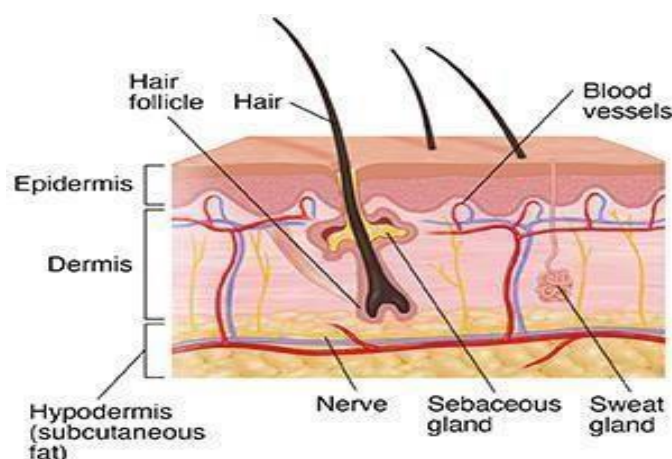


Fig. 2: Structure of skin.

Wound Healing Activity

Using excision and incision wound models in Swiss albino mice, the cream made with ethanol and aqueous extracts of *Acacia auriculiformis* leaves was assessed for studies on wound healing. Determining the hydroxyproline content and performing histopathological analyses on the treated groups were done. The findings demonstrated that both formulations have significant wound healing activity, which was demonstrated in all treated animals by shortened epithelialization time, enhanced wound contraction speed, tensile strength, hydroxyproline

content, granulation tissue creation, and collagen fibre synthesis. In comparison to the ointment containing water extract, the ethanol extract's activity was noticeably higher. The inclusion of different phytoconstituents such as tannins, flavonoids, and phenolic components may be the cause of the extracts' ability to heal wounds.^[12]

Topical Drug Delivery

Drugs have been administered to the human body by a variety of routes throughout the past few decades, including oral, sublingual, rectal, parental, topical, inhalation, etc., to cure illnesses. With the goal of containing the pharmacological or the effect of the drug to the surface of the skin or within the skin, topical delivery is the application of a drug-containing formulation to the skin to treat a cutaneous disorder or the cutaneous manifestations of a general disease (such as psoriasis). Semisolid formulations in all their diversity dominate the system for topical delivery, but foams, spray, medicated powders, solutions, and even medicated lotions can be used.

Advantages

- Avoidance of first pass metabolism.
- Reduce risk.
- Convenient and simple to use
- The drawbacks of intravenous therapy and the various conditions of absorption, such as pH fluctuations, the presence of enzymes, the rate at which the stomach empties, etc.

MATERIALS AND METHODS

Materials Formula

Table 1: Formula.

Sr. No.	Ingredients	F1C	F2C	F3C	F4C
1.	Turmeric extract	2.7 ml	1.42 ml	1 ml	0.9 ml
2.	Aloe vera extract	2.8 ml	1.47 ml	1.67 ml	1.79 ml
3.	Tulsi extract	1.7 ml	1 ml	1.1 ml	1.2 ml
4.	Acacia auriculiformis extract	0.9 ml	0.28 ml	0.67 ml	0.55 ml
5.	Bees wax	5.45 gm	4.97 gm	6.03 gm	6.9 gm
6.	Liquid paraffin	18.1 ml	21.32 ml	20.1 ml	19.7 ml
7.	Borax	0.36 gm	0.56 gm	1.5 gm	1 gm
8.	Methyl Paraben	0.03 gm	0.59 gm	0.50 gm	0.7 gm
9.	Distilled water	q. s.	q. s.	q. s.	q. s.
10.	Rose Water	q. s.	q. s.	q. s.	q. s.

Ingredients and their roles

Table 2: Ingredients and their roles.

Sr. No.	Ingredients	Roles
1.	Turmeric	Antiseptics & Anti-inflammatory
2.	Aloe vera	Anti-aging, reduce acne
3.	Tulsi	Antibacterial, add glow to face
4.	Acacia auriculiformis	Wounds healing
5.	Bees wax	Emulsifying agent
6.	Liquid paraffin	Lubricating agent
7.	Borax	Alkaline agent
8.	Methyl Paraben	Preservative
9.	Distilled water	Vehicle
10.	Rose Water	Fragrance

Methods

Collection of plants material

From the neighbourhood botanical garden, Turmeric, acacia Auriculiformis, Aloe vera, and Tulsi were harvested. There is no disputing the fact that drugs are properly collected when they have the highest concentration of active components, regardless of the type of crude drug or the location of collection. When collecting crude medications, the benefits of the current environmental conditions are also taken into account. However, when collecting natural drugs on a commercial scale, special emphasis should be given to the employment of professional workforce. Depending on the fruit component that is being used, the fruits are harvested. They only harvested fully grown, ripe or partially ripe fruit. Rhizomes are harvested when they have a sufficient supply of reserve food and have the highest concentration of chemical constituents.

Extraction process

Preparation of turmeric extract: Stir 1 g of turmeric powder with 10 ml of distilled water in a 250 ml volumetric flask that has been heated in a water bath for 5 to 10 minutes at 80°C to 100°C. After filtering it, turmeric extract is produced.



Fig. 3: Extraction of Turmeric powder.

Preparation of Aloe-vera extract: Pick an aloe vera leaf from the plant that is mature and fresh, then wash it with distilled water. It is hot air oven dried. Leaf longitudinally cut with a clean knife. Aloe vera that is semi-solid is gathered. Take out the fibres and contaminants. Extract from Aloe vera is obtained.



Fig. 4: Extraction of Aloe vera gel.

Preparation of Tulsi extract: Tulsi leaves were gathered, cleaned with distilled water, then dried in an oven using hot air. The leaves were then ground up after a thorough drying process. Then a volumetric flask was filled with 1 g of Tulsi leaf powder and 10 ml of dimethyl

sulfoxide. The solution was then boiled in a water bath at 80°C to 100°C for 5–10 minutes before being filtered through filter paper and Tulsi leaf extract.



Fig. 5: Extraction of Tulsi leaves.

Preparation of *Acacia auriculiformis* extract: Plant extract was created using the maceration procedure. After being air dried at room temperature, clean leaves were ground into a coarse powder. Petroleum ether was used to defatify the powdered dry leaves of *Acacia auriculiformis*, and then chloroform, ethyl acetate, acetone, butanol, and methanol were used to extract them.^[27]



Fig. 6: Extraction of *Acacia auriculiformis* leaves.



Fig. 7: Extraction of Herbal Plants.

Formulation of cream

Take 75 °C liquid paraffin and bees wax and heat it there (oil phase) in a borosilicate glass breaker. Borax and Methyl paraben should be dissolved in distilled water in another beaker while maintaining a temperature of 75°C with a water bath. The aqueous phase of the solution should be stirred with a glass rod until all solid particles are dissolved. Gently pour the hot aqueous phase into the heated oily phase while continuing to mix. Aloe-vera extract, Tulsi extract, Acacia auriculiformis extract, and Turmeric extract should be added right away after combining the two stages. Glass rod blending should continue until a smooth cream emerges. Rose oil should be added as a fragrance once the cream has formed.^[28]

Evaluation Parameters

1. Organoleptic Properties

The organoleptic properties such as colour, odour and appearance was observed.

2. Determination of PH

The pH value of freshly formulated emulsion was determined using a digital pH meter at room temperature.

3. Determination of homogeneity

The homogeneity of the herbal preparation was observed by visual appearance and by touch.

4. Determination of spreadability

The term spread ability is expressed as the extent of the area to which the topical application

spreads when applied to the affected region of the skin. The therapeutic efficacy of the herbal formulation is also dependent on its spreading range.

Thus, it is necessary to determine the spreading ability of the prepared formulation. For the determination about 3 gms of cream was applied between the two glass slides and pressed to obtain a thin film of uniform thickness. A weight of 5 gm was placed over the top slide to apply the required pressure for 5 minutes. Followed by addition of about 10 gms of weight in a pan and the upper slide was subjected to pull with the help of a string attached to a hook.

The time taken by the two slides to slip over each other by a distance of 10 cm under certain load was noted.

Following is the formula to calculate the spreadability of the prepared formulation.

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

Where,

S- Solubility

m- Weight tied to upper glass slide L- Length moved on glass slide

T- Time taken.

The results were carried out in a triplicate manner and the average of these readings were noted

7. Irritancy test

The formulated cream shows no redness, edema, irritation and inflammation during studies. The formulated cream is safe to use.

6. Phase Separation: Prepared cream is kept in tightly closed container at room temperature away from sunlight and observed for 24 hours for phase.

7. Washability: Formulation was applied on the skin and then ease extend of washing with water and checked.^[29]

RESULTS AND DISCUSSION

Evaluation Parameters Physical Parameters

Table 3: Physical Parameter.

Sr. No.	Parameters	F1C	F2C	F3C	F4C
1.	Colour	Faint Yellow	Faint Yellow	Faint Yellow	Faint Yellow
2.	Odour	Pleasant	Pleasant	Pleasant	Pleasant
3.	Texture	Smooth	Smooth	Smooth	Smooth
4.	State	Semi solid	Semi solid	Semi solid	Semi solid

Irritancy Test**Table 4: Irritancy Test.**

Sr. No.	Formulation	Irritant effects	Erythema	Edema
1	F1C	Nil	Nil	Nil
2	F2C	Nil	Nil	Nil
3	F3C	Nil	Nil	Nil
4	F4C	Nil	Nil	Nil

Washability test**Table 5: Washability test.**

Sr. No.	Formulation	Washability
1	F1C	Washable
2	F2C	Washable
3	F3C	Washable
4	F4C	Washable

Phase Separation**Table 6: Phase Separation.**

Sr. No.	Formulation	Phase separation
1	F1C	No Phase separation
2	F2C	No Phase separation
3	F3C	No Phase separation
4	F4C	No Phase separation

PH Test**Table 7: pH Test.**

Sr. No.	Formulation	pH
1	F1C	7.3
2	F2C	6.8
3	F3C	6.9
4	F4C	7.6

Spreadability test**Table 8: Spreadability test.**

Sr. No.	Formulation	Time (sec)	Spreadability (gcm/sec)
1	F1C	7	2.14
2	F2C	5	3
3	F3C	6	2.5
4	F4C	4	2.7

DISCUSSION

Understanding the fundamental mechanism of wound healing is challenging since it is a complicated, multifaceted process that varies pathologically. Complete wound closure in a

short amount of time without any negative consequences marks the boundary of perfect wound healing. In the current experiment, it was found that topical administration of polyherbal cream (F3C formulation) had powerful wound healing properties, indicating that it facilitates several stages of the healing process. The synergistic activity of phytochemical ingredients such as flavonoids, saponins, triterpenoids, and tannins may be the cause of F3C cream's remarkable wound healing ability. Flavonoids and triterpenoids, which are phytoconstituents with free radical scavenging abilities that affect the immune system to aid in wound healing.

CONCLUSION

The cream demonstrated wound healing effects from the usage of turmeric, aloe vera, *Acacia auriculiformis*, and tulsi, and all of the herbal constituents showed various noteworthy actions. According to the findings, all formulations F1C, F2C, F3C, and F4C were stable at room temperature and may be applied to the skin without risk. As a result, the formulation of F2C is superior to that of F1C, F3C, and F4C for the formulation of herbal cream. The potential of herbal extracts for cosmetic purposes is the focus of the current studies. The personal care industry has greatly expanded its usage of cosmetics. The use of bioactive ingredients in cosmetics affects the biological processes of the skin and supplies it with the nutrients it needs to be healthy. Throughout the trial period, the produced formulation shown high consistency, good spreadability, and no signs of phase separation.

The produced herbal cream has the best qualities and offers nutritional benefits while using less chemicals to protect the skin from a variety of skin problems. The cream is inexpensive since it was made with basic materials and a straightforward process. The herbal cosmetic mixture can be used to provide a barrier to protect skin and is safe for use. The results of various cream tests indicated that the formulation may be applied topically to shield skin from harm. The idea that natural medicines are safer and have fewer negative effects than synthetic ones makes them more acceptable. To verify the formulation's synergistic function scientifically, more research will be conducted.

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