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Research Paper

Formulation And Evaluation of Herbal Hair Serum Containing *Embelia Ribes* Seeds Extract

Akanksha Putale*, Baburao Chandakavathe, Samruddhi Gaikwad, Nikita Mali

Department of Pharmaceutics, D. S. T. S. Mandal's College of Pharmacy, Solapur,Maharashtra India – 413004.

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ABSTRACT

The present study focuses on the formulation and evaluation of a herbal hair serum containing *Embelia ribes* seed extract. Herbal ingredients were selected based on their traditional use and reported pharmacological activities such as antifungal and hair growth–promoting properties. The serum was prepared in different batches and evaluated for various physicochemical parameters including pH, appearance, and stability. The pH of the formulations was found to be within the acceptable range for scalp application, with the optimized batch showing better compatibility with scalp conditions. Literature-based studies confirmed the antifungal potential of the selected herbal ingredients, which may help in controlling dandruff and maintaining scalp hygiene. Overall, the formulated herbal serum demonstrated promising characteristics, indicating its potential as a natural and effective hair care product

INTRODUCTION

Hair is an important part of the body made of a protein called keratin, and it grows from small structures called hair follicles present in the skin. Each hair strand consists of three main layers: the cuticle (outer protective layer), cortex (middle layer responsible for strength and color), and medulla (inner core). The growth of hair occurs in a cyclic manner consisting of three phases: anagen (active growth phase), catagen (transitional phase), and telogen (resting phase). Proper functioning of this cycle is essential for maintaining healthy hair growth and density[1]. Hair plays a vital role in protection, thermoregulation, and aesthetic appearance, and is often considered a reflection of an individual's overall health. However, various internal and external factors such as hormonal imbalance, stress, pollution, microbial infections, and improper hair care practices. Among the most common scalp disorders are dandruff, seborrheic dermatitis, and fungal infections, which are primarily associated with microbial growth on the scalp. Conventional

***Corresponding Author:** Akanksha Putale
Address: *Department of Pharmaceutics, D. S. T. S. Mandal's College of Pharmacy, Solapur, Maharashtra India – 413004.*
Email ✉: akankshaputale@gmail.com

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hair care products often contain synthetic chemicals that may cause adverse effects such as irritation, dryness, and long-term damage. Hence, there is an increasing demand for herbal cosmetic formulations that are safe, effective, and biocompatible[2,3].

Among various medicinal plants, *Embelia ribes* (Vidanga) is a well-known Ayurvedic herb traditionally used for its antimicrobial and therapeutic properties. The seeds of *Embelia ribes* are rich in plant-derived bioactive compounds such as alkaloids, flavonoids, tannins, and phenolic compounds, along with the main active constituent embelin, a benzoquinone derivative responsible for its biological activities. These phytoconstituents exhibit multiple pharmacological effects including antimicrobial, antifungal, antioxidant, and anti-inflammatory activities[4]. Scientific studies have demonstrated that *Embelia ribes* seed extract exhibits significant antifungal activity against various fungal strains, where in-vitro investigations have reported effective inhibition of fungal growth. Due to these properties, *Embelia ribes* seed extract is highly effective in managing scalp disorders such as dandruff and fungal infections, while also promoting a healthy scalp environment conducive to hair growth[5].

In addition to *Embelia ribes*, the present formulation incorporates other herbal ingredients that enhance the therapeutic efficacy of the hair serum. Fenugreek seeds are rich in proteins, nicotinic acid, and lecithin, which help in strengthening hair, preventing hair fall, and combating dandruff. Studies have reported that fenugreek extracts possess antifungal and antidandruff activity, making them beneficial for scalp health. Flaxseed is a rich source of omega-3 fatty acids, lignans, and vitamin E, which nourish the scalp and promote hair growth. Aloe vera is widely used in hair care due to its moisturizing, soothing, and healing properties. Rose water acts as a natural conditioner and provides hydration to the scalp, helping to maintain pH balance and improve hair texture[6].

Hair serum is a modern cosmetic dosage form that offers advantages such as non-greasy texture, easy application, enhanced spreadability, and better penetration of active ingredients compared to traditional oils. The combination of multiple herbal ingredients in a serum formulation can provide synergistic effects, improving overall efficacy in treating dandruff, reducing hair fall, and promoting hair growth. Therefore, the present study aims to formulate and evaluate a herbal hair serum containing Embelia ribes seed extract and assess its potential as a natural, safe, and effective hair care product.

Figure 1: Image of *Embelia ribes* seeds

MATERIALS AND METHODS

Table 1: Herbal Ingredients

	Embelia ribes	Fenugreek	Flaxseed	Aloe vera
Botanical name	*Embelia ribes* Burm.f.	*Trigonella foenum-graecum*	*Linum usitatissimum*	*Aloe Barbadensis Miller.*
Family	Primulaceae	Leguminosae	Linaceae	Liliaceae
Synonyms	Vidanga, False Black Pepper, Vavding	Methi, Methika, Alholva, Chandrika.	Linseed, Common Flax	Ghritkumari, Barbados Aloe, True Aloe
Biological source	Dried ripe fruits (commonly called seeds) of *Embelia ribes* Burm.f.	Dried seeds of *Trigonella foenum-graecum*.	Dried fully ripe seeds of *Linum usitatissimum*	Leaves of various species of aloe vera
Chemical constituents	Embelin, Embeliol, Alkaloids, Flavonoids, Phenolic compounds, Tannins, Saponins, Glycosides	Diosgenin, Flavonoids, Saponins, Alkaloids, etc.	α-Linolenic acid (ALA)Phenolic compounds, Flavonoids, etc.	Anthraquinone glycoside, Aloin , Aloe-emodin
Uses	antifungal, antimicrobial, antioxidant, anti-inflammatory, anti-dandruff, prevents scalp infections	promotes hair growth, antibacterial, antioxidant	Natural hair conditioner, moisturizes scalp, anti-inflammatory	Moisturizes scalp, antimicrobial, soothing, reduces dandruff

Rose Water : Rose water acts as a natural astringent that helps control excess scalp oil and may reduce dandruff. Its anti-inflammatory properties help soothe scalp irritation associated with conditions such as psoriasis and eczema. Additionally, it helps reduce frizz, enhances hair softness, and imparts a natural shine, making it a valuable ingredient in herbal hair serum formulations.

Sodium Benzoate : Sodium benzoate is a white, crystalline, water-soluble powder widely used as a preservative in cosmetic formulations. It helps prevent the growth of fungi, yeast, and some bacteria, thereby improving product stability and extending shelf life[7].

Methodology :

Extraction of *Embelia ribes* Seeds

The dried seeds of *Embelia ribes* were cleaned to remove extraneous matter, shade-dried, and coarsely powdered using a mechanical grinder. The powdered material was passed through sieve No. 40 and stored in an airtight container until extraction. Approximately 100 g of the powdered seeds were transferred into a clean, airtight glass container and macerated with 70% ethanol in a drug-to-solvent ratio of 1:10 (w/v). The mixture was kept at room temperature (25 ± 2°C) for 72 h with intermittent shaking to facilitate the extraction of phytoconstituents. After completion of the extraction period, the mixture was filtered through Whatman No. 1 filter paper. The filtrates were allowed to evaporate naturally at room temperature until semisolid extract was obtained. The dried extract was transferred to an airtight amber-colored container, and stored at 4°C until further use in the formulation[8].

Figure 2: Extraction by Maceration

Formulation of Herbal Hair Serum

Solution 1:-

Flaxseeds 10 g were heated with 100 mL of distilled water in a water bath until a clear gel was formed. The gel was filtered through muslin cloth and stirred using a magnetic stirrer to obtain a homogeneous consistency.

Solution 2 :-

Fenugreek seeds 2 g were boiled with 40 mL of distilled water for 5 minutes. The mixture was cooled and filtered to obtain a clear extract.

Solution 3:-

The required quantities of flaxseed gel and fenugreek extract were mixed according to the formulation. *Embelia ribes* seed extract was added with continuous stirring, followed by Aloe vera gel, sodium benzoate, and rose water. Finally, distilled water was added to make up the required volume, and the mixture was stirred until a uniform herbal hair serum was obtained[9,10].

Formulation Table :

Table 2: Formulation Table

Ingredients	F1	F2	F3	F4
Embelia ribes Seeds Extract	3%	5%	3%	5%
Fenugreek seeds	5%	5%	10%	10%
Flaxseed gel	3ml	3ml	3ml	3ml
Aloe vera gel	4.5ml	4.5ml	4.5ml	4.5ml
Rose water	6ml	6ml	6ml	6ml
Sodium Benzoate	0.02	0.02	0.02	0.02
Distilled Water	Q.S.	Q.S.	Q.S.	Q.S.

Figure 3: Serum Formulation

Evaluation

1. **Organoleptic Properties**

The organoleptic properties of the prepared herbal hair serum were assessed for colour, texture, and odour.

2. **Homogeneity**

The homogeneity of the herbal hair serum was evaluated by applying a small amount of formulation on a clean glass slide and examining it for uniformity. The formulation was checked for the presence of any aggregates, lumps, or floccules[11].

3. **pH Test**

The pH of the herbal hair serum was determined using a digital pH meter. The instrument was calibrated using standard buffer solutions pH 4 and pH 7 before analysis. The electrode was then immersed in the serum sample, and the pH value was recorded. The formulation was maintained within a skin-compatible acidic pH range approximately 4–6.

4. **Viscosity**

The viscosity of the herbal hair serum was measured using a Brookfield viscometer fitted with spindle no. 61. A 30 mL sample of the formulation was transferred into a beaker, and viscosity measurements were recorded at rotational speed 100 RPM[12].

5. **Spreadability Test**

The spreadability of the herbal hair serum was evaluated using the parallel plate method. Approximately 1 g of serum was placed between two glass plates measuring 20 × 20 cm. A weight of 125 g was applied on the upper plate to ensure uniform spreading. The diameter of the spread area was measured after 1 minute. The spreadability was calculated using the following formula:

$S = M \times L / T$

Where,

S = Spreadability

M = Weight applied to the upper plate (g)

L = Length travelled by the slide (cm)

T = Time required for complete separation of slides (sec)

6. **Skin Irritation Test**

The skin irritation potential of the herbal hair serum was evaluated by applying a small amount of formulation on the skin. The applied area was observed for any signs of redness, itching, swelling, or irritation after 2 hours[13].

7. **Antifungal Testing**

The antifungal potential of *Embelia ribes* was supported by literature. The seed extract has shown inhibitory effects against fungi such as *Candida albicans*. This activity is attributed to embelin and phenolic compounds, which interfere with fungal growth and help maintain scalp hygiene by preventing fungal infections[15].

RESULTS AND DISCUSSION

1. **Organoleptic Properties**

The physical appearance, odour and texture of the prepared herbal hair serum are visually tested.

Table 3: Results of Organoleptic Properties

Parameter	Batch F1	Batch F2	Batch F3	Batch F4
Color	Reddish-brown	Reddish-brown	Reddish-brown	Reddish-brown
Odour	Characteristic	Characteristic	Characteristic	Characteristic
Texture	Smooth	Smooth	Smooth	Smooth

2. **Homogeneity Test**

The homogeneity of the prepared herbal hair serum was assessed by examining the formulation for uniform consistency and the presence of any lumps, floccules, or aggregates. The serum showed good homogeneity with a smooth and uniform texture.

3. **pH Test**

The pH of the prepared herbal hair serum was determined using a digital pH meter. The electrode was immersed into the serum sample, and the pH value was recorded after obtaining a stable reading.

Table 4: Results of pH Analysis

Parameter	Batch F1	Batch F2	Batch F3	Batch F4
pH of Serum	4.9	4.1	5.2	5.7

4. **Viscosity**

Viscosity of serum in Brookfield viscometer shows as follow:

Table 5: Results of Viscosity Analysis

RPM	F1	F2	F3	F4
100rpm	8.79	9.52	14.6	15.70

5. **Spreadability**

Table 6: Results of Spreadability Analysis

Parameter	F1	F2	F3	F4
Spreadability(g.cm/s)	65.68	75.69	84.56	88.75

6. **Skin Irritation Test**

The serum is applied to skin and kept for 2 hr to check any irritation and redness. After 2 hr no irritation or redness was observed.

CONCLUSION

The present study focused on the formulation and evaluation of a herbal hair serum containing *Embelia ribes* seed extract. Four formulations F1–F4 were prepared and evaluated for their organoleptic characteristics, physicochemical properties, homogeneity, pH, viscosity, spreadability, skin irritation. All formulations exhibited acceptable colour, pleasant odour, smooth texture, suitable pH, good homogeneity. Among the four formulations, F4 was found to be the optimized formulation due to its excellent physicochemical properties, optimum pH and desirable viscosity. These findings suggest that the developed F4 herbal hair serum is a safe, stable, and effective formulation for maintaining scalp health and reducing dandruff.

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Conflict Of Interest:

No conflict of interest.

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