

REVIEW ARTICLE

Comparison of anti-dandruff activity of synthetic shampoos and crude plant extracts on dandruff causing isolates

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Abstract

Dandruff, a common scalp condition identified by flaking and itchiness, impacts a wide portion of the population around the world. While synthetic shampoos were the traditional approach for curing dandruff, there is growing interest in exploring natural /herbal alternatives which include crude plant extracts. *Malassezia furfur*, the causative organism for dandruff, has been used in different experiments. This article seeks to analyze the anti-dandruff potential of synthetic shampoos and crude plant extracts against *dandruff-causing isolates* to shed light on their efficaciousness, safety, and expected benefits. Following the research strategy, dandruff-causing fungi number of samples accession are collected from affected people and examined, and then artificial shampoos and crude plant extracts. The commercially available synthetic shampoos that were used for this study are widely used to treat dandruff all around the world and include active components like selenium sulfide, zinc pyrithione, and ketoconazole. Some plant species, like neem (*Azadirachta indica*), tea tree (*Melaleuca alternifolia*), and aloe (*Aloe barbadensis*), etc. have been used as plant extracts because they contain antibacterial and anti-inflammatory properties. Synthetic shampoos show strong antifungal efficacy; ketoconazole has the strongest inhibitory effect on *Malassezia* growth. Their long-term effects on sebaceous gland function are a matter of concern, synthetic shampoos are an efficient way to control sebum production. Due to their ability to balance sebum production, crude plant extracts especially those from neem and tea trees offer a comprehensive method of managing dandruff by addressing both excess sebum and microbial overgrowth. Both plant extracts and shampoos have their effectiveness on *Malassezia furfur* (dandruff-causing fungi).

Keywords: Anti-dandruff, Isolates, *Malassezia furfur*, Plant extracts.

Introduction

Among the traits that characterize mammals is their hair. Dermal follicles, which are generated from the skin's ectoderm, are where hair, a protein filament, grows (Kumar 2021). Hair is one of those features in humans which makes

them look attractive, in both males and females. But hair gets damaged due to various reasons such as genetic disorders, loss of nutrition, unhealthy lifestyle, heat treatments, harsh chemical shampoos, and dandruff, which leads to hair fall and baldness. Dandruff is the main reason behind hair loss which is the highlight of this review paper. Dandruff is a common scalp condition, which affects up to 50% of the world population and around 70% of Indians suffer from dandruff. One out of every 5 people suffer from dandruff problems. Dandruff is characterized by keratinous debris on the scalp, erythema, and scaly skin. It has been reported that dandruff is a multifactorial condition caused by fungal colonization of the stratum corneum and inflammation. Dandruff makes the scalp itchy. The main causative organism of dandruff *Malassezia furfur* [Figure 1], is a lipophilic yeast. *Malassezia* infections are common in tropical and subtropical climates, particularly in areas with poor sanitation and poverty, where residents may contact the disease every year (American Academy of Dermatology) (Al-Bader *et al.* 2017).

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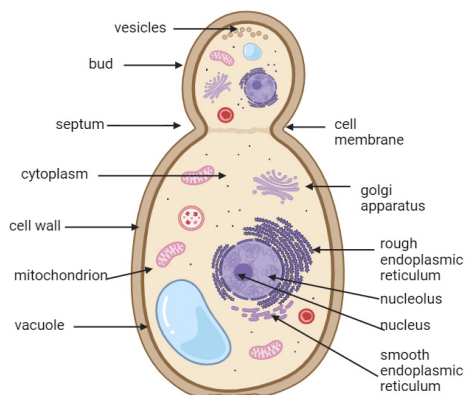


Figure1: A labeled diagram of *Malassezia furfur* (alamy.com)

The *Malassezia* fungus (which causes dandruff) uses this enzyme to break down sebum to oleic acid (pro-inflammatory free fatty acids (Raju *et al.* 2019) thus the proliferation of keratinocytes is done rapidly at extreme levels, resulting in dead skin or white flakes on the scalp. Essentially keratolytic agents, such as salicylic acid and sulfur, loosen the attachments between the corneocytes and allow them to be washed away with shampooing. Two forms of dandruff are distinguished based on the symptoms: Dry (common) and Oily. *Pityriasis simplex*, another name for dry dandruff, is characterized by an excessive amount of tiny, white, greyish, or ashen-colored scales that grow on the scalp. Initially confined to the central region of the scalp, these scales eventually extend to the parietal, frontal, and occipital regions. There is no noticeable significant hair loss with this kind of dandruff. *Pityriasis steatoides*, also known as oily dandruff, is another kind of dandruff. It appears on the scalp skin in varying degrees of sebum production intensity (Zoya *et al.* 2016). Treatment options currently available in the market contain different chemical formulations and zinc pyrithione, salicylic acid, imidazole derivatives, selenium sulfide, tar derivatives, ketoconazole, ciclopirox, triclosan, etc. As well-known keratolytic chemicals, salicylic acid, and sulfur serve primarily to weaken the attachments between corneocytes, allowing them to be rinsed away during shampooing (Ansari *et al.* 2020).

It is a well-known fact that this illness has no permanent cure. The current study compared the effectiveness of natural plant products and store-bought antidandruff shampoos to assess the former's antifungal properties (Raju 2019). Antifungal activity of plants against *Malassezia furfur* and the efficiency of some antidandruff shampoos against *Malassezia furfur* are carried out in this paper.

Causes of Dandruff

The major scalp problem known as dandruff is characterized due to the exfoliation of dead skin cells from the scalp, frequently accompanied by itching. Despite being generally

unharmful, it may be uncomfortable and embarrassing for those who have it. To know why dandruff occurs, one should investigate the reasons and symptoms of this condition. The reasons for the occurrence of dandruff are humidity, temperature changes, dryness, pollution, sensitivity to hair care products, and carelessness towards hair hygiene. This fungus (*Malassezia furfur*) normally inhabits the skin but overgrowth causes flaking and fast keratinization. Dandruff is often linked to seborrheic dermatitis that results in oily areas on the scalp, redness, and irritations. Another reason for dandruff is dry skin on the scalp which produces smaller flakes that are not as oily as those produced from excessive oil production. Another cause of dandruff is oily skin due to excess oil (sebum) secretion, which facilitates the growth of *Malassezia* fungus leading to dandruff, itching, irritation, and redness on the scalp.

Cultural conditions of *Malassezia furfur* in the laboratory

Malassezia furfur grows at less than 27°C for 7 days in laboratory conditions, on media

Mechanism of *Malassezia* fungus causing dandruff on the scalp

Dandruff is caused by *Malassezia*, a yeast-like fungus that grows naturally on the scalp. The *Malassezia* fungus breaks down sebum to oleic acid by using lipase enzymes. The oleic acid then penetrates the top layer of the skin and causes increased skin cell turnover in susceptible people. This, in turn, causes dandruff flakes and sometimes itching and redness (Patidar 2018) [Figure2].

Various plants used for their antidandruff activity till now

The following Table 1 shows different types of plants, their common names, family names, and their properties, which are used by various researchers for their antifungal, and anti-dandruff properties.

Future prospects

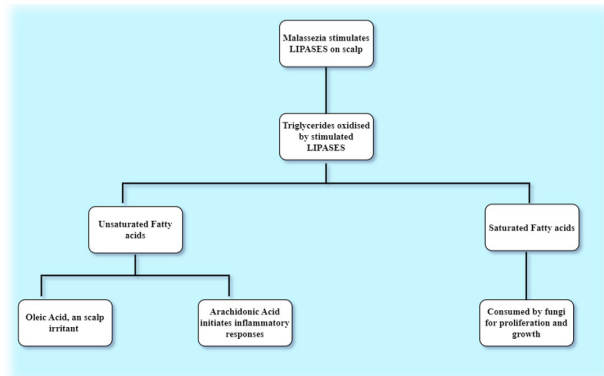
The future of using plants to cure dandruff looks optimistic, with continued research and breakthroughs in plant-based therapies. Synthetic shampoos contain chemicals that are harmful to our scalp and they cause hairfall sometimes. Now people are looking towards herbal and plant-based alternatives for treating dandruff. Here are a few possible future directions:

Identification of powerful Plant derived Compounds

Future studies will focus on discovering and isolating certain plant derived compounds that are extremely powerful against dandruff-causing fungi, notably *Malassezia* species. Plant-derived compounds such as terpenes, flavonoids, and phenolic acids have antifungal effects and could be used to build tailored treatments.

Table 1: Plant names, common names, family, parts used, and their properties

Sr. No.	Plant name	Common name	Family	Part used	Property	References
	<i>Acacia concinna</i>	Shikakai	Fabaceae	Nuts	saponins and other phytochemicals	Raju K S 2019
2.	<i>Achyranthes aspera</i>	Prickly chaff flower	Amaranthaceae	Leaves	alkaloids and flavonoids	Sathish Kumar P, et al. 2016
3.	<i>Albizia amara</i>	Indian walnut	Fabaceae	Leaves	anti-inflammatory and soothing compounds	Revan- siddappa, M et al. 2018
4.	<i>Allium cepa</i>	Onion	Amaryllidaceae	Bulb	sulfur compounds	Raju KS 2019
5.	<i>Aloe vera</i>	Aloe, Barbados aloe	Asphodelaceae	Leaves	enzymes and vitamins that can help soothe the scalp	Ansari SPMM 2020
6.	<i>Artemisia indica</i>	Wormwood Indian	Asteraceae	Leaves	bioactive compounds	Dahal P 2021
7.	<i>Azadirachta indica</i>	Neem	Maliaceae	Leaves, fruit	nimbidin and nimbin compounds	Kumar A 2021, Mishra R.C. et al. 2022
8.	<i>Cassia auriculata</i>	Tanner's Cassia	Caesalpiniaceae (Pea Family)	Flower	anti-inflammatory and anti-fungal properties	Mishra, R. C., 2022
9.	<i>Cassia fistula</i>	Indian Laburnum, Golden Shower	Caesalpiniaceae (Pea Family)	Leaves	bioactive compounds	Davina M S, and Pavithram K S (2015)
10.	<i>Rosmarinus officinalis</i> L	Rosemary	Lamiaceae	Leaves	Rosmarinic acid, ursolic acid	Sahaire Rad M 2015

**Figure 2:** Mechanism of *Malassezia* fungus causing dandruff on the scalp (Narshana and Ravikumar 2018).

Formulation Development

Future research will focus on incorporating plant-derived components into successful anti-dandruff products such as shampoos, conditioners, and scalp treatments. The emphasis will be on ensuring that these formulations are stable, effective, and consumer-acceptable.

Clinical experiments and Validation

Extensive clinical experiments will be done seeking approval from Human Ethical committee to confirm the efficacy and safety of plant-based dandruff therapies. These treatments will be tested on bigger groups of people with varied levels of dandruff severity.

Combination Therapies

Researchers will look into combining plant extracts with other active chemicals such as salicylic acid, zinc pyrithione,

or ketoconazole to improve efficacy and provide a broader range of dandruff treatment options.

Focused Delivery Systems

Advances in nanotechnology and delivery systems will enable more focused and sustained distribution of plant-based chemicals to the scalp, hence enhancing treatment effects and reducing application frequency.

Conclusion

The research on alternative treatments for this common scalp disease has been focused on the analysis of extracts obtained from fresh plants versus artificial shampoos as regards to their antibacterial ability against dandruff-causing organisms. Additionally, natural and synthetic methods are both efficient in controlling yeast overgrowth and soothing dandruff symptoms although there are pros and cons of each procedure. Whether synthetic shampoos are safe for long-term use on scalps, if allergic reactions are possible and whether the ingredients used in them are sustainable ecologically have all emerged as a result of their effectiveness. Synthetic shampoos had strong inhibitory effect on *Malassezia* growth with main anti-dandruff components including zinc pyrithione, ketoconazole, selenium sulfide, coal tar among others. Their fast action as well as established clinical efficacy make them popular among people seeking immediate relief from dandruff's symptomatic discomforts. However, crude plant extracts offer a viable option for a more all-encompassing and organic approach to treating dandruff. Plants with components including alkaloids, flavonoids, tannins, and saponins, showed anti-dandruff qualities. These extracts'

variety of bioactive ingredients provide a multimodal strategy that targets *Malassezia* growth while also having calming and anti-inflammatory benefits for the scalp.

Authors contribution

Shreya Omer wrote the manuscript. Anamika Tiwari planned this work and thoroughly checked and reviewed.

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Ethical approval

The author has followed ethical guidelines while preparing the manuscript. The author has no potential conflicts to disclose. No human or animal participants were involved in this research.

Conflict of interest

The author declares that they do not have any conflict of interest in this publication.

Consent to participate

The author has given consent to participate as per the journal guidelines and policies.

Consent to publish

The author has given consent to publish as per the journal guidelines and policy.

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