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Formulation and evaluation of Herbal cream : A Review

***V. T Iswariya, Medapatla Hari Priya and T. Rama Rao**

Department of Pharmaceutics,
CMR College of Pharmacy, Medchal,
KANDLAKOYA, HYDERABAD – 501401 (TELANGANA), INDIA
*Corresponding Author
E-mail : iswariyapharma@gmail.com

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ABSTRACT

Wound care management continues to face significant challenges, particularly with the emergence of multi-drug-resistant organisms and the limitations of existing therapeutic strategies. These concerns have renewed scientific and clinical interest in traditional and alternative medicinal systems. Among them, herbal formulations have gained attention owing to their availability, cost-effectiveness, patient acceptability, and therapeutic potential. Topical creams, being easy to apply and remove, remain a preferred dosage form for managing wounds such as cuts, burns, and infections, while also providing a protective barrier against microbial colonization. The present study aimed to develop and evaluate a topical herbal cream incorporating plant leaf extracts with potential wound-healing activity. A basic cream formulation was initially optimized through multiple trials, with the most suitable base selected on the basis of pH stability. The chosen base was then incorporated with varying concentrations of the plant extract, and the resulting formulations were assessed for key physical and functional parameters. Evaluation included pH, homogeneity (visual and tactile), organoleptic characteristics (color, appearance), spreadability, washability, viscosity, and irritancy. The findings suggest that the formulated herbal cream demonstrated favorable pharmaceutical properties, indicating its potential as a safe and effective alternative for wound care applications.

Figures : 05 References : 20 Tables : 11
KEY WORDS : Anti- oxidant activity, Evalution tests, Herbal extraction, *Melampodium divaricatum,* Wound healing cream.

Introduction

Wound Healing : Restoring structural and functional integrity is indeed the primary objective of tissue regeneration and repair, achieved through a well-coordinated series of molecular and cellular processes that unfold after injury. These processes, which depend on the interaction of soluble mediators, circulating immune cells, and resident parenchymal cells, proceed through three distinct but overlapping phases: exudative, proliferative, and extracellular matrix (ECM) remodleing. Tissue edema is the end result of the first exudative phase, which is marked by vascular alterations and inflammatory reactions. During the proliferative phase of wound healing, angiogenesis and reepithelialization are crucial processes that actively support tissue regeneration, while fibroblast activation and myofibroblast differentiation lead to fibroplasia and wound contraction.[1] Notably, endothelial cells' capacity to exhibit plasticity and transdifferentiate into mesenchymal lineages is strictly regulated by signaling networks such as the Hedgehog pathway. This review aims to give a general overview of the primary cellular and molecular mechanisms that underpin the healing of cutaneous wounds, with an emphasis on these regulatory pathways.

Tissue regeneration and repair initiate immediately upon the appearance of a lesion, whether due to trauma or an underlying medical condition. Internal or external sources, such as thermal, chemical, electrical, or physical insults, can cause a lesion, which is any disruption of the normal structural continuity of functional tissues. Such injuries can cause damage to entire cells as well as subcellular organelles[9]. The production of extracellular matrix, the recruitment of blood cells, the action of soluble mediators, and the proliferation of parenchymal cells are among the dynamic

TABLE-1: Formulation of Herbal Cream

S.No.	Ingredients	F1	F2	F3	F4	F5	Uses
1	Bees wax	5g	4g	4g	4g	5g	Emulsifier , thickener
2	Liquid paraffin	22ml	25ml	22ml	22ml	22ml	Moisturizing agent, skin softner
3	Methyl paraben	0.5g	0.4g	0.4g	0.4g	0.5g	Preservative
4	Borax	0.5g	0.4g	0.4g	0.4g	0.5g	Preservative, Buffering agent
5	Plant extract	4ml	5ml	5ml	4ml	4ml	Anti- oxidant, wound healing

events that are triggered by growth factors, which drive cellular proliferation. Tissue repair is a relatively linear process. The three primary phases of wound healing are: inflammatory response the cellular proliferation (which produces extracellular matrix components), and the remodelling phase that follows These phases happen in a way that overlaps over time rather than being distinct or mutually exclusive. This review aims to clarify the main biological mechanisms underlying tissue repair, with an emphasis on the functions of cells, growth factors, and cytokines that promote the healing of cutaneous wounds.

The ability of the body to heal wounds is innate and involves the regeneration of dermal and cutaneous tissues. For this process to promote healing, cooperation between different tissue types and cell lineages is necessary. Blood coagulation to stop bleeding, platelet aggregation, fibrin formation, inflammatory response, angiogenesis, or the creation of new blood vessels, re-epithelialization, or the renewal of epithelial cells to cover the wound, and changes in the extracellular matrix are important factors. These complex processes help to restore tissue integrity and facilitate efficient wound healing[7].

Skin Structure

The human skin is a complex, dynamic organ that performs several essential functions crucial for survival and well-being.This is a synopsis of the makeup and properties of human skin[10].

Epidermis: The epidermis the outermost layer of the human skin, is primarily composed of keratinocytes. These cells originate from the basal layer (stratum basale) and produce keratin, a key structural protein that provides the skin with strength and protectionprovides a protective barrier against outside influences.

Dermis: which lies beneath the epidermis, contains

TABLE 2: Organoleptic properties

Characteristic	Colour	Odour	State	Consistency
F1	Light green	Pleasant	Semi solid	Smooth
F2	Light green	Pleasant	Semi solid	Smooth
F3	Light green	Pleasant	Semi solid	Smooth
F4	Light green	Pleasant	Semi solid	Smooth
F5	Light green	Pleasant	Semi solid	Smooth

TABLE-3: pH Determination

S.No.	Formulations	Results
1	F1	6.4
2	F2	5.6
3	F3	6.42
4	F4	6.14
5	F5	6.31

TABLE-5 : Spreadability

S.No.	Formulations	Results (g.cm/s)
1	F1	34.5
2	F2	29.14
3	F3	24.18
4	F4	17.27
5	F5	25.6

connective tissue, blood vessels, nerves, and anatomical features like hair follicles and sweat glands. enhances the skin's strength, suppleness, and resilience. Adipose (fat) and connective tissue make up the hypodermis, or subcutaneous tissue. provides insulation, cushioning, and energy storage. Among the functions of the skin are:

I. Barrier Function: Protects the body from damage, chemicals, and infections.

II. Thermoregulation: This process uses sweating, vasodilation, and vasoconstriction to regulate body temperature.

III. Sensation: Consists of sensory receptors for touch, temperature, and pain.

IV. Vitamin D Synthesis: This process uses sunlight to create vitamin D, which is essential for calcium metabolism.

V. Immune Response: Contains immune cells (*e.g.,* Langerhans cells) that participate in immune responses.

VI. Excretion: Eliminates waste products through sweat, contributing to detoxification.

Skin wound healing is a vital physiological process that depends on the coordinated action of multiple cell types and the chemicals they secrete, progressing through four main stages: hemostasis, inflammation, proliferation, and remodeling. The rapid initiation of the response to tissue damage during the inflammatory phase can lead to either repair or regeneration. Repair involves replacing damaged specialized structures with collagen deposition, whereas regeneration refers to the growth and differentiation of resident cells or stem cells to restore normal tissue architecture. Importantly, these processes are not mutually exclusive; following a skin injury, regeneration and repair may occur simultaneously within the same tissue, contingent on the specific cell populations affected by the lesion[15].

Plant Profile

Taxonomical classification:

1. Kingdom – Plantae

TABLE-4 : Viscosity determination

S.No.	Formulations	Results (cpS)
1	F1	2220
2	F2	3670
3	F3	3260
4	F4	2640
5	F5	3170

TABLE-6 : Washability

S.No.	Formulations	Results
1	F1	Easily washable
2	F2	Easily washable
3	F3	Easily washable
4	F4	Easily washable
5	F5	Easily washable

TABLE-7 : After feel

S.No.	Formulations	Results
1	F1	Good
2	F2	Bad
3	F3	Good
4	F4	Good
5	F5	Good

2. Phylum – Tracheophyta
3. Order – Asterales
4. Family – Asteraceae
5. Genus – *Melampodium*
6. Species – *Melampodium divaricatum*

Melampodium, also known as the butter daisy, is a small, dependable, low-maintenance summer annual in the aster family. It typically grows 1.5 to 2 feet tall with a spread of about 1 foot. The plant features bright green, slightly fuzzy leaves with smooth, wavy, or slightly toothed edges, and produces abundant solitary, daisy-like yellow flowers with darker yellow centers from spring through fall until frost. Growing to a height of two feet and a width of one foot, it is a resilient plant[2]. The plant is indigenous to Brazil and Mexico. Although it originated in Mexico and Central America, it has spread to other tropical and subtropical areas[3]. In traditional medicine, different parts of the plant have been used to treat inflammation, wounds, and skin conditions.

[4]This investigates the possibility of using M. divaricatum leaves in a cream formulation intended for topical use. Blooming from May until frost, the abundant yellow daisy-like flowers make a striking contrast to the vivid green foliage[5]. The margins of the opposite, somewhat fuzzy leaves can be smooth, wavy, or slightly toothed. Because of its black stalks, the genus name is derived from the Greek words melam, which means black, and pous, which means foot. The name of the

TABLE-8 : Irritancy test

S.No.	Formulations	Results
1	F1	Non irritancy
2	F2	Irritancy
3	F3	Non irritancy
4	F4	Non irritancy
5	F5	Non irritncy

TABLE-9 : Greasiness

S.No.	Formulations	Results
1	F1	Non greasy
2	F2	Non greasy
3	F3	Non greasy
4	F4	Non greasy
5	F5	Non greasy

TABLE-10 : Marketed product

S.No.	Parameters	Results
1	Colour	White
2	Odour	Pleasant
3	State	Semi solid
4	Consistency	Smooth
5	ph	6.35
6	Spreadability	18.6cm
7	Viscocity	2810
8	Washability	Easily washable
9	Irritancy	Non irritancy
10	Greasiness	Non greasy
11	After feel	Good

TABLE-11 : Comparision Table

S.No.	Parameters	Herbal cream (F4)	Marketed cream
1	Colour	Light green	White
2	Odour	Pleasant	Pleasant
3	State	Smooth	Smooth
4	Consistency	Semi solid	Semi solid
5	ph	6.14	6.35
6	Spreadability	2640	2810
7	Viscocity	17.27cm	18.6cm
8	Washability	Easily washable	Easily washable
9	Irritancy	Non irritancy	Non irritancy
10	Greasiness	Non greasy	Non greasy
11	After feel	Good	Good

species refers to a straggling growth or spread[6]. One of the simplest annuals to grow, it requires full sun and soil that is evenly moist and well-drained. The soil should be a little dry, and watering should be regular but infrequent. Once established, *Melampodium* thrives in humid summers and can withstand drought. After the last frost, plant seeds straight into the garden. You can start seeds indoors six to eight weeks prior to the last frost date and plant them outdoors after the last frost date to guarantee early blooms[14].

Plant uses: wound healing, anti-oxidant, anti-inflammation, anti- microbial

Materials and Methodology

The herbal plant material used for the preparation of wound healing cream with the plant leaves extract of *Melampodium divaricatum* were collected from the garden of CMR college of pharmacy, Hyderabad. All the other chemicals were available in the college laboratory.

- Although whole plant parts are used for various purposes of treatment, in preparation of wound healing cream leaves are selected[12].
- Due to presences of flavonoids and phenolic compounds with are responsible for anti- oxidant activity which results in faster healing process of wound.

Preparation Plant Leaves Extract

Collected the leaves of *M. divaricatum,* washed it thoroughly with distilled water for 5-10 mins properly so that soil particals were completely washed out. Then soaked the leave in isopropyl alcohol for 3-4 days in a beaker[13].

Straining: After extraction period, separated the liquid extract from solid extract.

Filtration: filtered the liquid extract using filter paper to get a clear solution and to remove any fine solid particle.

Preparation Of Herbal Cream

Took liquid paraffin in a beaker along with bees wax of required quantity and placed it for heating until it got completely dissolved in it (oil phase). Then took methyl paraben and borax in a required quantity in another beaker and added distilled water to it. Then kept this for heating until it properly dissolved (aqueous phase). After preparation of both oil phase and aqueous

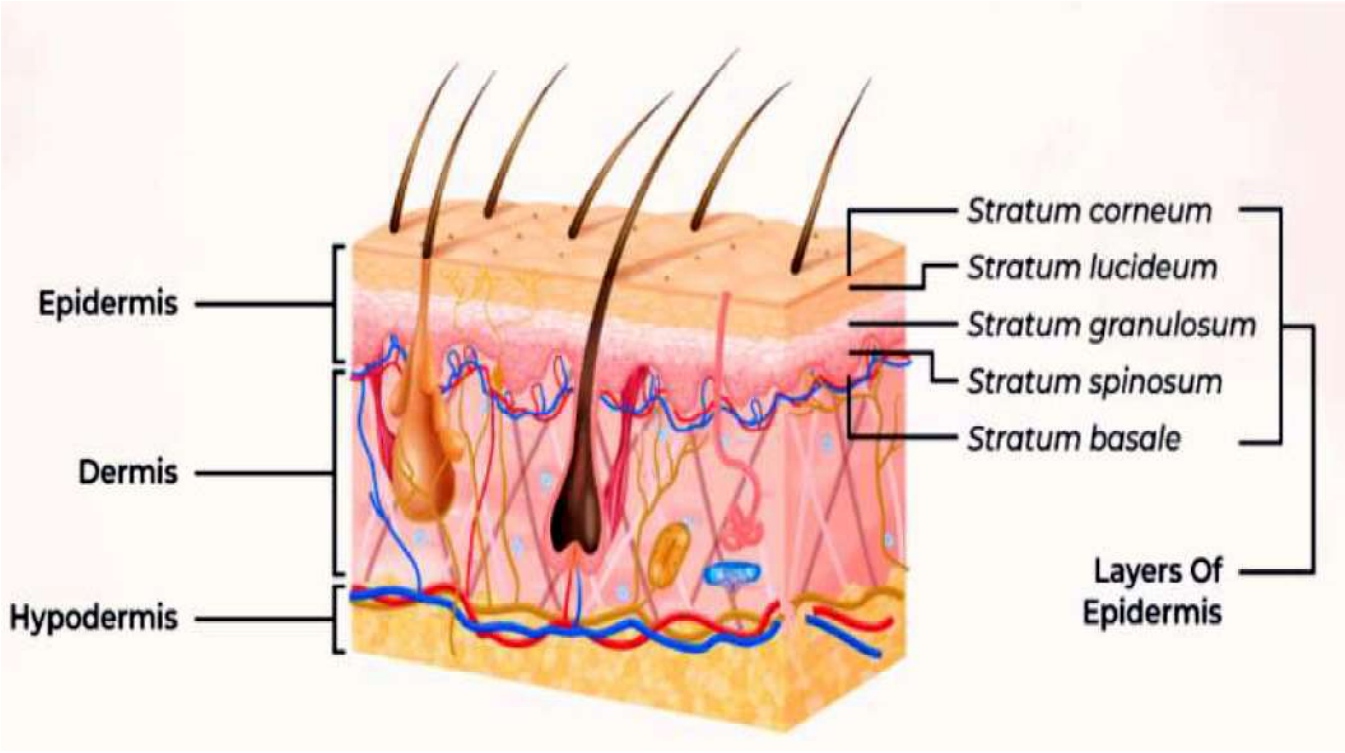

Fig. 1 : Skin Structure

phase, poured the aqueous phase into oil phase slowly by continuous stirring in a single direction to avoid lumps formation[11]. Then added the extract of *M. divaricatum* to the cream base drop by drop and mix well.to avoid lumps formation. Then added the extract of *M. divaricatum* to the cream base drop by drop and mixed well.

Evaluation Test

The assessment of the herbal cream followed[17].

Physical Evaluation:- The produced herbal creams were further assessed using the following physical criterion. physical characteristics, like the color, consistency, smell and state of the formulation.

a) **Colour:** The colour of the cream was observed by visual examination. The result was shown in Table

b) **Odour:** The odour of cream was found to be characteristics.

c) **State:** The cream was examined visually. The cream was solid in state, result was shown in Table 2.

d) **Consistency:** The formulation was examined by rubbing cream on hand manually. The cream was smooth consistency.

Determination of pH:- To determine the pH, dissolved 0.5 g of cream in 50 ml of distilled water**.** Then used a digital pH meter to determine its pH (Table 3).

Fig. 2 : *Melampodium divaricatum*

Fig. 3 : Extraction Process

Viscosity: Using spindle No. 7-14, the Brookfield viscometer was used to measure the formulation's viscosity at 100 r/min.

Spreadability:- Spreadability was done for all five formulations *i.e.,* F1, F2, F3, F4, F5. The less time took for separation of both the slides better the spreadability. Hence according to the above statement F4 had a better spreadability.

Washability:- Applied small amount of cream on hand for few mins, and washed it under tap water. All five formulations were easily washable.

After Feel:- The application of a predetermined quantity of cream16, emolliency, slipperiness, and residue amount were assessed.

Irritancy :- This is used to assess the quality of chemicals and materials and determine whether they are hazardous to the skin or mucosa.We must first mark the area on the left. the dorsal surface of the hand. Following that, we must apply the cream formulation to that area, and the time was recorded. The formulation must then be left for a few minutes so that we can assess for irritability.

Greasiness :- The main purpose of this test was to determine whether the cream is greasy or not.We can conclude from the results that every formulation was non-greasy.

Stability test: Cream samples were put into a centrifuge tube for the mechanical test at a speed of 3750 RPM for 30 minutes or 5000–10,000 RPM for 15 minutes, and then observed whether or not there is a separation.

Evaluation Tests for Presence of Phyto-Constituents:

Tests to determine whether phytoconstituents were present[16]:

1. Phenolic Test: The ferric chloride and litmus tests are the most widely used methods for determining whether plant extracts contain phenolic compounds.

Fig. 4 : Prepared Cream

Fig. 5 : Cream

❖ **Test for ferric chloride:**

- After dissolving the specified organic compounds in water, gradually added the netural ferric chloride solution.
- Looked for color changes that indicated the presence of phenolic compounds, such as blue, green, violet, or red.
- Neutral ferric chloride was made by gradually adding diluted NaOH to a solution of $FeCl_3$ until a permanent brown precipitate formed. Used the clear solution after filtering.

❖ **Litmus test:**

To perform the litmus test, put a drop of the sample or a tiny crystal of the compound onto a piece of wet blue litmus paper.

Phenolic compounds, which indicated acidity, might be present if the paper turns red.

2. Flavonoids test: The ferric chloride test, an alkaline reagent test, is the most widely used method for determining whether plant extracts contain flavonoids.

❖ Tested with an alkaline reagent:

- To 1-2 milliliters of plant extract, added two to three drops of NaOH.
- Noticed the formation of a bright yellow color. A few drops of diluted HCl was added. Flavonoids were present if the yellow color became colorless.

❖ **Ferric chloride test:**

- To test for ferric chloride, added a few drops of 10% ferric chloride to plant extract.
- There might be flavonoids present when a blackish red color formed.

Results and Discussion

Melampodium divaricatum extract was identified as one of the medicinal plants used in the formulation of the herbal cream, along with other ingredients that have been shown to promote wound healing, Physical appearance/visual inspection, pH, washability, viscosity, after feel, spread ability, greasiness, and irritancy test are some of the different quality control parameters. Every parameter produced a positive outcome. The current study's findings demonstrated that adding these medications' active ingredients to herbal cream results in more stable products with appealing appearances[17].

1) Organoleptic Properties: The prepared formulation's color, consistency, and odor were assessed.Through visual inspection, the cream's light green color was discernible. It was determined that the smell of cream was pleasant. A visual examination of the state was conducted. The texture of the cream was semisolid. By manually rubbing cream on the hand, the formulation was evaluated. The smooth consistency of the cream.

2) Determination of pH : Because it affects the skin and the surface was used on, the product's pH balance is crucial. Our cream's pH falls between 5.5 and 6.5, which is the ideal range for the cream.

3) Viscosity: Many characteristics, such as shelf-life ability and product aesthetics including clarity, ease of flow, on removal from packing, and reading when applied to the face, were explained and controlled in large part by viscosity. Using a Brooke field viscometer set to 25°C and spindle number 63 at rpm, the viscosity of the cream was measured[18].

4) Spreadability: The produced cream's spreadability was assessed by sandwiching the sample between two slides and applying a particular weight for

a predefined period of time. The time required to separate the two slides was measured using spread ability. Shorter separation durations between the two slides showed better spread ability. The following formula was used to determine spread ability.

$$\text{Spread ability (S)} = \frac{\text{Weight tide to upper slide (W) x Length of glass slide (L)}}{\text{Time taken to separate slid (T)}}$$

5) Washability: After applying the formulation to the skin, the ease of water washing was assessed.

6) After feel: After applying the prescribed quantity of cream, it was determined that the emolliency, slipperiness, and residue amount were satisfactory[20].

7) Irritancy test: The formulation of a herbal cream was assessed using the non-irritancy test. Redness, edema, inflammation, and irritability were absent from the preparation. The situation was observed for twenty-four hours.

8) Greasiness: Based on the results, we could conclude that all three formulations were non-greasy. The cream was applied to the skin's surface in the shape of a smear, and its oiliness or grease-likeness was assessed[19].

Marketed product

Marketed product SS Dee cream which is used for wound healing cream was compared with the herbal cream.

Comparision of Herbal cream with Marketed product:-

Summary and Conclusion

The study was focused on the formulation and evaluation of a herbal cream using the extract of *Melampodium divaricatum* leaves, which are traditionally known for their wound healing and antioxidant activities. The optimized formulation (F4) exhibited desirable physical and functional characteristics, including light green color, smooth consistency, pleasant odor, and semi-solid texture, which were favorable for topical application. The pH of 6.14 confirmed skin compatibility, while the viscosity 2640 cps and spreadability g·cm/s indicated ease of application and uniform distribution. Furthermore, the cream was easily washable with tap water, non-irritant, non-greasy, and provided a good after-feel, enhancing user acceptability. Overall, formulation F4 was found to be safe, stable, and effective, suggesting its potential as a promising herbal cream for wound healing with additional antioxidant benefits.

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