



## Research Article

# Formulation and Evaluation of Polyherbal Skin Lotion

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The present study was undertaken to formulate and evaluate a polyherbal skin lotion utilizing selected plant-derived ingredients known for their moisturizing, antioxidant, anti-inflammatory, and skin-brightening properties. The formulation incorporated coconut oil, cow ghee, and beeswax in the oil phase; rose water, flaxseed mucilage, and honey in the aqueous phase; and bioactive herbal actives including moringa oil (*Moringa oleifera*), ginger extract (*Zingiber officinale*), and saffron (*Crocus sativus*) as the functional components. Soapnut extract (*Sapindus mukorossi*) served as the natural emulsifying agent, while sandalwood oil and vitamin E provided fragrance and antioxidant support, respectively. The lotion was prepared by the oil-in-water (O/W) emulsification technique, wherein the oil and aqueous phases were separately heated to 70–75°C, emulsified with continuous stirring, and herbal actives were incorporated at ~40°C to preserve their bioactivity. The final formulation was evaluated for organoleptic properties, pH, viscosity, spreadability, homogeneity, washability, skin irritation (patch test), emulsion type, and stability under varying storage conditions. The prepared lotion exhibited a pale yellow, smooth, homogeneous appearance with a pleasant herbal fragrance. The pH was recorded at 5.6, within the physiologically compatible skin range of 5.5–6.0. Spreadability trials yielded an average value of 4.4 g.cm/sec, indicating ease of application. No erythema, itching, or irritation was observed during the skin irritation test, confirming dermal safety. Stability studies demonstrated no phase separation or significant physicochemical alteration across room temperature, refrigerated, and accelerated (40°C) conditions. The dye test confirmed an O/W emulsion type. Overall, the results demonstrate that a stable, safe, and cosmetically elegant polyherbal lotion can be successfully developed using entirely natural ingredients, offering a promising herbal alternative to synthetic commercial moisturizers.

**Keywords:** Polyherbal lotion, Natural emulsion, *Moringa oleifera*, *Zingiber officinale*, *Crocus sativus*, Flaxseed mucilage, Herbal cosmetics, Skin moisturization, O/W emulsion.

## INTRODUCTION

Skin is the largest organ of the human body and functions as the primary protective barrier against environmental factors such as microorganisms, ultraviolet radiation, chemicals, and mechanical injury. It plays a crucial role in thermoregulation, sensation, prevention of trans epidermal water loss, and immune defense mechanisms. Maintenance of healthy skin is essential not only for physiological protection but also for aesthetic appearance and psychological well-being. Damage to the skin barrier can lead to dryness, irritation, inflammation, and premature aging, thereby increasing the need for effective and safe skincare formulations (1).

## Herbal Cosmetics and Their Significance

Herbal cosmetics are formulations containing plant-derived ingredients intended to improve skin health and appearance. In recent years, there has been a marked shift toward natural and herbal products due to growing awareness of the adverse effects associated with synthetic chemicals. Herbal ingredients are widely accepted owing to their traditional usage, biocompatibility, and reduced side effects. These formulations provide both cosmetic and therapeutic benefits, including moisturization, soothing action, antioxidant protection, and anti-inflammatory effects (2,3).

## Lotions as Topical Drug Delivery Systems

Lotions are liquid or semi-solid topical preparations designed for application to the skin without excessive rubbing. They are commonly used for moisturizing, soothing, and protecting the skin. An ideal lotion should exhibit good spreadability, non-greasy texture, compatibility with skin pH, and a pleasant sensory profile. Herbal lotions are particularly advantageous as they combine hydration with the therapeutic properties of plant extracts, making them suitable for routine skincare applications (2,12).

## Polyherbal Concept in Formulation

The polyherbal approach involves the use of multiple herbal ingredients in a single formulation to achieve enhanced therapeutic efficacy. This concept is based on synergism, where combined herbs produce a greater effect than individual components. Polyherbal formulations are widely utilized in traditional medicinal systems and are increasingly being adopted in modern cosmetic science due to their ability to target multiple skin concerns such as oxidative stress, inflammation, microbial infection, and dryness simultaneously (1,14).

## Role of Natural Ingredients in Skin Care

Plant-based ingredients contain a wide range of bioactive compounds such as flavonoids, phenolics, vitamins, essential oils, and fatty acids that contribute to skin nourishment and protection. Natural oils help restore the skin's lipid barrier, while herbal extracts provide antioxidant and anti-inflammatory effects. Natural excipients like waxes and mucilage act as stabilizers and emollients, reducing reliance on synthetic agents and promoting eco-friendly formulation development (3,10).

## Selected Herbal Ingredients and Their Benefits

The herbs selected for this study possess well-documented dermatological benefits. *Moringa oleifera* is rich in vitamins and antioxidants that protect against oxidative stress and enhance skin nourishment (9). *Zingiber officinale* (ginger) contains bioactive compounds such as gingerols, which exhibit anti-inflammatory and antioxidant properties beneficial in reducing skin irritation (4,5). *Crocus*

*sativus* (saffron) is known for its skin-brightening and antioxidant effects due to the presence of crocin and crocetin (6). Additionally, *Santalum album* (sandalwood) exhibits antimicrobial, cooling, and soothing properties useful in dermatological applications (7).

## Need for the Present Study

Although numerous herbal lotions are available, many existing formulations rely on commonly used ingredients or synthetic stabilizers. There is a need to explore innovative combinations of herbal ingredients along with natural excipients to develop formulations that are safe, effective, and aligned with the increasing demand for chemical-free cosmetics. Therefore, the present study focuses on the formulation and evaluation of a natural polyherbal lotion using selected plant-based ingredients to provide multifunctional skin benefits while ensuring stability and user acceptability (14).

## MATERIALS AND METHODS

### A. MATERIALS

All ingredients used in the preparation of the polyherbal lotion were of analytical or cosmetic grade and procured from reliable commercial suppliers and local authenticated sources. The formulation comprised three functionally distinct phases: an oil phase, an aqueous phase, and a herbal active phase, with supplementary stabilizing and adjusting agents. The oil phase contained coconut oil (10 ml), cow ghee (1.5 g), beeswax (5 g), sandalwood oil (0.2 ml), and vitamin E (0.5 ml). The aqueous phase comprised rose water (40 ml), flaxseed mucilage (15 g), and honey (3 g). The herbal active phase included moringa oil (2 ml), ginger extract (0.5 ml), and saffron powder/extract (0.1 g). Soapnut extract (0.8 ml) and citric acid (q.s.) were used for emulsification and pH adjustment, respectively. Purified water was added q.s. to 100 g as the vehicle.

### B. Preparation of Flaxseed Mucilage

Dried seeds of *Linum usitatissimum* were weighed and soaked in measured volumes of purified water at room temperature for 3 hours to allow maximal swelling and mucilage release. The soaked seeds were

then subjected to gentle heating on a water bath at 60°C for 30 minutes with intermittent stirring to facilitate extraction of the polysaccharide fraction. The resulting slurry was filtered through double-layered muslin cloth under gentle pressure to collect the viscous mucilage filtrate. The recovered mucilage was cooled to room temperature and stored at 4°C until use, ensuring retention of its humectant and thickening properties.

### C. Preparation of Ginger Extract

Fresh rhizomes of *Zingiber officinale* were procured, washed thoroughly under running water to remove surface impurities, and peeled. The peeled rhizomes were shade dried for 48 hours, reduced to fine powder, and subsequently subjected to maceration in 60% ethanol for 48 hours with periodic agitation. The macerate was filtered through Whatman No. 1 filter paper, and the resultant extract was concentrated using a rotary evaporator under reduced pressure to obtain a semi-solid ethanolic extract. The extract was stored in an amber glass vial at 4°C and protected from direct light until incorporation into the formulation.

### D. Formulation Method

The polyherbal lotion was prepared using the standard hot-process oil-in-water emulsification technique with sequential incorporation of ingredients. In the first step, all oil phase components — coconut oil, cow ghee, beeswax, sandalwood oil, and vitamin E — were accurately weighed and combined in a clean glass beaker. The mixture was placed on a water bath

and heated uniformly to 70–75°C with continuous mechanical stirring until the beeswax melted completely and a clear, homogeneous oil blend was obtained. Concurrently, the aqueous phase — comprising rose water, flaxseed mucilage, and honey — was assembled in a separate beaker and heated independently to the same temperature (70–75°C) to ensure phase compatibility and facilitate uniform emulsification. The emulsification step was initiated by slowly adding the hot aqueous phase to the oil phase in a thin, continuous stream with vigorous mechanical stirring to generate a stable primary emulsion. Soapnut extract was introduced dropwise during this stage, serving as the natural emulsifying agent and reducing interfacial tension between the oil and water phases. Stirring was maintained at a uniform speed until the emulsion achieved a smooth, homogeneous consistency. The emulsion was then allowed to cool gradually to approximately 40°C under continued gentle stirring. At this stage, moringa oil, ginger extract, and saffron were incorporated sequentially and blended thoroughly to ensure uniform distribution of the herbal actives without thermal degradation of heat-sensitive constituents. Citric acid was added dropwise to adjust the final pH to the target range of 5.5–6.0, which is physiologically compatible with normal skin. Purified water was subsequently added quantitatively to make up the final formulation weight to 100 g, followed by thorough homogenization with a high-shear stirrer to produce a uniform, cosmetically elegant lotion. The finished product was filled into clean, airtight opaque containers, labeled, and stored at room temperature pending evaluation.

**Table 1: Formulation of Natural Polyherbal Skin Lotion (100 g)**

Sr. No.	Ingredient	Quantity	Function
1	Coconut oil ( <i>Cocos nucifera</i> )	10 ml	Emollient, moisturizer
2	Cow ghee	1.5 g	Skin conditioning agent
3	Beeswax	5 g	Thickener and emulsion stabilizer
4	Sandalwood oil	0.2 ml	Cooling agent, fragrance
5	Vitamin E (Tocopherol)	0.5 ml	Antioxidant
6	Rose water	40 ml	Soothing aqueous base
7	Flaxseed mucilage ( <i>Linum usitatissimum</i> )	15 g	Natural humectant and viscosity enhancer
8	Honey	3 g	Moisturizer and mild preservative support
9	Moringa oil ( <i>Moringa oleifera</i> )	2 ml	Skin repair and antioxidant
10	Ginger extract ( <i>Zingiber officinale</i> )	0.5 ml	Anti-inflammatory and skin revitalizer
11	Saffron extract ( <i>Crocus sativus</i> )	0.1 g	Skin brightening and antioxidant
12	Soapnut extract ( <i>Sapindus mukorossi</i> )	0.8 ml	Natural emulsifying agent

13	Citric acid	q.s.	pH adjustment to 5.5–6.0
14	Purified water	q.s. to 100 g	Vehicle

## Evaluation Parameters

The prepared polyherbal lotion was systematically evaluated for a comprehensive battery of physicochemical, safety, and stability parameters following standard cosmetic evaluation protocols.

### 1. Physical Appearance

The prepared lotion was evaluated visually for color, odor, and overall appearance. A small quantity was examined under normal ambient light conditions in a clear glass beaker to assess homogeneity, texture, and the absence of phase separation or particulate matter. The formulation was pressed gently between clean fingers to evaluate smoothness and consistency. A cosmetically acceptable lotion should present a uniform, creamy appearance with a pleasant characteristic odor.

### 2. pH Determination

The pH of the formulation was determined using a calibrated digital pH meter (accuracy  $\pm 0.01$  pH units). A 1% w/v dispersion of the lotion was prepared by dissolving 1 g of the formulation in 10 ml of freshly boiled and cooled distilled water. The electrode was immersed into the dispersion after standardization using pH 4.0 and 7.0 buffer solutions, and the reading was allowed to stabilize before recording. The ideal pH for a skin lotion should fall in the range of 5.0–6.5 to maintain skin compatibility and avoid irritation to the stratum corneum.

### 3. Viscosity Determination

The viscosity of the formulation was measured using a Brookfield rotational viscometer at a spindle speed appropriate for the semi-solid consistency of the lotion. The spindle was selected based on the expected viscosity range of the formulation, and measurements were performed in triplicate at room temperature ( $25 \pm 2^\circ\text{C}$ ). The average viscosity value was calculated and expressed in centipoise (cps). Appropriate viscosity ensures good flow properties, ease of

spreading on the skin, and acceptable consumer experience.

### 4. Spreadability

Spreadability was determined by the parallel glass slide method. A quantity of 0.5 g of the lotion was placed at the center of a clean glass slide and covered with a second identical slide. A standard weight of 100 g was applied on the upper slide for 5 minutes to compress the lotion to a uniform thickness. An additional weight was then applied, and the distance the lotion spread was measured. Spreadability (S) was calculated using the formula:

$$S = (M \times L) / T$$

where S = Spreadability (g·cm/sec), M = weight applied on the upper slide (g), L = length of spread (cm), and T = time taken for spreading (sec). Three trials were performed and the mean value was reported.

### 5. Homogeneity

Homogeneity of the lotion was assessed by visual examination and by applying a small quantity between two glass slides pressed together and then separated. The formulation was examined for the presence of undispersed particles, aggregates, or coarse granules. A homogeneous formulation should display uniform distribution of all components without any visible lumps or grittiness.

### 6. Washability

The ease of removal of the lotion from the skin was assessed by applying a uniform amount of the preparation on the dorsal surface of the hand and subsequently washing with water. The amount of product remaining after washing, the feel of the skin post-wash, and the presence of any greasy residue were recorded. An acceptable cosmetic lotion should be easily removable without leaving a persistent greasy film.

## 7. Skin Irritation Test (Patch Test)

Dermal safety was assessed through a standard patch test. The lotion was applied on a small demarcated area (2 × 2 cm) on the inner forearm of a volunteer, and the site was observed at 24-hour intervals for 72 hours. The area was examined for any signs of erythema (redness), edema, itching, or other forms of cutaneous irritation. The test was performed with informed consent, and formulations exhibiting no adverse dermal reactions were considered safe for topical application.

## 8. Emulsion Type (Dye Test)

The type of emulsion (oil-in-water or water-in-oil) was determined by the dye solubility method. A small quantity of a water-soluble dye (amaranth) was added to the formulation and mixed gently. If the color dispersed uniformly throughout the bulk of the lotion,

the formulation was classified as an oil-in-water (O/W) emulsion, indicating that water constitutes the continuous external phase.

## 9. Stability Study

Stability of the formulation was evaluated under three storage conditions over a period of four weeks in accordance with ICH Q1A guidelines: room temperature (25 ± 2°C), refrigerated condition (4 ± 1°C), and accelerated condition (40 ± 2°C). The samples were evaluated at weekly intervals for changes in color, odor, consistency, pH, phase separation, and overall appearance. Any observable alteration in these parameters was documented. A stable formulation should exhibit no significant physicochemical change throughout the study period.

## RESULTS

**Table 2: Organoleptic Properties**

Parameter	Observation	Inference
Color	Pale yellow	Acceptable — attributed to saffron and moringa
Odor	Pleasant herbal fragrance	Acceptable — characteristic of sandalwood and saffron
Texture	Smooth and creamy	Cosmetically elegant
Appearance	Uniform, homogeneous	No phase separation or visible aggregates
Consistency	Semi-solid, non-greasy	Suitable for topical application

**Table 3: Physicochemical Evaluation Parameters**

Parameter	Result / Observed Value	Inference
pH	5.6	Within skin-compatible range (5.0–6.5)
Viscosity	Moderate [Data – clarification required for exact cps]	Suitable for topical application
Spreadability (average)	4.4 g·cm/sec	Good; indicates ease of application
Homogeneity	Uniform, no lumps or grittiness	Excellent homogeneity
Washability	Easily washable; non-greasy residue	Acceptable
Emulsion type	Oil-in-water (O/W)	Confirmed by dye test; ideal for cosmetic use
Skin irritation	Absent (no erythema, itching, or edema)	Safe for topical application

**Table 4: Spreadability Trials**

Trial	Time (sec)	Spreadability (g·cm/sec)	Remarks
1	7	4.2	Good
2	6	4.8	Good
3	7	4.2	Good
<b>Mean</b>	—	<b>4.4</b>	<b>Excellent</b>

**Table 5: Stability Study Results**

Storage Condition	Temperature	Observation (4 weeks)	Inference
Room temperature	25 ± 2°C	No significant change in color, odor, or consistency	Stable
Refrigerated	4 ± 1°C	Stable; slight increase in viscosity reversible on warming	Stable
Accelerated	40 ± 2°C	No phase separation; minor softening of consistency	Stable

## RESULTS AND DISCUSSION

The formulated polyherbal lotion exhibited satisfactory physicochemical and functional properties. The preparation showed a smooth, homogeneous texture with an acceptable appearance, indicating proper emulsification and uniform distribution of ingredients. The pH of the formulation was maintained within the range of **5.5–6.0**, which is compatible with the natural skin pH and minimizes the risk of irritation. The viscosity of the lotion was found to be appropriate for topical application, ensuring good spreadability and ease of use. The presence of flaxseed mucilage contributed significantly to the rheological behavior of the formulation, acting as a natural thickening and stabilizing agent comparable to synthetic polymers reported in earlier studies (10). The formulation also demonstrated good washability, leaving minimal residue on the skin surface. No phase separation, color change, or instability was observed during the stability study period, indicating good physical stability of the emulsion system. The use of natural stabilizers such as beeswax and soapnut extract was effective in maintaining emulsion integrity, supporting findings from previous herbal formulation studies (2). The functional performance of the lotion can be attributed to the synergistic effect of the incorporated herbal ingredients. *Moringa oleifera* provided antioxidant and skin-nourishing effects, *Zingiber officinale* contributed anti-inflammatory activity, and *Crocus sativus* enhanced antioxidant and skin-brightening properties (4,6,9). Additionally, sandalwood oil imparted soothing and antimicrobial effects, improving overall skin compatibility. Compared to conventional herbal formulations, the present formulation demonstrates the advantage of utilizing natural excipients such as flaxseed mucilage and soapnut extract, reducing dependence on

synthetic additives while maintaining comparable stability and performance. Overall, the formulation exhibited good moisturizing, protective, and skin-friendly properties, making it suitable for topical application.

## CONCLUSION

The present study successfully demonstrates the feasibility of formulating a stable, cosmetically elegant, and dermatologically safe polyherbal skin lotion using a combination of natural plant-derived ingredients without recourse to synthetic emulsifiers, preservatives, or fragrances. The formulation achieved a physiologically compatible pH (5.6), acceptable spreadability (4.4 g·cm/sec), uniform consistency, and confirmed O/W emulsion character. No skin irritation was observed, and the product remained stable across diverse storage conditions for four weeks. The synergistic combination of moringa, ginger, saffron, flaxseed mucilage, honey, and rose water provides a multi-functional activity profile encompassing moisturization, antioxidant protection, anti-inflammatory action, and complexion enhancement. The developed polyherbal lotion represents a promising, evidence-based alternative to conventional synthetic cosmetic products. Future investigations should include long-term stability studies (six months to one year under ICH-compliant conditions), in vivo clinical efficacy studies on human volunteers, microbiological challenge testing, and standardization of the herbal active fractions to further establish quality benchmarks for this formulation category.

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