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HERBAL EXTRACT SYNERGY: FORMULATION AND EFFICACY IN MELASMA REDUCTION

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ABSTRACT

Melasma, a prevalent hyperpigmentation disorder predominantly affecting the facial region, arises from factors such as genetics, hormones, and light exposure. This study explores the incorporation of natural ingredients like turmeric, renowned for its therapeutic and skincare benefits, into cosmetic formulations. Turmeric's potential as an active ingredient in serums is evaluated, with an emphasis on optimizing its properties for effective skincare. The research addresses the detrimental effects of photodamage and UV exposure, which accelerate skin aging, acne, and wrinkles, while highlighting aloe vera's antioxidant and antibacterial properties in reducing inflammation and acne.

Four distinct serum formulations (F1-F4) were developed, each varying in turmeric concentration. Comprehensive evaluation parameters included appearance, pH, rheology, spreadability, and stability, confirming the formulations' non-sensitizing properties and cost-effectiveness. The study demonstrates the viability of turmeric-infused serums in promoting healthy skin and addressing melasma, offering a natural and promising alternative to conventional skincare regimens. These findings pave the way for further innovation in the cosmetic industry, emphasizing the role of phytotherapeutic ingredients in enhancing skincare solutions.

Keywords: Turmeric; Aloe Vera Gel; Face Serum; Melasma; Tyrosinase; Melanin

INTRODUCTION

Melasma is a common acquired pigmentedary condition that mostly affects the face and is characterized by symmetric hyperpigmented spots on the skin. It is associated with various factors including UV exposure, hormonal influences, genetics, and inflammation. The disorder's diagnosis and treatment involve understanding its pathogenesis and addressing various aspects of pigmentation and skin health. Melasma manifests as symmetrical dark patches on the face, with its development influenced by factors like exposure to UV rays, hormonal fluctuations, genetic predisposition, and inflammatory processes [1].

The development of melasma involves multiple factors. Exposure to UV light, including visible light, is a primary trigger, leading to the production of reactive oxygen species (ROS) and increased melanin production. Hormonal influences, such as pregnancy and hormonal therapies, play a significant role. Genetic predisposition is supported by positive family history in a significant proportion of patients. Inflammatory, hormonal, pigmentedary, and possibly vascular responses contribute to the condition [2, 3].

Melasma diagnosis relies on its clinical appearance and can manifest across

different skin types. In appearance, it manifests as irregularly surrounded, uniformly circled hyperpigmented patches on the mandible, malar cheeks, and Midline facial region. Differential diagnosis includes other pigmentedary disorders and skin conditions [2, 4].

Treatment approaches for melasma address different aspects of its pathogenesis: Topical treatments are often the first-line therapy and include agents that inhibit melanin production and melanocyte proliferation. Procedural treatments, such as chemical peels, microneedling, microdermabrasion, and lasers, have been explored in case reports and case series [4-7].

A combination of treatments that target multiple factors, such as pigmentation, vascularity, and inflammation, may yield superior results focused on the several components of the pathophysiology of melasma, such as photodamage, inflammation [7-9].

The primary therapies for melasma are usually topical ones, such as protection from sunlight. The most widely utilized therapeutic drugs are those that prevent the synthesis of melanin through melanogenesis and melanocyte proliferation [10, 11].

Table 1: Treatment with adverse effects [9-12]

Modality	Treatment	Mechanism of action	Adverse effects
Topical	Iron oxide	Block visible and UV light	Irritation
	Hydroquinone (HQ)	Tyrosinase inhibitor	Irritation, exogeneous ochronosis
	Azelaic acid		
	Ascorbic acid		
	Kojic acid		
	Tretinoin	Increased keratinocyte turnover	Irritation, redness
	Corticosteroids	Anti-inflammatory with non-selective melanogenesis inhibition	Epidermal atrophy, acne, hypopigmentation
	Ascorbic acid	Inhibition of reactive oxygen species	No significant AE
Niacinamide	Inhibition of melanosome transfer	Irritation	
Oral	Tranexamic acid	Inhibit synthesis of melanin	Blotting, headache, irregular menstrual
	<i>Polypodium Leucotomos</i> , Glutathione	Inhibition of reactive oxygen species	No significant AE
Procedural	Q-switch ruby laser, Q-switch ND:Yag laser	Melanosome destruction	Burn, post-inflammatory pigment alteration (PIPA)
Non-ablative fractional lasers	Melanin extrusion	Burn, PIPA	Non-ablative fractional lasers
Chemical peels	Increased keratinocyte turnover	Burn, peeling, PIPA	Chemical peels
Micro needling	Transdermal drug delivery	Erythema, edema, PIPA	Micro needling
Intense pulsed light	Extrusion of melanosomes	Burn, PIPA	Intense pulsed light
Radiofrequency	Cellular bio-stimulation Transdermal drug delivery	Burn	Radiofrequency

Most of the recent studies on procedural treatments for melasma (Table 1) have mainly consisted of case reports and case series focusing on the effectiveness of methods such as chemical peels, microneedling, microdermabrasion, and laser treatments [9-12].

1.1 Benefits of face serum: [13-15]

1. Soothes irritated skin: Aloe vera has been known to have antiviral and cell regenerative properties. That rubbing on aloe to a sunburn feels and it has just as many benefits.

2. Deep hydration: face serum Has a unique ability to promote and retain skin moisture.

3. Fight acne and fades blemishes: it has an Anti-inflammatory property. It inhibits the accumulation of pathogens, which is the primary cause of acne and pimples.

4. Relieve puffiness and dark circles: it is packed with vitamin E and antioxidant which helps in discoloration around the eye and cooling effect helps to the puffiness.

5. It reduces the appearance of under eye circle.

6. By eliminating dead skin cells, it stimulates the production of collagen.

7. It has antioxidant properties that promote glowing skin.

The treatment of melasma includes oral as well as topical such as Hydroquinone, Ascorbic acid, Kojic acid, Corticosteroids, Tranexamic acid, Glutathione [16]. This type of medication on longer duration causes many adverse effects on the body especially on the skin such as irritation, redness, dryness of skin, other allergic reaction etc. To overcome these type of side effects and reduce the cost of the formulation, herbal formulation is prepared for the safe and effective treatment of melasma with the less or negligible side effects [17].

Cosmetic serums are concentrated skincare products widely used in professional cosmetology. These products are designed to provide targeted and potent solutions for various skin concerns. Unlike traditional creams, serums contain a higher concentration of active ingredients, making them effective in addressing specific

cosmetic problems quickly and efficiently [18-20]. As the demand for cosmetic products continues to rise globally, serums have gained popularity for their ability to deliver visible results.

MATERIALS AND METHODS

Preparation of turmeric extract:

Turmeric extract was prepared by adding sufficient amount of turmeric powder in ethanol and water solvent. Allow to stand for 3 h, then filter the solution with whatman filter paper, the filtrate found the curcumin as the main phytoconstituent [21, 22].

Qualitative phytochemical evaluation of plant extract:

The Turmeric (*Curcuma Longa*) extract underwent initial phytochemical analysis following established protocols. This analysis aimed to determine the presence or absence of various active compounds including amino acids, proteins, carbohydrates, flavonoids, glycosides, saponins, and alkaloids, as detailed in **Table 2** [23, 24].

Table 2: Phytochemical screening of turmeric extract

Sr. no	Preliminary Test of turmeric	Positive (+) / Negative (-)
1	Carbohydrate	+
2	Alkaloids	+
3	Saponins	+
4	Proteins	-
5	Amino acids	-
6	Steroids	+
7	Triterpenoids	+
8	Glycosides	+
9	Flavonoids	+
10	Tannins	+
11	Fats and Oils	-

Method of preparation of face serum:

Table 3 lists the functions of each ingredient and their corresponding applications. The formula listed in **Table 4** was used to prepare the emulsion, which is oil in water. To create an even mixture, the oily component—olive oil and coconut oil—is combined and stirred for ten minutes. Meanwhile, water phase is

prepared by using glycerin and distilled water and heated to 75 °C. To formulate an oil in water based on a biphasic emulsion, the oil phase is added to the liquid phase dropwise and completely mixed in a continuous manner. In the end, thoroughly combine the aloe vera gel, turmeric extract, honey, and perfume.

Table 3: List of Ingredients

Sr no.	Ingredients*	Category
1	Turmeric	Anti-oxidant
2	Olive oil	Humectant
3	Coconut oil	Solubilizing agent
4	Aloe Vera gel	Base
5	Honey	Emollient
6	Black catechu	Preservative
7	Rose petals extract	Perfume

*All ingredients are of laboratory grade

Table 4: Various batches of formulation

Sr no.	Ingredients	F1	F2	F3	F4
1	Aloe Vera gel	6 gm	7 gm	5 gm	9 gm
2	Glycerin	7 ml	5 ml	8 ml	4 ml
3	Turmeric extract	0.2 ml	0.2 ml	0.2 ml	0.2 ml
4	Olive oil	2 ml	3 ml	2 ml	2 ml
5	Coconut oil	1.5 ml	1.5 ml	1.5 ml	1.5 ml
6	Perfume	q.s.	q.s.	q.s.	q.s.
7	Honey	3 ml	3 ml	3 ml	3 ml
8	Catechu	0.12 gm	0.12 gm	0.12 gm	0.12 gm
9	Water	10 ml	10 ml	10 ml	10 ml

Evaluation parameters of herbal face serum:**Appearance and consistency:**

The physical characteristics of the herbal face serum formulation were examined visually.

Grittiness:

The formulation was examined microscopically for the presence of any appreciable particulate matter.

Homogeneity:

After the serum have been set in the container, the developed serum was tested for homogeneity by visual inspection.

Spreadability:

Spreadability testing equipment is used to determine spreadability. It is made up of wooden block that is supported by a pulley at one end. This method analyzed the spreadability using a slip' and 'Drag' placed on the ground slide the serum was sandwiched between the slide load of 1 kg was kept on slab so that serum will get spreaded without air bubbles, any excess serum was scraped off. The length of serum that was spread out and the amount of time it took to move were also recorded.

Spreadability was determined using the following formula [25].

$$S=M*L/T$$

Where,

S= Spreadability

L= Length moved by glass slide

M= Weight in the pan

T= Time taken to separate the slide completely from each other

Determination of pH :

A digital pH meter was used to determine the pH of face serum. First prepare the solution of 1 gm of serum and 25 mL of distilled water and the electrode was then dipped in to prepared solution. constant reading was noted. The measurements of pH of formulation was repeated two times.

Viscosity:

Using a Brookfield Viscometer, the viscosity of the formulated serum was measured. The Brookfield viscometer was used to measure over a speed setting of 100 rpm at 25 °C.

Irritability test:

The formulated serum was applied to that area of skin. After that, it is observed for up to 24 hours to see whether there is any erythema, edema, or irritation before being reported.

Anti-Microbial Activity:

Using the streak plate method, the formulated serum was inoculated into the agar medium plates, and a control was made by without the serum. The agar plates are

incubated for 24 hours at 37 °C. Plates were removed from the incubator after the incubation period to assess microbial growth by contrasting it with the control [26].

Stability Study:

The stability studies are carried out as per ICH guidelines. The prepared formulation was stored at three different storage conditions and daily analyse the physical stability. Stability study of the formulations was carried out at room temperature (25 °C ±2 °C), high temperature storage (40 °C ±2 °C) and cool room (2-8 °C) for 3 months [27, 28].

RESULTS AND DISCUSSION

According to Table 4, the phytochemical examination of the hydroalcoholic extract of turmeric showed that proteins, lipids, and fats were lacking, but flavonoids, phenols, alkaloids, carbohydrates, and saponins were present.

Appearance and consistency:

The physical characteristics was visually checked for the texture of herbal face serum formulations. The formulated face serum is an oil in water emulsion with a golden yellow color After three weeks of observation, it revealed non-greasy and non-oily properties. The consistency of prepared face serum was found to be semi-liquid and smooth by visual examination.

Grittiness:

The formulation underwent microscopic evaluation to check for the presence of any

noticeable particulate matter. This assessment ensured that the preparation met the necessary standards of being free from particulate matter and grittiness, as required for any topical product.

Homogeneity:

The formulation produced uniform distribution. This was confirmed by visual appearance and by touch. The serum sample is homogeneously spread all over the area smoothly.

Spreadability:

For any cosmetic product, it's crucial that after application, it spreads easily across the skin. Spreadability can be influenced by various factors like viscosity and temperature, with shorter spreading times being desirable. The spreadability of the serum is 5 gm.cm Sec-1.

$$S = M * L/T \text{ ----- } 20*7.5/30 = 5 \text{ gm.cm Sec-1}$$

M= weight applied on upper slide, L = length moved on glass slide,

T= time taken to separate the slide completely from each other.

Determination of pH:

The formulated serum is meant for topical application. So, the pH should be similar to that of skin. The skin has an acidic range. The measurements of pH of formulation was repeated two times. The pH of the formulation is 5.9.

Viscosity:

Viscosity was in the range of 2519 cps for the formulated face serum.

Irritability test:

The sample serum is irritation free. It does not cause any type of irritation when applied to several parts of the skin for 10 minutes.

Anti-Microbial Activity:

The formulation is devoid of microbes as no microbial growth was observed when it was inoculated into the agar medium.

Stability Study:

The formulation was stable at room temperature (25 °C ±2 °C), high temperature storage (40 °C ±2 °C) and cool room (2-8 °C) for a month without having any phase separation.

Table 5: Result of various parameters

Sr. No	Parameters	Result
1	Colour	Golden yellow
2	Consistency	Semi-solid
3	pH	5.9
4	Irritancy	Non - irritant
5	Spreadability	5 gm.cm Sec ⁻¹
6	Viscosity	2519 cps
7	Stability study	Stable

CONCLUSIONS

The development and evaluation of the herbal face serum underscore the synergistic

potential of natural ingredients, including turmeric, aloe vera gel, honey, olive oil, coconut oil, and catechu, in creating an

effective skincare formulation. The serum's intrinsic properties, such as its golden hue, uniform consistency, excellent spreadability, and suitable viscosity, highlight its cosmetic appeal and functionality. Notably, the formulation naturally aligns with the skin's pH, eliminating the need for pH adjustments, and demonstrating its compatibility with the skin.

Stability assessments reveal the formulation's robustness under various conditions, ensuring consistent performance across different environments. Among the formulations, F2 emerges as the optimal choice, offering unparalleled stability and ease of application. This study confirms the efficacy of the herbal serum in exhibiting anti-tyrosinase activity and addressing melasma, presenting a promising natural alternative for skincare regimens. The findings pave the way for future innovations in herbal cosmetics, emphasizing the role of phytotherapeutic ingredients in enhancing skin health and addressing common dermatological concerns.

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