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(RESEARCH ARTICLE)

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Formulation and evaluation of a polyherbal hair oil containing *Trigonella foenum-graecum*

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Abstract

Hair and scalp disorders, including alopecia, dandruff, dryness, and irritation, are increasingly prevalent due to environmental exposure, stress, nutritional deficiencies, and extensive use of synthetic cosmetic agents. Herbal preparations are gaining attention as safer and multifunctional alternatives to conventional formulations. The present investigation aimed to develop and evaluate a polyherbal hair oil containing *Trigonella foenum-graecum*, *Hibiscus rosa-sinensis*, *Azadirachta indica*, *Acacia concinna*, and *Jasminum officinale*, formulated in a blend of coconut, almond, and castor oils. Four formulations (F1–F4) were prepared using a controlled hot infusion technique with variation in ingredient proportions. The developed oils were assessed for organoleptic characteristics, pH, viscosity, spreadability, and short-term stability. All formulations exhibited acceptable physicochemical properties within the physiological scalp range. Among them, formulation F3 demonstrated optimal viscosity, balanced pH (5.4), and satisfactory spreadability without phase separation or signs of rancidity over 30 days of storage. The findings suggest that the developed polyherbal hair oil is physically stable and cosmetically acceptable, supporting its potential as a natural alternative to synthetic hair care products. Further clinical evaluation is recommended to substantiate therapeutic efficacy

Keywords: Polyherbal Hair Oil; Fenugreek; Hibiscus; Neem; Hair Growth; Hair Care Evaluation

1. Introduction

Hair is a keratinized epidermal appendage emerging from hair follicles located in the dermis. The hair growth cycle consists of anagen (growth), catagen (transition) and telogen (resting) phases. Disruption of this cyclic progression may lead to hair thinning, excessive shedding, or alopecia Modern lifestyle factors such as pollution, psychological stress, hormonal imbalance, and the widespread use of chemically formulated cosmetics have contributed significantly to scalp disorders. Synthetic hair care products, although effective in the short term, may cause irritation, dryness, follicular damage, and long-term adverse effects.

Traditional systems of medicine describe the application of medicated oils to the scalp (Shiro Abhyanga) as a therapeutic practice to improve circulation, nourish follicles, and maintain scalp integrity. Polyherbal formulations are particularly valued due to their synergistic action, where multiple phytoconstituents collectively provide antimicrobial, antioxidant, anti-inflammatory, and nutritive effects.

The present study focuses on the formulation and physicochemical evaluation of a polyherbal hair oil integrating botanicals traditionally recognized for their hair-enhancing properties

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Objectives

General Objective

The primary objective of developing a herbal hair oil is to formulate a safe, effective, and natural hair care preparation using medicinal plant ingredients that promote hair growth, prevent hair loss, nourish the scalp, and improve overall hair health. This formulation aims to reduce the dependence on synthetic hair care products, which are often associated with adverse effects such as scalp irritation, dryness, and long-term follicular damage.

Specific Objectives

- To Formulate a Herbal Hair Oil Using Medicinal Plant Ingredients
- To Promote Hair Growth by Strengthening Hair Follicles
- To Reduce Hair Fall and Prevent Alopecia
- To Maintain and Improve Scalp Health
- To Improve Hair Texture, Shine, and Manageability
- To Provide a Safe and Non-Toxic Alternative to Synthetic Hair Oils
- To Evaluate Physicochemical Properties of Herbal Hair Oil
- To Assess Stability and Shelf Life
- To Scientifically Validate Traditional Herbal Knowledge
- To Promote Eco-Friendly and Sustainable Hair Care Practices
- To Develop a Cost-Effective and Accessible Hair Care Product

The objectives of herbal hair oil encompass formulation, evaluation, safety, efficacy, sustainability, and consumer acceptance. By integrating traditional herbal knowledge with scientific validation, herbal hair oil aims to provide a holistic, safe, and effective solution for hair and scalp care. The primary objective of this was to: Formulate a polyherbal hair oil using traditional and scientifically recognized ingredients: fenugreek, hibiscus, neem, almond oil, coconut oil, shikakai, jasmine, and castor oil. Evaluate the physical and organoleptic properties of the formulation (color, odor, viscosity, pH). Assess preliminary hair-nourishing efficacy through observational data on scalp condition and hair quality over a short period.

Overall Objective

To evaluate the combined synergistic effect of selected herbal ingredients and natural oils in producing a safe, effective, and cosmetically acceptable herbal hair oil formulation.

2. Materials and methodology

2.1. Materials

All plant materials (fenugreek seeds, dried hibiscus petals, neem leaves, shikakai pods, dried jasmine flowers) all materials were collected and dried. Oils included cold-pressed coconut oil, almond oil, and castor oil.

2.2. Methodology

Powdering and preparation: Dried fenugreek seeds, hibiscus petals, neem leaves, shikakai pods, and jasmine flowers were cleaned, dried, and powdered.

2.3. Infusion

A base of coconut oil (60%) was heated in a double boiler (60–70 °C). Powdered herbs were sequentially added and macerated for 1 hour with occasional stirring to facilitate extraction of phytochemicals into the oil.

2.3.1. Addition of Carrier Oils

Almond oil (25%) and castor oil (15%) were mixed thoroughly to yield a homogeneous blend.

2.3.2. Filtration

After cooling, the oil was filtered using muslin cloth and stored in amber glass bottles to protect from light and oxidation.

Ingredients

Table 1 Ingredients Used in Herbal Hair Oil Formulation

S. No.	Common Name	Botanical Name	Family	Part Used	Benefits	Disadvantages	Objective
1	Fenugreek	*Trigonella foenum-graecum*	Fabaceae	Seeds	Strengthens hair roots; reduces dandruff and dryness; promotes hair growth	Strong odor in high concentration may cause mild irritation	Hair-strengthening and anti-dandruff properties
2	Hibiscus	*Hibiscus rosa-sinensis*	Malvaceae	Flowers	Natural conditioner; improves shine; prevents premature greying; stimulates follicles	May cause slight heaviness if overused	Enhance softness, shine and growth
3	Neem	*Azadirachta indica*	Meliaceae	Leaves	Antimicrobial and antifungal; treats dandruff and infection	Bitter smell; excess use may dry scalp	Maintain scalp health and prevent infections
4	Shikakai	*Acacia concinna*	Fabaceae	Pods	Natural cleanser; promotes growth; prevents breakage	Can cause dryness if not balanced with oils	Natural cleansing and strengthening agent
5	Jasmine	*Jasminum officinale*	Oleaceae	Flowers	Soothing fragrance; antimicrobial; scalp relaxation	May cause allergy in sensitive users	Enhance fragrance and user acceptability
6	Coconut Oil	*Cocos nucifera*	Arecaceae	Kernel Oil	Deep penetration; prevents protein loss; excellent carrier oil	Heavy for oily scalp types	Base oil and carrier for extraction
7	Almond Oil	*Prunus dulcis*	Rosaceae	Oil	Rich in Vitamin E; nourishes scalp; improves elasticity	Not suitable for nut allergies	Nutritional support and strengthening
8	Castor Oil	*Ricinus communis*	Euphorbiaceae	Seeds	Improves circulation; promotes thick growth; prevents breakage	Highly viscous and sticky	Promote hair growth and thickness

2.4. Method of Preparation

2.4.1. Powdering and Preparation of Crude Drugs

- Dried fenugreek seeds, hibiscus petals, neem leaves, shikakai pods, and jasmine flowers were cleaned to remove foreign matter.
- The materials were shade-dried to preserve phytoconstituents.
- Each crude drug was separately powdered using a mechanical grinder.
- The powder was passed through sieve no. 40 to obtain uniform particle size.

2.4.2. Preparation of Herbal Infused Oil

- Coconut oil (as per formulation batch) was taken as the base oil.
- The oil was heated using a double boiler method at 60–70°C.
- Powdered herbal drugs were added sequentially with continuous stirring.
- The mixture was macerated for 1 hour to allow extraction of active phytochemicals into the oil.
- Heating was maintained carefully to avoid degradation of thermolabile constituents.

2.4.3. Addition of Carrier Oils

- After herbal infusion, almond oil and castor oil were added according to the formulation.
- The mixture was stirred continuously to obtain a homogeneous blend.

2.4.4. Filtration

- The prepared oil was allowed to cool to room temperature.
- It was filtered using a clean muslin cloth to remove residual plant material.
- The clear filtrate was collected

2.4.5. Storage

The final herbal hair oil was filled in amber-colored glass bottles. Stored at room temperature away from direct sunlight to prevent oxidation and degradation

2.5. Formulation table and method of preparation

Table 2 Composition of F1, F2, F3 and F4 (% w/v)

Sr No	Ingredients	F1 (%)	F2 (%)	F3 (%)	F4 (%)	Function
1	*Trigonella foenum-graecum* (Fenugreek Seeds Powder)	5	7	6	8	Hair strengthening, anti-dandruff
2	*Hibiscus rosa-sinensis* (Hibiscus Flower Powder)	4	5	6	5	Conditioner, shine enhancer
3	*Azadirachta indica* (Neem Leaves Powder)	3	4	5	4	Antimicrobial, scalp protection
4	*Acacia concinna* (Shikakai Pod Powder)	3	3	4	4	Natural cleanser, growth promoter
5	*Jasminum officinale* (Jasmine Flower Powder)	2	2	3	3	Fragrance, soothing agent
6	*Cocos nucifera* Oil (Coconut oil)	60	55	50	50	Base oil and carrier
7	*Prunus dulcis* Oil (Almond oil)	25	25	25	20	Nourishing oil
8	*Ricinus communis* Oil (Castor oil)	15	15	15	16	Hair growth enhancer

2.6. Evaluation Parameters

- **Organoleptic characteristics:** colour, odour, clarity, texture
- **pH determination:** using calibrated digital pH meter
- **Viscosity:** measured by standard viscometric technique
- **Spreadability:** assessed by comparative manual method
- **Stability study:** observation for 30 days at room temperature

3. Results

3.1. Physicochemical Evaluation

- Colour: Light amber with herbal hues
- Odor: Mild herbal fragrance with jasmine undertones
- Viscosity: Slightly higher than plain coconut oil (due to herbal infusion)
- pH: Measured within the range conducive to scalp health (approx. 5.5–6.5)

The formulation remained stable over 30 days; no phase separation, sedimentation, or rancidity was observed. Four trial formulations (F1, F2, F3, and F4) of herbal hair oil were successfully prepared using the same ingredients hibiscus, coconut oil, almond oil, castor oil, jasmine oil, fenugreek, and vitamin E—by different individuals with slight variation in oil ratios.

All formulations were evaluated for appearance, viscosity, pH, spreadability, and stability. The results showed that:

- F1 exhibited low viscosity, good clarity, and excellent spreadability but comparatively lower nourishment.
- F2 showed moderate viscosity and improved consistency due to a slight increase in castor oil.
- F3 demonstrated optimum viscosity, acceptable pH (5.4), good spreadability, and enhanced herbal nourishment.
- F4 showed high viscosity and lower spreadability because of higher castor oil concentration.

All formulations were found to be physically stable with no phase separation or rancidity observed during the study period.

These observations suggest a positive user experience but require further controlled studies for statistical validation.

Table 3 Evaluation table

Parameter	F1	F2	F3	F4	Inference
Appearance	Clear, light yellow	Clear	Slightly dark	Dark yellow	Yellowish colour preparation
pH	5.8	5.6	5.4	5.2	Within scalp range
Viscosity	Low	Moderate	Optimal	High	F3 best balance
Spreadability	Excellent	Good	Good	Moderate	Decreases with viscosity
Stability	Stable	Stable	Stable	Stable	No phase separation

F3 exhibited optimum balance between viscosity and spreadability while maintaining acceptable pH. All formulations remained stable during study period.

4. Conclusion

The results align with previous research showing the promise of herbal hair oils in improving hair and scalp conditions. Herbal constituents likely act synergistically: fenugreek and neem contribute antimicrobial and antifungal activities that may reduce dandruff and irritation; coconut and almond oils deliver fatty acids and vitamins that nourish and condition; hibiscus and jasmine enhance hydration and fragrance, thus improving compliance; while castor oil may promote scalp circulation.
Compared to single-component oils, polyherbal formulations harness a broader spectrum of phytochemicals, offering

multiple benefits for hair health. However, objective clinical trials remain necessary to quantify efficacy and compare results with placebo or commercial products.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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