



A REVIEW OF ANTIFUNGAL EFFECT OF PLANT EXTRACT VS CHEMICAL SUBSTANCES AGAINST MALASSEZIA SPP.

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ABSTRACT

Flaking of the scalp is a symptom of seborrhoeic dermatitis, also called dandruff. It frequently occurs around the folds of the nose and eyebrows in addition to the scalp. The epidermal layers of the scalp are continually replaced and the cells are pushed outwards and they flake off giving white or grayish patches on the scalp, skin and clothes. Oily scalp, hormones or a fungus *Malassezia* seems to be the cause of dandruff. Dandruff can be treated with over the counter products, which are shampoos containing antifungal and antibacterial ingredients like zinc-pyrithione and selenium sulfide, salicylic acid etc. These can only slow down the flaking. Herbal extracts have proved to be good alternatives for the chemical preparations. A number of herbal shampoos and polyherbal hair oils have excellent results due to their synergistic, antifungal, anti-inflammatory and immunostimulatory action.

KEYWORDS : Antidandruff, Plant extract, Malassezia, Seborrhoeic dermatitis



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INTRODUCTION

Dandruff is a common embarrassing scalp disorder affecting a large chunk of population. Dandruff is caused due to excessive shedding of dead skin cells from the scalp. It affects 5% of the population and mostly occurs after puberty, between 20-30 years and dandruff affects males more than females¹. Currently available treatment options for the management of dandruff include therapeutic use of antidandruff shampoos containing keratolytics, antimicrobials like Zinc pyrithione, Selenium sulphide, Salicylic acid, Imidazole derivatives, Sulphur Coal tar etc².

However, these agents have certain limitations, either due to poor clinical efficiency or due to compliance issues. Furthermore, these drugs are unable to prevent reoccurrence of dandruff which is the commonest problem. Recently identification of *Malasseziafurfur* on skin has been aided by the application of molecular DNA based technique. These investigations show that the species of *Malasseziafurfur* causing most skin diseases in humans including the most common cause of dandruff and Seborrheicdermatitis is *Malassezia globosa*³.

Chemical treatment for dandruff

The chemicals used for the treatment of dandruff have certain limitations; they are unable to prevent occurrence, which is a common troublesome clinical problem. Most products which are designed to fight dandruff contain zinc pyrithione. Other hair and skin products also contain this complex, as do certain prescription medications and it also has some industrial uses, most notably in paints. Zinc pyrithione has antifungal effect, it has the ability to disrupt membrane transport by blocking the proton pump that energizes the transport mechanism. A new study proposes that the mode of action of zinc pyrithione arises from iron starvation⁴. Experiments have suggested that the fungus is capable of inactivating pyrithione at low concentrations⁵.

Ketoconazole and Zinc pyrithione (ZnPTO) based shampoos (Over the Counter products) are used more by the consumers for common dandruff problems. The shampoos with ZnPTO are preferred by majority of the consumers, as the shampoos brands with ZnPTO (Anti Dandruff ingredient) are not only cheaper but also provide the desired functional benefit. However, in very severe cases of dandruff, ketoconazole based shampoos are preferred despite their relatively higher costs, so it may take some experimenting to find a formula that works for a specific condition.

A successful anti-dandruff shampoo not only has to provide superior anti-dandruff relief to ensure patient compliance but also also needs to offer excellent cosmetic and hair conditioning benefits at the same time. The efficacy of a shampoo containing piroctoneolamine and climbazole was compared with a widely available commercial shampoo containing zinc pyrithione. Overall, the shampoo formulation with piroctoneolamine and climbazole effectively reduces the amount of dandruff and at the same time provides hair conditioning advantages⁶.

Antidandruff activity of ketoconazole coated silver nanoparticles (AgNp) of 4±2 nm on the dandruff scales collected from human volunteers by disc diffusion method was investigated. It was concluded that AgNp enhanced the activity of ketoconazole. This is because Ketoconazole acts on fungi at the level of cell wall, while AgNp powerfully penetrates through the membrane leading to complete eradication of the fungi⁷.

Scalp lesions are quite common among all patients. A number of topical corticosteroids are used for the treatment, but corticosteroids as creams and ointments may have some undesirable effects. A shampoo containing fluocinoloneacetonide(0.01%) is approved for the treatment. This study showed that clobetasol propionate shampoo improved the results⁸.

Patients with dermatoses have a deficient cell mediated immune response to *Malassezia furfur*. The cell mediated immune response to this fungus was tested in 10 patients with dandruff. But the results did not indicate the presence of any cell mediated immune deficiency to *Malassezia furfur* in patients with dandruff⁹.

Keratolytics regulators of keratinization, antimicrobials and naturopathic drugs were included in a study by¹⁰, their efficacies were compared in eradicating dryness and flaking of scalp. It has been recently reported that the tannins and propylgallate, were inhibitory to food borne, water borne and off flavor producing microorganisms¹¹.

Herbal treatment for dandruff

Herbal drugs or their formulations are viable alternative to synthetic drugs. During the past few decades, there has been a dramatic increase in the use of natural products in cosmetics. The awareness and need for cosmetics with herbs is on the rise, primarily because it is believed that these products are safe and free from sideeffects. Now-a-days, many herbal shampoos are available in the market which contains herbal ingredients such as plant extracts and essential oils. There are large numbers of plants which are reported to have beneficial effects on hair and are commonly used in shampoos¹². A novel protein from lemon grass - lemin can inhibit the dandruff generated upto 95%. Lemon grass was washed and chopped into small pieces and extracted with phenol and chloroform¹³.

Twenty-five patients of both sexes, from the age group of 20-45 years, who were clinically diagnosed as suffering from mild to moderate dandruff and who were willing to give informed consent were enrolled in the study. All enrolled patients underwent a thorough clinical examination, with special emphasis on local scalp skin examination. All patients were advised to apply 10 ml of "Anti-Dandruff Hair Oil," twice daily for a period of 2 weeks with gentle massage to the entire scalp and were advised to leave it on the scalp for a contact

period of minimum 3-4 hours after application. All patients were followed for a period of 2 weeks. Clinical assessment of scalp lesions was done objectively and also subjectively. Thorough scalp examination was done after the completion of two weeks of all application. The hair oil had extracts of *Hibiscus rosa-sinensis* (China rose), *Centella asiatica* (Brahmi), *Eclipta alba* (bhringaraj), *Embllica officinalis* (amla) and *Terminalia bellerica* (vivitaki). This study was planned to evaluate the clinical efficacy and safety of "Anti-Dandruff Hair Oil" in the management of dandruff. The aim of treatment is to reduce the level of the *Pityrosporum ovale* on the scalp and the goals of therapy are to reduce morbidity and prevent complications. This study observed a significant reduction in the mean scores of itching and white scales. Subjective evaluation revealed remarkable improvement. The excellent antidandruff action of "Anti-Dandruff Hair Oil" might have been due to the synergistic antifungal, anti-inflammatory and local immunostimulatory actions of its ingredients¹⁴.

Poly-herbal hair oil was studied for anti-dandruff activity using microbiological and clinical tests. There was a clear symptomatic relief from dandruff in all the volunteers after 10 days of use. The plant extracts included *Wrightia tinctoria* (Indrajev), *Cassia alata* (Dadmari) and bitter fraction of *Azadirachta indica* (Neem). Methylene blue reductase test was employed to study the anti-dandruff efficacy of the oil.

For most of the anti dandruff products like shampoo, the effect is fungistatic i.e. the product removes the dead cell from the top but does not address the root cause, hence there is further recurrence. Danoan herbal preparation had been used for all kinds of dandruff problems. DANO has fungicidal effect, being hair oil, it goes inside the hair root and eliminates the chance of recurrence, provided proper hygiene is maintained. Dano is a powerful herbal stimulant that contains active herbals essential for getting rid of dandruff and

infection that might occur on the scalp due to some negligence or unknown etiology¹⁵.

The shampoo extract of *Ocimum sanctum*(tulsi) and *Azadirachta indica*(neem) leaves have good antimicrobial activity due to the presence of flavonoids, it was found to be effective, harmless and economic¹⁶. A number of plants have been used for antidandruff shampoos and oils like, *Glycine max* (soyabean), *Rosmarinus officinalis*(rosemary), *Arctium lappa*(burdock), *Zingiber officinalis*(ginger), *Plantago major*(greater plantain), *Melaleuca spp* (tea tree), *Camellia chinensis*(tea), *Salvia officinalis*(sage), *Mentha piperata*(mint), *Thymus vulgaris*(thyme), *Glycerriza glabra*(yashtimadhu)¹⁷. Inhibitory effect of the fruit extracts of *Terminalia bellerica*(baehra) can be attributed to the chemical substances gallic acid and ethyl gallate present in the fruits¹⁸, and in the case of *Terminalia chebula*(haritaki) tannins like beta sitosterol, gallic acid, ellagic acid, gallate, galloyl glucose, chebulagic acid¹⁹. Crude and methanol extracts of dry fruit of *Terminalia bellerica* possessed broad spectrum antimicrobial activity²⁰.

Scanning electron microscope study of the effects of toiletry treatment with shampoo on the microstructure of hair, using complete herbal shampoos formulated in the laboratory and their conditioning effects were evaluated by comparing with commercially available shampoo. The micrographs were studied quantitatively using image analyzer software. The damage caused to the hair due to sodium lauryl sulphate (SLS) present in the commercial shampoo was visible in the micrograph. The laboratory formulations were found to be better than the commercially available products. The clinical efficacy and safety of "Herbal Antidandruff Shampoo" was reported in the management of dandruff. Herbal antidandruff shampoo formulation was found to be effective and safe in the management of dandruff²¹. Among the herbal ingredients tea tree oil recorded significant anti-fungal activity. Tea tree oil is an essential

oil of the leaves of the Australian *Melaleuca alternifolia*(tea tree) tree. It is a mixture of hydrocarbons and terpenes, consisting of almost 100 substances. The antimicrobial property is attributed primarily to the major component, terpinen-4-ol. Tea tree oil represents a sound alternative for patients with dandruff who prefer a natural product and who are willing to shampoo their hair daily. Basil oil and Coleus oil are known to have the highest activity among the herbal ingredients. Other herbs used were *Nyctanthes arbor-tristis*(Harshingar), *Hibiscus rosasinensis*(Gurhal), *Azadirachta indica*(Neem), *Emblica officinalis* (Amalki), *Casytha filiformis* (Amar Bel), *Cinnamomum camphora* (Karpoo), *Curcuma longa* (Haldi), *Rubia cordifolia* (Majistha). Herbal ingredients like tea tree oil, rosemary oil, clove oil, pepper extract, neem extract, rosemary oil, henna, and lemon also recorded good anti-pityrosporum activity²². A polyherbal shampoo containing the extracts of *Rosmarinus officinalis*(rosemary), *Vetiveria zizanioides*(khus), *Nigella sativa*(nutmeg), *Santalum album*(sandalwood), *Ficus bengalensis*(banyan), *Citrus limon*(lemon) and oil of *Melaleuca leucadendron*(tea tree), showed anti-fungal, anti-inflammatory and local immunostimulatory actions²³.

Formulated polyherbal antidandruff hair oil is very effective in management of dandruff. Experiments with volatile oils of *Eucalyptus globules* and *Ocimum gratissimum*(African basil) along with the petroleum ether extract of *Hibiscus rosa-sinensis*(china rose), *Phyllanthus embelica* (Amla), *Tridax procumbens*(jayantiveda) possess antifungal activity. The last two extracts have significant hair growth activity. *Hibiscus* is used in management of dandruff. Its leaves and flowers not only promote the growth of hair but also color the hair and are good for healing ulcers. Amla helps in good growth of hair hence most of the marketed herbal hair oils contain amla as one of the chief ingredients²⁴. A total of 50 patients who were diagnosed as suffering from moderate to severe form of

dandruff with dry and damaged hair were included in a study using polyherbal cream recommended for the treatment of dandruff. The formulations contained the extracts of *Cicer arietinum* (Indianpea), *Rosmarinus officinalis* (rosemary), *Ocimum sanctum* (Tulsi) and oils of *Pongamia glabra* (karanja) *Melaleuca leucadendron* (Teatree), *Azadirachta indica* (Neem), *Sesamum indicum* and *Vitis vinifera* (common grape vine)¹.

Henna is shown to have strong fungicidal as well as anti-inflammatory, analgesic and antibacterial properties. The chemical constituents of this plant extract include naphthaline derivatives, quinoids, beta sitosterol, flavonoids and gallic acid. It also acts as a very good conditioner to the hair and has anticancer properties²⁵. Antifungal effects of chloroformic, methanolic and aqueous extracts of henna (*Lawsonia inermis*) leaves on *Malassezia furfur* were studied. The study reported that chloroformic extract of henna completely inhibited the growth of *Malassezia furfur*²⁶. Plant extracts were prepared from *Citrus limon* (lemon), *Embllica officinalis* (amla), *Trigonella foenum graecum* (fenugreek), *Vitis vinifera* (grape vine), *Papaver somniferum* (poppy) and *Allium cepa* (onion) in different concentration. The aqueous plant extracts were added to the wells of *Malassezia furfur* inoculated plates. Results showed that *Citrus limon* extract had maximum zone of inhibition than other plant extracts and extracts of *Papaver somniferum* and *Allium cepa* did not show any inhibition zone²⁷.

Similar work with *Ilex paraguariensis* on the growth of *Malassezia furfur* was analyzed. High performance liquid chromatography (HPLC) was employed to identify and isolate compounds of *I. paragua riensis* (yerba mate). The fungicidal/fungistatic effect was evaluated by the modified Thompson assay²⁸. Ten plant extracts were investigated for *in vitro* antidandruff activity. Extracts, which showed a significant reduction in growth, were further tested to determine minimum inhibitory concentration (MIC). The potentials of four extracts viz. *Hibiscus rosa-sinensis* (chinarose),

Phyllanthus emblica (amla), *Allium sativum* (garlic) and *Terminalia chebula* (haritaki) were established as active antidandruff plants²⁹. *Acacia concinna* (shikakai) is an important medicinal plant in Thailand and throughout Asian countries. Its dried pods are traditionally utilized as herbal medicine to treat many health symptoms e.g. constipation, cough, dandruff and skin diseases. The antimicrobial potential of *A. concinna* extracts against the fungal causative agents has been worked out³⁰.

In an investigation nineteen plant spp. were collected from in and around Karur District of Tamil Nadu and were tested for their antimycotic activity against *M. furfur*. *Aloe vera* (kumari) *Eucalyptus globules* (blue gum), *Phyllanthus emblica* (Amla) and *Wrightia tinctoria* (pala) leaf extracts and oil showed antifungal property as they progressively inhibited the growth of *M. furfur* on Sabouraud's dextrose agar medium. The volatile oil of *Eucalyptus globulus*, significantly reduced the growth of *M. furfur*³¹.

The effect of piroctoneolamine and climbazole with extracts of *Urtica dioica* (nettle), *Matricaria chamomilla* (chamomile), *Rosmarinus officinalis* (rosemary), *Salvia officinalis* (sage), *Mentha piperata* (pepper mint) and *Triticum* (wheat germ) were assessed. Benefit of these herbal extracts on the skin and hair is clear and are widely used in Iranian shampoos. Both shampoos containing climbazole or piroctoneolamine besides herbal extracts are effective in the reduction of dandruff and relief of other seborrheic dermatitis symptoms but climbazole seems to be more effective than piroctoneolamine in the treatment of dandruff.

The petroleum ether extract of *Tridax procumbens* was found to be effective against dandruff. Formulation (liquid cream shampoo) was developed using active extract of *Tridax procumbens* and was evaluated using various parameters, which proved its efficacy and safety³².

A polyherbal hair oil containing methanolic extracts of *Albizia amara*, *Achyranthes aspera*, *Cassia fistula*, *Cassia auriculata*, *Datura stramonium* and *Azadirachta indica* was formulated. The hair oil was effective against dandruff and was safe³³. *Embllica officinalis* decreased the induction of nitric oxide synthase³⁴.

The antifungal activity of the plant extracts was determined by well diffusion method using *Terminalia bellerica*, *Terminalia chebula*, *Embllica officinalis* and *Lantana camara*³⁵. *Lantana camara* possesses antifungal properties. The essential oil of *Lantana camara*, tested against seven bacteria and eight fungi showed a wide spectrum of antibacterial and antifungal activity³⁶.

Ocimum sanctum has a high content of flavonoids. The principle ingredients of *Ocimum sanctum* are fatty acid i.e., stearic, palmitic, oleic and linoleic acid³⁷. It has significant anti inflammatory activity against prostaglandin E2, leukotriene, and arachidonic acid and acts as a microbial agent³⁸.

Studies have been conducted to check the antifungal properties of Neem (*Azadirachta indica*) leaves extract to treat hair dandruff. The 100% extract of neem leaves produced the widest zone of inhibition which was found

statistically higher than the other concentration. It can also cure skin diseases or epidermal problems ranging from dandruff, acne, and psoriasis and ringworm infection. It is also known to produce pain relieving anti-inflammatory compounds³⁹.

A completely herbal shampoo from *Asparagus racemosus*, *Acacia concina*, *Sapindus mukorossias* main ingredients along with other herbal ingredients was prepared. This shampoo was self-preserving to avoid the risk posed by chemical preservatives. They used *Aloe veragel* and other plant extracts to provide the conditioning effects⁴⁰.

⁴¹Standardized culture medium for growing *Malassezia* species by adding cotton seed oil as lipid source in medium composition. This can be used along with Eugenol and *Micromeria biflora* essential oil. Further work can be done to exploit its antimalssezia activity individually or in combination.

CONCLUSION

Herbal products are cost effective. Proper use of herbs for anti dandruff condition can reduce the side effects and irritation potential of chemicals to a large extent.

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