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FORMULATION AND EVALUATION OF HERBAL WOUND HEALING CREAM CONTAINING KOKUM (GARCINIAINDICA) LEAF EXTRACT

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ABSTRACT

Wound healing is a complex and coordinated biological process involving hemostasis, inflammation, proliferation, collagen deposition, tissue remodeling, and re-epithelialization. The increasing demand for safe, effective, and affordable topical therapies has led to growing interest in herbal formulations because of their therapeutic potential and minimal adverse effects. The present study was aimed at the formulation and evaluation of a herbal wound healing cream containing Kokum (Garcinia indica) leaf extract as the principal bioactive ingredient. Kokum leaves are rich in flavonoids, polyphenols, xanthones, garcinol, and other phenolic compounds that possess antioxidant, anti-inflammatory, and antimicrobial activities, which may promote faster wound healing and tissue regeneration. Neem oil and β-caryophyllene were incorporated to enhance antimicrobial, anti-inflammatory, and skin-repair properties, while suitable pharmaceutical excipients were used to obtain a stable topical cream formulation. The herbal cream was prepared by the fusion method using separate oil and aqueous phases, followed by emulsification and controlled cooling to obtain a homogeneous semisolid preparation. The developed formulations were evaluated for organoleptic characteristics, pH, homogeneity, spreadability, viscosity, washability, extrudability, stability, skin irritation potential, antimicrobial activity, in-vitro drug release, and wound healing activity. The prepared cream exhibited a smooth texture, uniform

consistency, acceptable pH suitable for topical application, good spreadability, satisfactory washability, and excellent physical stability without phase separation. The presence of antioxidant and antimicrobial phytoconstituents is expected to reduce oxidative stress, inhibit microbial growth, minimize inflammation, and accelerate tissue repair. The findings indicate that the developed herbal wound healing cream possesses desirable physicochemical properties and shows promising potential as a natural topical formulation for wound management. However, further pharmacological investigations, in-vivo studies, and well-designed clinical trials are recommended to establish its therapeutic efficacy, safety, and long-term stability before clinical application.

KEYWORDS: Wound Healing, Herbal Cream, Kokum Leaf Extract, Garcinia Indica, Antioxidant Activity, Anti-inflammatory Activity Antimicrobial Activity.

INTRODUCTION

The skin acts as the primary protective barrier of the human body against physical injury, microbial invasion, dehydration, and environmental stress. Any disruption in the structural or functional continuity of the skin results in wound formation, which initiates a complex cascade of biological events aimed at restoring tissue integrity.[1-2]

Wound healing is a dynamic physiological process involving overlapping phases such as hemostasis, inflammation, proliferation, and remodeling.[1-3]

A wound is defined as a loss or breaking of the cellular, anatomical, or functional continuity of living tissues. Wound healing involves platelet aggregation, blood clotting, fibrin formation, inflammatory response, angiogenesis, and re-epithelialization.[2-4]

Wound management has been a major clinical challenge since ancient times, and severe wound infections may lead to septicemia and increased mortality if left untreated.[5-6]

There is a need for new cost-effective therapies with better efficacy for wound healing. Medicinal plants are important sources of bioactive compounds with significant therapeutic potential in wound management.[7-8]

The World Health Organization (WHO) has emphasized the importance of traditional herbal medicines in primary healthcare, particularly in developing countries where medicinal plants remain an essential source of therapy.[9]

Herbal wound healing products have gained substantial scientific and commercial interest because of their reduced side effects, better patient compliance, and improved safety profiles.[10]

Furthermore, recent advances in herbal pharmaceutical technology have enabled the development of novel topical formulations with improved drug release, enhanced skin penetration, and better patient compliance.[11]

Standardization of herbal extracts, quality control, and scientific validation through preclinical and clinical studies are essential to ensure the safety, efficacy, and reproducibility of herbal wound healing formulations.[12]

Therefore, the development of evidence-based herbal wound healing creams may provide a safe, effective, and economical alternative for the management of acute and chronic wounds in clinical practice.[13]

Fig No: 1.

Garcinia indica (Kokum)
Scientific name: Garcinia Indica Choisy
Family: Clusiaceae (Guttiferae)

Kokum (Garcinia Indica) is an evergreen tropical tree native to the Western Ghats of India, predominantly distributed in Maharashtra, Goa, Karnataka, and Kerala. The plant is well known for its medicinal, nutritional, and commercial importance. While the fruit rind is widely used as a food ingredient and traditional remedy, the leaves have also attracted

scientific interest because of their antioxidant and anti-inflammatory phytochemicals. The leaves are dark green, glossy, oval to lanceolate in shape, approximately 5– 10 cm long, and young leaves are reddish before turning green.[14,16]

Biological Source

Kokum consists of the dried ripe fruits of Garcinia Indica Choisy belonging to the family Clusiaceae. In the present study, fresh leaves of Garcinia Indica were collected and used for the preparation of leaf extract.[14,16]

Chemical Constituents

Different parts of Garcinia Indica contain several bioactive phytochemicals including: Garcinol

Hydroxycitric acid (mainly fruit rind)

Anthocyanins

Flavonoids

Polyphenols

Citric acid

Malic acid

Leaf extracts have also been reported to contain phenolic compounds and flavonoids responsible for antioxidant activity.[15-18]

Pharmacological and Traditional Uses

Antioxidant activity

Anti-inflammatory activity

Traditional use for indigestion and acidity

Cooling and refreshing effect as kokum sherbet (fruit)

Moisturizing property of kokum butter (seed fat)

Traditional external application of leaves/bark for minor wounds and skin disorders (limited clinical evidence)

Potential wound healing activity due to antioxidant and anti-inflammatory effects.[15-19]

Safety

Kokum is generally considered safe when consumed in dietary amounts. However, scientific evidence regarding the therapeutic use of kokum leaves in humans remains limited, and further clinical studies are required to establish their safety and efficacy.[19]

1. Kokum Leaf Extract (Garciniaindica)

Kokumleafextract containspolyphenols, flavonoidsandxanthones, whichexhibitantioxidant, anti-inflammatoryand antimicrobial activities. It promoteswoundhealingby reducingoxidative stressandsupporting tissueregeneration.[20]

Fig No: 02.

2. Neem Oil

Neemoil is rich inazadirachtin, ninbinandgedunin. Itpossessesbroad-spectrum antibacterial, antifungalandanti-inflammatoryproperties, making it useful forpreventing wound infections and accelerating healing.[21]

Fig No. 03.

3. β-Caryophyllene

β-Caryophylleneisanatural sesquiterpene withpotent anti-inflammatoryandanalgesic effects. Itactivatescannabinoid receptor-2 (CB2), helping reduce inflammationand supporting tissuerepairduring woundhealing. andacceleratinghealing.[22]

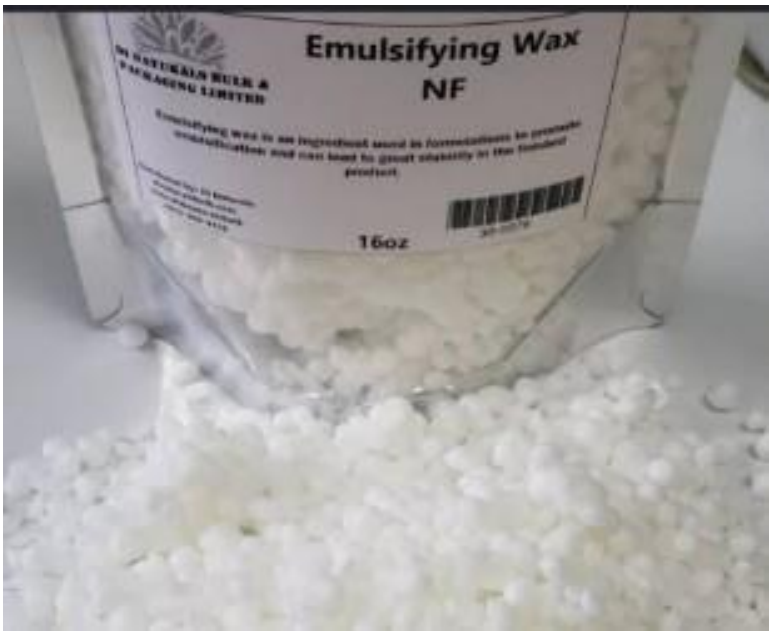
Fig No. 04.

4. Bees Wax

Beeswax actsasastiffening agentandemollientincreamformulations. It improves consistency, enhance eesstability, formsaprotectivebarrierontheskin, andhelps retain moisture.[23]

FigNo: 05 5. EmulsifyingWax.

Emulsifying waxisanon-ionicemulsifierthat stabilizesoil-in-wateremulsions. It provides asmoothtexture, preventsphaseseparation, andimprovestheoveral stabilityofthe cream.[24]



6. CetylAlcohol

Cetylalcohol is afatty alcohol used as athickening and stabilizingagent. It enhances creamviscosity, improvesspreadability, and providesasmooth, non-greasy feelonthe skin.[25]

7. Glycerin

isahumectant thatattracts andretainsmoistureintheskin. It improvesskinhydration, maintainselasticity, and supportsthewound healing process.[26]

8. Methyl Paraben

Methylparaben isapreservative widelyusedintopical formulation inhibitthegrowth of bacteria, yeast andmolds, there byimproving productshelflife.[27]

9. Propyl Paraben

Propyl paraben isanantimicrobial preservative effectiveagainst fungi andmolds. It is commonlyusedwithmethylparabentoprovidebroad-spectrum preservation.[28]

10. Purified Water

Purifiedwaterservesasthevehicle increamformulations. It dissolveswater-soluble ingredients, facilitatesemulsification, and ensuresuniformdistributionofactive constituents.[29]

Aim

Toformulateandevaluate aherbal woundhealingcreamcontaining Garciniaindica (Kokum) leafextract.

OBJECTIVES

1) To prepare aherbal woundhealingcreamcontaining Garciniaindicaleafextract.
2) oevaluatethephysicochemical propertiesofthepreparedcream.
3) Toassessthe stabilityoftheformulation.

Toinvestigate the

4) Potential woundhealing properties of theformulation.

MATERIALS AND METHODS

2.1 Materials

The materials used for the preparation of the herbal wound healing cream are listed in Table 1. Kokum leaf extract (Garcinia Indica) was used as the primary active ingredient due to its antioxidant and wound healing properties. Neem oil served as an antimicrobial agent, while β-caryophyllene was incorporated for its anti-inflammatory activity. Bees wax, emulsifying wax, cetyl alcohol, glycerin, methyl paraben, propyl paraben, and purified water were used as pharmaceutical excipients.

Table 1: Composition of Herbal Wound Healing Cream (F1 and F2).

Sr. No.	Ingredients	Function	F1 (g)	F2 (g)
1.	Kokum Leaf Extract (*Garcinia indica*)	Active ingredient	0.5	1
2.	Neem Oil	Antimicrobial agent	2	2
3.	β-Caryophyllene	Anti-inflammatory agent	0.5	1
4.	Bees Wax	Stiffening agent	5	5
5.	Emulsifying Wax	Emulsifying agent	6	6
6.	Cetyl Alcohol	Thickening agent	2	2
7.	Glycerin	Humectant	5	5
8.	Methyl Paraben	Preservative	0.18	0.18
9.	Propyl Paraben	Preservative	0.02	0.02
10.	Purified Water	Vehicle	q.s. to 100 g	q.s. to 100 g

2.2 Method of Preparation of Herbal Wound Healing Cream

The herbal wound healing cream was prepared by the fusion method using separate oil and aqueous phases.

Step 1: Preparation of Oil Phase

Bees wax, emulsifying wax, and cetyl alcohol were accurately weighed and transferred into a clean beaker. Neem oil and β-caryophyllene were added to the mixture. The oil phase was heated to 70 ± 2° C with continuous stirring until all waxes melted completely and a clear homogeneous mixture was obtained.

Step 2: Preparation of Aqueous Phase

Purified water was heated separately to 70 ± 2° C. Glycerin was dissolved in the warm water, followed by methyl paraben and propyl paraben until completely dissolved.

Step 3: Incorporation of Kokum Leaf Extract

The accurately weighed Kokum leaf extract (0.5 g for F1 and 1 g for F2) was dispersed in a small quantity of warm purified water to obtain a smooth dispersion and then added to the aqueous phase with continuous stirring.

Step 4: Emulsification

The hot aqueous phase was slowly added into the hot oil phase under continuous mechanical stirring. Stirring was continued until a smooth and uniform emulsion was formed.

Step 5: Cooling

The prepared cream was stirred continuously during cooling to room temperature (25– 30° C). Continuous stirring prevented phase separation and ensured uniform consistency.

Step 6: Packaging

The final cream formulations (F1 and F2) were transferred into clean, dry, sterilized, airtight containers and stored at room temperature for further evaluation.

2.3 Formulation Design

Two formulations (F1 and F2) were prepared by varying the concentration of Kokum leaf extract and β-caryophyllene while keeping all other ingredients constant. The formulations were evaluated to determine the optimum concentration for wound healing activity and physicochemical stability.

Evaluation Tests

1. Organoleptic Evaluation

The prepared herbal cream formulations were visu all examined for colour, odour, Appearance, texture, consistency, and smoothness. The observations were recorded to assess the overall physical acceptability of the formulations.

2. pH Determination

The pH of the prepared cream was determined using a calibrated digital pH meter. One gram of cream was dispersed in 10mLofdistilled water, and the pH was measured at room temperature. The determination was carried out in triplicate, and the average value was recorded.

3. Homogeneity

The prepared formulations were evaluated for homogeneity by visual inspection. The Cream was examined for uniformity, absence of lumps, grittiness, and phaseseparation.

4. Spreadability

Spreadability was determined by placing a known quantity of cream between two glass slides. A specified weight was applied, and the time required for the upper slide to move a fixed distance was recorded. Good spreadability indicates easy application on the skin.

5. Viscosity

The viscosity of the cream was measured using a Brook field viscometer at room temperature. The readings were recorded incentipoise (cP).

6. Washability

Washability was evaluated by applying a small quantity of cream to the skin and washing it with water. The ease of removal was observed and recorded.

7. Extrudability

Extrudability was determined by measuring the ease with which the cream was extruded from a collapsible tube under gentle pressure. The formulation was evaluated for smooth and uniform extrusion.

8. Stability Study

The prepared formulations were stored under different storage conditions and observed

periodicaly for changes in colour, odour, pH, consistency, and phase separation.

9. Skin Irritation Test

The skin irritation potential of the formulation was evaluated by applying a sma l quantity of cream to the skin using an appropriate experimental method. The application site was observation ed for redness, swelling, or any signs of irritation.

10. Antimicrobial Activity

The antimicrobial activity of the prepared cream was evaluated by the agar well diffusion method against selected microbial strains. The diameter of the zone of inhibition was measured after incubation.

11. In-vitro Drug Release Study

Thein-vitro drug release study was carried out using a Franz diffusion cell. The cumulative percentage of drug released from the formulation was determined at predetermined time intervals.

12. Wound Healing Activity

The wound healing activity of the prepared herbal cream wase valuated using a suitable wound model. The percentage of wound contraction and the epithelialization period were recorded to assess the wound healing potential of the formulation.

RESULTS AND DISCUSSION

Theherbal creamcontaining Garciniaindica(Kokum) leafextract wassuccessfully formulated andevaluatedforitsphysicochemical characteristics. The formulation exhibitedasmoothtexture, uniformappearance, and goodconsistencywithout any evidenceofphase separation. Thecreampossessed acharacteristicherbal odourand lightgreenishcolourdue to the presenceof Kokumleafextract.

ThepHofthe formulationwasfoundtobewithintheacceptablerangefortopical application(5.5–6.5), indicatingitscompatibilitywithnormal skinandminimizing the possibilityofirritation. Thecreamshowed excellent homogeneitywithnovisible lumpsor grittiness, confirming the uniformdistributionofingredientsthroughout the formulation.

Spreadabilitystudiesdemonstratedthatthecreamspread easilyontheskinwithminimal effort, ensuringconvenient applicationandbetterpatientcompliance. Washabilitywas satisfactory,

asthecreamcouldbe removed easilywithwaterwithout leaving excessive residue ontheskin.

The formulation remained physicallystablеduring thestabilitystudy, withnosignificant changesincolour, odour, pH, consistency, orphase separation. Thisindicatesthatthe selected excipientswerecompatiblewith Kokumleafextract andmaintained the stability of the formulation.

Overall, the evaluationresultssuggestthattheherbal creamcontaining Garciniaindica leafextract possessesdesirablephysicochemical propertiessuitable for topicaluse. The presenceofnaturalphytoconstituentssuchasflavonoids, phenolic compounds, and antioxidantsin Kokumleavesmaycontribute tothecreampotential antioxidant, anti-inflammatory, and wound-healing activities. Furtherpharmacological andclinical studiesarerecommendedtoconfirmitstherapeutic efficacyand safety.

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