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# FORMULATION AND EVALUATION OF HERBAL HAIR GROWTH SERUM CONTAINING HORSETAIL MILLET EXTRACT

**Venkatesh Kumar P.*[1], Jisha J. J.[2], Sowmiya B.[3], Mukundan S.[4], Mohamed Ibrahim U.[5]**

[*1]Assistant Professor, PPG College of Pharmacy Coimbatore, Tamil Nadu, India.

[2,3,4,5]Students, PPG College of Pharmacy Coimbatore, Tamil Nadu, India.

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***Corresponding Author**

**Venkatesh Kumar P.**

Assistant Professor, PPG College of Pharmacy Coimbatore, Tamil Nadu, India.

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## ABSTRACT

Hair loss, dandruff, dryness, and poor scalp health are common problems affecting both men and women. Continuous exposure to pollution, stress, nutritional deficiency, and chemical-based cosmetic products may damage hair follicles and reduce hair growth. Herbal formulations are increasingly preferred due to their natural origin, safety, and reduced side effects compared to synthetic preparations. The present study was aimed at the formulation and evaluation of a herbal hair growth serum containing horsetail millet extract as the major active ingredient. The serum was prepared using natural ingredients such as aloe vera gel, glycerin, jojoba oil, vitamin E oil, rose oil, and rose water. Horsetail millet extract was prepared using Soxhlet extraction method. The prepared serum was evaluated for organoleptic properties, pH, viscosity, spreadability, phytochemical screening, stability studies, and anti-inflammatory activity. The formulated serum showed satisfactory physicochemical characteristics with pH 5.4, viscosity 520 cps, and spreadability 6 cm. Phytochemical screening confirmed the presence of flavonoids and phenolic compounds. Stability studies showed no significant changes in color, odor, consistency, or phase separation under different storage conditions.

**KEYWORDS**: Horsetail millet extract, Herbal hair serum, Hair growth, Herbal cosmetics.

## INTRODUCTION

Hair is considered one of the most important aspects of physical appearance and personality. Healthy hair not only improves beauty but also reflects the overall health condition of an individual. Hair problems such as hair fall, dandruff, premature greying, scalp irritation, and thinning of hair have become increasingly common due to stress, environmental pollution, hormonal imbalance, nutritional deficiency, and excessive use of synthetic cosmetic products. Modern hair care products often contain synthetic chemicals that may provide temporary improvement but can also produce adverse effects such as scalp irritation, dryness, allergic reactions, and damage to hair follicles after prolonged use. Therefore, there is increasing demand for herbal cosmetic formulations because they are safer, naturally derived, economical, and possess minimal side effects.

Horsetail millet extract contains bioactive constituents such as flavonoids, phenolic compounds, tannins, alkaloids, saponins, and essential minerals including iron, magnesium, zinc, calcium, and silica. These compounds support hair strengthening and scalp nourishment.

## AIM AND OBJECTIVES

### AIM

To formulate and evaluate a herbal hair growth serum containing horsetail millet extract for promoting hair growth and improving scalp health.

### OBJECTIVES

- To prepare a stable herbal hair serum using horsetail millet extract.
- To evaluate the serum for pH, viscosity, spreadability, and stability.
- To assess the physicochemical properties of the formulation.
- To determine the cosmetic acceptability of the formulation.

## MATERIALS REQUIRED

- Horsetail millet extract
- Aloe vera gel
- Glycerin
- Jojoba oil
- Vitamin E oil
- Rose oil
- Rose water
- Benzoic acid
- Soxhlet apparatus
- Beakers and measuring cylinder
- pH meter
- Brookfield viscometer

## METHOD OF PREPARATION

### Extraction Process (Soxhlet extraction method)

The horsetail millet was first cleaned properly to remove dust and other impurities. The cleaned millet grains were dried under shade and then converted into fine powder using a grinder. About 50 g of the dried powder was accurately weighed and transferred into a soxhlet apparatus. Approximately 200 mL of 95% ethanol or hydroalcoholic solvent was used as the extraction solvent. The solvent was heated continuously to reflux for about 6–8 hours. During the extraction process, the solvent repeatedly passed through the powdered material and extracted the active phytoconstituents present in the millet

The extraction process was continued until the siphoning solvent became colorless, indicating complete extraction of the active constituents. The obtained extract was collected carefully and concentrated. The concentrated extract was stored in an airtight container for further formulation studies.

**Formulation of Herbal Hair Growth Serum**

**Step 1: Preparation of Base Extract**

About 5 mL of horsetail millet extract was measured and transferred into a clean and dry glass beaker. Benzoic acid (0.2%) was added as preservative to prevent microbial growth and improve shelf life of the formulation. The mixture was stirred gently until the preservative dissolved completely.

**Step 2: Addition of Aloe Vera Gel**

About 10 mL of aloe vera gel was added slowly into the extract with continuous stirring. Aloe vera gel acts as a moisturizing and soothing agent. The mixture was stirred thoroughly to obtain a smooth and uniform consistency.

**Step 3: Incorporation of Moisturizers**

About 5 mL of glycerin was added to the formulation followed by 2–3 drops of jojoba oil or argan oil. Glycerin acts as a humectant that retains moisture within the hair shaft, while jojoba oil provides nourishment and conditioning effect to the hair.

**Step 4: Addition of Antioxidant and Fragrance**

A few drops of vitamin E oil and rose essential oil were added into the mixture. Vitamin E oil acts as an antioxidant and protects hair follicles from oxidative damage. Rose oil provides pleasant fragrance and improves cosmetic acceptability of the serum.

**Step 5: Final Blending**

About 20 mL of rose water was added gradually into the formulation. The entire mixture was stirred continuously using a glass rod until a smooth, homogeneous, and uniform serum was obtained.

**Step 6: Filtration**

If any undissolved particles or turbidity were observed, the serum was filtered using muslin cloth or fine filter paper to obtain a clear solution.

**Step 7: Packaging and Storage**

The prepared serum was transferred into sterilized amber-coloured bottles with dropper caps. The bottles were labeled properly and stored under cool and dry conditions away from direct sunlight.

## EVALUATION PARAMETERS

### Organoleptic Evaluation

**Purpose**

The organoleptic evaluation was performed to study the physical appearance of the prepared serum including color, odor, clarity, texture, and homogeneity.

**Procedure**

The prepared serum was visually inspected under adequate light conditions. The color, clarity, consistency, and presence of any suspended particles were carefully observed. The odor of the serum was evaluated manually.

## OBSERVATION

The serum was found to be transparent light white in color with pleasant characteristic odor. The formulation showed smooth texture and good homogeneity without any visible particulate matter or phase separation.

**pH Determination**

**Purpose**

The pH determination was carried out to ensure that the serum was compatible with the natural pH of the scalp and would not cause irritation during application.

**Procedure**

About 10 mL of the serum was taken in a clean beaker. A calibrated digital pH meter was dipped into the sample and the pH value was recorded.

**Observation**

The obtained pH value was found to be 5.4, which is within the acceptable range suitable for scalp application.

**Viscosity Determination**

**Purpose**

Viscosity determination was performed to evaluate the flow property and consistency of the serum formulation.

**Procedure**

The viscosity of the serum was measured using a Brookfield viscometer at room temperature. The readings were noted carefully.

The viscosity of the serum was found to be approximately 520 cps, indicating a lightweight and non-greasy consistency suitable for easy application.

**Observation**

**Spreadability Test**

**Purpose**

The spreadability test was carried out to determine how easily the serum spreads over the scalp surface.

**Procedure**

A small quantity of serum was placed between two glass slides. A certain weight was placed over the upper slide and the time required for the slide to move a fixed distance was noted.

**Observation**

The serum showed good spreadability with a value of about 6 cm, indicating uniform distribution over the scalp surface.

**Stability Studies**

**Purpose**

The stability study was performed to determine the physical stability and shelf life of the prepared formulation under different storage conditions.

**Procedure**

The serum samples were stored at room temperature (25°C), refrigerated condition (4°C), and elevated temperature (40°C). The samples were observed periodically for changes in color, odor, consistency, pH, and phase separation.

**Observation**

The serum remained stable under different storage conditions without any significant change in color, odor, consistency, or phase separation.

**Phytochemical Screening**

**Purpose**

Phytochemical screening was carried out to identify the presence of active phytoconstituents responsible for antioxidant and hair growth-promoting activities.

**Tests Performed**

- Lead acetate test
- Ferric chloride test
- Alkaline reagent test

**Observation**

The phytochemical tests confirmed the presence of flavonoids and phenolic compounds in the horsetail millet extract.

**Anti-inflammatory Activity**

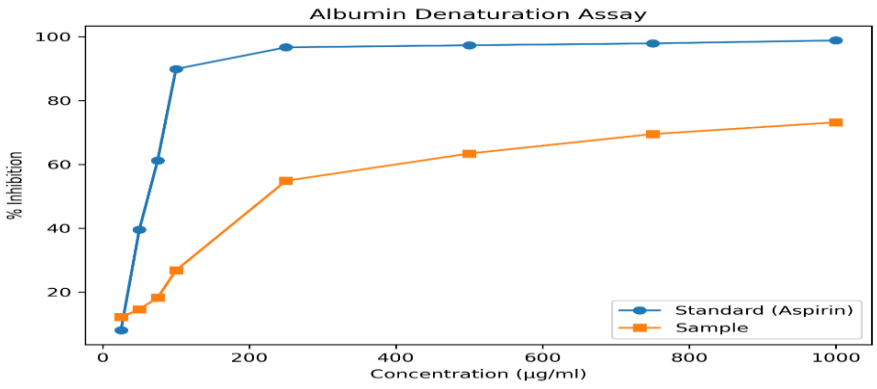
**Purpose**

Anti-inflammatory activity was evaluated to determine the ability of the formulation to reduce inflammation.

**METHODS**

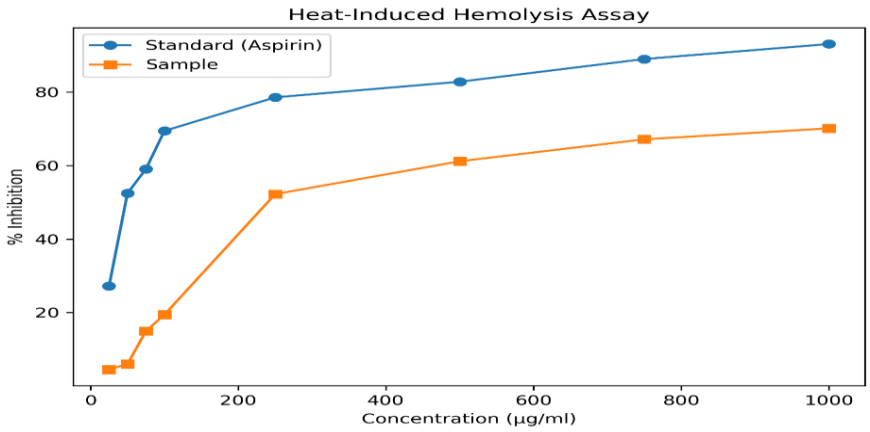
• **Albumin denaturation assay**

| Concentration (µg/ml) | Standard (Aspirin) | Sample |
|---|---|---|
| 25 | 8.10 | 12.20 |
| 50 | 39.55 | 14.63 |
| 75 | 61.22 | 18.29 |
| 100 | 89.88 | 26.83 |
| 250 | 96.65 | 54.88 |
| 500 | 97.3 | 63.41 |
| 750 | 97.88 | 69.51 |
| 1000 | 98.81 | 73.17 |
| **IC50** | **62.06 µg/ml** | **223.90 µg/ml** |



• **Heat-induced hemolysis assay**

| Concentration (µg/ml) | Standard (Aspirin) | Sample |
|---|---|---|
| 25 | 27.18 | 4.48 % |
| 50 | 52.48 | 5.97 % |
| 75 | 59.07 | 14.93 % |
| 100 | 69.46 | 19.40 % |
| 250 | 78.59 | 52.24 % |
| 500 | 82.84 | 61.19 % |
| 750 | 89.03 | 67.16 % |
| 1000 | 93.11 | 70.15 % |
| **IC50** | **47.55 µg/ml** | **239.77 µg/ml** |




**Observation**

The sample showed dose-dependent anti-inflammatory activity in both methods, although lower than the standard drug aspirin.

**RESULTS AND DISCUSSION**

- The formulated serum showed transparent light white color with pleasant odor and smooth consistency.
- The pH of the serum was found to be 5.4, which is suitable for scalp application.
- The viscosity of the serum was 520 cps, indicating lightweight and non-greasy consistency.
- The spreadability value was 6 cm, indicating good spreading property.
- Phytochemical screening confirmed the presence of flavonoids and phenolic compounds.
- Stability studies showed that the formulation remained stable under different storage conditions without any significant changes.
- The anti-inflammatory studies demonstrated dose-dependent activity in albumin denaturation and heat-induced hemolysis assays.

**Table**

| S.NO | PROPERTIES | RESULT |
|---|---|---|
| 1. | Organoleptic Property | Transparent light white in color |
| 2. | pH | 5.4 |
| 3. | Viscosity | 520cps |
| 4. | Spreadability | 6cm |
| 5. | Phytochemical Screening | Presence of Flavonoids is confirmed |
| 6. | Stability testing | Stable at different temperature without any changes. |

## CONCLUSION

The present study successfully formulated and evaluated a herbal hair growth serum containing horsetail millet extract. The formulation showed satisfactory physicochemical properties including suitable pH, viscosity, spreadability, and stability.

The serum was found to be cosmetically acceptable, non-greasy, and easy to apply. Therefore, horsetail millet extract can be considered as a promising natural ingredient for safe and effective herbal hair care formulations.

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