

Potential of Essential Oil as Anti-Dandruff in Scalp Treatment Preparations

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ABSTRACT

Most scalp problems in the community are dandruff. The most widely known microorganism that contributes to dandruff is *Malassezia* spp. The currently available treatment options for anti-dandruff are mostly synthetic substances. Unfortunately, these synthetic substances can cause various problems, such as side effects and drug resistance, especially the compliance of the patient. Herbal remedies that can be used to reduce the risks are essential oils. There are several essential oils that have been researched on anti-dandruff potential are Tea Tree, Lemongrass, Lavender, Rosemary, Eucalyptus, Coleus amboinicus, etc. The potential of essential oils as anti-dandruff ingredients in scalp remedies will be discussed in this article review. This article review was conducted using a comparative research method from a variety of sources, including online research journals and other sources. The outcome of this review article revealed that the previously mentioned essential oils have positive results in inhibiting the growth of the *Malassezia* sp., in its pure form, a combination of pure essential oils, or when in product form.

Keywords: Essential Oil; Natural Anti-dandruff; Scalp Care

INTRODUCTION

The most scalp problem in society is dandruff. Dandruff is a collection of corneocytes that have detached from the skin's stratum corneum and accumulated with parakeratosis cells. Although experimental evidence is lacking, potential non-microbial causes of dandruff include excessive sun exposure, scalp irritation from over-shampooing, a lot of combing, dust and dirt exposure, and the usage of specific cosmetic products (Park, et al., 2012).

Natural oils produced by the scalp are called sebum, and pathogenic microorganisms use it as food, like *Malassezia* spp. (Siddiqui, 2020), *Propionibacterium*, and *Staphylococcus*

(Xu, et al., 2016). Pathogen density from a healthy scalp typically ranges between 10^3 - 10^5 organism/mm². *Malassezia* is significantly linked to dandruff, albeit not everyone with *Malassezia* on their skin has dandruff (Park, et al., 2012). The predominant flora found in the scalp is *Malassezia* spp., and when the scalp is infected with dandruff, this microbe is replicated 1.5 - 2 times (Chaisripipat, Lourith, & Kanlayavattanukul, 2015). The most widely known microorganism that contributes greatly to dandruff, versicolor, atopic dermatitis, seborrheic dermatitis, pityriasis, and other folliculitis is *Malassezia* spp. (Siddiqui, 2020).

Malassezia is a monophyletic fungal that is found in 7 billion human skin and is related

to the skin health condition. In someone who has immunocompromised, *Malassezia* also can cause systemic infection (Saunderss, Scheynius, & Heitman, 2012).

Chemical substances are effective at removing dandruff; however, inflammation as a side effect is harming sufferers. Plant extracts are being used in the pharmaceutical sector to alleviate this problem and improve effectiveness. (Sahraie-Rad, Izadyari, Rakizadeh, & Sharifi-Rad, 2015). The currently available treatment options for dandruff management are imidazole derivatives, zinc pyrithione, tar derivatives, glycolic acid, salicylic acid, steroid, and sulfur. These are all synthetic materials, ketoconazole (imidazole derivatives) which is a major competitor among the many dandruff treatment options. However, these anti-dandruff ingredients have several weaknesses, like low efficacy or due to regulatory issues. Besides that, these drugs can't prevent recurrence and can't be used for a long time, which is the most common problem (Pooja, Arun, & Maninder, 2013).

Currently, there are many studies on natural ingredients to replace synthetic materials such as anti-dandruff, one of the natural ingredients known to help treat dandruff is essential oil. Essential oil is a hydrophobic liquid that contains high amounts of volatile aromatic chemicals from plants. Natural essential oil can give a potential alternative to the currently used control agent because the composition of essential oil is rich in bioactive chemical compounds (Selvakumar, Naveena, & S, 2012).

Several essential oils which have been studied have anti-dandruff potential are *Eucalyptus globulus*, *Coleus amboinicus* (Selvakumar, Naveena, & S, 2012), Lavender, Rosemary (Lee, et al., 2018), Clove oil, Basil oil, Rosemary oil (Bhatt, Kumar, & Sharma, 2017), and Tea Tree (Umar, et al., 2020).

Dandruff scalp care must be carried out routinely, so it takes a dosage form that can be used routinely comfortably, including Hair Cream, Shampoo, and Hair Tonic (Siddiqui,

2020), (Umar, et al., 2020), & (Chaisripiat, Lourith, & Kanlayavattanakul, 2015). This article review was written to know what essential oils have the most potential as anti-dandruff in scalp care preparations.

METHOD

This review paper employs a comparative evaluation of diverse sources acquired from several research journals on the internet. This literature study was conducted online through journals found *GoogleScholar* and *Scopus*.

Inclusion criteria are journals and articles that discuss the anti-dandruff potential of pure essential oil or essential oil on scalp care formulation published between 2012 – 2022 (ten years back). Exclusion criteria are a journal published before 2012 and a scalp care formulation that contains no essential oil.

The total of journals used in this article is 50 journals, of which 43 are primary journals and 7 are secondary journals. The journals that are used as references are international journals with keywords “*tea tree oil as anti-dandruff*”, “*anti-dandruff agent*”, “*essential oil for scalp*”, “*essential oil for anti-dandruff*”, and “*Malassezia dandruff*”.

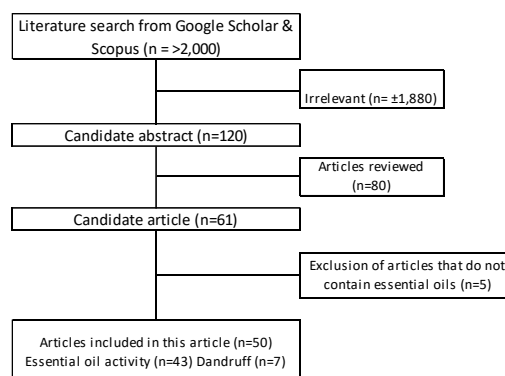


Figure 1. Diagram of Article Writing Method

RESULT AND DISCUSSION

Since fungal colonies are implicated in seborrheic dermatitis and dandruff, antifungal or antifungal agents are widely used for their treatment. However, antifungals used continuously (long-term) can cause problems

such as side effects, drug resistance, and patient non-adherence in its use (Lee, et al., 2018).

For this reason, there have been many developments in anti-fungal ingredients that are safer to use continuously, one of which is essential oil. Some of the data in the research in this article show that there are anti-dandruff effects in some essential oils to prevent the formation of germs that cause scalp dandruff. Both pure essential oils and essential oils that have been formulated in several hair preparation forms, which in this journal review are in the form of shampoo (rinse off cosmetic), hair tonic (leave on cosmetic), and essential oil diluted with a carrier oil, give excellent results. positive for inhibiting fungal growth on the scalp.

Essential oils have been evidence to possess analgesic, anesthetic, anti-acne, antidiarrheal, anti-neuralgic, antiseptic, antispasmodic, Central Nervous System stimulant, anticancer, cosmetic, biopesticide, anti-asthmatic, anti-bacterial, anti-inflammatory, sedative, and its pleasant odor is used in perfume (Saraswathy & Lavanya, 2013). Essential oils are widely preferred to be included in the formulation of a cosmetic preparation because of their characteristics which have a distinctive odor according to the plant, and besides that, they have various antibacterial, antifungal, and other effects.

According to certain studies, combining essential oils can have a synergistic effect on inhibiting the growth of fungus. This can be a start for further research on various formulations of hair dosage forms with anti-dandruff effects, and can even be a choice for patients with seborrheic dermatitis caused by *Malassezia* spp. as a routine scalp care preparation. From the various journals reviewed in this article, the following data were obtained:

Anti-Dandruff Activity of Essential Oil

Tea Tree Oil

According to Umar, et al., from 6 shampoo formulations containing tea tree oil with a gradual concentration (0.5% - 3%) compared to the control (tea tree oil solution)

with the same level of concentration, it was discovered that tea tree essential oil has anti-dandruff properties against the fungus *Candida albicans* was better than the standard. The zone of inhibition of the samples from the 6 shampoo formulas was 20.1 mm – 26.9 mm. This inhibition zone is close to the inhibition zone value of Selsun Blue shampoo of 20.45 mm ± 0.9. However, these results are still below other brands of anti-dandruff shampoo.

Tea tree oil has potential anti-microbial and fungal because it can penetrate through the cell wall and then cytoplasmic membrane of the studied bacterial and fungal strains. It is producing structural damage and consequent loss of cytoplasmic material. Because of their lipophilicity, essential oils can pass through the cytoplasmic membrane. Tea tree oil may also permeate fungal organelle membranes and cause organelle destruction. Finally, the permanent alterations caused by tea tree oil result in cell death (Li, et al., 2016).

Cinnamon Oil, Cajeput Oil, and Kapur Tulsi Oil

From the research of Pooja, et al., it was discovered that the Minimum Inhibitory Concentration (MIC) against *Malassezia furfur* value of Cinnamon Oil was 32 µg/mL, Kapur Tulsi Oil 128 µg/mL, while Cajeput Oil was 64 µg/mL. The three MIC results obtained are still smaller than the standard of Tea Tree Oil which is 16 µg/mL. Different results were obtained when two essential oils were combined, namely the MIC of Cinnamon Oil and Kapur Tulsi Oil of 4 µg/mL.

Lavender Oil

Lavender Oil showed MIC₅₀ results were 0,125% against *Malassezia furfur* and 0,0625% against *Malassezia sympodialis*. The results of the Minimal Fungicidal Concentration (MFC) test from Lavender Oil were 0,5% against *M. furfur* and 0,25% against *M. sympodial*. Meanwhile, the result from the antifungal activity of Lavender Oil was 9 mm against *M. furfur* and 13 mm against *M. sympodialis* (Lee, et al., 2018).

The test results of Lavender Oil were compared with a positive control, Zinc pyrithione, and it was found that the positive control gave a very good effect compared to Lavender Oil with the following results: 0,000625% (MIC₅₀); 0,0025% (MFC); 27 mm (antifungal activity) against *M. furfur*; 0,000039% (MIC₅₀); 0,000078% (MFC); 26 mm (antifungal activity) against *M. sympodialis* (Lee, et al., 2018).

Rosemary Oil

Rosemary oil showed the result MIC₅₀ was 0.25% against *Malassezia furfur* and 0.125% against *Malassezia sympodialis*. The result of the Minimal Fungicidal Concentration (MFC) test from rosemary oil were 0,5% against *M. furfur* and 0,25% against *M. sympodialis*. Meanwhile, the antifungal activity of rosemary oil was 9 mm against *M. furfur* and 9 mm against *M. sympodialis* (Lee, et al., 2018).

The test results from rosemary oil were compared with a positive control, Zinc pyrithione, and it was found that the positive control gave a very good effect compared to Rosemary Oil (Lee, et al., 2018). In another research study, rosemary oil had a MIC value of 0.5% against *M. furfur*. The results showed that rosemary essential oil has considerable inhibitory properties. (K. & Gadekar, 2021).

Furthermore, rosemary oil has antifungal effect against *Candida albicans*, Ksouri et. al. reported that the value of MIC 80% of essential oil rosemary was varying between 23.99 and 31.08 g/mL against ten isolates of *C. albicans* and for the standard of *C. albicans* strain was at the same range (30.27 µg/mL). According to Matsuzaki et al., when the components of rosemary oil (cineol, verbenone, and camphor) are combined with Tween 80, the action of antifungals against *Candida albicans* is enhanced. The values of MIC and MFC of the components (cineol, verbenone, and camphor) were the same at 1.25 µl/ml, 2.5 µl/ml, and 5.0 µl/ml respectively (Matsuzaki, Tsujisawa, Nishihara, Nakamura, & Kakinoki, 2013).

Based on this research, it can be inferred that rosemary oil's antifungal action against *Malassezia sp.* is more potent than rosemary oil's antifungal activity against *Candida albicans*.

***Coleus amboinicus* Oil and *Eucalyptus globulus* Oil**

Eucalyptus globulus is one of the world's most utilized medicinal plants. Ramel brought them to Algeria in 1854 after they were introduced to Australia. Today, there are over 900 distinct *Eucalyptus* species worldwide, of which roughly 300 contain volatile oils and 20 are employed as traditional medicinal cures (Sharifi-Rad, et al., 2017). The primary components of *E. globulus* essential oil were found to be p-cymene (20.24%), spathulenol (14.10%), and eucalyptol (11.30%). Phellandrene (5.10%), cryptone (5.02%), -thujene (3.40%), cuminal (2.64%), elixene (3.00), and phellandral (2.54%) were also found in the essential oil (Benabdesslem, Hachem, & Mébarki, 2020).

From research conducted by Selvakumar, et al., the data obtained that the anti-dandruff effect of essential oils of *Coleus amboinicus* and *Eucalyptus globulus* showed zone of inhibition respectively 31 mm and 37 mm. Pure *Coleus amboinicus* also showed a MIC value of 0.9% (K. & Gadekar, 2021). While the essential oil is diluted using coconut oil with a concentration of 75%, 50%, and 25% respectively was 27 mm, 23 mm, and 16 mm for *Coleus amboinicus* essential oil, then 31 mm, 24 mm, and 20 mm for *Eucalyptus globulus* essential oil. The two oils were compared with the positive control, Ketoconazole shampoo, and the result was the pure essential oil showed efficient and better anti-dandruff activity than the control positive.

Lemongrass Oil (Cymbopogon flexuosus)

Chaisripipat, et al., stated that a hair tonic containing Lemongrass Oil in his research had a smaller therapeutic effect as an anti-dandruff than Tea Tree Oil Shampoo, which had the same 5% content. Within two weeks of usage,

a 5% Tea Tree Oil Shampoo concentration reduced dandruff by 78,57%. However, despite having the lowest concentration of 5%, Lemongrass Oil Hair Tonic gave significant results in suppressing the occurrence of scalp flakes, which means suppressing the occurrence of dandruff. Meanwhile, pure lemongrass oil (*C. flexuosus*) was found to exhibit antifungal activity against *Malassezia furfur* in a broth dilution test, with a MIC value of 60 g/ml. (Chandra & Ah, 2014).

Peppermint Oil (*Mentha arvensis* Oil and *Mentha piperita* Oil)

Chandra & Ah reported in their study that *Mentha arvensis* oil has antifungal activity against *M. furfur* with MIC value 50 µg/ml by broth dilution assay. The zone of inhibition of *Mentha arvensis* against *M.furfur* is 22.44± 1.26 mm, which means that *Mentha arvensis* has moderate antifungal activity (Pandey, Upadhyay, & Singh, 2019).

In other species, peppermint oil as *Mentha piperita* oil reported by Saharkhiz, et. al. exhibits antifungal activity against *Candida albicans*, with MIC values ranging from 1 to 2 L/mL and MFC values ranging from 2 to 4 L/mL. In addition, *Mentha piperita* oil can inhibit the biofilm of *Candida albicans* at a concentration of up to 2 µL/mL (Saharkhiz, et al., 2012). According to Reddy et al., the MIC of *Mentha piperita* oil against *Candida albicans* was 1.50 ± 0.16 µg/mL. Both experiments came to the same conclusion: *Mentha piperita* essential oil has high antifungal activity against *Candida albicans*.

Tagetes minuta Oil

Essential oil of *T. minuta* exhibited antifungal activity with an inhibition zone diameter of 31.07 ± 2.01 mm against *M. furfur*, while the MIC value is < 5 µl/ml (Pandey, Upadhyay, & Singh, 2019). According to Garcia et al., *T. minuta* essential oil was resistant to the fungus, which might be possibly due to the

presence of four monoterpene constituents: dihydrotagetone, limonene, tagetone, and β-Ocimene. Dihydrotagetone has been identified as one of the most prevalent elements of *T. minuta* oils from plants collected in a variety of places, including Kenya (Garcia, et al., 2012).

***Eucalyptus citriodora* Oil**

E. citriodora essential oil exhibited significant antifungal efficacy against *M. furfur* showing a 24.75 ± 0.05 mm zone of inhibition, while the MIC value is < 15 µl/ml (Pandey, Upadhyay, & Singh, 2019).

Basil Oil

Basil oil also shown significant antifungal action, and the MIC of basil oil against *M. Furfur* had a concentration of 0.7%. (K. & Gadekar, 2021).

***Coleus zeylanicus* Oil**

Coleus zeylanicus is considered an aromatic therapeutic application plant that belongs to the Lamiaceae family. This plant contains several medicinally important components such as alkaloids, volatile compounds, sesquiterpene, and flavonoids. Recent pharmacological investigation of the leaves and root extract of the genus *Coleus* revealed its immunomodulator, antimicrobial, anticancer, anti-inflammatory, antioxidant, and antiallergic properties (Ramalakshmi, Subramanian, & Saravanan, 2014).

The anti-fungal effects of *Coleus zeylanicus* essential oil were evaluated against *Candida albicans* and *Malassezia furfur*. EO of *Coleus zeylanicus* showed a higher antifungal effect against *Malassezia furfur* than *Candida albicans* with remarkable inhibition of 32.00±0.50 mm and 15.00±1.25 mm respectively. The effects were higher than those obtained with the positive control Clotrimazole (M & S, 2021).

Table 1. Anti-dandruff activities of some essential oils

Name of Essential Oil	MIC	MIC ₅₀	MFC	Zone of Inhibition
Tea Tree oil in shampoo (0.5% - 3%) against <i>Candida albicans</i>	-	-	-	20.1 mm – 26.9 mm
Cinnamon Oil	32 µg/mL	-	-	-
Kapur Tulsi Oil	128 µg/mL	-	-	-
Cajeput Oil	64 µg/mL	-	-	-
Tea Tree Oil (pure)	16 µg/mL	-	-	-
Cinnamon Oil and Kapur Tulsi Oil against <i>M. furfur</i>	4 µg/mL	-	-	-
Lavender Oil against <i>M. furfur</i>	-	0.125%	0.5%	9 mm
Lavender Oil against <i>M. sympodialis</i>	-	0.0625%	0.25%	13 mm
Rosemary Oil against <i>M. furfur</i>	0.5%	0.25%	0.5%	9 mm
Rosemary Oil against <i>M. sympodialis</i>	-	0.125%	0.25%	9 mm
Rosemary Oil against <i>C. albicans</i>	23.99 - 31.08 µg/mL	-	-	-
Pure <i>Coleus amboinicus</i> Oil	0.9%	-	-	31 mm
Pure <i>Eucalyptus globulus</i> Oil	-	-	-	37 mm
<i>Coleus amboinicus</i> Oil diluted in Coconut Oil 75%	-	-	-	27 mm
<i>Coleus amboinicus</i> Oil diluted in Coconut Oil 50%	-	-	-	23 mm
<i>Coleus amboinicus</i> Oil diluted in Coconut Oil 25%	-	-	-	16 mm
<i>Eucalyptus globulus</i> Oil diluted in Coconut Oil 75%	-	-	-	31 mm
<i>Eucalyptus globulus</i> Oil diluted in Coconut Oil 50%	-	-	-	24 mm
<i>Eucalyptus globulus</i> Oil diluted in Coconut Oil 25%	-	-	-	20 mm
<i>Cymbopogon flexuosus</i> Oil against <i>M. furfur</i>	60 µg/ml	-	-	-
<i>Mentha arvensis</i> Oil against <i>M. furfur</i>	50 µg/ml	-	-	22.44± 1.26 mm
<i>Mentha piperita</i> Oil against <i>C. albicans</i>	1 – 2 µL/mL	-	2 – 4 µL/mL	-
<i>Tagetes minuta</i> Oil against <i>M. furfur</i>	< 5 µl/ml	-	-	31.07 ± 2.01 mm
<i>Eucalyptus citriodora</i> Oil against <i>M. furfur</i>	< 15 µl/ml	-	-	24.75 ± 0.05 mm
Basil Oil against <i>M. furfur</i>	0.7%	-	-	-
<i>Coleus zeylanicus</i> Oil against <i>M. furfur</i>	-	-	-	32.00±0.50 mm
<i>Coleus zeylanicus</i> Oil against <i>C. albicans</i>	-	-	-	15.00±1.25 mm

Some Herbal Anti-Dandruff Preparations

Anti-dandruff treatment can be done using shampoo, hair conditioner, or hair tonic preparations. Shampoo is needed for removing surface oil and grime from the hair shaft and scalp. Shampoo's principal function is to

perform cleaning or detergent activity (Khaloud & Shah, 2014).

Chandran et. al. conducted a study about anti-dandruff shampoo formulations containing natural ingredients, such as *Sida cordifolia*, *Ocimum sanctum*, and *Citrus limon* extracts as active ingredients for fighting

dandruff. The results showed that the anti-dandruff shampoo formulation has qualities comparable to a well-known marketed brand of synthetic anti-dandruff shampoo. Fermented *Ocimum sanctum* product also conducted to be formulated in anti-dandruff shampoo by Punyoyai et. al. who found that fermented *Ocimum sanctum* can inhibit *M. furfur* effectively and the product was suggested for use as an anti-dandruff shampoo.

Patel & Talathi, have researched the formulation of the herbal shampoo and conducted its physiochemical analysis. Cleaning action, detergency ability, foamability, and foam stability test are the parameters of the physiochemical examination of the herbal shampoo to compare the activity of the formulation. Shampoo composition must have both cleansing and detergency properties. Grease encapsulating, or cleaning, action is demonstrated by hydrophobic compounds such as phenolics and flavonoids. The capacity to deter relies on the amount of surfactant present in the sample extracts. Saponins have been shown to be surfactant molecules that lower surface tension and improve cleaning performance (Patel & Talathi, 2016).

Powder shampoo is also a new way to clean our scalp and hair, and herbal with anti-dandruff activity powder shampoo formulation is conducted by Madhusudhan, et al. The research variety of several natural shampoo compositions is between 5% and 15% w/w Peppermint, 1% to 3% w/w Lemon, and 2.5% to 24.5% w/w Hibiscus concentrations. Powdered shampoo compositions including 15% Peppermint, 1% to 3% Lemon, and 12.5% to 14.5% Hibiscus outperform commercial versions. When compared to marketed formulations, the optimized herbal powdered shampoos have great cleaning, detergency, conditioning, and foaming actions, are suited for normal hair, and have acceptable pH and organoleptic stability properties.

Cosmetics in this era have been developed in various forms. One cosmetic preparation that steals attention nowadays is serum preparation. The serum is a product that can rapidly in

absorption and penetrate the skin to the deeper layer. The serum contains a very high concentration of active substances (Aggnihotri, 2021). It can be a new development of scalp treatment products in a very effective way.

Anti-dandruff treatment must be synergistic with scalp care by paying attention to the scalp barrier. According to Kim et al., improving the scalp barrier can facilitate the continued use of scalp care products. Many dandruff patients have suffered from a sensitive scalp. In this condition, other than the choice of an anti-dandruff agent is important, dealing with mild formula is more important.

Anti-fungal Activity of Essential Oil

Essential oils are found to be an anti-dandruff agent in the scalp's treatment against *Malassezia* sp. Other than that, several essential oils haven't been conducted as an anti-dandruff agent, but have a great potency to be anti-dandruff as great as an anti-fungal agent against *Candida albicans*. The result of these studies are quite interesting, that essential oil has antifungal activity with a range of potency that is weak to strong against positive control. The following are some of the data obtained:

Salvia officinalis L. Oil

Two investigations by Badiee, et. al. and Sookto, et. al. established the antifungal efficacy of *Salvia officinalis* oil against *Candida albicans*. According to Badiee, et. al., the MIC of *Salvia officinalis* oil against *Candida albicans* was 15.6 µg/ml in standard species and 31.3 µg/ml in *C. albicans* isolated from patients. However, according to Sookto, et. al., the MIC of *Salvia officinalis* oil against *C. albicans* was 2.78 g/L.

Anethum graveolens seeds Oil

Dill (*Anethum graveolens*) is widely used as a food flavor and the seed is known in traditional Chinese medicine, such as antimicrobial activity. Chen, et. al. researched dill seed essential oil's mechanism against *Candida albicans*. The results of the study were the value of MIC and MFC of *Anethum*

graveolens seeds oil. The MIC of dill seed oil was 0.625 µg/ml while the MFC was 1.25 µg/ml (Chen, et al., 2013).

The results of dill seed essential oil were evaluated with the positive control Fluconazole. Positive control gave results of MIC and MFC were 3.12 µg/ml and 6.25 µg/ml respectively. The effects of dill seed essential oil were quite effective for *Candida albicans* compared to the positive control (Chen, et al., 2013).

Geranium Oil

Geranium oil is a common essential oil that is used in aromatherapy and has traditionally been used for mosquito repellent and used for vagina candidiasis, too. Geranium has a marker compound called Geraniol. Geraniol is a major component of geranium oil and it can be about 20% of it (Leite, Bezerra, Sousa, & Lima, 2015).

Leite et. al. proved the antifungal activity of geraniol against *Candida albicans* with MIC of geraniol was stable in 16 µg/ml for ten strains of *Candida albicans* isolates including standard strain. Only in one isolate, the MIC of geraniol was 32 µg/ml. This study was compared to positive control Amphotericin-B and has a MIC value was 2 µg/ml for ten strains of *Candida albicans* isolates. It means that geraniol has good antifungal activity against *Candida albicans*.

Laurus nobilis Oil (Bay Leaves Oil)

Bay Leaves are commonly used in culinary as a spice in the Mediterranean region. Peixoto et. al. conducted anti-fungal activity of *Laurus nobilis* oil compared with Nystatin using the Minimum Inhibitory Concentration Test against *Candida* spp. The results are *Laurus nobilis* oil has MIC value against *Candida albicans* (2 strains) at 250 µg/mL while Nystatin is at 0.4 µg/mL, against *Candida krusei* (2 strains) at 500 µg/mL while Nystatin is at 0.8 and 1.6 µg/mL, against *Candida tropicalis* strain CBS 94 at 500 µg/mL, while Nystatin is at 0.4 µg/mL, against *Candida tropicalis* strain ATCC 750 at 250

µg/mL while Nystatin is at 0.4 µg/mL, and against *Candida glabrata* at 500 µg/mL while Nystatin is at 0.4 µg/mL.

Satureja hortensis Oil (Summer Savory)

Satureja is an aromatic plant genus in the Lamiaceae family. Many Satureja species are said to offer fragrant and therapeutic characteristics. These species' aerial parts have different flavors and may be used in stuffing and sausages. The leaves, blossoms, and stems are used to make herbal tea and are used in traditional medicine to alleviate cramps, muscular aches, nausea, and infectious infections (Valizadeh, Fakhri, Mahmoudi, Katirae, & Gajarbeygi, 2014).

Valizadeh et. al. conducted anti-fungal activity of Satureja essential oil with a Minimum Inhibitory Concentration test and Minimum Fungicidal Concentration test against *Candida* spp. (*Candida albicans*, *Candida krusei*, and *Candida parapsilosis*). The MIC values of Satureja essential oil against *Candida albicans*, *Candida krusei*, and *Candida parapsilosis* are 0.048%, 0.012%, and 0.024% respectively. While the MFC's values of Satureja essential oil against *Candida albicans*, *Candida krusei*, and *Candida parapsilosis* are the same as the MIC's value.

Blend Oil of Cinnamomum zeylanicum, Syzygium aromaticum, Origanum vulgare, Daucus carota, and Camelina sativa oil.

Brochot et. al. conducted research on anti-fungal activity from blend oils that consist of *Cinnamomum zeylanicum*, *Syzygium aromaticum*, *Origanum vulgare*, *Daucus carota*, and *Camelina sativa* oil against *Candida albicans*. It gave the results of MIC and MFC values against *Candida albicans* at 0.02% v/v and 0.02% v/v respectively.

Coriandrum sativum Essential Oil

Anti-fungal activity of *Coriandrum sativum* essential oil was evaluated against *Candida* spp. in the MIC test, MFC test, and growth inhibition zone. The result showed that the mean value of MIC *Coriandrum sativum* oil was at 434 µg/mL, the mean value of MFC

was at 872 µg/mL, and the mean of the growth inhibition zone was at 9.25 ± 0.5 mm. While the growth inhibition zone of amphotericin B was 10.25 ± 1.26 mm (Soares, et al., 2012).

Juniperus communis Essential Oil

Anti-fungal activity of *Juniperus communis* essential oil was evaluated against *Candida albicans* in the MIC test by Cabral et. al. The MIC result was compared with standard Fluconazole. The value of MIC *Juniperus communis* essential oil was 2.5 µL/mL and the

MIC value of standard Fluconazole was 1 µg/mL.

Lavandula multifidi Essential Oil

Zuzarte et. al. have researched anti-fungal activity from *Lavandula multifidi* essential oil against *C. albicans*. The anti-fungal activity was proved by the MIC value of the *Lavandula multifidi* essential oil against *C. albicans* at 0.32 µL/mL. This result was compared with standard Fluconazole, and the MIC value of Fluconazole was 1 µg/mL.

Table 2. Anti-fungal activities against *Candida albicans* of several essential oils.

Name of Essential Oil	MIC	MFC	Zone of Inhibition
<i>Salvia officinalis</i> Oil (standard species)	15.6 µg/ml	-	-
<i>Salvia officinalis</i> Oil (isolated species from the patient)	31.3 µg/ml	-	-
<i>Salvia officinalis</i> Oil	2.78 g/L (2780 µg/ml)	-	-
<i>Anethum graveolens</i> seeds Oil	0.625 µg/ml	1.25 µg/ml	-
Geranium Oil (as Geraniol)	16 - 32 µg/ml	-	-
<i>Laurus nobilis</i> Oil	250 µg/ml	-	-
<i>Satureja hortensis</i> Oil	0.048% v/v	0.048% v/v	-
Blend Oil consist of: <i>Cinnamomum zeylanicum</i> , <i>Syzygium aromaticum</i> , <i>Origanum vulgare</i> , <i>Daucus carota</i> , and <i>Camelina sativa</i> oil.	0.02% v/v	0.02% v/v	-
<i>Coriandrum sativum</i> Oil	434 µg/mL	872 µg/mL	9.25 ± 0.5 mm
<i>Juniper communis</i> Oil	2.5 µL/mL	-	-
<i>Lavandula multifidi</i> Essential Oil	0.32 µL/mL	-	-

CONCLUSION

Based on the review source data, it can be concluded that many essential oils have anti-dandruff and antifungal potential. The essential oil that has the most effective and easy to find in suppressing dandruff on the scalp is tea tree oil, but other essential oils can also be an alternative as an anti-dandruff. Including the use of a combination of several essential oils to increase its effectiveness.

Making scalp care preparations containing essential oils can have the same therapeutic effect as pure essential oils. Many herbal anti-dandruff scalp care formulations can be applied in the preparation of cosmetics, such as shampoo, powder shampoo, conditioner, and more. The results of this article review can be continued for further research in

the manufacture of scalp preparations that are effective in suppressing the growth of dandruff.

Suggestions from the author for further research is to make micro or nano-emulsion forms to reduce the possibility of essential oils in a preparation quickly volatilizing and oxidizing so that the preparation is more stable. The author hopes that this review article can be useful for future research as a consideration for the development of cosmetics, especially dandruff scalp treatments with herbal active ingredients.

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