A Novel Polyherbal Cream for Melasma: Design, Characterization

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ABSTRACT

Melasma is a chronic hyperpigmentation disorder characterized by symmetrical brown to greyish patches on sun-exposed areas of the skin, particularly affecting women with darker skin types. Although not harmful, it significantly impacts aesthetic appearance and psychological well-being. The condition arises due to increased melanogenesis triggered by ultraviolet (UV) radiation, hormonal influences, genetic predisposition, and oxidative stress. Conventional treatments such as hydroquinone, retinoids, and corticosteroids are commonly used but are often associated with adverse effects, limiting their long-term application.

The present study focuses on the formulation and evaluation of a herbal cream as a safer and effective alternative for melasma management. The cream was developed using natural ingredients including aloe vera, rose water, licorice extract, almond oil, shea butter, vitamin E, and emulsifying wax. These ingredients possess antioxidant, anti-inflammatory, moisturizing, and tyrosinase-inhibiting properties, which collectively help in reducing melanin production, protecting against UV-induced damage, and improving overall skin health.

The formulation was prepared using the oil-in-water (O/W) emulsion method and evaluated for various physicochemical parameters such as pH, spreadability, washability, texture, homogeneity, and irritancy. The results indicated that the cream had a smooth texture, good spreadability, excellent washability, and a skinfriendly pH of 5.60. No irritation or phase separation was observed, confirming its stability and safety.

In conclusion, the developed herbal cream demonstrated promising characteristics and can be considered a safe, effective, and economical alternative for the management of melasma with minimal side effects and improved patient compliance.

Keywords: Melasma, Herbal cream, Hyperpigmentation, Tyrosinase inhibition, Antioxidant, Skin depigmentation, Aloe vera, Licorice extract, almond oil

INTRODUCTION

Melasma is a chronic, acquired hyperpigmentation disorder **(Fig. 1–a, b)** characterized by symmetrical, irregularly shaped brown to greyish-brown macules and patches, predominantly affecting sun-exposed areas of the skin such as the cheeks, forehead, nose, and upper lip[1].

It is more commonly observed in women, particularly those with darker skin types (Fitzpatrick skin types III–V), and is frequently associated with hormonal changes during pregnancy, oral contraceptive use, and hormone replacement therapy. Although melasma is not medically harmful, it poses a significant cosmetic concern and can negatively impact the psychological and social wellbeing of affected individuals[2].

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Figure 1: Melasma patches on skin of (a) face and (b) hand

The pathogenesis of melasma **(Fig. 2)** is multifactorial and complex. The primary mechanism involves increased melanogenesis, which is the overproduction of melanin pigment by melanocytes. Exposure to ultraviolet (UV) radiation plays a crucial role in triggering melasma by stimulating melanocyte activity and increasing the expression of tyrosinase, a key enzyme involved in melanin synthesis[3].

UV radiation also generates reactive oxygen species (ROS), leading to oxidative stress, which further enhances melanin production. In addition to UV exposure, hormonal factors such as elevated estrogen and progesterone levels stimulate melanocytes, contributing to the development of melasma. Genetic predisposition and certain medications or cosmetic products may also exacerbate the condition[4].

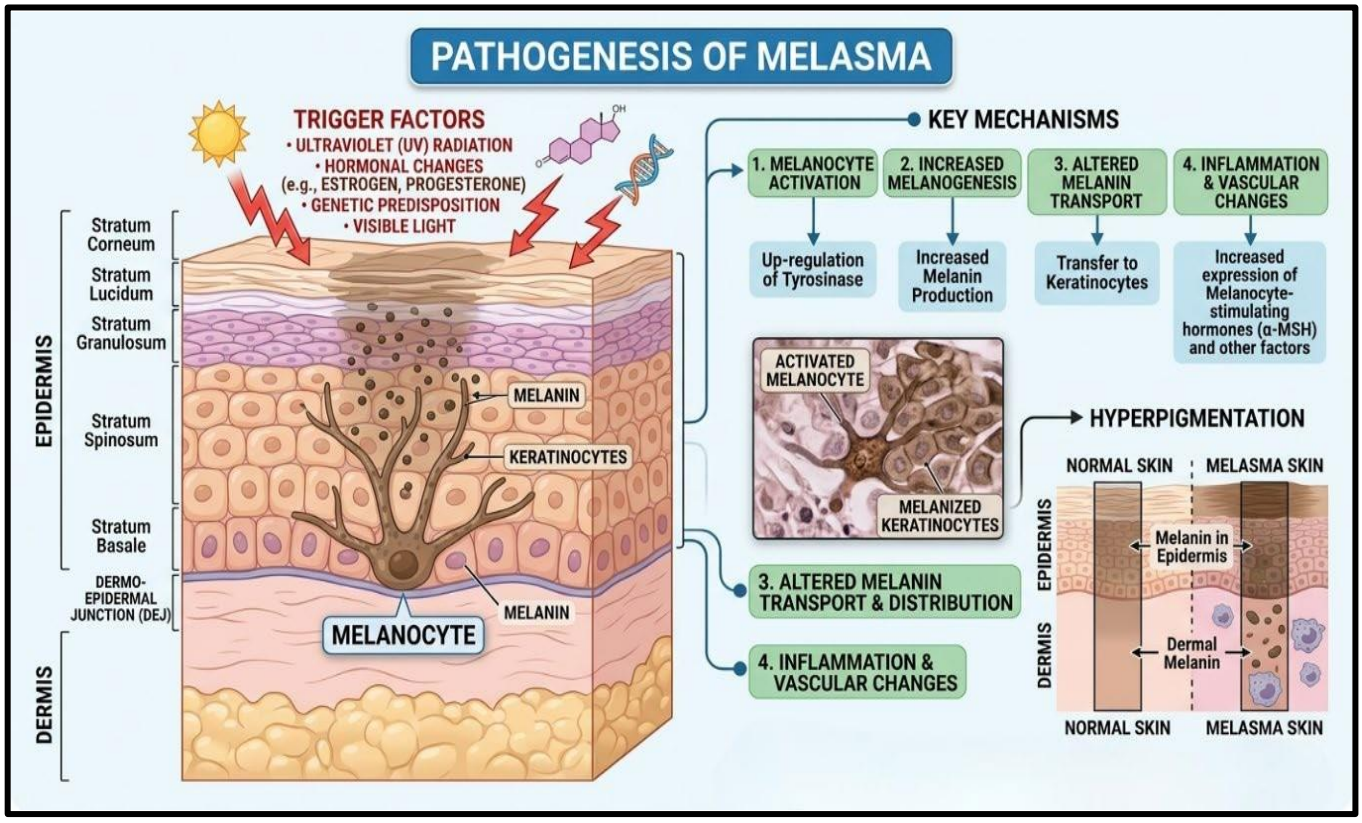

Figure 2: Pathogenesis of melasma

Melasma occurs when melanocytes become hyperactive and produce excessive melanin, which is then transferred to surrounding keratinocytes, resulting in visible pigmentation on the skin surface[5]. Depending on the depth of pigment deposition, melasma is classified into epidermal, dermal, or mixed types. Epidermal melasma is characterized by increased melanin in the basal and suprabasal layers, while dermal melasma involves the presence of melanophages in the dermis. Mixed melasma exhibits features of both types and is the most common form[6].

Management of melasma primarily focuses on reducing melanin synthesis, protecting the skin from UV radiation, and promoting skin renewal. Conventional treatments include topical depigmenting agents such as hydroquinone, retinoids, corticosteroids, and chemical peels. These agents act by inhibiting tyrosinase activity, accelerating cell turnover, and reducing pigmentation. However, prolonged use of synthetic formulations is often associated with adverse effects such as skin irritation, erythema, contact dermatitis, and exogenous ochronosis, which limits their long-term use[7].

In recent years, there has been a growing interest in herbal and natural remedies for the treatment of melasma due to their safety, efficacy, and minimal side effects. Herbal creams are topical formulations that incorporate plant-based active ingredients possessing antioxidant, anti-inflammatory, and tyrosinase inhibitory properties[8]. Ingredients such as aloe vera, rose water, licorice and coconut oil are widely used for their ability to reduce pigmentation, protect against UV-induced damage, and improve overall skin health. These herbal constituents help in scavenging free radicals, regulating melanin synthesis, and enhancing skin regeneration.

Herbal creams offer several advantages, including better patient compliance, reduced risk of adverse reactions, and suitability for prolonged use[9]. They also provide additional benefits such as skin hydration, nourishment, and protection against environmental stressors. Therefore, the development of the herbal cream for melasma represents a promising and safer alternative to conventional therapies.

The present study is focused on the formulation and evaluation of a herbal cream intended for the management of melasma. The formulation aims to utilize selected herbal ingredients with proven depigmenting and protective properties. The prepared cream is evaluated for various physicochemical parameters such as pH, viscosity, spreadability, homogeneity, stability, and skin irritation to ensure its quality, safety, and therapeutic effectiveness.

Types Of Cream

Creams are semi-solid emulsions consisting of two immiscible phases: oil and water, stabilized by emulsifying agents. Based on the dispersion of phases, creams are classified into two main types - Oil-in-Water Creams and Water-in-Oil Creams **(Fig. 3)**.

Oil-in-Water (O/W) Creams:

In this type, oil droplets are dispersed in a continuous water phase. These creams are non-greasy, light, and easily washable with water. They provide a cooling effect and are suitable for normal to oily skin. O/W creams are commonly used as moisturizing creams, vanishing creams, and cosmetic formulations[10].

Water-in-Oil (W/O) Creams:

In this type, water droplets are dispersed in a continuous oil phase. These creams are thicker, greasy, and provide an occlusive effect that prevents moisture loss from the skin. They are not easily washable with water and are ideal for dry and rough skin. W/O creams are often used as cold creams and nourishing creams[11].

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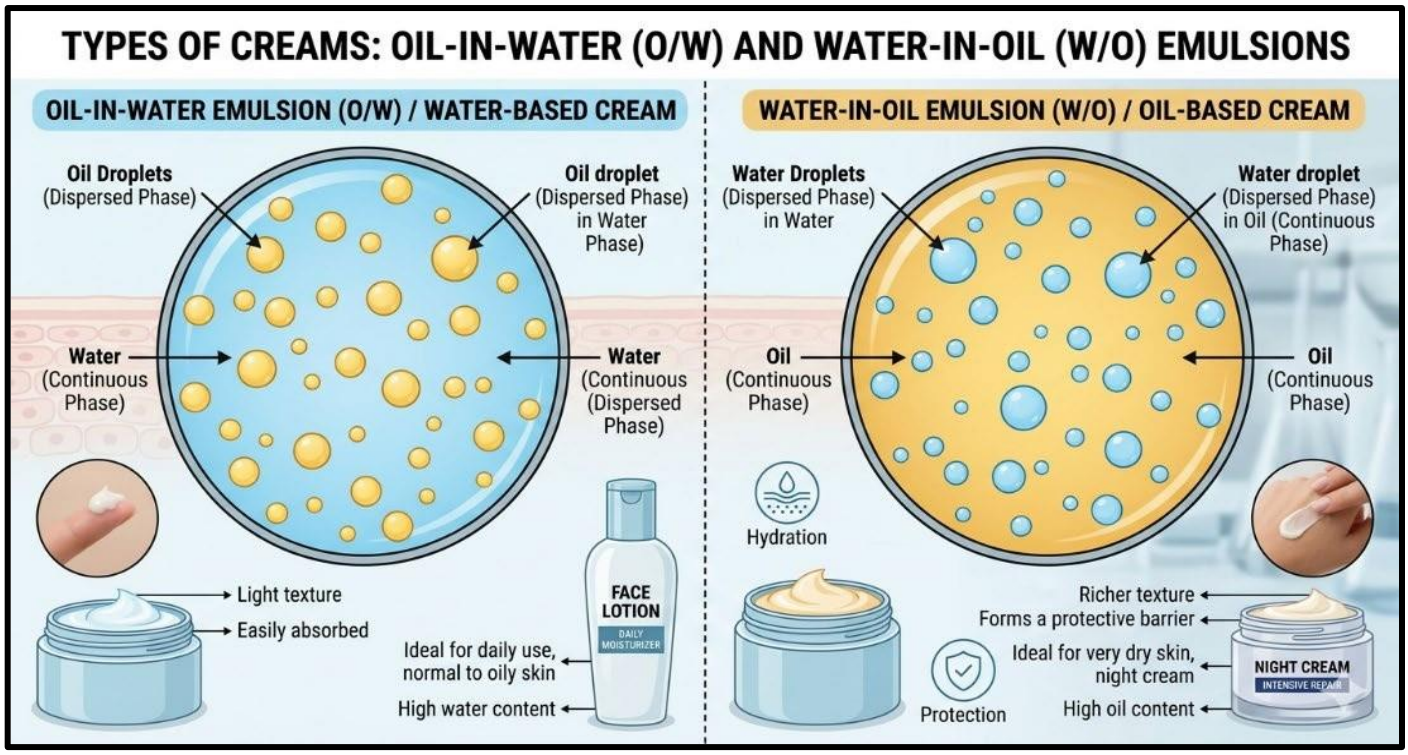

Figure 3: Types of cream

Risk Factors (Fig. 4) of Melasma[12]

Sun exposure (UV rays), Hormonal changes (pregnancy, OCPs), Female gender, Dark skin type, Family history, Cosmetics/skin products, Certain medications, Heat and light exposure.

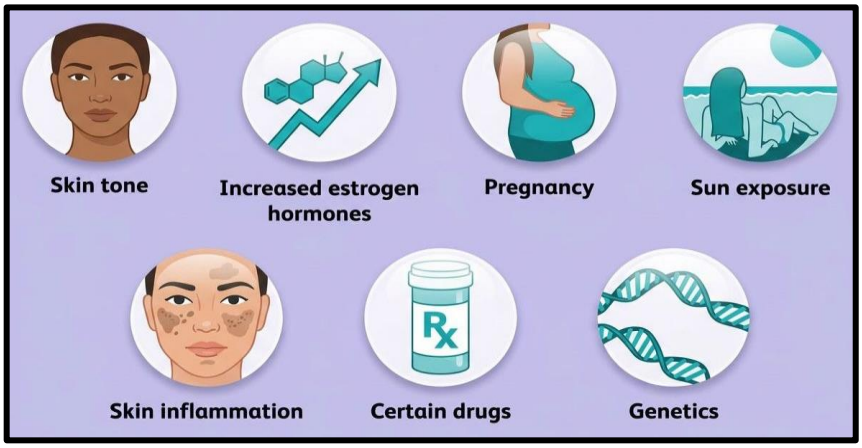

Figure 4: Risk factors of melasma

The following ingredients were used in the preparation of herbal cream for melasma Aloe Vera

Aloe vera **(Fig. 5)** gel is widely known for its soothing, moisturizing, and skin-healing properties. It contains aloin and other bioactive compounds that help reduce hyperpigmentation by inhibiting melanin synthesis. It also provides anti-inflammatory effects, reducing skin irritation associated with melasma. In formulation, it acts as a natural base, enhancing hydration, improving spreadability, and promoting skin repair and regeneration[13].

Uses:

- Reduces hyperpigmentation by inhibiting melanin production
- Soothes inflammation and irritation

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- Promotes skin healing and hydration

Taxonomical Classification:

- **Kingdom:** Plantae
- **Phylum:** Magnoliophyta
- **Class:** Liliopsida
- **Order:** Asparagales
- **Family:** Asphodelaceae
- **Genus:** *Aloe*
- **Species:** *Aloe vera*

Figure 5: Aloe-vera plant

Rose Water

Rose water **(Fig. 6)** possesses mild astringent, antioxidant, and soothing properties, making it beneficial in managing melasma[14]. It helps maintain skin pH and reduces redness and irritation. It is refreshing nature supports skin toning and cleansing. In formulation, it is used as an aqueous phase component, providing fragrance, hydration, and improving the overall sensory appeal of the cream[15].

Uses:

- Maintains skin pH balance
- Provides soothing and cooling effect
- Refreshes and tones the skin

Taxonomical Classification:

- **Kingdom:** Plantae
- **Phylum:** Magnoliophyta
- **Class:** Magnoliopsida
- **Order:** Rosales
- **Family:** Rosaceae **Genus:** *Rosa*
- **Species:** *Rosa indica*

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Figure 6: Rose petals and its oil

Licorice Extract

Licorice **(Fig. 7)** is a well-known depigmenting agent containing glabridin, which inhibits tyrosinase activity and reduces melanin production. It also exhibits anti-inflammatory and antioxidant properties, making it highly effective in treating melasma. In formulation, it acts as a key active ingredient, contributing significantly to skin lightening, improving complexion, and protecting against UV-induced pigmentation[16].

Uses:

- Inhibits tyrosinase to reduce melanin synthesis
- Lightens dark patches and pigmentation
- Provides antioxidant and anti-inflammatory effects

Taxonomical Classification:

- **Kingdom:** Plantae
- **Phylum:** Magnoliophyta
- **Class:** Magnoliopsida
- **Order:** Fabales
- **Family:** Fabaceae
- **Genus:** *Glycyrrhiza*
- **Species:** *Glycyrrhiza glabra*

Figure 7: Licorice stem

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Almond Oil

Almond oil **(Fig. 8)** is rich in Vitamin E, fatty acids, and antioxidants that nourish and moisturize the skin. It helps improve skin tone and may reduce pigmentation over time by promoting skin regeneration. In formulation, it acts as an emollient, enhancing softness, improving texture, and aiding in the smooth application of the cream while preventing dryness[17].

Uses:

- Moisturizes and nourishes the skin
- Improves skin tone and texture
- Promotes skin regeneration

Taxonomical Classification:

- **Kingdom:** Plantae
- **Phylum:** Magnoliophyta
- **Class:** Magnoliopsida
- **Order:** Rosales
- **Family:** Rosaceae **Genus:** *Prunus*
- **Species:** *Prunus Dulcis*

Figure 8: Raw almond and its oil

Coconut Oil

Coconut oil **(Fig. 9)** has excellent moisturizing and antimicrobial properties. It helps maintain skin barrier function and prevents dryness, which is important in melasma management. Its antioxidant content may support skin repair. In formulation, it acts as an emollient and oil phase component, improving consistency, spreadability, and overall stability of the cream[18].

Uses:

- Provides deep hydration
- Strengthens skin barrier

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- Protects against environmental damage

Taxonomical Classification:

- **Kingdom:** Plantae
- **Phylum:** Magnoliophyta
- **Class:** Liliopsisa
- **Order:** Arecales
- **Family:** Arecaceae **Genus:** *Cocos*
- **Species:** *Cocos nucifera*

Figure 9: Coconut oil and its paste

Shea Butter

Shea butter **(Fig. 10)** is a natural fat extracted from the nuts of the *Vitellaria paradoxa* tree and is rich in essential vitamins such as A and E, along with fatty acids like oleic, stearic, and linoleic acids. These components contribute to its excellent moisturizing, antioxidant, and skin-soothing properties[19]. It deeply nourishes the skin by restoring the lipid barrier, preventing moisture loss, and maintaining skin softness and elasticity. Its antiinflammatory properties help reduce redness, irritation, and sensitivity, which can be particularly beneficial in melasma-affected skin where inflammation may worsen pigmentation[20].

In addition, shea butter supports skin repair by promoting cell regeneration and enhancing healing of damaged skin. Its antioxidant content helps protect the skin from oxidative stress and environmental damage, which are contributing factors in hyperpigmentation disorders like melasma[21].

From a formulation perspective, shea butter acts as an effective emollient and thickening agent. It improves the consistency and spreadability of creams, providing a smooth, rich texture. It also enhances the stability of the formulation by contributing to the oil phase and helps in delivering long-lasting hydration by forming a protective barrier on the skin surface[22].

Uses:

- Deeply moisturizes and softens skin

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- Reduces inflammation and irritation
- Enhances skin elasticity and repair

Figure 10: Shea butter

Emulsifying Wax

Emulsifying wax **(Fig. 11)** is essential for forming a stable oil-in-water emulsion in cream formulations. It helps blend oil and water phases uniformly, preventing separation. Although it has no direct effect on melasma, it plays a crucial role in ensuring consistency, stability, and smooth texture of the cream, thereby improving its usability and shelf life[23].

Uses:

- Stabilizes oil and water phases
- Improves cream texture and consistency
- Ensures uniform distribution of ingredients

Figure 11: Emulsifying wax

Vitamin E (Tocopherol)

Vitamin E **(Fig. 12)** is a powerful antioxidant that protects the skin from oxidative stress and UV-induced damage, both of which contribute to melasma. It also supports skin repair and improves overall skin health. In

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formulation, it acts as an active ingredient and preservative, enhancing stability of oils and extending shelf life while providing skin nourishment[24].

Uses:

- Acts as a strong antioxidant
- Protects against UV-induced damage
- Supports skin repair and nourishment

Figure 12: Vitamin E capsules

MATERIALS AND METHODS

All the ingredients were purchased from the local market of Aminabad (Mata badal pansar, Kundan kirana store), Lucknow, Uttar Pradesh and some of the crude ingredient like licorice extract, emulsifying wax were taken from pharmacognosy lab. And pharmaceutics lab. (Integral University, Lucknow Uttar Pradesh). Listed crude drugs **(Table 1)** were authenticated with the reference no. IU/PHAR/HRB/26/04 by Dr. Mohd. Arif (Associate Professor, Department of Pharmacy, Integral University Lucknow).

Table 1: List of ingredients used in herbal cream for melasma

S. No.	Ingredients	Quantity (100 g)
1.	Aleo vera gel	40 g
2.	Rose water	30 g
3.	Licorice extract	3 g
4.	Almond oil	10 g
5.	Coconut oil	5 g
6.	Shea butter	5 g
7.	Emulsifying wax	6 g
8.	Vitamin E	1 g

Method for preparation of Polyherbal Cream for Treatment of Melasma [25].

Step 1: Preparation

All the ingredients were accurately weighed **(Fig.13)** using a digital balance.

Clean and dry glass beakers were taken to maintain proper hygiene.

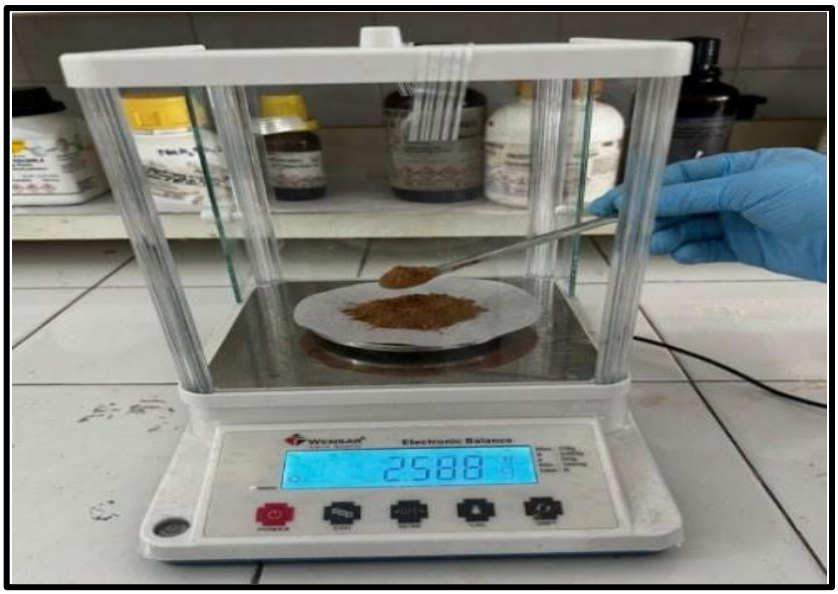

Figure 13: Weighing of licorice powder

Step 2: Preparation of Water Phase (Fig.14-a, b)

Aloe vera gel, rose water, and licorice extract were added into a beaker.

The mixture was heated to about 70°C with continuous stirring.

Proper mixing was ensured to obtain a uniform solution.

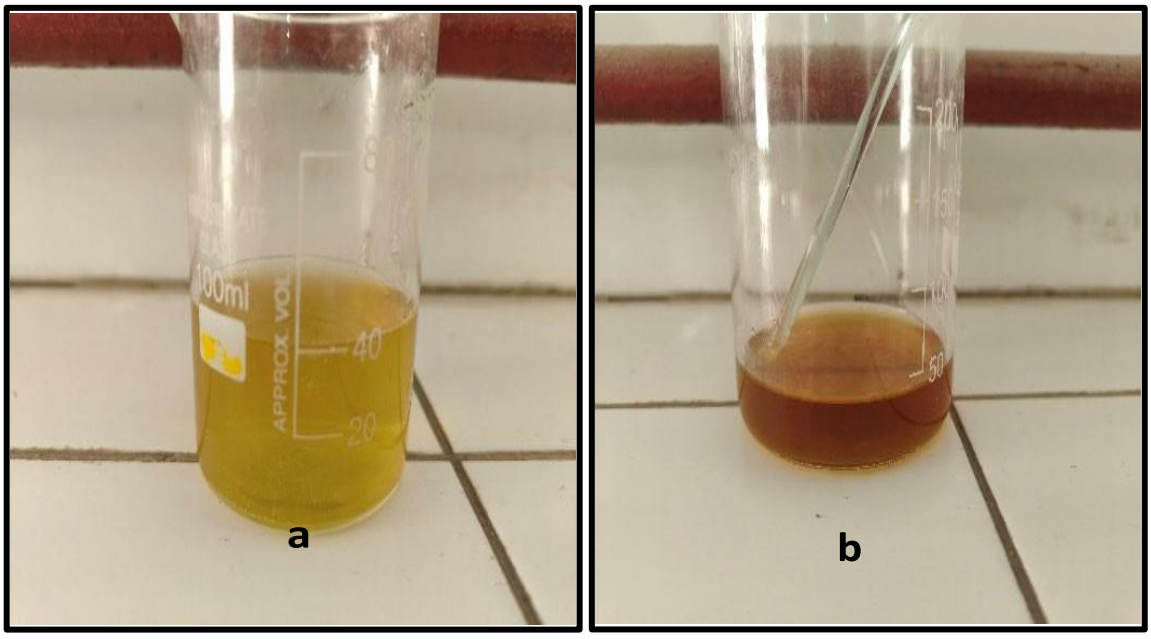

Figure 14: (a)Water phase mixture (b) Licorice extract

Step 3: Preparation of Oil Phase

Almond oil, coconut oil, shea butter, and emulsifying wax were taken in another beaker.

The mixture was heated to about 70°C until the wax was completely melted.

A clear and uniform oil phase was obtained **(Fig.15)**.

Figure 15: Clear and uniform oil phase mixture

Step 4: Emulsification

The oil phase was slowly added into the water phase **(Fig.16)** with continuous stirring.

The mixture was stirred continuously until a smooth and homogeneous cream was formed.

Figure 16: Combining oil phase into aqueous phase for emulsification

Step 5: Cooling Phase

The prepared cream was allowed to cool down **(Fig. 17)** to room temperature (~40°C).

Gentle stirring was continued to maintain uniformity.

Figure 17: Clear and homogenous cream obtained

Step 6: Addition of Vitamin E

Vitamin E was added to the cooled cream.

The mixture was stirred thoroughly to ensure uniform distribution.

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Step 7: Filling and Storage

The final cream was transferred into a clean, air-tight container.

The container was properly labelled with necessary details **(fig.18)**.

The product was stored in a cool and dry place.

Here is a refined and melasma-focused version of your content

Figure 18: Cream filled in container and labelled properly

How to Use Melasma cream

STEP-1 Cleanse the area:

Gently wash the affected area with a mild, non-irritating cleanser to remove dirt, oil, and impurities. Clean skin enhances the absorption of active ingredients and prepares it for treatment.

STEP-2 Pat dry softly:

After cleansing, gently pat the skin dry using a soft, clean towel. Avoid rubbing, as melasma-prone skin can be sensitive. Ensure the skin is dry before application.

STEP-3 Apply the cream:

Take a small amount of the anti-melasma bio-ferment cream on your fingertips. Apply a thin, even layer over the pigmented areas or as directed. Avoid excessive application.

STEP-4 Massage gently:

Using light circular motions, massage the cream into the skin until fully absorbed. This helps improve blood circulation and enhances penetration of active ingredients to target melasma effectively.

STEP-5 Use sunscreen (Daytime essential):

If applying during the day, always follow with a broad-spectrum sunscreen (SPF 30 or higher). Sun protection is crucial to prevent further darkening of melasma.

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STEP-6 Regular use:

For best results, use the cream consistently as advised (usually once or twice daily). Visible improvement in melasma may take a few weeks with regular use.

Evaluation of cream

Organoleptic properties: The physical characteristics of formulation including appearance, color and texture were evaluated through visual inspection **(Table 4)**. To assess texture, a small quantity of cream was gently pressed between the thumb and index finger. Consistency and the presence of coarse particles were key indicators used in this evaluation[26]. Additionally, the immediate tactile sensation upon application was examined, focusing on parameters such as stiffness, grittiness, and greasiness.

Spreadability: It was determined by taking 1g of melasma cream and placing it on a circle glass plate of 1cm diameter, another glass plate was placed on it and a certain weight was applied on the upper plate for 5 min.

Spreadability was measured **(Fig. 19)** by the spread of cream uniformly and there should be no unmixed particles.

Figure 19: Spreadability testing

Washability: A small amount of the prepared cream was applied evenly to a specified area of the skin and then exposed to running water **(Fig. 20)** for a fixed duration. The ease with which the cream was removed on the skin surface after rinsing was observed and recorded[27].

Figure 20: Washability testing

Determination of pH: A solution was prepared from the cream by weighing 1g of cream and dissolved in 10 ml of water. When a proper solution was prepared pH was determined by using a pH paper or pH meter[28].

Comparative Evaluation: A comparative evaluation was performed using a marketed anti-melasma cream, Melaglow Rich Cream, as a reference standard. This formulation is widely used for the management of hyperpigmentation and contains known depigmenting agents. The pH and spreadability of both the marketed formulation and the prepared herbal cream were evaluated using standard procedures to compare their physicochemical properties.

Irritancy test: The formulated cream was applied to the required area of the skin. After 1 hr the skin was checked for any irritancy, redness or inflammation on the skin.

Accelerated Stability Study: Accelerated stability studies were carried out to evaluate the physicochemical and microbiological stability of the formulated polyherbal cream under stressed environmental conditions (**Table 4**). The study was performed in accordance with the guidelines of the International Council for Harmonisation (Q1A(R2)).

The prepared cream was filled in suitable, tightly closed containers and stored in a stability chamber maintained at 40°C ± 2°C and 75% ± 5% relative humidity (RH) for a period of three months. Samples were withdrawn at predetermined time intervals (0, 1, 2, and 3 months) and evaluated for the following parameters: Physical appearance, pH, Spreadability, Phase separation, Microbial load.

All evaluations were performed to ensure accuracy and reproducibility. The stability of the formulation was determined based on the absence of significant changes in these parameters over the study period.

In-vitro Tyrosinase Inhibition Study: Tyrosinase is a key enzyme involved in melanin synthesis, catalyzing the oxidation of L-DOPA to dopachrome. Inhibition of tyrosinase activity (**Table 5**) is an important strategy for controlling hyperpigmentation disorders such as melasma. The present study evaluates the tyrosinase inhibitory activity of licorice extract and the developed polyherbal cream formulation using a mushroom tyrosinase enzyme assay.

Materials-Mushroom tyrosinase enzyme, L-DOPA (substrate), Phosphate buffer (pH 6.8), Licorice extract, Prepared cream formulation, UV-Visible spectrophotometer

METHODOLOGY

The tyrosinase inhibition assay was carried out using L-DOPA as the substrate. The reaction mixture consisted of phosphate buffer (pH 6.8), mushroom tyrosinase enzyme, and varying concentrations of licorice extract and cream formulation.

- Different concentrations (20, 40, 60, 80, and 100 µg/mL) of licorice extract and cream formulation were prepared.
- Each sample was mixed with phosphate buffer and tyrosinase enzyme and incubated for 10 minutes at room temperature.
- L-DOPA was then added to initiate the reaction.
- The increase in absorbance due to dopachrome formation was measured at 475 nm using a UV-Visible spectrophotometer.

Calculation-The percentage inhibition of tyrosinase activity was calculated using the formula:

$$\% \text{ Inhibition} = A_C - A_S / A_C * 100$$

Where, A_C = Absorbance of control, A_S = Absorbance of sample

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RESULT & DISCUSSION

Organoleptic Properties

The formulation exhibited desirable organoleptic characteristics. The creams were smooth, homogenous, and free from coarse particles or phase separation. Upon application, the formulation spread evenly without sigs of grittiness or greasiness, confirming good texture and aesthetic appeal. Such properties are essential as they directly influence patient compliance.

Spreadability

The spreadability studies showed uniform distribution of the cream without unmixed particles. The average spread diameter indicated good spreadability and it was found to be 96.335 (**Table 2**), suggesting that the formulation can be easily applied with minimal effort. It is measured from the formula S=M*L/T where, [Sspreadability, M-mass (g), L-distance (cm), T-time (s)], and spreadability is measured in (g.cm/s) where, (gramscentimeters per seconds). An ideal topical formulation should have sufficient spreadability to ensure even coverage, which was observed in this study.

Table 2. Spreadability testing of melasma cream

Trail	Time (s)	Spreadability (g.cm/s)
1	10	100
2	12	83.33
3	09	111.11
4	11	90.90
Average	**10.5 s**	**96.335 g.cm/s**

NOTE: For creams tested by parallel plate method, 80-150 g.cm/s is good.

Below 80: Too thick/sticky (poor).

Above 150: Too runny (may not stay put).

Washability

The formulation demonstrated excellent washability, as the cream was easily removed under running water. This property ensures convenience for users while maintaining effective adherence during the period of application.

pH Determination

The average pH values of the formulations were found to be 5.60 (**Table 3**), which is close to the skin's natural pH. This indicates that the cream is skin-friendly and minimizes the risk of irritation or disruption of the skin barrier. Maintaining near-neutral pH is particularly important for long-term topical use.

Table 3. Determination of pH value

Solution	Reading
10 ml	5.61
10ml	5.60
10ml	5.60
Average	**5.60**

Comparative Evaluation Result

The formulated herbal cream was compared with the marketed formulation, Melaglow Rich Cream(Abbott), for parameters such as pH and spreadability. The marketed cream showed a pH of 5.70, which is comparable to the prepared formulation (pH 5.60), indicating compatibility with skin pH.

The spreadability of the marketed cream was found to be 92.741 g·cm/s, comparable to the developed formulation (96.335 g·cm/s). This suggests that the herbal cream has similar application properties and can ensure ease of use and better patient compliance.

Accelerated Stability Study Results

The accelerated stability study demonstrated that the formulated herbal cream remained stable under the tested conditions of elevated temperature and humidity over a period of three months. No significant changes were observed in the physical appearance, and the formulation retained its original light yellow colour, smooth texture, and characteristic odour throughout the study.

Table 4. Accelerated Stability Data

Time (months)	pH	Appearance	Spreadability (g·cm/s)	Phase Separation	Microbial Load
0	5.60	Smooth, Yellow	96.33	None	Within Limits
1	5.59	No Change	95.80	None	Within Limits
2	5.61	No Change	96.10	None	Within Limits
3	5.58	No Change	95.65	None	Within Limits

The pH of the formulation showed minimal variation (5.58–5.62), remaining within the acceptable skin-friendly range, indicating that the formulation maintained its compatibility with skin over time. Similarly, spreadability values showed no significant deviation from the initial value (96.335 g·cm/s), suggesting that the consistency and ease of application were preserved.

No phase separation or signs of instability such as creaming or cracking were observed, confirming the robustness of the emulsion system. Microbial analysis revealed that the total viable count remained within acceptable limits, indicating good microbiological stability of the formulation.

Overall, the results confirm that the developed polyherbal cream possesses satisfactory stability under accelerated conditions as per ICH guidelines. This suggests that the formulation is likely to remain stable during storage and distribution, ensuring its quality, safety, and efficacy over time.

Tyrosinase Inhibition Activity

Table 5. Observation Table of Tyrosinase Inhibition Activity

Concentration (µg/mL)	Licorice Extract (%inhibition)	Cream Formulation (%inhibition)
20	28.5	22.3
40	45.2	38.7
60	62.8	54.1
80	78.4	69.5
100	89.6	81.2

IC_{50} Values

- Licorice extract – 52.4 µg/mL

- Cream formulation – 64.8 µg/mL

The prepared Melasma cream exhibited satisfactory physical characteristics (**Table 6**) with a smooth texture and yellow colour. The pH of the formulation was found to be 5.60, confirming its skin-friendly and non-irritant nature. The cream showed good spreadability, was non-greasy, and easily washable with water. The combined effects of Aloe vera, Rose Water, Shea butter, Liquorice, and Almond oil contributed to moisturizing and healing properties. Overall, the formulation was found to be stable, effective, and suitable for the management of Melasma.

Table 6. Observation of evaluation parameters for the herbal melasma cream

PARAMETER	RESULT
Colour	Light Yellow
Odour	Characteristic
Texture	Smooth
Irritancy	NO
Washability	Washable
Emulsion Type	O/W
pH	5.60
Spreadability	96.335 g.cm/s
Phase Separation	No Phase Separation

Future Purpective and Scope for Further Research

- No clinical or ex-vivo imaging studies were conducted in the present work. Therefore, baseline and posttreatment visual comparisons under standardized lighting conditions are not available. Future studies will include clinical evaluation with photographic documentation to assess visible reduction in pigmentation.
- Optimization of Formulation: Further optimize the concentration of active herbal ingredients to enhance therapeutic efficacy and stability.
- Advanced Drug Delivery Approaches: Investigate novel delivery systems (e.g., nanoemulsions, liposomes) to improve skin penetration and bioavailability of active constituents.
- Safety and Toxicity Studies: Conduct long-term dermal toxicity, sensitization, and allergenicity studies to confirm safety for chronic use.
- Scale-up and Commercial Feasibility: Evaluate large-scale manufacturing processes, cost-effectiveness, and regulatory requirements for potential commercialization.

CONCLUSION

The present study successfully demonstrated the formulation and evaluation of a polyherbal cream intended for the management of melasma using natural, plant-based ingredients. The developed oil-in-water emulsion exhibited desirable physicochemical properties, including smooth texture, homogeneity, good spreadability (96.335 g·cm/s), excellent washability, and a skin-compatible pH of 5.60. The absence of irritation, phase separation, and microbial instability confirmed the safety and stability of the formulation under both normal and accelerated conditions.

The inclusion of bioactive ingredients such as aloe vera, licorice extract, almond oil, coconut oil, shea butter, rose water, and vitamin E contributed synergistically to antioxidant, anti-inflammatory, moisturizing, and tyrosinase-inhibiting effects. The in-vitro tyrosinase inhibition study further supported the depigmenting potential of the formulation, showing significant inhibition activity comparable to the licorice extract alone. Comparative analysis with a marketed formulation (Melaglow Rich Cream) indicated similar pH and spreadability, suggesting equivalent usability and patient compliance.

Overall, the formulated herbal cream can be considered a safe, effective, and economical alternative to conventional treatments for melasma. Its natural composition minimizes the risk of adverse effects, making it suitable for long-term use. However, further clinical studies are recommended to validate its therapeutic efficacy in human subjects.

Conflict of Interest

The authors declare no conflicts of interest and agree to the publication of this work.

Author's Contribution

All the authors are equally contributed in this research work

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