

Design and evaluation of a polyherbal anti-aging skin cream

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Abstract

The popularity for herbal creams has grown now a days due to their natural ingredients and can be applied gently on the skin. Aloe vera, papaya, and grape seed oil, recognized for their pharmacological and antioxidant properties in traditional medicine, were selected as active constituents in the formulation of a polyherbal anti-aging cream. The plant extracts were prepared and subsequently evaluated for their phytochemical constituents. Five different herbal cream formulations (F1-F5) were prepared using varying concentrations of polyherbal extracts (2%, 5%, 10%, 15%, and 20%). These formulations were evaluated for physicochemical properties such as pH, texture, and spread ability, along with other quality parameters. Additionally, the extracts were assessed for their antioxidant activity. Among all the formulations, polyherbal anti-aging cream F5 has showed the best results in terms of spread ability, appearance, stability, and skin safety offering potential anti-aging benefits.

Keywords: Polyherbal Cream; Aloe Vera; Papaya Extract; Grape Seed Oil

1. Introduction

The skin, which covers the whole exterior of the body, is the biggest organ with distinct physical features and purposes. This organ also plays a crucial role in regulating body temperature and water loss to the environment. Due to its thick epidermis, the back has the thickest skin among these areas [1,2]. The skin's comprehensive roles highlight its complexity and importance in maintaining overall health and well [3,4]. Creams are intended for topical application to improve site-specific medication delivery to the skin for skin conditions [5]. Traditionally, semisolid formulations that are either water-in-oil (like cold cream) or oil-in-water (like vanishing cream) have been referred to as cream [6]. Herbal creams are emulsions that include both oil and water. These herbal formulations may contain different natural extracts like neem, papaya, aloe vera, Tulsi, turmeric and natural nutrients like vitamins and minerals. They are free of synthetic additives that might be toxic [7,8]. Anti-aging creams are cosmeceutical skincare products that are mostly moisturizers to make the client appear younger by minimizing the appearance of aged skin and pores. Vitamins C and A are typically used to make anti-aging creams [9]. Vitamin A functions as an antioxidant to slow down aging, while Vitamin C shields skin cells from harmful free radicals caused by UV exposure and also prevents the skin from producing melanin, which helps to minimize hyperpigmentation and lessen dark patches.

The objective of this study was to formulate a polyherbal anti-aging cream enriched with natural extracts and to evaluate its effectiveness in improving skin texture, reducing visible signs of aging, and addressing common skin-related problems.

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2. Materials and method

The various ingredients and excipients used in the formulation of the cream like Aloe vera leaves were collected from the garden of Gokaraju Tangaraju College Pharmacy and Papaya Leaves were collected from local market and grape seed extract were outsourced from e-commerce.

Table 1 List of excipients and herbal ingredients with their roles

S. No.	Ingredients	Role
1	Aloe vera extract	Reduce the inflammation in the skin layers
2	Papaya leaves extract	Anti-oxidant activity
3	Grape seed extract	Anti-aging and improve elasticity of skin.
4	Cetyl alcohol	Stabilizer, emulsifier
5	Lanolin	Emollient
6	Stearic acid	Thickening agent
7	Glycerin	Moisturizing agent
8	Propylene glycol	Emulsifier
9	Sodium Benzoate	Preservative
10	Triethanolamine	pH adjustment
11	Water	Vehicle

2.1. Extraction process

- **Method of extraction of Aloe vera:** Fresh and mature Aloe vera leaves were removed from the plant and cleaned with purified water. Using a sterile knife, the leaf is dissected longitudinally and semi- solid gel is gathered. Then the obtained jelly mass was crushed in a mortar with pestle. Aloe vera extract was collected and preserved [10].
- **Method of extraction of Papaya Leaf:** The collected plant material was washed with running tap water to remove surface contamination and shade dried for about 15 days. The dried leaves were cut into small pieces and crushed into a fine powder. Then the known amount of dried powder of papaya was mixed with 70% MeOH. The mixture was stirred on stirrer for 72 hours. Further the mixture was filtered and stored [11].



Figure 1 a) Extraction of aloe vera gel b) Extraction of papaya leaves

2.2. Phytochemical Screening of Extracts

The different qualitative chemical tests were performed for establishing profile of a given extracts for its nature of chemical composition. The following tests were carried out on the extracts to detect various phytoconstituents present in them.

2.3. Test for Flavonoids

- **Shinoda test** to dry powder or extract, add 5ml 95% ethanol/t-butyl alcohol, few drops of concentrated HCl and 0.5 g magnesium turnings was added. Orange, pink, red to purple color appears (flavanols, dihydro derivatives and xanthene). Add t-butyl alcohol before adding the acid to avoid accidents from a violent reaction and to dissolve the colored compounds into upper phase. By using zinc instead of magnesium, only flavanols give a deep red to magenta color while flavanones and flavanols give weak pink to magenta colors or no color.
- **Sulphury acid test** Upon addition of sulphuric acid (66% or 80%) flavones and flavanols dissolve into it and give a deep yellow solution. Chalcones and aurones give red or red bluish solutions. Flavones give orange to red colour. To small quantity residue, lead acetate solution was added. Yellow colour precipitate was formed. Heat test solution with Zinc dust and HCl, pink to red colour is formed.

2.3.1. Test for alkaloids

- **Dragan Dorf's test:** To 2-3ml filtrate, few drops of Dragan Dorf's reagent (Solution of potassium bismuth iodide composing of basic bismuth nitrate, tartaric acid and potassium iodide (KI) was added and orange precipitate formation confirms the test as positive.

2.3.2. Test for Tannins and Phenolic compounds

- **Lead acetate test:** To 2-3ml of aqueous extract or alcoholic extract, few drops of lead acetate solution, was added and observed for precipitate.

2.3.3. Test for sterols

- **Salkowski's test:** 2ml of extract was treated with 2ml chloroform and 2ml concentrated sulphuric acid, Chloroform layer was observed in red colour and acid layer was observed green colour [12].

2.3.4. Determination of anti-oxidant activity Hydrogen peroxide (H₂O₂) scavenging activity

Phosphate buffer (pH-7.4): To 40ml of 0.2M Disodium hydrogen phosphate and 10ml of Sodium dihydrogen phosphate, 0.9g of sodium chloride was added to the above solution. Stir until dissolved, make the volume to 100ml with distilled water adjust pH to 7.4.

40mM H₂O₂: Add 136g of hydrogen peroxide in 100ml of phosphate buffer (pH-7.4)

Stock Solution: To prepare an extract solution of 1000 µg/ml, 1 mg of the extract was accurately weighed, placed into a 10 ml volumetric flask, and dissolved in distilled water. From this solution, 1 ml, 2 ml, 3 ml, 4 ml, and 5 ml were each diluted to 10 ml with distilled water to obtain final extract concentrations of 100 µg/ml, 200 µg/ml, 300 µg/ml, 400 µg/ml, and 500 µg/ml, respectively.

Standard solution preparation: Similarly, to prepare a 1000 µg/ml solution of ascorbic acid, 1 mg of ascorbic acid was weighed, transferred into a 10 ml volumetric flask, and dissolved in distilled water. Then, 1 ml, 2 ml, 3 ml, 4 ml, and 5 ml portions were each diluted to 10 ml with distilled water to yield final concentrations of 100 µg/ml, 200 µg/ml, 300 µg/ml, 400 µg/ml, and 500 µg/ml, respectively.

Procedure: The hydrogen peroxide (H₂O₂) scavenging potential of the extracts was evaluated based on the method outlined by Ruch et al. (1989), with slight modifications. A 3% H₂O₂ stock solution was initially prepared using 40 mM phosphate buffer (pH 7.4) and subsequently diluted to obtain a working concentration of 10 mM. For the assay, 3 ml of 50 mM H₂O₂ solution was mixed with 3 ml of the extract at varying concentrations. The resulting mixtures were incubated at room temperature for approximately 10 to 15 min. After 10 min, absorbance was recorded at 230 nm using a UV-visible spectrophotometer, with phosphate buffer (lacking H₂O₂) as the blank. A parallel control using the extract solvent was also included, while L-ascorbic acid was used as a standard reference antioxidant [13].

$$\% \text{ Scavenged (H}_2\text{O}_2) = [(Ac-At/Ac) \times 100]$$

Where Ac is the standard absorbance and at the test absorbance

- **Formulation of cream:** Polyherbal anti-aging cream formulations (F1–F5) were developed using varying concentrations of herbal extracts—2%, 5%, 10%, 15%, and 20%, respectively. The extracts included Aloe vera leaves, grape seed, and papaya leaves, as detailed in Table 2.
- **Preparation of oil phase:** Accurately weighed amounts of stearic acid and lanolin were placed in a glass beaker and heated to 70 °C. Once the temperature was reached, cetyl alcohol and grape seed extract were added to the mixture. The contents were continuously stirred while maintaining the temperature at 70 °C. The temperature was monitored regularly using a thermometer to ensure consistency.
- **Preparation of water phase:** All aqueous phase ingredients, including Aloe vera gel, papaya leaf extract, glycerin, and propylene glycol, were accurately weighed and transferred into a beaker containing the specified volume of water. The mixture was stirred continuously until all components were completely dissolved. Throughout the process, the temperature was maintained at 70 °C.
- **Preparation of cream:** After attaining the required temperature, the aqueous phase contents were transferred into mortar and the oil phase contents was added drop by drop to the above preparation continuously by stirring until smooth consistent cream was obtained. To it, Triethanolamine was added to adjust the pH. Then it is transferred into the container.
- **Preparation of poly herbal cream:** To the prepared cream, extracts were added and stirring was continued until a smooth cream was formed. Preservative was added like Sodium benzoate, triethanolamine was added as shown in Figure 2.



Figure 2 Polyherbal Cream Formulations (F1-F5)

Table 2 Formulation of Poly herbal anti-aging Cream

S. No	Ingredients	F1 [2%]	F2 [5%]	F3 [10%]	F4 [15%]	F5 [20%]
1	Aloe vera extract (ml)	0.4 ml	1 ml	2 ml	3 ml	4 ml
2	Papaya leaves extract(ml)	0.4 ml	1 ml	2 ml	3 ml	4 ml
3	Grape seed extract (ml)	0.4 ml	1 ml	2 ml	3 ml	4 ml
4	Cetyl alcohol (gm)	0.4 gm	0.4 gm	0.4 gm	0.4 gm	0.4 gm
5	Lanolin (gm)	0.2 gm	0.2 gm	0.2 gm	0.2 gm	0.2 gm
6	Stearic acid (gm)	2.6 gm	2.6 gm	2.6 gm	2.6 gm	2.6 gm
7	Glycerin (ml)	2.4 ml	2.4 ml	2.4 ml	2.4 ml	2.4 ml
8	Propylene glycol (ml)	0.2 ml	0.2 ml	0.2 ml	0.2 ml	0.2 ml
9	Sodium Benzoate (gm)	0.03 gm	0.03 gm	0.03 gm	0.03 gm	0.03 gm
10	Triethanolamine (ml)	q.s	q.s	q.s	q.s	q.s
11	Water (ml)	q.s	q.s	q.s	q.s	q.s

2.4. Evaluation of Polyherbal cream

- **Physical evaluation:** All the prepared creams (F1-F5) were evaluated physically for the color, odor, texture and state of cream and observations were recorded.
- **Irritancy test:** Irritancy test was done by marking 1cm² area on left hand dorsal. Cream was applied on that area and observed for every one hour up to 12 hours. Irritant effect, erythema and oedema was checked.[14]
- **Appearance:** The formulations were kept for long time and the color change was observed.
- **After feel:** A fixed amount of herbal cream was applied and checked for emollience and greasiness if any present was noted down.
- **Homogeneity:** This test was done by pressing a small quantity of prepared cream between the thumb and index finger. It was analyzed by visual inspection for the appearance and existence of any clog was reported.
- **Spread ability:** It was done by taking 1gm of cream on the glass slide and involves the measurement of diameter of spreading of cream before and after keeping weight of 150 gm. Spread ability denotes the extent of area to which a cream readily spreads on the application to the skin.
- **pH:** The pH of the prepared cream was measured using digital pH meter. The solution of cream was prepared using 100 ml of distilled water and set aside for 2hrs. Average pH (n=3) was determined.
- **Viscosity:** Brookfield viscometer was used to check the viscosity of formulated cream (F1-F5) by using spindle no. 63, 2.5 rpm at 25°C. The viscosity of the cream was obtained by multiplying the corresponding dial reading with the factor given in the Brookfield Viscometer catalogue.

3. Results and discussion

3.1. Phytochemical screening test were done for the obtained extracts

The prepared herbal extracts of aloe vera, papaya leaves extract, grape seed oil was used for the preparation of herbal creams and are subjected to phytochemical screening. The results shown the presence of flavonoids, alkaloids, phenols, tannins and sterols given in Table 3.

Table 3 Phytochemical screening tests

S. No	Chemical tests	Aloe vera Extract	Papaya leaves extract	Grape seed oil extract	Color change
1.	Test for flavonoids Sopheric acid Test	Positive	Positive	Positive	Yellow color precipitate formed
2.	Test for Alkaloids Dandruff's test	Positive	Positive	Positive	Orange precipitate formed
3.	Test for Phenols/ Tannins Lead acetate	Positive	Positive	Positive	Precipitate formed
4.	Test for Sterols Salkowski test	Positive	Positive	Positive	Chloroform layer-red color Acid layer- green color

- **Antioxidant activity of extracts:** Anti-oxidant property has been checked with papaya leaf extract and grape seed extract by hydrogen peroxide scavenging assay method. The IC₅₀ values obtained for papaya leaves extract is 32.5, grape seed extract is 20 and standard ascorbic acid is 36.4. These results indicate that both plant extracts exhibit appreciable antioxidant activity, with grape seed oil extract demonstrating significantly greater potency than the standard. The lower IC₅₀ values suggest a higher efficiency in neutralizing free radicals at lower concentrations. Papaya leaf extract also exhibited stronger antioxidant capacity than ascorbic acid, but to a lesser extent compared to grape seed oil. These results support the potential application of both extracts particularly grape seed oil as effective natural antioxidants.

Table 4 Antioxidant activity of extracts

S. No	Treatment	IC 50
1	Grape seed oil Extract	20
2	Papaya leaves Extract	32.5
3	Ascorbic acid	36.4

3.2. Evaluation of poly herbal cream

- **Physical evaluation:** The prepared formulations were evaluated for color, odor, texture, and state. All the formulations prepared F1-F5 were found to be smooth, and pleasant given in table 5.

Table 5 Physical properties of Polyherbal creams F1-F5

S. No	Parameters	F1	F2	F3	F4	F5
1	Colour	White	Pale green	Light green	Jade green	Jade green
2	Odour	Pleasant	Pleasant	Pleasant	Pleasant	Pleasant
3	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth
4	Physical state	Semi solid	Semi solid	Semi solid	Semi solid	Semi solid

Irritancy test: The prepared herbal formulations F1 to F5 subjected to irritancy test. No signs of redness, oedema, inflammation and irritation were observed during irritancy studies for all the formulation given in Table 6. Hence, these formulations are safe to use for skin.

Table 6 Irritancy test for herbal formulations F1-F5

S. No	Parameters	F1	F2	F3	F4	F5
1	Erythema	Nil	Nil	Nil	Nil	Nil
2	Oedema	Nil	Nil	Nil	Nil	Nil
3	Irritant effect	Nil	Nil	Nil	Nil	Nil
4	Inflammation	Nil	Nil	Nil	Nil	Nil

Appearance, after feel and homogeneity: The prepared polyherbal formulations (F1–F5) were evaluated for appearance, after-feel, and homogeneity. All formulations, except F1, retained their original colour over a prolonged period, indicating good stability. In terms of after-feel characteristics, all preparations (F1–F5) exhibited desirable properties such as good emollient, slipperiness, non-greasiness, and an acceptable amount of residue left after the application of a fixed amount of cream, as presented in Table 7. Homogeneity assessment revealed uniform distribution of extracts in all formulations except F1, as confirmed by visual inspection and tactile evaluation given in Table 7.

Table 7 After feel test and Homogeneity for F1-F5

S. No	Formulation	After Feel	Homogeneity
1	F1	Emollient, non-greasy	Average
2	F2	Emollient, non-greasy	Good
3	F3	Emollient, non-greasy	Good
4	F4	Emollient, non-greasy	Excellent
5	F5	Emollient, non-greasy	Excellent

- **Spreadability:** Spreadability is the less time taken for the separation of both the slides and this was carried out for all the formulations, i.e., F1 - F5 after diameter was found in the range of 1.8 to 5cm given in Table 8. Among F1 -F5, F5 has better Spreadability when compared to the other preparations.

Table 8 Spreadability test for formulations F1-F5

S.No	Formulation	Before diameter (in cm)	After diameter (in cm)
1	F1	1.5	1.8
2	F2	1.5	2.7
3	F3	1.9	3.3
4	F4	2.2	4.6
5	F5	2.2	5

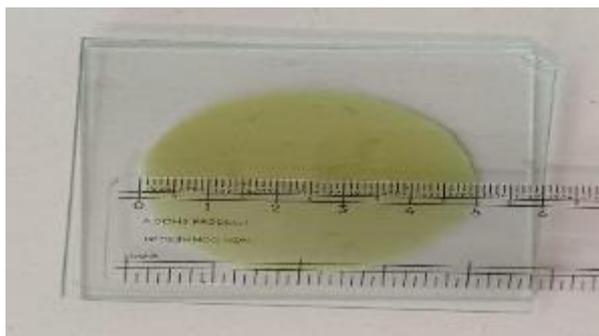


Figure 3 Spreadability of Polyherbal Anti-Aging Cream (F5)

- **pH, viscosity, washability:** The pH of the prepared polyherbal creams (F1–F5) ranged from 5.5 to 7.8, indicating that all formulations had pH values close to that of the skin, with F5 showing the most compatibility at a pH of 5.5. The viscosity of the creams was found to be having good spreadability with minimal shear; notably, F5 exhibited a viscosity of 705 cps, which is suitable for delivering rich, long-lasting moisture. In terms of washability, all formulations (F1–F5) were easily washable within 8 seconds, well within the acceptable limit of 15 minutes, demonstrating their ease of removal and favorable user experience.

Table 9 Poly herbal creams pH, Viscosity and Washability

S. No	Formulation	pH	Viscosity (cps)	Washability (sec)
1	F1	7.8	625	20
2	F2	6.9	590	18
3	F3	7.1	540	15
4	F4	6.2	601	10
5	F5	5.5	705	8

4. Conclusion

The formulated polyherbal anti-aging cream, enriched with Aloe vera, papaya leaves, and grape seed oil extracts, demonstrated significant antioxidant activity. Among all formulations, F5 with the highest extract concentration has showed good spreadability, ideal pH, and zero skin irritation, confirming its safety and enhanced efficacy. This optimized formulation holds strong promise as a natural, effective, and well-tolerated anti-aging topical product, addressing the growing demand for herbal cosmeceuticals. Further clinical validation will be essential to confirm its long-term benefits on skin aging.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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