



Research Article

Formulation and Evaluation of Anti-Lice Roll on Serum

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Pediculosis capitis (head lice infestation) is a common problem, especially among school going children, causing itching, irritation, and discomfort. The present study focuses on the formulation and evaluation of an anti-lice hair roll-on using natural ingredients such as bhringraj extract, shikakai extract, and Rampal (*Annona reticulata*) seed extract, glycerin, Rose Oil, Clove Oil, and distilled water. These ingredients possess insecticidal, antimicrobial, and soothing properties that help in eliminating lice and preventing their recurrence. The roll-on formulation was designed for easy application, improved patient compliance, and targeted delivery to the scalp. Evaluation parameters included physical appearance, pH, viscosity, spread ability, stability, and anti-lice activity. The formulation showed acceptable pH suitable for scalp application, good stability, and effective lice control due to the synergistic action of components. The study concludes that the developed anti-lice roll-on is a safe, effective, and convenient alternative to synthetic pediculicides, which are often associated with side effects and resistance. This formulation can be further optimized and clinically evaluate for commercial use.

Keywords: Scalp, Children, Head Lice, Ramphal extract, Hair, Roll on.

INTRODUCTION

• Introduction to Hair and Hair Disorders

Hair is a keratinized filament that grows from hair follicles located in the dermis of the skin. It plays an important role in protection, thermoregulation, sensation, and social/psychological identity. Structurally, hair consists of three main parts: the cuticle

(outer layer), cortex (middle layer), and medulla (inner core). The primary protein in hair is keratin, which provides strength and elasticity (1,6).

Hair growth follows a cyclic pattern consisting of three phases

Anagen (growth phase) – active hair growth

Catagen (transition phase) – follicle regression

Telogen (resting phase) – shedding of hair, A normal scalp contains approximately 100,000–150,000 hair follicles, and daily shedding of 50–100 hairs is considered physiological (2,7).

• Hair Disorders

Hair disorders (trichological conditions) refer to abnormalities affecting hair growth, structure, or scalp health. These conditions may result from genetic, hormonal, environmental nutritional, or microbial factors.

Common Hair Disorders

1. Alopecia (Hair Loss)

Alopecia is one of the most common hair disorders and can be classified into:

Androgenetic alopecia (pattern baldness)

Alopecia areata (autoimmune condition)

Telogen effluvium (stress-induced hair shedding) (5,8).

2. Pediculosis Capitis (Head Lice Infestation)

This condition is caused by the parasite *Pediculus humans capitis*. It leads to:

Scalp itching

Irritation

Secondary infections

This is particularly relevant in children and is often treated using anti-lice formulations (herbal or synthetic) (3,9).

3. Dandruff (Pityriasis Capitis)

Dandruff is characterized by flaking of the scalp and is commonly associated with the fungus *Malassezia* species

4. Seborrheic Dermatitis

A more severe form of dandruff involving inflammation, redness, and greasy scales (10).

5. Hair Shaft Disorders

These include structural abnormalities such as:

Trichorrhexis nodosa (hair breakage)

Monilethrix (beaded hair) (4,11).

Currently available products for managing hair lice include medicated, herbal, and mechanical treatments.

Medicated products such as permethrin lotions/shampoos are most commonly used and act by paralyzing and killing lice (3,12) Herbal products like neem and tea tree oil-based shampoos are safer alternatives with anti-parasitic activity (813). In addition, fine lice combs and oil treatments help in the physical removal of lice and nits (14). Combination

therapy (shampoo + combing) is considered most effective (15).

- Common Side Effects

- ✓ Scalp irritation
- ✓ Itching and redness
- ✓ Burning or stinging sensation
- ✓ Dryness of hair and scalp
- ✓ Moderate Side Effects
- ✓ Allergic reactions (rash, swelling)
- ✓ Eye irritation (if accidental contact occurs)
- ✓ Increased hair fall (temporary) (16).

- Serious Side Effects (Rare)

- ✓ Neurotoxicity (especially with misuse or overuse)
- ✓ Breathing difficulty (in sensitive individuals)
- ✓ Toxicity in young children (17).

- Advantages of herbal anti-lice formulations

Safe and less toxic: Herbal ingredients like neem and tea tree oil have minimal side effects compared to chemical insecticides.

Low risk of resistance: Unlike permethrin, herbal products show less chance of lice developing resistance.

Eco-friendly and biodegradable: Natural origin makes them safer for the environment. Multiple actions:

Table 1: Anti Lice serum ingredients

Sr. No	Material	Quantity	Function
1	Neem Oil	0.5ml	Antimicrobial, antifungal, antilice activity
2	Clove Oil	0.5ml	Mild preservative
3	Tween 80	0.5ml	Emulsifying agent
4	Shikakai Extract	4ml	Natural cleanser, conditioning agent
5	Bhringraj Extract	3ml	Promotes hair growth, strengthens hair
6	Ramphal seed extract	1ml	Antilice activity
7	Tween 20	0.5ml	Stabiliser, emulsifier
8	Carbopol 940	0.12g	thickener
9	Coconut Oil	1ml	Moisturizer
10	Karanj Oil	1ml	Antilice activity, Antifungal
11	Triethanolamine	0.2ml	Ph adjuster
12	EDTA	02g	Chelating agent
13	Amaranth (colour)	0.02g	Coloring agent
14	Rose Oil	2.64 ml	Fragrance



Fig 1: Neem Oil



Fig 2: Bhringraj



Fig 3: Shikakai



Fig 4: Ramphal

RESEARCH METHODOLOGY

• Study Design

The present work was designed as an experimental laboratory-based study for the formulation and evaluation of a anti-lice roll-on serum. The study included formulation development, physicochemical characterization, stability testing, and in vitro pediculicidal activity assessment.

• Materials and Formulation

1. Material
2. Neem Oil
3. Clove Oil
4. Tween 80
5. Shikakai Extract
6. Bhringraj Extract
7. Ramphal seed extract
8. Tween 20
9. Carbopol 940
10. Coconut Oil
11. Karanj Oil
12. Triethanolamine
13. EDTA

14. Amaranth

15. Rose Oil

• Preparation Method

- Aqueous Extraction of Shikakai (*Acacia concinna*)

Method: Maceration (Aqueous Extraction)

1. Dried shikakai pods were cleaned, shade-dried, and powdered using a mechanical grinder.
2. About 40 g powder was taken and soaked in 400 mL distilled water (1:10 ratio).
3. The mixture was kept for 24 hours at room temperature with intermittent stirring.
4. The extract was filtered using muslin cloth followed by Whatman filter paper.
5. The filtrate was concentrated using a water bath at 40–50°C.
6. The final extract was stored in an airtight container at 4°C until further use (19).



Fig 5: Shikakai extract

- Ethanolic Extraction of Bhringraj Leaves (*Eclipta alba*)

Method: Soxhlet Extraction

1. Fresh leaves were washed, shade-dried, and powdered.
2. 50 g powder was placed in Soxhlet apparatus.
3. Extraction was carried out using 500 mL ethanol (95%).
4. The process was continued for 6-7 hours (~15 cycles).
5. Extract was concentrated using rotary evaporator.
6. Semi-solid extract was stored at 4°C (20).

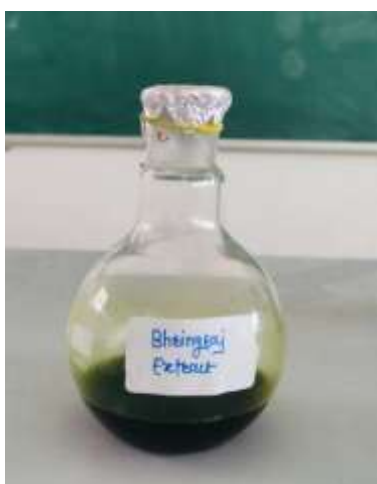


Fig 6: Bhringraj extract

- Ethanolic Extraction of Ramphal Seed Powder (*Annona squamosa*)

Method: Soxhlet Extraction

1. Ramphal seeds were cleaned, dried, and finely powdered.
2. 50 g seed powder was loaded into Soxhlet apparatus.
3. Extraction was performed using 500 mL ethanol.
4. Process continued for 5-6 hours (12-15 cycles).
5. Extract was filtered and concentrated using rotary evaporator.
6. The final extract was stored in amber-coloured container at 4°C (21).



Fig 7: Ramphal extract

1. Preparation of oil phase: Take neem oil, clove oil, coconut oil, and karanja oil in a clean beaker and mix properly.
2. Preparation of aqueous phase: In another beaker, take water and add shikakai extract, bhringraj extract, and ramphal seed extract. Mix well.
3. Emulsification: Slowly add the aqueous phase into the oil phase with continuous stirring.
4. Homogenization: Homogenize the mixture for about 15 minutes to obtain a uniform emulsion.
5. Addition of gelling agent: Add Carbopol 940 slowly with continuous stirring to avoid lump formation.
6. Addition of emulsifiers: Add Tween 80 followed by Tween 20 and mix properly.
7. Neutralization: Add triethanolamine dropwise to neutralize Carbopol and form gel.
8. Addition of stabilizer: Add EDTA and mix well.
9. Final additions: Add amaranth (color) and rose oil (fragrance).

10. Make up volume: Add water if required to make the final volume (≈ 15 ml) and mix thoroughly.

➤ **Evaluation Tests of F3 Formulation (Anti-Lice Serum)**

1. Organoleptic Evaluation

Color: Reddish brown

Odour: Clove-like (pleasant)

Texture: Highly smooth & non-sticky

Clarity: Most turbid

2. pH Determination

Observed pH: 6.5

Inference: Suitable for scalp application (near neutral, non-irritant)



Fig 8: PH Meter

3. Viscosity Determination

Time: 13 sec

Distance: 7.5 cm

Inference: Moderate viscosity → good spread ability and easy application



Fig 9: F3 formulation

4. Homogeneity Test

Observation: No lumps

Inference: Acceptable but not perfectly uniform (needs slight improvement in mixing)

5. Skin Irritation Test

Observation: No irritation

Inference: Safe for topical application

6. Washability Test

Observation: Washes easily with water

Inference: Good washability, no residue

7. Silicate Test

Observation: No colour

Inference: Silicate test fail



Fig 10: Silicate Test

8. In Vitro test

Observation: death occurs within 1 seconds

Inference: The formulation shows high pediculicidal activity.



Fig13: Anti Lice Roll on Serum



Fig 11: In vitro Test

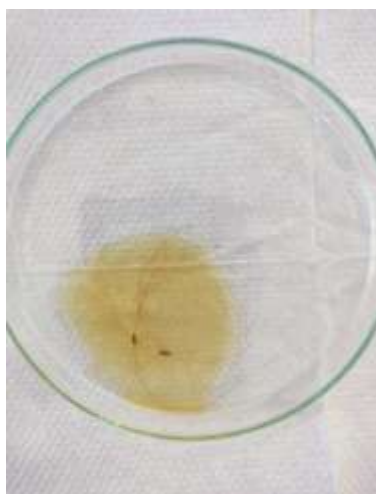


Fig 12: Dead Lice

RESULTS AND DISCUSSION

Results of Descriptive Statics of Study Variables

RESULTS

The formulated anti-lice roll-on serum was evaluated for various physicochemical and biological parameters. The texture was smooth and suitable for roll-on application. The pH of the formulation was found to be 6.5, which is compatible with scalp pH, indicating good skin suitability. The viscosity was moderate, allowing easy application without leakage, and was found to be stable without phase separation. In the homogeneity test, the formulation showed uniform distribution of ingredients with no visible lumps or aggregation. The spread ability was good, ensuring easy application over the scalp. The in vitro

anti-lice activity demonstrated effective action against lice. The formulation showed significant lice mortality within a short duration (1 to 5 seconds), indicating good pediculicidal activity. Neem oil and clove oil contributed majorly to this activity due to their known insecticidal properties. The silicate test performed on the formulation showed a negative result, confirming the absence of silicate impurities and ensuring formulation safety. Stability studies conducted under different conditions showed no significant change in color, odor, pH, or viscosity, indicating that the formulation is stable.

DISCUSSION

The results indicate that the developed herbal anti-lice serum is physically stable, cosmetically acceptable, and biologically effective. The pH being close to scalp

pH suggests that the formulation is non-irritant and safe for topical application. The presence of natural extracts like shikakai and bhringraj enhances hair conditioning and scalp health, while ramphal seed extract, neem oil, and clove oil contribute to strong anti-lice activity. These ingredients work synergistically to paralyze and kill lice while also preventing reinfestation. The use of surfactants such as Tween 20 and Tween 80 helped in forming a stable emulsion, preventing phase separation and improving the overall consistency of the serum. Carbopol 940 provided appropriate viscosity, making the formulation suitable for roll-on application. The *in vitro* results confirm that the formulation is effective against lice, supporting its potential as a natural alternative to synthetic pediculicides, which often cause resistance and side effects. Overall, the formulation meets the desired criteria of efficacy, stability, safety, and user acceptability, making it a promising herbal anti-lice treatment.

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