

Formulation and Evaluation of Anti-Dandruff Herbal Shampoo

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ABSTRACT

An infection of the scalp caused by the yeast *Pityrosporum* is called dandruff. Dandruff is caused primarily by a fungus called *Malassezia furfur*. This fungus produces dandruff that changes the normal excretion of dead cells. In order to effectively manage and control dandruff, this needs to be completely eliminated. Dandruff is treated with a variety of anti-fungal agents. Shampoo can be used to remove surface grease, dirt, and skin debris from hair shafts and scalps without harming the user's scalp or hair by using suitable surfactants (surface-active materials) in liquid, solid, or powder form. Synthetic shampoos are known to cause side effects including hair loss, increased scaling, scratching, nausea, and headaches. Due to this, herbal anti-dandruff shampoo was developed which is safer than chemical-based anti-dandruff shampoo in terms of health and treatment of dandruff. In herbal shampoos, the leaf extracts of Henna, Hibiscus, Neem and Tulsi, the flower extracts of Bhringraj, Mexican poppy, the fruit extracts of Reetha, Datura, Amla, the seed extracts of Black Cumin, Pomegranate and many other herbal ingredients are used. There were several criteria used to evaluate the shampoo formulations, including Physical Appearance, pH determination, Wash ability, Solid Contents, Dirt Dispersibility, Rheological evaluation, Wetting Time, Foam Productivity, Surface Tension and Anti-Microbial properties.

Keywords: Anti-Dandruff, Herbal, *Malassezia furfur*, Scalp, Shampoo

INTRODUCTION

In the modern world, the most common hair problem is dandruff. When the sebaceous glands are more active in adulthood, dandruff usually develops between puberty and middle age. Flake formation on the scalp is accompanied by itching on the skin. Dandruff, the most dermatological skin condition, is characterized by an intense range of scalp tissue being affected, as well as non-inflammatory and chronic symptoms. Dandruff is caused primarily by *Malassezia furfur*. This fungus produces dandruff that changes the normal excretion of dead cells. Few enzymes on the scalp devour connections between dead skin cells to sludge case by case. *Malassezia furfur* changes enzyme functions and inhibits the connector's cutoff. The result is an aggregation of the coenocytes which break into clusters, leading to visible white flakes called dandruff (1).

Shampooing is the most common way to treat hair. The main goal of shampooing products is cleansing the hair and the scalp (2). Though the foam effect does not assume a cleansing effect, people mentally prefer a product with a high foam content. Even good shampoos can have adverse effects, such as drying hair when manipulated or combed. Thus, the important consideration is to condition the hair properly, some shampoos cause eye irritation and a long-lasting corneal cloud (3).

The plant-based or herbal shampoo is a preparation of wetting agents in liquid, solid, or powder form that, when used under specific conditions, will eliminate the surface fat and dirt on the skin debris from the hair shaft and scalp without causing any side effects (4).

Dandruff

Scaling on the scalp is a sign of the non-inflammatory condition known as dandruff, which is thought to be a mild case of seborrheic dermatitis. Regardless of age or gender, nearly half of post-pubertal people experience dandruff, which has a number of potential causes, including both microbial and non-microbial factors (5, 6, 7).

Symptoms: Presence of fragments (scaling), itching of the scalp, and redness around the scalp (7).

Most experts agree that the presence of lipophilic yeast from the genus *Malassezia* is the most prevalent microbial etiopathology (8). *Staphylococcus spp.*, *Propionibacterium spp.*, and *Malassezia spp.* are known members of the scalp's biotic community (9). Additionally, Seborrheic Dermatitis (SD), atopic dermatitis, and pityriasis Versicolor are known to be caused by *Malassezia* species (10, 11).

Malassezia species are lipid-dependent microorganisms that can fit into a small niche left by skin that produces a lot of sebum. *Malassezia furfur*, a lipophilic dimorphic yeast in addition to *M.restricta* and *M.globosa*, of the typical causative microorganisms causing dandruff. *Malassezia furfur* feeds on the lipids and proteins found in the skin and facilitates the activity of the lipase enzyme, which results in dermal inflammation and tissue damage. Lipid is a necessary component for *Malassezia furfur's* growth. Some people experience the signs of dandruff and other types of dermatitis due to the increased oleic acid levels brought on by the *Malassezia* metabolism (12).

Shampoo

Shampoos unquestionably prevent hair shaft damage in addition to cleaning the scalp. Active ingredients added to the formulations of shampoo can also treat a variety of scalp conditions. Whatever the illness or condition (dermatitis, seborrhea, alopecia, psoriasis), it is preferable to maintain the hair's aesthetic appeal by maintaining its softness, comb ability, and shine while treating the scalp. While products with as few as four ingredients are also available, shampoos typically contain 10 to 30 ingredients. The ingredients are divided into four categories: 1) cleansing agents, 2) comforting additives, 3) conditioning agents, which are meant to add softness and gloss, reduce flyaways, and improve anti-frizability and 4) special care ingredients, which are meant to address particular issues like dandruff and oily hair. The difficulties in detangling the strands and the frizz effect are the two conditions that are most impacted by the use of aggressive shampoos. By carefully formulating cleaning products, the main cause of frizz, attrition, can be reduced. On the other hand, fiber attrition is impacted if the shampoo formulas do not present an adequate composition. Shampoos, despite being regarded as safe products, can lead to contact dermatitis. Cocamidopropyl betaine, methylchloroisothiazolinone, formaldehyde-releasing preservatives, propylene glycol, Vitamin E (tocopherol), parabens, and benzophenones are common allergens in shampoo (13).

Shampoo Ingredients: It contains detergents, conditioners, thickeners, opacifiers, fragrances, and preservatives (14).

Types Of Shampoo: The different types of shampoo are powder shampoo, liquid shampoo, cream shampoo, jelly shampoo, aerosol shampoo, keratin shampoo, volumizing shampoo, specialized shampoo, and conditioner (under conditioner two types are there as follows: anti-dandruff, baby) (15).

Anti-Dandruff Shampoo

The main purpose of anti-dandruff shampoo is to prevent or treat dandruff on the scalp of the hair. It is a specific type of shampoo that contains an anti-dandruff agent. There are two different kinds of anti-dandruff shampoos on the market.

- 1) Synthetic shampoos for removing dandruff (based on ingredients of chemical origin)
- 2) Herbal shampoos that fight dandruff (based on plant ingredients) (16)

Synthetic Shampoo: These formulations include anti-dandruff agents that are used therapeutically and are divided into three groups based on how they work.

- 1) Fungicidal agents like zinc pyrithione and imidazoles are two examples.
- 2) Cytostatic agents include tar, selenium sulfide, and ciclopirox.
- 3) Substances that can reduce keratinization, like sulfur compounds and salicylic acid (16)

Herbal Shampoo: Anti-dandruff shampoos made from herbal ingredients, such as plant extracts and essential oils, are cosmetic products. These herbal shampoos are typically used to treat dandruff, add natural color to hair, remove excess oil from hair, promote healthy hair growth, remove scales, dust, and other debris from the scalp, stop hair from falling out, give the hair shaft softness and smoothness, etc. They are thought to be able to reach the root shafts, activate the sebaceous glands, improve blood flow, and give the hair root and shaft more strength. Additionally, they are used to treat alopecia, hair shaft roughness, hair breakage, and hair thinning, clubbing, and greying. There are numerous plants that are used in shampoos and have positive effects on hair (17).







Ideal Characteristics Of Herbal Anti-Dandruff Shampoo




- Dust and excess sebum should be effectively and completely removed.
- Hair should be washed effective manner.
- Should generate a significant amount of foam
- Rinsing with water should easily remove the shampoo.
- Hair should be non-drying, soft, and lustrous, with good manageability.

- Should give the hair a pleasant fragrance.
- Should not cause the hand to become rough and chapped.
- There should be no side effects or irritation to the skin or eyes (18).

To study hair care properties, various sections of the plant were chosen.

Table1: Herbs Used In The Shampoo

S. No	PLANTS	COMMON NAME	FAMILY	PARTS	USES	FIGURE	REFE RENC ES
1	<i>Azadirach ta indica</i>	Neem	Meliaceae	Leaves	Anti-dandruff		(19)
2	<i>Hibiscus rosa Sinensis</i>	Hibiscus	Malvaceae	Leaves & Flowers	Hair conditioner & prevent hair loss		(20)
3	<i>Lawsonia inermis</i>	Henna	Lythraceae	Leaves	Cleansing agent & hair conditioner		(21)
4	<i>Acacia concinna</i>	Shikakai	Sapindaceae	Pods	Foam base, cleansing agent & Anti-dandruff		(22)
5	<i>Aloe barbadensis miller</i>	Aloe vera	Liliaceae	Leaves	Hair growth promoter, Anti-dandruff & Conditioning agent		(23)
6	<i>Embelica officianalis</i>	Amla	Euphorbiaceae	Fruits	Darkening of hair, Hair growth promoter		(22)

7	<i>Datura metal</i>	Datura	Solanaceae	Fruits	Anti-dandruff		(16)
8	<i>Sapindus mukorossi</i>	Reetha	Sapindaceae	Fruits	Foaming agents		(24)
9	<i>Ocimum tenuiflorum</i>	Tulsi	Lamiaceae	Leaves	Anti-bacterial		(24)
10	<i>Musa</i>	Banana	Musaceae	Roots	Imparts color		(25)
11	<i>Nigella Sativa</i>	Black cumin	Ranunculaceae	Seeds	Anti-dandruff, prevent hair fall & premature greying of hair		(25)
12	<i>Eclipta Prostrata</i>	Bhringraj	Asteraceae	Leaves & Flowers	Hair growth		(26)
13	<i>Cassia Auriculata</i>	Cassia	Fabaceae	Leaves	Anti-Dandruff		(26)
14	<i>Argemone mexicana</i>	Mexican poppy	Papaveraceae	Flowers	Anti-dandruff		(27)

15	<i>Calotropis Gigantea</i>	Crown Flower	Apocynaceae	Flowers	Anti-dandruff		(27)
16	<i>Punica Granatum</i>	Pomegranate	Punicaceae	Seeds	Anti-dandruff		(28)
17	<i>Cicer Arientinum</i>	Bengal Gram	Fabaceae	Seeds	Hair Growth		(28)
18	<i>Vigna Radiata</i>	Green Gram	Fabaceae	Beans	Anti-dandruff		(28)
19	<i>Centella Asiatica</i>	Brahmi	Apiaceae	Leaves	Hair Tonic		(28)
20	<i>Calendula Officinalis</i>	Mari Gold	Calendulaceae	Flowers	Conditioner		(28)
21	<i>Murraya Koenigii</i>	Curry Tree	Rutaceae	Leaves	Hair growth promoter		(16)
22	<i>Mimosa Pudica</i>	Touch-Me-Not plant	Fabaceae	Leaves	Prevent Hair Loss		(29)
23	<i>Glycyrrhiza Glabra</i>	Licorice	Fabaceae	Bark	Promote blood circulation in the scalp		(28)

FORMULATION OF ANTI-DANDRUFF HERBAL SHAMPOO

Priya D. Gaikwad *et al.* (2018) formulated a poly-herbal anti-dandruff shampoo using hibiscus leaf, henna leaf, Neem leaf, Amla fruit, Shikakai fruit, Reeta fruit, *Aloe vera* leaf, banyan root, soya milk, gaur gum, almond by decoction method and evaluated for Physical appearance, pH, Rheological evaluation, Dirt dispersion, Skin sensitization test, Stability test, Foaming ability, and Foam stability. Finally, it's considered not only safe and also reduces hair loss (30).

Sucharitha Kannappan Mohavel *et al.* (2017) evaluated the utilization of henna leaf extract as a source of natural anti-dandruff compounds. Thin-layer chromatography analysis revealed the presence of imidazole-like anti-dandruff compounds in the crude ethyl acetate extract of henna leaves. The extracted compound was identified as imidazole by NMR analysis. The compounds expected structure resembled ketoconazole. Thus, it is assumed that a ketoconazole-like anti-dandruff compound was present in the ethyl acetate extract of henna leaves (31).

Instead of using a synthetic functional ingredient, Shreya Kothari *et al.*, (2018) created a poly-herbal shampoo with Hibiscus, Datura, Amla, Garlic, Mint, and other plant extracts. This article is intended to raise awareness of herbal extracts that are both safe and free of side effects. Foam ability, wetting action, oral toxicity, eye irritation test, pH, % of solid contents, detergency, and cleansing action were all evaluated (16).

Revan siddappa *et al.* (2018) developed an anti-dandruff herbal shampoo with Ritha, Liquorice, Bengal gram, Brahmi, Green gram, Banana, Pomegranate, Hibiscus, Marigold, and Lemon and tested it for color, odor, transparency, pH, percent of solid content, foam volume, surface tension, anti-fungal activity, and wetting time in different formulations F1, F2, F3, F4. The presence of green gram and Pomegranate, both of which have anti-dandruff activity, may account for the formulation's maximum antifungal activity. The results should show that the anti-dandruff herbal shampoo formulation F4 was found to be safe and cost-effective active when compared to synthetic anti-dandruff shampoo (28).

Vijayalakshmi (*et al.*, 2018) created a herbal shampoo that reduces hair loss while combing, is safer than a chemical conditioning agent, and helps to strengthen hair growth. Hibiscus, Shikakai, Amla, Soapnut, Cassia, Bhringraj, and Aloe vera were used to create a herbal shampoo that was evaluated for color, transparency, odor, pH, solid contents, foam volume, foam type, surface tension, and wetting time (26).

Shweta Patel (*et al.*, 2022) formulated an anti-dandruff herbal shampoo by using the powder form of *Calotropis gigantea* and *Argemone Mexicana* was extracted by using a sequential method and also evaluated for visual appearance, pH, viscosity, and % of solid contents, foaming ability, foaming stability and detergency. The formulated anti-dandruff herbal shampoo was safe and effective to use compared with the synthetic one (27).

Sandeep *et al.* (2021) developed a polyherbal anti-dandruff shampoo using mimosa pudica, Hibiscus laceio, Azadirachta indica, Lacosoni alarms, and Murraya Koenig and evaluated it for its physical properties. The cup plate method was used to determine the anti-dandruff activity of shampoo. In comparison to the remaining formulations, formula F6 had a greater zone of inhibition due to its higher concentration of plant extracts. The use of herbal shampoo is considered to be a more cost-effective and eco-friendly alternative to synthetic shampoos (29).

Nair *et al.* (2022) created a pure herbal shampoo using Reetha, Neem, Banana root, Mentha, Black cumin, Xanthum gum, Tulsi, and Lavendar oil in a standard mixing process and evaluated some physiochemical properties. The herbal anti-dandruff shampoo has fewer side effects, is less expensive, and is more effective than synthetic shampoos. It also promotes healthy hair growth (25).

EVALUATION OF ANTI-DANDRUFF HERBAL SHAMPOO

The formulated herbal shampoo was evaluated by performing quality control tests including physicochemical characterization such as physical appearance, determination of pH, washability, determination of % solid contents, dirt dispersion test, rheological or viscosity, wetting time, foam production & foam stability and surface tension.

Physical Appearance

The prepared formulation was evaluated visually for color, clarity, odor, and froth content (32).

Determination Of pH

At a room temperature of 25 ± 2 °C, the pH levels of the shampoos tested in 1% and 10% water solutions were measured using a pH meter. Acidic solutions cause the hair's cuticle (outer layer) to shrink and lie flat on the hair shaft. The cuticle swells and opens as a result of basic solutions. Acidic solutions smooth the hair, while basic solutions make it frizzier (33).

Washability

After applying the formulations to the skin, the ease and extent of washing with water were manually assessed (34).

Determination Of % Solid Contents

In a clean dry evaporating dish, 4g of the prepared shampoo was placed. The dish and shampoo were weighed. By placing the shampoo on a hot plate, the liquid portion was evaporated. The weight of the shampoo's solid contents was determined after complete drying (35).

Dirt Dispersion Test

It is then filled with 10 ml of distilled water in the test tube. Two drops of shampoo formulation are then added to the test tube. Following that, one drop of Indian ink is added to the test tube. After that, the test tube is corked and shaken 10 times. The results were written based on the amount of ink used, such as None, Light, Moderate, or Heavy (36).

Rheological Or Viscosity Evaluation

A Brookfield viscometer was used to determine the viscosity of the shampoos. 10ml of shampoo is placed in a beaker, and the spindle is dipped in it for about 5 minutes before reading (15).

Wetting Time

Wetting time was calculated by noting how long it took the canvas paper to completely sink. Canvas paper weighing 0.44 g was cut into a 1-inch-diameter disc. The canvas paper disc was placed over the shampoo (1% v/v) surface, and the time it took for the paper to sink was timed using a stopwatch (37).

Foam Production And Foam Stability

The force of foam was determined using a cylinder motion. 50 ml of 1% shampoo solution was added to a 250 ml cylinder and hand-shaken ten times before covering it with a cylinder (38).

Determination Of Surface Tension

At room temperature, the surface tension of herbal shampoo was measured using a tensiometer. The surface tension of water was also measured under the same conditions and used as a control (39).

Anti-Microbial Activity

Using the well diffusion method, the antimicrobial activity of herbal shampoo was tested against dandruff. On separate solidified Muller Hinton Agar plates, the bacterial lawn of 0.1 ml of each fungal and bacterial culture was created. The center was made into a well. The wells of individual Muller Hinton Agar plates were filled with 0.5 ml of the herbal shampoo using a sterilized borer. For 2-4 days, all of the fungal culture plates were incubated at room temperature. While bacterial culture plates were kept at 37°C for 24 hours of incubation. After incubation, the inhibition zone on the plates was checked (16).

CONCLUSION

The objective of the study is to materialize a stable and functionally effective herbal shampoo by avoiding synthetic chemicals, which are commonly used in formulations. Further research can be conducted to conclude that herbal anti-dandruff shampoos are formulated and recovered in overall performance as that of the marketed formulation, but further research is required for the improvement of its quality. It is possible to create a herbal antidandruff shampoo that is not only as effective as synthetic antidandruff shampoos but also has greater safety, efficacy, and purity. The shampoo can be evaluated using various parameters and found to be suitable for application to the hair.

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