

Effect of Neem Leaf Paste Application on Dandruff

1. Tanvi Wale 2. Harshwardhan Suryawanshi 3. Sayali Shendage 4. Prajakta Mali 5. Sakshi Kolekar

Abstract

Dandruff is a common scalp disorder characterized by flaking, itching, and irritation, primarily caused by the overgrowth of *Malassezia* species and excess sebum production. Conventional treatments, including antifungal and keratolytic agents, often provide temporary relief and may cause side effects with prolonged use. This study explores the effect of neem (*Azadirachta indica*) leaf paste application as a natural, cost-effective alternative therapy for dandruff management. Neem leaves are rich in bioactive compounds such as nimbin, nimbidin, and azadirachtin, which possess antifungal, antibacterial, and anti-inflammatory properties.

In this project, neem leaves were ground into a fine paste and applied to the scalp twice a week for two weeks among individuals with moderate dandruff. Dandruff severity was assessed using a modified Van Abbe's scale before and after the intervention. Results showed a marked reduction in flaking, scalp irritation, and itchiness among participants following neem paste application. The findings suggest that neem leaf paste is effective in reducing dandruff symptoms and improving scalp health, likely due to its antifungal and soothing effects.

Thus, neem (*Azadirachta indica*) leaf paste offers a promising, safe, and natural approach for managing dandruff, particularly in communities where herbal remedies are accessible and preferred over synthetic formulations. Further clinical studies are recommended to standardize dosage, formulation, and application frequency.

Category

Public health, Dermatology

Keywords

Application, Dandruff, Effect, Female student, Neem leaves past.

1. Introduction

Dandruff (pityriasis capitis) is a chronic scalp condition marked by flaking, itchiness, and sometimes irritation or discomfort. It affects a large proportion of the global population—especially after puberty—and is often associated with *Malassezia* spp., a yeast that lives on the scalp and interacts with skin cells to trigger excessive shedding of scalp skin. Untreated, dandruff can lead to social self-consciousness and reduced quality of life.

Current standard treatments include antifungal shampoos (e.g. ketoconazole), keratolytic agents, and anti-inflammatory topicals. However these can be expensive, may cause side effects (dryness, irritation), and sometimes lose effectiveness with long-term use. Because of this, there is interest in natural remedies that might be safer, cheaper, and acceptable to people who prefer more traditional or plant-based treatment options.

Neem (*Azadirachta indica*) has a long history in traditional medicine. Its leaves contain bioactive compounds like terpenoids, nimbin, azadirachtin and others, which have demonstrated antimicrobial, antifungal, anti-inflammatory, and antioxidant effects in various in vitro and formulation studies. These properties suggest neem might help address the underlying causes of dandruff: the fungal overgrowth, scalp irritation, and inflammation.

A recent quasi-experimental study (female students aged 18-24) tested neem leaf paste applied to the scalp compared with a control group, measuring dandruff levels using a modified Van Abbe's scale. Results showed that after two weeks of treatment the experimental group's mean dandruff score dropped significantly compared to controls.

Therefore, investigating the effect of neem leaf paste application on dandruff is timely. It may provide evidence for a natural, low-cost, accessible treatment that complements or even substitutes for chemical antifungal agents, especially in settings where these are not readily available or cause undesirable effects.

1. Neem Fruit (*Azadirachta indica*):

Dorsal view: Smooth, oval or ellipsoidal drupe, yellowish-green when mature. The outer surface is glossy and slightly fleshy.

Ventral view: Not much difference — still smooth, sometimes showing a faint ridge or line where the fruit developed on the stalk.

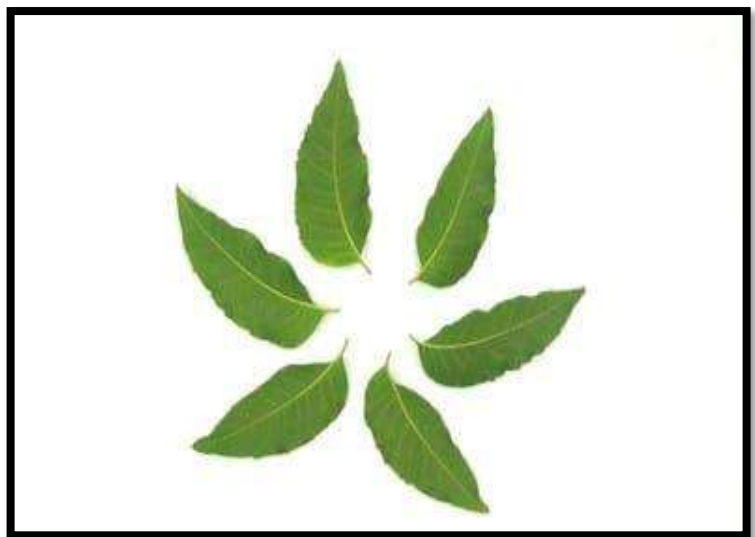
Neem Leaf:

Dorsal (upper) view: Dark green, smooth, and glossy surface. The leaflets are lanceolate (long and narrow), with pointed tips and serrated margins.

Ventral (lower) view: Paler green with visible midrib and lateral veins. Slightly rougher texture than the upper side.



(A) Figure 1. Neem fruit and leaves



(B) Figure 2. Neem leaves with ventral view



(C) Figure 3. Neem with dorsal view

2. Chemical Characteristics of Neem Leaves:

Neem leaves are chemical overachievers, stuffed with dozens of bioactive compounds. Major groups include: Limonoids (Triterpenoids): Azadirachtin, nimbin, nimbidin, nimbolide — the heavyweights behind neem's bitterness and medicinal power.

Flavonoids: Quercetin and myricetin, which act as antioxidants.

Glycosides and Saponins: Contribute to antimicrobial and anti-inflammatory activity.

Tannins: Help with wound healing and act as natural astringents.

Steroids and Coumarins: Add to its anti-inflammatory and antifungal roles.

3. Bioactivity of Neem Leaves:

Neem leaves don't sit quietly on trees; they attack pathogens for fun.

Antibacterial: Effective against *Staphylococcus aureus*, *E. coli*, *Pseudomonas aeruginosa* and other troublemakers.

Antifungal: Active against *Candida albicans* and dermatophytes that cause skin infections.

Antioxidant: Flavonoids and polyphenols neutralize free radicals, protecting cells from oxidative stress.

Antidiabetic: Compounds like nimbidin help lower blood glucose and improve insulin sensitivity.

Anti-inflammatory: Reduces swelling and pain by inhibiting prostaglandin synthesis.

Antimalarial and antiviral: Shown to inhibit the growth of *Plasmodium* parasites and some viruses.

Immunomodulatory: Stimulates white blood cells, strengthening the immune system.

I. Central Focus: The Neem Tree

The image places a neem tree in the center, highlighting that all parts of the plant—leaves, seeds, bark, stems, neem oil, and isolated phytochemicals—possess significant biological activity.

II. Antibacterial Activity (Red section, left side)

Neem targets a broad range of pathogenic bacteria, including both Gram-positive and Gram-negative strains.

Examples listed:

Escherichia coli O157:H7

Staphylococcus aureus

Pseudomonas aeruginosa

Salmonella enterica

Vibrio cholerae

These are common culprits in infections of the gut, skin, and wounds. Neem compounds like nimbidin, azadirachtin, and quercetin disrupt bacterial cell walls and metabolic functions.

III. Antiviral Activity (Blue section, right side)

Neem extracts have shown inhibitory effects against several viruses, such as:

Dengue virus

Herpes Simplex Virus (HSV)

Influenza virus

SARS-CoV-2 (COVID-19)

The mechanism often involves blocking viral replication or entry into host cells through immune modulation and interference with viral proteins.

IV. Antifungal Activity (Green section, bottom right)

Targets fungi that cause human infections, including:

Aspergillus flavus

Aspergillus niger

Candida albicans

Candida tropicalis Neem's limonoids and flavonoids damage fungal membranes and inhibit spore formation

V. Antiparasitic Activity (Orange section, bottom left)

Shows neem's effect on parasitic pathogens, including:

Leishmania donovani (causes leishmaniasis)

Plasmodium falciparum (causes malaria)

Schistosoma mansoni (causes schistosomiasis)

Active compounds interfere with parasite metabolism and reproduction.

VI. Overall Message

The image captures neem's broad-spectrum bioactivity:

Antibacterial

Antiviral

Antifungal

Antiparasitic

4. Material and Method

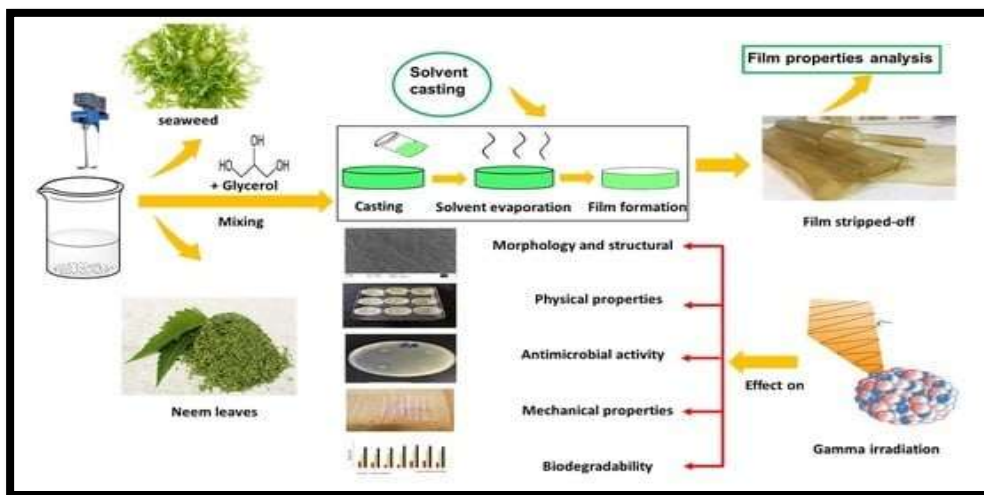


Fig.2 Materials and Method

Previous research on the antimicrobial activity of neem extracts showed that the incorporation of an antimicrobial agent in seaweed films enhanced the antimicrobial activities and mechanical properties of the films. It was also demonstrated in the study, that the incorporation of neem leaves extracts at 5% w/w showed the most optimum and desired improvement in mechanical, water vapour permeability, and antimicrobial properties.

Hence, this current study analyzed the physical, barrier, mechanical, optical, microscopic, and antimicrobial properties of gamma-irradiated seaweed-neem biodegradable films for possible use as packaging material.

4.1 Material

Ethanol (95% pure) of vapour density 1.59, boiling point 78.3 °C, melting point -114 °C, and density of 0.789 g/mL at 20 °C was purchased from Sigma-Aldrich Co., St. Louis, MO, USA. Moreover, the glycerol was purchased from Sigma-Aldrich Co., St. Louis, MO, USA with a boiling temperature of 182 °C/20 mmHg, melting point 20 °C, and density of 1.25 g/mL was used for this study. The seaweed was purchased from Green Leaf Synergy Sdn. Bhd., Tawau, Sabah, East-Malaysia), while the neem leaves were picked from Bukit Mertajam, Penang, Malaysia.

4.2 Preparation of Neem Leaves Powder

The fully matured *Azadirachta indica* (neem) leaves were collected and washed under tap water to remove any dirt. The leaves were air dried for 20 days, then ground into a powder and stored in airtight bottles.

4.3. Extraction of Neem Leaves

Ethanol was used for the isolation of neem leaves extract from its leaves as described by Al-Hashemi with slight modification. The neem leave powder (170 g) was soaked in 95% ethanol (1700 mL) in a covered 1 L conical flask and placed in a reciprocating shaker at 28 °C for 24 h. The whole extract was filtered with a Whatman No. 42 (125 mm) filter paper and cotton wool. The obtained filtrate solution was concentrated, and ethanol was evaporated in a vacuumed rotary evaporator (Buchi Rotavapor R-200, Daya Qurban Saintifik Sdn Bhd., Flawil, Switzerland) with the hot water bath set at 40 °C to form a paste. The extracted paste was dried further in the oven at 40 °C to get a thicker paste (47.27 g). The crude neem extract obtained was sealed in a Petri plate and at room temperature (28 °C). The percentage of crude ethanol extract yield was calculated based on the weight of dried and ground neem leaves.

4.4 Preparation of Seaweed-Neem Films

The fabrication of seaweed-neem films was prepared with the method reported by Shellikeri et al.. Seaweed (1%, w/v) with the weight of 6 g was dissolved in 300 mL distilled water at 82 °C and stirred mechanically for 15 min. An amount of 1.8 g of glycerol (50% w/w seaweed) was added and stirred for another 25 min. The neem leaves extract of 5% w/w was added to the seaweed film solution, based on previous work on the incorporation of different neem leaves extract in the seaweed-based film and cast on a Teflon-coated plate. The cast solution mix was then dried in an oven at 40 °C for 24 h and stored in a desiccator at a relative humidity of 53% for 72 h for analysis. The films after 72 h were irradiated with different radiation doses of 0.5, 1.5, 2.5, 3.5, and 4.5 kGy with a ⁶⁰Co gamma-radiation source at room temperature. The evaluation of the physical, mechanical, barrier, and antimicrobial characteristics of the irradiated seaweed-neem films were conducted and compared to the nonirradiated seaweed-neem film (control film).

Conclusion:-

The present study demonstrates that neem (*Azadirachta indica*) leaf paste is an effective, natural, and affordable option for managing dandruff. Application of neem leaf paste twice a week for two weeks resulted in a clear reduction in flaking, itching, and scalp irritation, as measured by the modified Van Abbe's scale. These results support the antifungal, antibacterial, and anti-inflammatory properties of neem's bioactive compounds such as nimbin, nimbidin, and azadirachtin, which collectively help restore scalp health and control *Malassezia* overgrowth the primary cause of dandruff.

Compared with conventional antifungal and keratolytic treatments, neem paste offers a safer and more sustainable alternative with minimal side effects. Its accessibility and cost-effectiveness make it especially suitable for communities where herbal remedies are culturally preferred and modern formulations may be expensive or less available. That combines traditional further clinical trials are recommended to determine standardized dosages, paste concentrations, and treatment frequency to optimize therapeutic outcomes. Overall, neem leaf paste stands out as a promising herbal therapy wisdom with modern scientific validation for effective dandruff management

Reference :-

1. Pandey, A., Barve, D., & Singh, A. (2014). Pharmacological and therapeutic potential of *Azadirachta indica* (Neem): A review. *Journal of Pharmacognosy and Phytochemistry*,
2. Pothuraju, R., Kumar, N. A., & Suryanarayana, P. (2016). Neem (*Azadirachta indica*) and its potential for the control of dandruff and scalp infections. *International Journal of Research in Ayurveda and Pharmacy (IJRAP)*,
3. Sharma, S., & Garg, R. (2024). Effect of neem leaf paste application on dandruff among college students. *International Journal of Innovative Science and Research Technology*.
4. Subapriya, R., & Nagini, S. (2005). Medicinal properties of neem leaves: A review. *Current Medicinal Chemistry – Anti-Cancer Agents*.
5. World Health Organization (2009). Traditional medicine: Growing needs and potential. WHO Policy Perspectives on Medicines.
6. Biswas, K., Chattopadhyay, I., Banerjee, R. K., & Bandyopadhyay, U. (2002). Biological activities and medicinal properties of neem (*Azadirachta indica*). *Current science*.
7. Borda LJ, Wikramanayake TC: Seborrheic dermatitis and dandruff: a comprehensive review. *J Clin Investig Dermatol*.
8. Board on Science and Technology for International Development: Neem: A Tree for Solving Global Problems.
9. Nawaf A, Sanusi J, Ibrahim S, Babangida I, Liadi S: Prevalence of dandruff among the pupils and staff of some selected public schools in Katsina State
10. Dani, P. B., & Ghorpade, V. K. (2025). Effect of Neem Leaf Paste Application on Dandruff.
11. Khandagale, S., Supekar, A., Sarukh, V., et al. Formulation and Evaluation of Herbal Neem Anti-Dandruff Shampoo.
12. Rosemary + Neem combined extract (RN-E 2:1). Rosemary and neem: insight into their combined anti-dandruff and anti-hair loss efficacy.