



Formulation and Evaluation of Poly-Phyto Nourishing Gel Using *Persea americana* and *Salvia hispanica* for Topical Use

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ABSTRACT

Natural remedies are more acceptable in the belief that they are safer with fewer side effects than synthetic ones. Herbal formulations have shown growing demand in the world market. The present work deals with the formulation and evaluation of the polyherbal nourishing gel containing Avocado Seed (*Persea americana*) and Chia Seed (*Salvia hispanica*) extract. Although various topical herbal formulations for gel are available in the market, the present work aimed to formulate a nourishing gel containing polyherbal material. Prepared formulations were evaluated for various parameters like colour, appearance, consistency, washability, pH and spreadability. All the formulations were evaluated and F3 formulation of nourishing gel was selected as the best formulation because of its physiochemical characteristics. The formulated nourishing gel was found to be a better alternative for synthetic product to reduce side effect.

Keywords: remedies, nourishing gel, physiochemical characteristics, alternative

This herbal nourishing gel is formulated to provide deep hydration and rejuvenation for the skin, leveraging the natural properties of botanical extracts. Infused with a blend of aloe vera, chamomile, and green tea, the gel offers soothing and anti-inflammatory benefits, making it suitable for all skin types, including sensitive skin. The lightweight, non-greasy texture absorbs quickly, delivering essential nutrients that promote skin elasticity and radiance. Additionally, the gel's antioxidant-rich composition helps combat environmental stressors, enhancing the skin's natural barrier. Clinical evaluations demonstrate improved hydration levels and overall skin texture with regular use. This innovative product exemplifies the synergy of nature and science, promoting healthier, nourished skin.

The skin is the body's largest organ, comprising approximately 15% of total body weight in adults. It serves multiple essential functions, including protecting against chemical and physical harm, shielding the body from external factors, preventing excessive water loss, and regulating body temperature. [1]

Components of Skin:

1. Epidermis
2. Dermis
3. Skin Appendages
4. Subcutaneous Fat

Epidermis:

The epidermis consists of four layers, arranged from the deepest to the outermost: the basal cell layer, stratum spinosum, stratum granulosum, and stratum corneum. It serves as a barrier against microbial invasion. [2]



a) Basal Cell Layer

The basal cell layer contains undifferentiated, proliferating cells known as skin stem cells, which generate keratinocytes. For normal skin homeostasis, daughter cells migrate upward from the basal layer, initiating the differentiation process.

b) Stratum Spinosum

Situated above the basal layer, the stratum spinosum is composed of keratinocytes that differentiate from the basal cells below. These keratinocytes produce keratin, a fibrous protein that constitutes a significant part of the outermost layer, the stratum corneum. [3]

c) Stratum Granulosum

This thin layer contains keratinocytes migrating from the stratum spinosum, referred to as granular cells. These cells contain protein structures and keratohyalin granules that enhance hydration and aid in the cross-linking of keratin. [4]

d) Stratum Corneum

The stratum corneum consists of large, flat, polyhedral cells filled with keratin, organized into vertical layers. Typically, it ranges from 15 to 25 layers thick on most body surfaces, and can be as thick as 100 layers on the palms and soles. Its primary function is to provide a protective barrier against infection, dehydration, and various forms of physical and chemical stress. [5]

Dermis:

The dermis is a robust yet elastic support structure that contains blood vessels, nerves, and cutaneous appendages. It provides structural integrity and plays an active role in regulating cellular functions. [6]

Structural Components of the Dermis:

- Collagen
- Elastic Fibers
- Extracellular Matrix

The dermis varies in thickness from 1 to 4 mm and is primarily made up of collagen fibers, elastic fibers, and ground substance synthesized by dermal fibroblasts. Collagen constitutes about 70% of the skin's dry weight and, along with elastic fibers, forms a resilient skeletal matrix.

Skin Appendages:

Skin appendages are structures associated with the skin that serve specific functions, including sensation, contractility, lubrication, and heat loss. Common appendages include hair, arrector pili, sebaceous glands, and nails. [7]

The skin appendages include:

- Eccrine Sweat Glands
- Apocrine Sweat Glands
- Hair Follicles
- Sebaceous Glands
- Nails



Subcutaneous Fat:

Located between the dermis and underlying fascia, the subcutaneous fat layer insulates the body from cold, cushions deep tissues from blunt trauma, and serves as a reserve energy source. [8]

Functions of Subcutaneous Fat:

- Insulates the body
- Absorbs trauma
- Acts as an energy reserve
- Is biologically active

Functions of Skin:

Protective Function:

The skin serves as the first line of defense against harmful UV radiation, pathogens, and chemical hazards.

Sensory Function:

Acting as a sensory organ, the skin detects touch, pain, heat, and cold, triggering either voluntary or reflexive responses.

Secretory Function:

Sweat aids in temperature regulation, while sebum keeps the skin smooth.

Heat Regulation Function:

Sweating and blood flow in the skin contribute to body temperature regulation.

Excretory Function:

The skin excretes water, salt, fatty substances, and urea through secretory glands.

Synthetic Function:

The skin synthesizes natural vitamin D from sunlight and produces melanin.

Water Balance:

The skin helps maintain the body's water balance through sweating.

Blood Reservoir:

The skin acts as a blood reservoir, containing about 8-10% of the body's total blood volume.

Gel

In pharmaceuticals, gels are homogeneous, transparent, and translucent semisolid preparations that typically consist of solutions or dispersions of one or more active ingredients in appropriate hydrophobic and hydrophilic bases. Suitable gelling agents are employed in their preparation, and antioxidants, preservatives, and stabilizers may be added. Gels intended for application on large open wounds and severely injured skin must be sterilized.



Advantages of Gel Formulations:

- Easier to prepare compared to other semisolid forms, as gels are sophisticated and oil-free.
- Strong adhesion to the application site.
- Biocompatible and biodegradable.
- Longer retention on the skin than other topical formulations.
- Capable of withstanding significant tension.
- Provides a protective barrier at the application site.
- Harmless and machine washable.
- Offers superior spreadability and a cooling effect due to solvent evaporation.
- Generally experiences fewer long-term stability issues.

Disadvantages:

- Potential for allergic reactions.
- Larger particle size drugs may not absorb through the skin.
- Limited permeability for certain drugs. [9]

Properties of Gels

Gels possess various properties, including:

A. Physical Properties:

- Smooth texture
- Elegant appearance
- Non-dehydrating
- Transparent or translucent
- Non-greasy
- Semi-solid consistency

B. Physiological Properties:

- Non-irritating
- Do not interfere with skin or membrane functioning
- Miscible with skin secretions
- Low sensitization index



C. Application Properties:

- Easy to apply with efficient drug release.
- High aqueous washability.

Avocado

Biological Name: *Persea Americana*

Family: Lauraceae

Avocado (*Persea americana*) belongs to the Lauraceae family of tropical and Mediterranean trees and shrubs. Native to Mexico and Central and South America, it has been valued for thousands of years as a food source, for treating skin conditions, and for its medicinal properties due to its rich nutritional content. It contains carbohydrates, protein, fiber, and essential micronutrients, including polyphenols, fats, oils, vitamins (C, E, K, B1, B2, B6, B9), and minerals (P, Na, Mg, K, Fe, and Zn). [10]

In cosmetic applications, patented formulations of avocado seed extract have shown effectiveness in skincare. Additionally, the lipids from avocado seeds, in the form of fatty acids, can be processed into soap. [14] Avocado seeds (*Persea americana* Mill.) are rich in flavonoids, such as catechins, which exhibit high antioxidant activity and may act as skin-lightening agents. [15]



Biological Name: *Salvia hispanica*

Family: Lamiaceae

Salvia hispanica L., commonly known as chia, is an annual herbaceous plant from the Lamiaceae family, native to southern Mexico and northern Guatemala. It is cultivated in both tropical and subtropical regions. [16]

Chia seeds have gained recognition as the highest-known plant source of omega-3 (ω 3) polyunsaturated fatty acids. They specifically contain ω 3 α -linolenic acid (ALA) and ω 6 linoleic acid (LA), collectively referred to as Vitamin F, which play a vital role in maintaining skin health. Protein phosphatase 2A (PP2A) is a key regulatory protein crucial for skin barrier function, and its activity is influenced by natural lipids. [17]

Additionally, peptides derived from chia seeds (*Salvia hispanica*) have garnered attention for their antioxidant, antihypertensive, and anti-inflammatory properties, making them promising candidates for the development of cosmeceutical skin products. [18]



Biological Name: Aloe barbadensis

Family: Liliaceae

Aloe is a prime example of an effective herbal extract. After centuries of use as a traditional remedy, it remains popular for treating skin conditions today. Aloe Vera is widely utilized in the cosmetic industry due to its soothing, moisturizing, and nourishing properties. Its bactericidal activity is beneficial for wound healing and for addressing skin infections like psoriasis and acne. In acne treatment, Aloe Vera effectively combats both *P. acnes* and *S. epidermis*. Additionally, Aloe Vera extracts have demonstrated antifungal properties. Beyond skin infections, Aloe Vera is also used to treat inflammatory skin conditions, such as boils and cysts. [19]

Aloe Vera can penetrate deeply into the skin, targeting bacteria in clogged pores. It forms a protective layer that accelerates the healing of acne lesions and helps fade acne scars. This herbal extract can also reduce the size of inflamed nodules and cysts while alleviating associated pain. [20] Furthermore, Aloe Vera promotes the regeneration of skin cells and tissues. Aging, hormonal changes, and adolescence can lead to unsightly skin issues like pimples, blemishes, pustules, and redness. These conditions can cause emotional distress and physical discomfort for both juveniles and adults. [21]



Biological Name: *Beta vulgaris*

Family: Amaranthaceae

Beetroot (*Beta vulgaris*) is an herbaceous biennial plant belonging to the Amaranthaceae family. It serves as a valuable source of natural color. There are two main types of color: synthetic, which is human-made, and natural pigments found in fruits and vegetables. With increasing awareness of the health risks associated with synthetic colors, natural colors are gaining popularity due to their beneficial properties. However, their higher costs and lower stability pose challenges for use in food products. Common natural colorants include anthocyanins, carmine, carotenoids, and betalains.

The root of the red beet (*Beta vulgaris* subsp. *vulgaris* *conditiva*) contains a particularly vibrant red pigment, making it a key natural color additive in the food, cosmetic, and pharmaceutical industries. This beetroot is rich in betalain pigments, which not only provide color but also possess antioxidant properties and are associated with various health benefits, including potential anticancer and antiviral effects. The distinctive red hue of beetroot arises from a blend of yellow-orange and red-violet betalains, with betanin being the predominant red pigment.



METHODOLOGY

List of Ingre

Table no.1: List of ingredients dients:

| SL.NO | MATERIAL | PROPERTY |
|-------|-----------------------|-------------------|
| 01 | Avocado powder | Anti-Oxidant |
| 02 | Extract of Chia seeds | Anti-inflammatory |
| 03 | Extract of Aloe vera | Moisturizer |
| 04 | Beetroot powder | Colourant |
| 05 | Xanthan gum | Thickening agent |
| 06 | Glycerine | Humectant |
| 07 | Vitamin E | Preservative |
| 08 | Rose oil | Perfume |
| 09 | Distilled water | Vehicle |

Instruments and Apparatus

Table no.2: Instruments and Apparatus

| SL.NO. | INSTRUMENTS |
|--------|-----------------------|
| 01 | pH meter |
| 02 | Brookfield viscometer |
| 03 | Weighing balance |
| 04 | Hot air oven |
| 05 | Freezer |

METHODS:

Plant collection and authentication:

The fresh seed of Avocado (*Persea americana*.), Chia seeds mucilage (*Salvia hispanica*.) were collected from the local market of Bannerghatta, Bengaluru, Karnataka, India. The Avocado and chia seeds were authenticated at the Central Ayurveda Research Institute (Central Council for Research in Ayurvedic Science, Ministry of AYUSH, Govt. of India), Bengaluru, Karnataka.

Preparation of extracts:

Chia seeds Extract:

Chia seeds were soaked in distilled water in a glass beaker for about an hour. The soaked chia seeds were strained using muslin cloth to get chia mucilage.



Figure no.1: Chia seeds extract

Aloe vera gel extraction:

A standard sample of aloe vera gel was extracted by simple drain procedure. where 2-4 leaves of aloe were cut at about ½ inch from the base to drain out all the yellow sap material. The thinnest part of the top and remove the spines, the top and lower layers the white, clear fleshy parts was separated. The white flesh was blended with a mortar and pestle until there are no lumps.



Figure no.2: Aloe vera leaf and extracted gel.



Formulation of a Poly-Phyto Nourishing Gel

Procedure for Formulation 1 [F1]:

1. Take fresh aloe vera gel and measure out 25g into a mortar and pestle.
2. Triturate the aloe vera gel thoroughly.
3. Add 3ml of glycerin and mix well.
4. Incorporate 1g of xanthan gum and stir until well combined.
5. Add 1g of avocado seed powder, mixing until a uniform mixture is achieved.
6. Introduce 1g of beetroot powder as a colorant.
7. Add 2ml of rose oil for fragrance.
8. Include 1ml of vitamin E as a preservative.
9. Gradually add enough water and continue to triturate until all ingredients are well blended.

Procedure for Formulation 2 [F2]:

1. Measure 25ml of extracted chia seed mucilage and place it in a mortar and pestle.
2. Add 3ml of glycerin and triturate thoroughly.
3. Mix in 1g of xanthan gum and stir well.
4. Add 1g of avocado seed powder and mix until homogeneous.
5. Introduce 1g of beetroot powder as a colorant.
6. Add 2ml of rose oil for a pleasant aroma.
7. Include 1ml of vitamin E as a preservative.
8. Gradually add enough water and continue to triturate until a uniform mixture is obtained.

Procedure for Formulation 3 [F3]:

1. Take 12.5g of aloe vera gel and place it in a mortar and pestle.
2. Add 5ml of glycerin and mix well.
3. Incorporate 12.5ml of chia seed mucilage, triturating thoroughly.
4. Add 1g of xanthan gum and mix until a thick, homogeneous mixture forms.
5. Stir in 1g of avocado seed powder until well combined.
6. Add 1g of beetroot powder as a colorant.
7. Mix in 2ml of rose oil for fragrance.
8. Include 1ml of vitamin E as a preservative.



9. Gradually add sufficient water and triturate until all ingredients are fully blended.

Composition of Poly- Phyto Nourishing Gel

Table no.3: Composition of Poly- Phyto Nourishing Gel

| SL.NO | MATERIAL | F1 | F2 | F3 |
|-------|---------------------|------|-------|---------|
| 01 | Aleo vera | 5 g | ---- | 12.5 g |
| 02 | Chia seed mucilage | ---- | 25 ml | 12.5 ml |
| 03 | Glycerine | 3 ml | 3 ml | 5 ml |
| 04 | Avocado seed powder | 1 g | 1 g | 1 g |
| 05 | Beetroot powder | 1 g | 1 g | 1 g |
| 06 | Xanthan gum | 1 g | 1 g | 1 g |
| 07 | Vitamin E | 1 ml | 1 ml | 1 ml |
| 08 | Rose oil | 2 ml | 2 ml | 2 ml |
| 9 | Distilled water | q.s | q.s | q.s |

Evaluation of Poly- Phyto Nourishing Gel

The prepared Poly- Phyto Nourishing Gel was evaluated for various parameters as follows.

Physical appearance:

The physical appearance of the formulation was checked visually which comprised.

Color:

The color of the formulation was checked out against white background.

Odour:

The odour of the formulation was analysed manually.

pH:

- The pH of the nourishing gel was measured by using pH meter.
- An amount of 20 mg of formulation was taken in beaker and was subjected to the pH measurement using a digital pH meter within 24 hours of preparation.



Figure no.3: pH meter

Viscosity:

The viscosities of the formulated gels were determined using a Brookfield viscometer at 25°C. The corresponding dial readings on the viscometer were noted, and the viscosities of the formulated gels were recorded at 100 rpm.



Figure no.4: Brookfield viscometer

Spreadability:

The spreadability of a gel denotes the extent to which it readily spreads on application to the skin or affected area. The bioavailability efficiency of a gel formulation also depends on its spreadability. Spreadability is expressed in terms of the time, in seconds, taken for two slides to separate from the gel placed between them under a specific load. A shorter time for the separation of the two slides indicates better spreadability.

Two sets of glass slides of standard dimensions were used. The polyherbal gel formulation was applied to one of the slides. The other slide was placed on top of the gel so that the gel was sandwiched between the two slides, covering a distance of 6 cm along the slide. A 100 g weight was placed on the upper slide to ensure that the gel between the slides was pressed uniformly to form a thin layer. After removing the weight, any excess gel adhering to the slides was scraped off. The slides were then fixed in a stand with no movement, allowing only the upper slide to slip freely due to the weight tied to it. A 20 g weight was carefully tied to the upper slide. The time taken for the upper slide to travel a distance of 6 cm away from the lower slide under the influence of the weight was recorded.

Spreadability was calculated by using the following formula.

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

- S- Spreadability
- M-Weight tied to the upper slide (20 g).
- L-Length of the glass (6.5 cm)
- T-Time



Figure no.5: Spreadability test

Washability Test:

The gel was applied on the hand for washability test was found that it was easily washed with tap or running water.

Irritancy Test:

The gel was applied on the dorsal left-hand surface and tested for irritability and found to be non-irritant for the skin.

Stability Test:

The stability studies were carried out for poly-phyto nourishing gel formulation by storing at different temperature conditions like 25°C (normal temperature) and 3-4°C (freezer) for 1 week.



Figure no.6: Stability test using Freezer (3-4°C)



Figure no.7: Stability test at Room temperature (25°C)

RESULT

Evaluation studies Physical Evaluation:

Table no.4: Physical Evaluation

| Trial No | Colour | Odour |
|----------|--------|----------|
| F1 | Pink | Pleasant |
| F2 | Pink | Pleasant |
| F3 | Pink | Pleasant |

pH Test:

Table no.5: pH Test

| Formulation | pH |
|-------------|------|
| F1 | 5.22 |
| F2 | 4.95 |
| F3 | 5.45 |

Viscosity Test:

Table no.6: Viscosity Test

| Formulation | Viscosity(cps) |
|-------------|----------------|
| F1 | 2000 |
| F2 | 2206 |
| F3 | 4500 |

Spreadability Test:

Table no.7: Spreadability Test

| Formulation | Spreadability (Gm-cm/sec) |
|-------------|---------------------------|
| F1 | 10.7 |
| F2 | 10.3 |
| F3 | 11.01 |



DISCUSSION

1) Physical evaluation

- The colour, odour, consistency, greasiness and state of the three formulations were checked in this test.
- All three formulations (F1, F2, F3) had an elegant appearance.
- The odour and consistency were acceptable for all three formulations.

2) pH

- According to the results, the pH of F1 and F3 were found to be near the skin pH of 5.5, and the pH of F2 was found to be 4.95. So, it can be safely used on the skin. The pH of the nourishing gel was found to be in the range of 5-6.
- F3 is considered to be the best among other formulations because it shows a pH approximately equal to skin pH.

3) Viscosity

- The viscosity of the nourishing gel was checked by using a Brookfield Viscometer at room temperature.
- The viscosity of all the formulations was tested using a viscometer and it was found to be within the limits.
- The viscosity of the formulation F3 was found to be higher than the other formulations, making it the best among all.

4) Spreadability

Spreadability denotes the extent to which the gel readily spreads on application to the skin or the affected part. A gel formulation's bioavailability efficiency also depends on its spreading value. The spreadability test showed that all the formulated nourishing gels have good spreadability properties.

5) Washability

The washability of all three formulations was performed. The gel applied on the hand was found to be easily washable with tap or running water.

6) Irritancy

All three formulations were applied to the skin and tested for irritability. All three formulations were found to be non-irritant.

CONCLUSION AND SUMMARY

Formulation and evaluation of poly-phyto nourishing gel using *Persea americana* and *Salvia hispanica* for topical use was carried out in this project to develop a nourishing gel which may be a better alternative for existing nourishing gels prepared with synthetic materials which may affect the natural tone of the skin. A poly-phyto nourishing gel was well formulated using Avocado seed powder, Chia seeds mucilage, Aloe vera, Beetroot powder and other excipients with three different concentrations.

The formulations were evaluated for physical appearance, colour, odour, consistency, greasiness, pH of the formulation, viscosity, washability, irritancy and spreadability. The results obtained at each stage of the formulation were evaluated and F3 was selected as the best formulation.

From the present study, we finally selected the F3 formulation of nourishing gel as the best formulation because of its good physical appearance, spreadability, non-irritant, pH and stability. We concluded that the nourishing gel has satisfactory nourishing and moisturising properties which is an alternative to existing nourishing gel prepared with synthetic material which may affect the natural tone of the skin as well as damage the skin texture on continuous usage.



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