

Formulation And Evaluation of a Polyherbal Moisturizing Cream for Supportive Management of Harlequin Ichthyosis

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Abstract—Harlequin ichthyosis is a rare, severe congenital dermatological disorder characterized by catastrophic hyperkeratosis, profound skin thickening, generalized scaling, and deep, painful fissures caused by a fundamentally impaired epidermal barrier that accelerates trans epidermal water loss (TEWL). To support barrier repair and manage this severe xerosis, the present study aimed to formulate and evaluate a supportive polyherbal moisturizing cream utilizing the synergistic bioactivities of Aloe vera, Calendula officinalis, and Hemidesmus indicus (Sariva). The formulation was fabricated using an optimized oil-in water (o/w) emulsion technique and subjected to comprehensive physicochemical characterization, including testing for pH, parallel-plate spread ability, dynamic viscosity, structural homogeneity, washability, acute dermal irritancy, and accelerated stability. The resulting cream exhibited a smooth texture, excellent uniform consistency, acceptable spread ability for fragile skin, and a skin-compatible pH, with no signs of localized irritation or phase separation under varying storage conditions. Backed by the intrinsic moisturizing, soothing, wound-healing, and anti-inflammatory properties of its botanical constituents, this study concludes that the prepared polyherbal cream serves as a safe, highly stable, and effective supportive topical therapy to improve hydration and comfort in patients suffering from severe xerotic skin conditions like Harlequin ichthyosis.

Index Terms—Harlequin ichthyosis, Herbal cream, Aloe vera, Calendula officinalis, Hemidesmus indicus, Moisturizer, Polyherbal formulation, Skin hydration, Dermatological formulation

I. INTRODUCTION

Harlequin ichthyosis is a severe congenital skin disorder caused by mutations in the ABCA12 gene,

which disrupts lipid transport and prevents the proper formation of the skin's protective barrier. This genetic defect leads to extreme hyperkeratosis, resulting in thick, armor like scales separated by deep, painful fissures across the body. Because the skin barrier is completely compromised, patients suffer from massive trans epidermal water loss (TEWL), causing severe dehydration, xerosis, loss of mobility, and a high susceptibility to life-threatening microbial infections. Consequently, intensive and continuous topical hydration therapy is the cornerstone of patient care, serving to seal the cracked epidermis, soften hyperkeratotic tissue, reduce scaling, and restore structural flexibility.

To address these severe symptoms safely, natural bioactive ingredients are increasingly preferred in dermatological formulations due to their biocompatibility and low risk of irritation. This study evaluates a polyherbal moisturizing cream utilizing a synergistic triad of botanical extracts: Aloe vera, which uses mucilaginous polysaccharides to bind moisture and accelerate wound healing; Calendula officinalis, which provides anti-inflammatory and antimicrobial defences to prevent infection; and Hemidesmus indicus (Sariva), traditionally valued in Ayurveda for its profound soothing and skin-cooling properties. By compounding these active extracts into a stable oil-in-water emulsion with non-irritating pharmaceutical excipients, this research aims to develop an optimized, cost-effective topical delivery system that actively supports skin barrier repair and improves the patient's overall comfort and quality of life.

II. MATERIALS AND EQUIPMENTS

The formulation consisted of Beeswax, Liquid Paraffin, Borax, Distilled Water, Aloe vera Gel, Calendula Extract, Hemidesmus indicus Extract, Methyl Paraben, and Perfume.

Herbal Drug

- Aloe vera Gel: Binds moisture into the skin via rich mucilaginous polysaccharides to deliver soothing hydration.
- Calendula officinalis Extract: Downregulates inflammatory pathways and accelerates tissue repair to heal painful cutaneous fissures.
- Hemidesmus indicus Extract: Provides potent antioxidant protection and traditional cooling relief to highly irritated, burning skin.

Other Excipients

- Beeswax (Cera\ alba): Thickens the formulation and creates a protective lipid shield over the damaged stratum corneum.
- Liquid Paraffin: Prevents excessive trans epidermal water loss (TEWL) by acting as a heavy, moisture-sealing occlusive emollient.
- Borax (Sodium Borate): Reacts with the fatty acids in beeswax to create a stable, uniform emulsion base.
- Distilled Water: Serves as the essential hydration vehicle required to soften and moisturize thickened, hyperkeratotic skin.
- Methyl Paraben: Protects the cream's water phase against microbial contamination to ensure consumer safety and product shelf life.
- Perfume: Improves the formulation's organoleptic profile by masking raw botanical odors to enhance overall patient compliance.

Equipment's

- Beaker
- Water bath
- Glass rod
- Ph meter
- Digital weighing balance
- Brookfield viscometer
- Thermometer
- Spatula



Fig.1

Formulation Table

Ingredient	Quantity	Role
Beeswax	10g	Thickening agent
Liquid Paraffin	25g	Emollient
Borax	1g	Emulsifying agent
Distilled Water	50g	Aqueous base
Aloe vera Gel	8g	Moisturizer
Calendula Extract	3g	Healing agent
Hemidesmus indicus Extract	2g	Skin soothing agent
Methyl Paraben	1g	Preservative
Perfume	q. s	Add pleasant fragrance to the formulation

III. DRUG PROFILE

Aloe vera:

- Biological Source: Mucilaginous gel obtained from the fresh parenchymatous leaf tissue of Aloe barbadense Miller.
- Family: Asphodelaceae.
- Uses: Deep humectant moisturizer, downregulates inflammation, and accelerates cellular wound healing.

Calendula officinalis:

- Biological Source: Meticulously dried flower heads belonging to the plant matrix.
- Family: Asteraceae.
- Uses: Broad-spectrum antimicrobial defense, downregulates pro-inflammatory cytokines, and supports epithelial tissue repair.

Hemidesmus indicus:

- Biological Source: Cleaned and dried roots traditionally known as Sariva. Family: Apocynaceae.

- Uses: Thermogenic skin-cooling agent, free-radical scavenging antioxidant, and deep cutaneous soothing reliever.



Fig 2



Fig 3



Fig 4

IV. METHODOLOGY

- The oil phase containing beeswax and liquid paraffin was heated at 70–75°C.
- The aqueous phase containing distilled water, borax, and methyl paraben was heated separately.
- The aqueous phase was slowly added into the oil phase with continuous stirring to form an emulsion.
- After cooling to approximately 40°C, herbal extracts were added with continuous mixing.
- Perfume was added at room temperature.
- The prepared cream was transferred into airtight containers and stored in a cool and dry place.



Fig.5



Fig.6

V. PHYTOCHEMICAL SCREENING

Phytochemical tests were carried out for herbal extracts.

1. Alkaloid Test: Orange precipitate observed.
2. Flavonoid Test: Yellow color observed.
3. Tannin Test: Blue-black color observed.
4. Saponin Test: Persistent foam observed.
5. Glycoside Test: Brown ring observed.
6. Terpenoid Test: Reddish brown layer observed.

These tests confirmed the presence of bioactive constituents responsible for therapeutic effects.

VI. EVALUATION TESTS

The prepared cream was evaluated for

- organoleptic characteristics
- pH
- spread ability
- viscosity
- homogeneity
- washability
- irritancy
- phase separation
- stability.

Organoleptic Characteristics:

Method / Description: Checked by looking at the color and appearance of the cream, feeling its texture, and smelling its scent.

Significance: Helps make sure the cream looks, feels, and smells pleasant so that users will actually want to apply it.

pH:

Method / Description: Tested by inserting a digital pH meter into a mixture of the cream and water.

Significance: Ensures the cream matches the skin's natural chemistry so it does not cause stinging, burning, or redness.

Spread ability:

Method / Description: Measured by placing the cream between two glass slides under a weight to see how easily it spreads out.

Significance: Makes sure the cream rubs on smoothly and easily without hurting or pulling on sore, fragile skin.

Viscosity:

Method / Description: Measured using a machine called a viscometer to check how thick or thin the cream is.

Significance: Ensures the cream has the right thickness so it stays on the skin well and is easy to squeeze out of a tube or jar.

Homogeneity:

Method / Description: Tested by looking closely at the cream and rubbing it between the fingers to check for lumps.

Significance: Confirms that the herbal ingredients are mixed perfectly and evenly through the entire batch.

Washability:

Method / Description: Tested by applying the cream to the skin and seeing how easily it washes off with plain water.

Significance: Makes sure the cream can be cleaned off easily when needed without having to scrub the skin too hard.

Irritancy:

Method / Description: Tested by applying a small patch of cream to the skin and watching for redness, itching, or swelling over 24 hours.

Significance: Proves that the cream is completely safe, gentle, and non-irritating for sensitive or damaged skin.

Phase Separation:

Method / Description: Checked by letting the cream sit over time to see if the oil and water layers start to split apart.

Significance: Shows that the cream is properly put together and will not separate into an oily mess.

Stability:

Method / Description: Tested by storing the cream in different hot and cold places to see if it changes over time.

Significance: Guarantees that the cream will stay fresh, effective, and safe to use for a long time on the shelf.

The pH was determined using a digital pH meter. Spread ability was evaluated using glass slide method. Viscosity was measured using viscometer. Irritancy studies were performed on skin surface to observe redness or itching.



Fig.8

Fig.7



Fig.10

Fig.9



Fig.12



Fig.11

VII. RESULTS AND DISCUSSION

The prepared cream exhibited smooth texture, good consistency, pleasant odour, and acceptable appearance. The pH of the cream was found between 5 and 6 which is suitable for skin application. The

formulation showed good spread ability and homogeneity. No irritation or redness was observed during skin application studies. Stability studies demonstrated no phase separation or significant change in appearance under storage conditions. The herbal ingredients contributed to moisturizing, soothing, antioxidant, and anti-inflammatory activities. The combination of herbal extracts and excipients improved skin hydration and barrier protection. The formulation may therefore be useful in supportive care management of severe dry skin conditions.

Evaluation Results

Parameter	Observation	Result
Color	Pale Yellow	Acceptable
Odor	Pleasant	Acceptable
Texture	Smooth	Good
pH	5.6	Suitable
Spread ability	Good	Pass
Homogeneity	Uniform	Pass
Irritation	No irritation	Safe
Phase Separation	Absent	Stable

VIII. CONCLUSION

The present study concluded that the prepared polyherbal moisturizing cream demonstrated satisfactory physicochemical properties, good stability, suitable pH, and excellent skin compatibility. The herbal ingredients provided moisturizing, soothing, and protective effects. The formulation may be useful for supportive management of harlequin ichthyosis and other severe dry skin conditions. Further clinical and dermatological studies are recommended to establish long-term efficacy and safety.

FUTURE PROSPECTIVE

1. Further studies can be carried out to improve the therapeutic effectiveness of the herbal moisturizing cream.
2. Advanced stability studies can be performed for longer storage periods.
3. Clinical studies may be conducted on patients with Harlequin Ichthyosis to evaluate safety and efficacy.

4. Additional herbal ingredients with anti-inflammatory and skin-healing properties can be incorporated.

The formulation can be modified into different dosage forms such as lotion, gel, or ointment

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Stability Study

Condition	Observation after 30 days
Room Temperature	Stable with no phase separation
Refrigerated Condition	No significant color change
Elevated Temperature	Slight viscosity variation

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INGREDIENTS (for 100 g batch)

Ingredient	Quantity
Beeswax	10 g
Liquid paraffin	25 g
Borax	1 g
Distilled water	50 g
Aloe vera gel	8 g
Calendula powder/extract	3 g
Sariva extract/powder	2 g
Methyl paraben	1 g
Perfume	q.s. (as required)

CATEGORY
Herbal Skin Care – Moisturizing Cream

STORAGE CONDITION
Store in a cool, dry place. Keep away from direct sunlight. Keep the lid tightly closed after use.

DIRECTIONS FOR USE
Apply a small amount on clean face and body. Massage gently until fully absorbed.

CAUTION
For external use only. Avoid contact with eyes. In case of irritation, discontinue use.

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