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Research Article

Formulation and Evaluation of Herbal Anti-Aging Cream Containing Natural Bioactive Ingredients

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Abstract

The present study aimed to formulate and evaluate an herbal anti-aging cream using natural ingredients such as papaya leaves, tulsi powder, olive oil, ginger, rice water, ashwagandha, aloevera, vitamin E, beeswax, glycerin, and sandalwood oil, prepared by the emulsification method in three variations (F1, F2, and F3). The formulations were assessed for organoleptic properties, pH, spread ability, homogeneity, irritancy, dilution, sensitivity, and wash ability. All creams were pale green, semi-solid, smooth in texture, and had a pleasant sandalwood fragrance, with pH values ranging from 5.4 to 5.9, within the ideal range for skin compatibility. They exhibited excellent spread ability, homogeneity, and stability, were easily washable, and showed no signs of irritation or sensitivity, confirming dermatological safety. The creams were identified as water-in-oil emulsions, offering enhanced moisturization and prolonged hydration. Among the three, F1 demonstrated superior overall performance in terms of texture, stability, and user acceptability, indicating its potential as an effective, safe, and natural alternative to synthetic anti-aging formulations.

Keywords: Papaya leaves, anti-ageing, anti-wrinkle, skin care, moisturising, skin nourishing.

Introduction

The skin is the largest organ of the body with a total area of about 20 square feet. The skin protects us from microbes and the elements, helps regulate body temperature, and permits the sensations of touch, heat, and cold [1].

Physiology of the skin:

The skin is composed of multiple layers, each with distinct structures and functions. The outermost layer, the epidermis, is made up of stratified keratinized squamous epithelium, with varying thickness depending on the body part—it is thickest on the palms of the hands and soles of the feet. This layer lacks blood vessels and nerve endings, but its deeper cells are nourished by interstitial fluid from the underlying dermis, which provides oxygen and

nutrients and also facilitates lymphatic drainage. Beneath the epidermis lies the dermis, a tough and elastic layer composed of connective tissue with a matrix rich in collagen and interwoven elastic fibres. When the skin is overstretched, as in pregnancy or obesity, elastic fibres may rupture, resulting in permanent stretch marks. Collagen fibres in the dermis bind water and give the skin its tensile strength, though this ability declines with age, contributing to the formation of wrinkles. The dermis also contains cells such as fibroblasts, macrophages, and mast cells, and its deepest layer rests on areolar tissue with varying amounts of adipose tissue. Embedded in the skin are sebaceous glands, which consist of secretory epithelial cells originating from the same tissue as hair follicles. These glands secrete an oily substance called sebum into hair follicles and are found throughout the skin except on the palms of the hands and soles of the feet.

Functions of skin:

The skin serves several vital functions essential to maintaining overall health and homeostasis. One of its primary roles is protection, acting as an anatomical barrier that defends the body against pathogens and physical damage. Langerhans cells within the skin contribute to this defence as part of the adaptive immune system. The skin is also crucial for sensation, containing a wide array of nerve endings that respond to stimuli such as heat, cold, touch, pressure, vibration, and injury, making it an integral part of the sensory system. In terms of heat regulation, the skin has a rich blood supply that exceeds its basic needs, allowing it to regulate body temperature through mechanisms like radiation, convection, and conduction. Blood vessels dilate to increase blood flow and heat loss or constrict to reduce blood flow and conserve heat. The skin also plays a role in the control of evaporation, serving as a semi-permeable barrier that minimizes fluid loss; when this barrier is compromised, as in the case of burns, significant fluid loss can occur. Structurally, the skin is organized into layers: the outer layer contains skin cells, pigment, and proteins; the middle layer houses sweat glands, hair follicles, blood vessels, and fat; and the inner layer includes skin cells, nerves, blood vessels, hair follicles, and oil glands. The dermis supports the epidermis by supplying nutrients and is composed of connective tissue with collagen fibres for strength and elastin fibres for flexibility and resilience [2].

Anti-ageing cream:

Anti-aging creams are moisturizer-primarily based cosmeceutical skincare merchandise. With the promise of creating the patron to look more youthful by way of reducing the signs of pores and skin aging [3].

Damage to cellular DNA and proteins causes a continuous degradation process that leads to skin aging. Sequential skin aging and photo aging are the two different categories into which the aging process is divided. Each category has unique historical and clinical characteristics. The universal and predictable

process of sequential skin aging is defined by changes in the way the skin functions physiologically. The aging process causes dry, pale skin with wrinkles because keratinocytes can no longer generate a viable stratum corneum and the pace at which neutral lipids are formed slows down [4]. On the other hand, excessive exposure to UV radiation from sunshine results in photo aging. It is distinguished by dry, sallow, and pale skin that exhibits deep furrows and fine wrinkles brought on by the disarray of dermal and epidermal components linked to heliodermatis and elastosis. Plants and herbs have previously shown promise as a supplemental medical tool [5]. Cosmetics are used to improve skin's appearance and protect against both endogenous and external hazardous substances [6]. Using cosmetics helps people look better on the outside and maintain excellent health for longer by lowering the prevalence of skin conditions [7]. The natural or artificial components included in skin care products that promote skin health, texture, and integrity, as well as hydrating, preserving skin elasticity through the decrease of type I collagen, and providing photo protection, among other benefits. This characteristic of cosmetics results from inclusion of components in skin care products, since they aid in lowering the skin's generation of free radicals and maintaining its characteristics over time [8]. The greatest option for reducing skin conditions including hyperpigmentation, wrinkles, aging, rough skin texture, etc., is cosmetic items. The market for herbal cosmetics is growing quickly. Vitamin A can be found in large quantities in olive oil.

It slows down the aging process by acting as an excellent antioxidant. The body uses vitamin C to generate collagen, a protein that is necessary for our skin to be elastic and to avoid wrinkles [9]. According to research, the anti-oxidant compounds in that living organism always function as a "protective chain," meaning that various anti-oxidant compounds work in concert to shield one another from direct harm during the processes that neutralize free radicals and other reactive species [10]. The effects of the polyherbal cosmetic formulation are well acknowledged in the communities of various nations, and it has long been advised for the management of skin characteristics. Numerous skin conditions have been treated with the crude extract of the chosen herbal extract that is the subject of this inquiry [11].

History:

The fight against skin aging has existed since antiquity and has developed as a result of scientific advancements. Improvements like the usage of eggshell membranes and retinol are the result of a better understanding of the underlying causes, such as inflammation. The use of plants' therapeutic qualities by civilizations has made traditional herbal treatments essential. Modern anti-aging compositions have been made possible by this historical progression [12]

Some Incredible benefits of using anti-aging creams:

Skin tightening and proper hydration provide a range of benefits for both your appearance and overall health. They help improve the skin's natural glow, making it look more radiant and vibrant, which in turn can boost your self-esteem. These practices also support healthy skin function and contribute positively to your general well-being. By keeping the skin firm and well-moisturized, they can reduce the likelihood of developing age spots and uneven skin tone. Furthermore, taking care of your skin in this way may lessen the need for costly cosmetic treatments, offering a more affordable and natural solution for maintaining youthful skin.

Advantages of anti-aging cream:

Anti-aging creams offer several advantages, making them a valuable addition to a skincare routine. They help you look younger by reducing the appearance of wrinkles and fine lines, while also protecting the skin from dryness and flaking. By improving skin texture and radiance, they boost self-confidence and enhance overall appearance. In addition, regular use of anti-aging creams promotes better skin health, which in turn supports overall well-being and positively influences other aspects of life.

Disadvantages of anti-aging cream:

You possibly need to use the wrinkle cream a couple of times the afternoon for decreasing the getting old and brighten the pores and skin but when you discontinue the use of the product your skin is possible to return to its original 3635 look. There are some side effects also in anti-aging cream, a few merchandises may also reason pores and skin inflammation, rashes, burning, or redness on the face Anti-aging cream is dangerous for children- As in step with Dermatologists, they advise the use of anti-aging cream after 24 due to the fact it's miles the proper time to start the usage of anti-aging products or as a minimum have a proper skincare routine.

Usage of Anti-aging cream:

Use anti-getting old creams to moisturize, brighten, tighten, and lift up your sagging skin, specifically the skin around your eyes and neck. Those potions do not have artificial colourings, scents, and parabens. The moisturizing impact of those lotions will work wonders on males and females' skin [13].

Methodology:

Procedure:

The required amount of white bee's wax, glycerine, and olive oil were taken as the oil phase in a porcelain dish and melted at 70°C. Simultaneously, aloevera, vitamin E capsule, ginger, papaya leaf powder, tulsi powder, ashwagandha powder, and rice water were taken as the aqueous phase in another porcelain dish and heated to 70°C. The aqueous phase was then added gradually to the oil phase with continuous stirring, with additional rice water added in small amounts if necessary. Stirring was continued until a cream of the desired consistency was obtained, after which sandalwood oil was added as a perfume just before transferring the finished product into a suitable container. By varying the proportions of ingredients, three different formulations, namely

F1, F2, and F3, were prepared and subsequently evaluated through various tests [14].

Table 1: Ingredients Profile

Ingredient	Role of ingredients
Papaya leaves	Skin whitening; reduces unwanted hair; exfoliates dead skin; repairs ageing skin
Tulsi powder	Antioxidant; anti-inflammatory; antimicrobial; analgesic
Olive oil	Antioxidant; anti-inflammatory; antibacterial; anti-wrinkle; reduces skin inflammation; protects against sun damage; prevents acne-causing bacteria; moisturizes and hydrates skin
Ginger	Antioxidant; anti-inflammatory; antimicrobial; analgesic
Rice water	Reduces pigmentation; lightens dark spots; soothes sunburn; anti-ageing
Ashwagandha	Antioxidant; reduces wrinkles and fine lines; anti-inflammatory
Aloevera	Anti-inflammatory; anti-ageing; wound healing; soothes sunburn
Vitamin e capsule	Acts as an antioxidant
Bee's wax	Helps emulsify and stabilize the cream
Glycerine	Humectant that attracts moisture; prevents dryness; maintains skin's natural moisture balance
Sandalwood oil	Improves skin tone; hydrates and nourishes skin; treats acne; reduces signs of ageing; antioxidant and anti-inflammatory; reduces fine lines and wrinkles

Table 2: Formulation table

Sl no.	Ingredients	F1	F2	F3
1.	Papaya leaves	2.5gm	3.5gm	3gm
2.	Tulsi powder	2.5gm	3.5gm	3gm
3.	Olive oil	2ml	2.5ml	1.5ml
4.	Ginger	1.5gm	1.5gm	1.5gm
5.	Rice water	6ml	5ml	7ml
6.	Ashwagandha	2.5gm	2.5gm	2.5gm
7.	Aloevera	1.5gm	1.5gm	1.5gm
8.	Vitamin E capsule	2ml	2ml	2ml
9.	Bee's wax	2gm	2gm	2gm
10.	Glycerine	1.5ml	1.5ml	1.5ml
11.	Sandalwood oil	Q. S	Q. S	Q. S

Evaluation of Anti-Aging Cream:

1. Organoleptic evaluation: The sensory characteristics, including colour, smell, and appearance, were noted.

2. Homogeneity: All developed creams were tested for homogeneity by visual inspection after the creams have been set in the container. They were tested for their appearance and presence of any aggregates [15]

3. pH of the cream: The pH meter was calibrated using standard buffer solution. About 1 g of the cream was weighted & dissolved in 50 ml of distilled water. The pH of the suspension was determined at 27^0C [16].

4. Spreadability: Spreadability is determined by measuring the time, in seconds, it takes for two glass slides to separate from the cream; a shorter time indicates better Spread ability. To perform the measurement, 3 g of herbal cream was placed between two slides and pressed to create a uniform thin layer. A weight of 1000 g was then applied for 5 minutes. Following this, an additional 10 g was added using a pan, and the upper slide was connected to a string and hook for pulling. The time taken for the upper slide to move 10 cm over the lower slide was recorded, and Spreadability was calculated using the designated formula.

$$S = \frac{M \times L}{T}$$

Where,

S – Spreadability,

M – Weight tied to the upper slide (20g)

L - Length of the glass (7.5 cm)

T-Time taken in seconds [17].

5. Irritancy test: An area of one square centimetre is outlined on the left dorsal side. The cream is applied to the marked area, and the starting time is noted. Any signs of irritation, redness, or swelling are monitored and documented at regular intervals over a 24-hour period [18]

6. Dilution Test: The dilution test identifies the type of emulsion by mixing it with either water or oil. An O/W emulsion will mix completely with water but separate when mixed with oil, while a W/O emulsion will blend with oil but separate when mixed with water [19]

7. Sensitivity test: The cream that was prepared was applied to the skin of the hand and exposed to sunlight for 4 to 5 minutes.my research [20]

8. Washability Test: Removal of the applied cream from the skin was conducted by gentle washing under tap water, ensuring minimal force to effectively cleanse the skin [21-22].

Results and Discussion:

1. Organoleptic Evaluation

The formulated herbal anti-aging creams (F1, F2, and F3) were evaluated for their color, odor, and appearance. All formulations exhibited a pale-green color with a characteristic sandalwood odor and a semi-solid appearance, as shown in Table 3. These properties indicate uniformity and acceptable aesthetic characteristics, which enhance consumer

appeal and acceptability.

Table 3: Organoleptic Property

Sl. No	Properties	F1	F2/F3
1	Colour	Pale green	Pale green
2	Odour	Sandalwood	Sandalwood
3	Appearance	Semi-solid	Semi-solid

2. Homogeneity

All formulations exhibited good homogeneity, with uniform distribution of herbal extracts throughout the cream base. This was confirmed by visual inspection and by touch. The smooth texture without any lumps or phase separation confirmed proper emulsification and stability of the formulations.

3. pH of the Cream

The pH of all formulations was found to be in the range of 5.4 to 5.9, which is suitable for topical application and compatible with the natural skin pH (around 5.5–6.8). Maintaining the pH within this range minimizes the risk of irritation or allergic reactions. Among the formulations, F2 showed the lowest pH (5.4), while F3 had the highest (5.9).

Table 4: pH of the Formulations

Sl. No	Formulation	pH
1	F1	5.8
2	F2	5.4
3	F3	5.9

4. Spreadability

The spreadability of the formulations was determined to evaluate the ease of application on the skin. All formulations exhibited good spreadability, indicating smooth and uniform application without excessive drag. Among the three, F1 showed slightly higher spreadability (23.52 gm·cm/sec), followed by F3 (22.2 gm·cm/sec) and F2 (21.05 gm·cm/sec). This indicates that F1 provides a more desirable consistency for topical use.

Table 5: Spreadability of the formulations

Formulation	Mass (gm)	Radius (cm)	Time (sec)	Spreadability (gm·cm/sec)	Observation
F1	100	2.0	8.5	23.52	Spreadable
F2	100	2.0	9.5	21.05	Spreadable
F3	100	2.0	9.8	22.20	Spreadable

5. Irritancy Test

All three formulations were tested for skin irritancy and were found to be non-irritant. This confirms the safety of the herbal ingredients used and indicates that the formulations are suitable for regular topical use.

6. Dilution Test

The dilution test revealed that all formulations were immiscible with water but miscible with oil, confirming that the prepared creams are water-in-oil (W/O) type emulsions. Such emulsions are beneficial for dry or aged skin as they provide enhanced moisturizing effects and longer retention on the skin surface.

Table 6: Dilution test

Sl. No	Formulation	Water	Oil
1	F1	Immiscible	Miscible
2	F2	Immiscible	Miscible
3	F3	Immiscible	Miscible

7. Sensitivity Test

The sensitivity test indicated no sensitivity reactions for any of the formulations (F1, F2, or F3). This demonstrates that the herbal extracts and excipients used in the formulation are safe and non-allergenic for topical application.

Table 7: **Sensitivity test**

Sl. No	Formulation	Sensitivity
1	F1	No
2	F2	No
3	F3	No

8. Washability Test

All formulations were found to be easily washable with water, which enhances user convenience and improves consumer acceptability. This property also indicates the proper emulsification and physical stability of the formulations.

Table 8: Washability test

Sl. No	Formulation	Washability
1	F1	Easily washable
2	F2	Easily washable
3	F3	Easily washable

Overall Discussion

The prepared herbal anti-aging cream formulations (F1, F2, and F3) showed satisfactory physicochemical properties, including appropriate color, odor, texture, pH, and spreadability. All formulations were homogeneous, stable, non-irritant, and easily washable. The W/O type emulsion nature ensures better moisturization and longer retention on the skin, which is beneficial for anti-aging applications. Among the three, F1 exhibited slightly superior spreadability and balanced pH, indicating its potential as an optimized formulation for further studies and commercialization.

Conclusion:

The formulated herbal anti-ageing cream containing papaya leaves, tulsi, ginger, ashwagandha, olive oil, rice water, aloe vera, vitamin E, beeswax, glycerine, and sandalwood oil was successfully developed and evaluated. The formulation showed excellent organoleptic characteristics, good homogeneity, skin-friendly pH, smooth spreadability, and no signs of irritation or sensitivity. It also passed washability and dilution tests effectively. All evaluation parameters indicated that the cream is safe, stable, and suitable for regular use, making it a promising herbal formulation for anti-ageing skincare.

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