

Review

A review on potential herbal treatments for ‘dandruff’ - the embarrassing scalp disorder

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Abstract

Dandruff is a scalp disorder that is characterized by itching, and abnormal and rapid turnover of the outermost layer of the skin of the scalp. The fungi of the genus *Malassezia* are responsible for causing dandruff. Several herbal remedies have been in use since ancient times for curing dandruff. The effectiveness of herbal extracts and their formulations against the fungi causing dandruff has been assessed previously. This review summarizes the findings of the studies which were focused on assessing the anti-dandruff effect of medicinal plants that are commonly available in Sri Lanka. *Punica granatum*, *Mentha piperita*, *Bacopa monnieri*, *Asparagus racemosus*, *Azadirachta indica*, *Elaeocarpus serratus*, *Psidium guajava*, *Trigonella foenum-graecum*, *Cuminum cyminum*, and *Hibiscus* spp. have been shown to be having *in-vitro* anti-malassezian action. However, the number of clinical trials done on assessing such effects of herbal preparations are limited, and the knowledge generated through the clinical trials hitherto shows that the use of combined preparations of plant extracts are successful in treating dandruff compared to single herb preparations.

Keywords: Dandruff, *Malassezia* spp., Herbal treatments, Home remedies, Antifungals

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Introduction

Dandruff is a scalp disorder characterized by itching and abnormal and rapid turnover of the outermost layer of the human scalp. The dead skin is usually released as patches and flakes of greyish-white colour (1). Dandruff and Seborrheic Dermatitis (SD) are the continuations of the same condition that affect skin areas with high sebum secretion. Dandruff is restricted to the scalp and involves itchy, flaking skin without visible inflammation. SD affects the scalp and other seborrheic areas and involves itchy and flaking or scaling skin, inflammation, and pruritus (2).

Three main factors encourage the formation of dandruff. They are fungal infections of the scalp, sebaceous secretions, and individual sensitivity to various chemical substances (3). The most widely accepted microbial organism is the lipophilic yeast which belongs to the genus *Malassezia*. *M. restricta* and *M. globosa* are the commonest species causing dandruff (4, 5).

Clinical symptoms associated with dandruff are skin flaking, pruritus, irritation, and the feeling of a dry or tight scalp. Loosely adherent, small white or grey flakes are characteristic of dandruff, whereas seborrheic dermatitis presents with yellowish oily scales (6). Though dandruff is not an easily contagious disease or a disease with serious clinical outcomes, it is an embarrassing condition that may affect self-confidence and even lead to psychological disturbances in more severe stages (2).

Usual anti-dandruff treatments

Active ingredients used in anti-dandruff medications include keratinolytic agents and antimicrobial agents. Salicylic acid, sulfur, and tar are the main keratinolytic agents used in dandruff treatment, while selenium sulfide, imidazole, flavonoids, phenolic acids, saponins, and hydroxypyridones are the key chemical constituents effective in treating dandruff (7). Table 01 shows the commonly used therapies for dandruff, which have been proven to be effective by *in-vitro* and/or clinical studies. Apart from those scientifically accepted medications, hundreds of commercial products in the form of shampoo, cream, scalp lotions are being sold and advertised worldwide. Some of them are claimed to contain 'anti-dandruff herbs', despite non-availability of research evidence (8). Furthermore, there are many herbal treatments in the form of home remedies used by people over many years.

Some of the herbal preparations have been tested, and significant anti-dandruff effects were reported in the literature. Evaluation of the *in-vitro* anti-malassezial effect is based on the demonstration of the zone of inhibition around a disk soaked with the aqueous or alcoholic extract of the herbal plant material under evaluation (9). In this review, we have summarized the publications that have described the anti-dandruff and/or anti-malassezial effects of various herbal preparations, which are commonly available in Sri Lanka.

Table 1: Commonly used anti-dandruff preparations with proven effectiveness

Substance	Preparation	Mechanism	Evidence
Ketoconazole	1-2% ketoconazole	Decreasing both skin flakes and <i>Malassezia</i> density	Piérard-Franchimont C <i>et al.</i> , 2001(7)
	Ketoconazole coated silver nanoparticles (AgNp)	AgNp enhance the activity of ketoconazole penetrating through the cell membrane leading to the destruction of the fungus	MathewJ <i>et al.</i> , 2015(10)
Selenium sulfide	2.5% selenium sulfide shampoo	An anti-hyperkeratotic agent that can be used effectively for the treatment of seborrheic dermatitis which is a severe form of dandruff.	Sheth RA. 1983 (11) Rosenthal D, Margesson LJ ,1993(12)
Ciclopirox	1% shampoo	Exhibits antifungal activity against <i>Malassezia spp</i>	Lebwohl M, Plott T 2004 (13)
Topical Corticosteroid Therapy (TCS)	Low to low-mid potency TCS	Anti-pruritic and anti-inflammatory effect	Del Rosso JQ, 2011(14)

Medicinal plant preparations tested for antifungal effects

Punica granatum (English: Pomegranate, Sinhala: Delum, Tamil: Madalai)

Punica granatum belongs to the family Punicaceae. The studies done by Gill *et al.* (15) and Alireza *et al.* (16) have demonstrated that the chemical constituents in *Punica* inhibits pro-inflammatory cytokines. Furthermore, it has been shown that *Punica granatum* has anti-inflammatory, anti-itching, anti-dandruff and anti-oxidant properties (17,18). In a clinical trial done in 2014 in Iran (19), a herbal shampoo prepared with methanol extract of flowers of *Punica granatum* in combination with other six medicinal plants, *Rosmarinus officinalis*, *Matricaria chamomilla*, *Urtica dioica*, *Mentha piperita*, *Salvia officinalis*, and *Pirocton olamine* had shown effectiveness on dandruff removal, with fewer side effects (19).

Mentha piperita (English: Peppermint, Sinhala: Minchi, Tamil: Pudina)

Mentha piperita is a plant of the family Labiate, which is widespread across the world while mainly found in Europe. Some flavonoids in *Mentha piperita* leaves, such as menthoside rosmarinic acid and tannins, can inhibit bacterial, fungal, and yeast growth (20). An Iranian research group has observed significant anti-malassezial effects of essential oils made up of *Mentha piperita* (19).

Bacopa monnieri (English: Waterhyssop, Sinhala: Lunuwila, Tamil: Nīrppirami)

Phytochemical analysis of *Bacopa monnieri* leaves has revealed the presence of tannin, saponin, steroids, flavonoids, phenol, and alkaloids, which are known chemicals to have anti-dandruff effects (21). Crude aqueous and ethanoic extracts of *B. monniera* have been tested for the antifungal effects against the dermatophytic fungi. In the results of that study, both ethanoic extract and aqueous extracts had high inhibitory action against the studied dermatophytic fungus (22).

Though the effect of *Bacopa* against *Malassezia* spp. is not available in published literature, it may be reasonable to expect some effect against dandruff as the isolated chemical constituents include steroids which have antipruritic action and in use as a treatment in dandruff (Table 02).

***Asparagus racemosus* (English: Asparagus, Sinhala: Hathawariya, Tamil: Shatavari)**

Asparagus racemosus root extract has shown *in-vitro* antifungal effects against dandruff causing yeasts *M. globosa* and *M. furfur* (23). Together with its inherent anti-inflammatory effect *A. racemosus*, is considered a potential ingredient in anti-dandruff formulations (24).

***Azadirachta indica* (English: Neem, Sinhala: Kohomba, Tamil: Veppai)**

Saranya et al. (25) have revealed that the silver nanoparticles synthesized through green synthesis using *Azadirachta indica* leaf extract inhibit the growth of *Malassezia* spp. *in-vitro*. Neem extract has been reported to be having an anti-pityrosporum activity (26).

***Elaeocarpus serratus* (English: Ceylon olive, Sinhala: Veralu Tamil: Karamaram) and**

***Psidium guajava* (English: Guava, Sinhala: Pera, Tamil: Caiṭiyam koyyā)**

In ayurvedic medicine, a paste made of the leaves of *Elaeocarpus serratus* and *Psidium guajava* were used for many years in Sri Lanka. The anti-dandruff action of *E. serratus* and *P. guajava* paste was assessed clinically in Sri Lankan patients by Pramodini and Wickramarachchi (27) and concluded that the paste is effective managing dandruff.

***Trigonella foenum-graecum* (English: Fenugreek, Sinhala: Uluhā, Tamil: Vendayam)**

The leaf extracts of *Trigonella foenum – graecum* have been found to have an antifungal effect in a study in India (28). Aqueous preparation of germinated fenugreek seeds has been able to produce a zone of inhibition in *Malassezia* growth, suggesting the possibility of using it as an anti-dandruff agent.

***Cuminum cyminum* (English: Cumin; Sinhala: Sooduru, Tamil: Cīrakam)**

Essential oil prepared with *Cuminum cyminum* seeds has shown inhibition zones larger in size than the antifungal medication ketoconazole when tested against *Malassezia* spp. (19). Furthermore, cumin is known to consist of anti-allergic and anti-inflammatory properties, which may contribute to the beneficial effects as a potential herbal treatment against dandruff (29).

***Hibiscus* spp. (English: Hibiscus/Roselle; Sinhala: Vada, Tamil: Cemparutti)**

The butanolic extract of *Hibiscus sabdarifa* has been tested by Surabhi Pisal and Vaishali Mane (30) using the well diffusion method. They have reported that the zone

of inhibition is 25 mm with a 100% concentration of the extract. Extracts of flowers of *Hibiscus rosa – sinensis* has also shown *in-vitro* anti – *Malassezia* effects.

Discussion

This review summarizes the findings of the studies which were focused on assessing the anti-dandruff effect of medicinal plants that are commonly available in Sri Lanka. Most of the above studies were *in-vitro* tests of plant aqueous or ethanolic extracts. Only a few clinical studies were available in the literature with promising results, of which some were done using preparations made by combining several plant materials. Interpretations, comparisons, and reproducibility of results may be difficult in such studies done using combined preparations.

The studies which have assessed the zones of inhibition for the *Malassezia* spp. grown on agar-based media may be comparable. However, a comparison of the sizes of the zone of inhibition between studies may not be precise as the media used and the anti-fungal sensitivity test methods involved were different across the studies. Therefore, observation of a significant inhibition zone as defined by the authors of each study was considered as the presence of the anti-dandruff effect for this review. The reviewers would like to suggest further *in-vitro* as well as clinical studies on these identified herbs, *Punica granatum* (pomegranate), *Cuminum cyminum* (cumin), *Trigonella foenum-graecum* (fenugreek), *Hibiscus* spp. (vada), *Bacopa monnieri* (water hyssop), *Azadirachta indica* (kohomba, neem), and *Mentha piperita* (peppermint) to investigate the safety profile and to purify the chemical constituents with anti-dandruff property, etc. Pramodini and Wickramarachchi (27), in their clinical study done in Sri Lanka testing the efficacy of a paste made with leaves of *Elaeocarpus serratus* (veralu) and *Psidium guajava* (pera), which are in traditional medicine as a home remedy for dandruff in Sri Lanka, has reported promising results with remarkable symptomatic improvement and complete control of dandruff, with minimum adverse effects (34). Since the authors have not described the preparation of the tested product in detail, the reproducibility of such a result is somewhat questionable. However, we believe further evaluations of such preparation for product development will be worthwhile.

In conclusion, the aqueous and ethanolic extracts of herbs that have demonstrated anti-*Malassezia* effects in *in-vitro* tests include several commonly available plants in Sri Lanka. As some of these are traditional home remedies already in use for years, the development of commercial products after establishing proper scientific clinical evidence should be encouraged.

Table 2: Herbs with anti-dandruff properties

Plant	Preparation	Possible effect on dandruff	Chemical substances with anti-dandruff activity	Evidence	Remarks
<i>Punica granatum</i>	Herbal shampoo prepared with methanol extract of flowers	Anti-malassezial effect Anti-inflammatory and anti-pruritic effect	Saponin, Steroids Phenol	Gil MI <i>et al.</i> ,2000(15) Ghasemian A <i>et al.</i> , 2006(16) Naeini AR <i>et al.</i> , 2019 (19)	<i>Punica granatum</i> , in combination with six other medicinal plants, <i>Rosmarinus officinalis</i> , <i>Matricaria chamomilla</i> , <i>Urtica dioica</i> , <i>Mentha piperita</i> , and <i>Salvia officinalis</i> , and <i>Pirocton olamine</i> , has shown effectiveness on dandruff removal with fewer side effects in a clinical study (31).
<i>Mentha piperita</i>	Essential oils prepared from leaves	Inhibition of fungal growth	Flavonoids Rosmarinic acid Tannins	Naeini AR <i>et al.</i> , 2019 (19) Paul Rita and Animesh DK 2011(20)	Commercial preparations consisting of essential oils (EO) of <i>Mentha piperita</i> , <i>Citrus aurantium</i> , <i>Lavandula</i> , <i>origanum vulgare</i> , <i>Origanum majorana</i> , and <i>Helichrysum italicum</i> was reported
<i>Bacopa monnieri</i>	Crude aqueous and ethanoic extracts of leaves	Inhibition of fungal growth	Tannin Phlobatannin, Saponin, Steroids, Flavonoid, Cardiac Glycosides, Phenol, Alkaloids	Jain P <i>et al.</i> , 2017(21) Ayyappan SR <i>et al.</i> ,2013 (22)	No clinical studies available
<i>Asparagus racemosus</i>	Root extracts	<i>In-vitro</i> antifungal effects against dandruff causing yeasts <i>M. globosa</i> and <i>M. furfur</i> (32)	Not established	Onlome C <i>et al.</i> ,2019(23) Battu GR, Kumar BM 2010 (24)	No clinical studies available
<i>Azadirachta indica</i>	Leaf extracts	Anti-pityrosporum activity	Phenols Flavonoids <i>Nimbin</i>	Saranya <i>et al.</i> ,2014(25) Prabhmanju <i>et al.</i> , 2009(26)	A poly-herbal hair oil containing <i>Azadirachta indica</i> extracts and other five constituents was found to have activity against <i>P. ovale</i> in-vitro by Krishnamoorthy et al. 2006(33)
<i>Elaeocarpus serratus</i>	Leaves paste	Antifungal and anti-inflammatory effects	Phenols Flavonoid Tannins	Pramodani <i>et al.</i> , (2019)(34)	An excellent anti-dandruff action of <i>Elaeocarpus serratus</i> leaves paste is reported in a clinical study by Pramodani et al. (2019)(34)

<i>Psidium guajava</i>	Leaves paste	Antifungal and anti-inflammatory effects	Tannins Polyphenolic compounds Flavonoids	Pramodani <i>et al.</i> , (2019)(34)	The excellent anti-dandruff action of <i>Psidium guajava</i> leaves paste is reported in a clinical study by Pramodani et al. (2019). (34)
<i>Trigonella foenum-graecum</i>	Aqueous preparation	Antifungal effect	Saponins Alkaloids	Dharajiya et al., 2019 (28)	No clinical studies available
<i>Cuminum cyminum</i>	Essential oil	<i>In-vitro</i> anti-malassezial effect	Flavonoid Phenols	Naeini AR <i>et al.</i> , 2019 (19) Sowbhagya HB 2016(29)	No clinical studies available
<i>Hibiscus spp.</i>	The butanolic extract of <i>Hibiscus sabdarifa</i>	<i>In-vitro</i> antifungal effect	Flavonoid Phenolic acids Tannins	Pisal S, Mane V 2105 (30)	No clinical studies available

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