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Mini-Review

Melaleuca essential oil in the control of the seborrheic dermatitis: a mini-review

Greice Dantas dos Santos [1], Isabel Cristina Vieira da Silva [2,*]

[1] Centro Universitário Serra dos Órgãos (UNIFESO), Teresópolis, Rio de Janeiro, RJ, Brazil.

***** Correspondence: gredantas@hotmail.com.

Abstract

Introduction: In clinical trichology practice, *Melaleuca alternifolia* is used in topical formulations to control signs and symptoms of seborrheic dermatitis. This study aims to carry out a narrative review of the literature to support this therapeutic practice. Seborrheic dermatitis or seborrheic eczema is a chronic, non-contagious condition and one of the most common scalp pathologies presenting erythematous-scaly plaques that can also occur in some areas of the face such as eyebrows and corners of the nose. Melaleuca alternifolia is an Australian tree from which melaleuca essential oil, also called "tea tree oil", is extracted. Essential oils can be used as important active ingredients in products intended for the treatment of human beings.

Material and Methods: Regarding the mentioned species, it was necessary to use databases such as Google Scholar, SciELO, and Scopus. Various combinations of keywords were used: Seborrheic Dermatitis; Seborrheic Eczema; Melaleuca alternifolia; Tea Tree Oil.

Results and Discussions: It can be considered a safe agent that fights bacterial infections, having good skin permeation properties, and can therefore be used in cosmetic formulations to assist in treatments. The symptoms caused by this pathology can be minimized using the phytochemicals found in this essential oil and the main topical therapeutic applications, it can be a powerful ally in the fight against microorganisms, such as fungi and bacteria resistant to conventional medicines.

Keywords: Seborrheic dermatitis; Seborrheic eczema; *Melaleuca alternifolia*; Tea Tree Oil.

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1. Introduction

Seborrheic Dermatitis is a chronic dermatosis that ranges from mild to moderate erythema to papular, exudative, and/or scaly lesions, with periods of exacerbation related to stress or lack of sleep. The affected areas and their corresponding prevalence are as follows: face (87.7%), scalp (70.3%), chest (26.8%), lower limbs (2.3%), upper limbs (1.3%), and other locations (5.4%). The lesions can have bacterial infection as their main complication, leading to worsening of erythema and exudate (fluid with a high content of serum proteins and leukocytes that exits blood vessels and deposits in tissue surfaces) and local discomfort near the affected areas [1].

According to Steiner (1998), Seborrheic Eczema is a chronic, non-contagious, and recurrent disorder in which inflammation occurs in areas of the skin with a higher number of sebaceous glands. It is characterized by round, oval, erythematous-scaly plaques located in oilier areas such as the scalp, face, neck, and back. Itching may vary in intensity. However, other areas such as the groin, armpits, breast region, and buttocks can also be affected. The most

common site of involvement is the scalp and can be observed in various degrees, from mild to acute [2].

It also presents in infantile form, typically appearing during the first few months of life, specifically between the second week and the sixth month, with an incidence peak between the third and eighth weeks. The eruption usually begins with coarse yellow scales on the scalp, known as cradle cap. Seborrheic dermatitis in children often occurs because male androgen hormones, which are elevated during pregnancy, are passed on to the newborn, making their sebaceous glands more active [3].

Borda (2015) characterizes seborrheic dermatitis and dandruff as part of a continuous spectrum of the same disease affecting seborrheic areas of the body. Dandruff is limited to the scalp and involves itching and skin flaking without visible inflammation. Seborrheic dermatitis can affect the scalp as well as other seborrheic areas and also involves itching, skin flaking, inflammation, and itching. Various intrinsic and environmental factors such as sebaceous secretions, fungal colonization of the skin surface, individual susceptibility, and interactions between these factors contribute to the pathogenesis (origin of the disease) of seborrheic dermatitis and dandruff [4].

The etiopathogenesis is multifactorial, resulting from the interaction between the physiopathology, cutaneous microflora, and the individual's immune system, with particular emphasis on the innate immune response of the epidermis. It is believed that the fungal genus of the skin, Malassezia, is responsible for the development of seborrheic dermatitis. As this microorganism requires lipids for growth, it primarily colonizes sebum-rich areas such as the face and trunk. Sebum is hydrolyzed into glycerin and fatty acids by the lipase secreted in Malassezia [7].

The etiology is not fully elucidated, but there is consensus that three factors are important in the development of the disease: sebaceous gland secretion, alterations in the skin's microbiota (Malassezia spp.), and the individual's immune response [7]. Patients with Seborrheic Dermatitis do not necessarily have hypersecretory sebaceous glands but may have quantitative differences in the skin's sebum composition, which would favor colonization by lipid-dependent microorganisms [8]. The genus Malassezia was described by Baillon in 1889 and is a lipophilic fungus constituting the normal flora of human skin. Because it is a chronic inflammatory disease, it is thought to be in response to the likely presence of a fungus (Malassezia spp.) on the skin and its metabolism through the utilization of skin lipids [1].

The first rule is to clarify to patients the chronic recurrent nature of the disease. The treatment aims to control inflammation, microorganism proliferation, and oiliness. Various classes of medications are used to control seborrheic dermatitis: corticosteroids, imidazole-derived antifungals, topical calcineurin inhibitors, keratolytics based on salicylic acid (2 to 6%) with or without sulfur (2 to 5%), which promote the removal of adherent scales, anti-inflammatories with corticosteroids (clobetasol propionate), and antifungals such as 2% ketoconazole, 1% ciclopirox, selenium sulfide, and zinc pyrithione, which have similar effects when used as scalp solutions [1].

Other pharmacological treatments, such as various natural therapies with therapeutic modalities like soaps and shampoos based on Melaleuca oil, have proven effective against seborrheic dermatitis due to their antifungal potential. Essential oils have been used for over 6,000 years. Tea Tree essential oil, obtained from the Tea Tree, common in the New South Wales region of Australia, is one of them [9]. According to Silva (2019), they are secondary metabolites extracted from various parts of plants. They have a complex chemical composition and provide adaptive advantages to plants in their environment. Essential oils can be used for important treatments in humans, and their medicinal properties are mainly attributed to terpinen-4-ol, a monoterpene that is the main component of the oil, being the mediator of its medicinal properties [10].

In general, essential oils perform biological functions in nature by acting against microorganisms, insects, herbivores, participating in mutual interactions, attracting pollinators and seed dispersers, and some even act as photoprotectors. They can concentrate in specific plant organs such as leaves, branches, roots, rhizomes, seeds, fruits, flowers, and stems. However, the concentration is higher in greener structures due to photosynthesis metabolic pathways. Nevertheless, the concentration rate can vary depending on the time of year, plant age, climate, and soil [11].

Essential oils can also be referred to as volatile oils, ethereal oils, or essences. These compounds have a chemical characteristic of being soluble in nonpolar organic solvents like ether; however, in a solution containing water, solubility may be limited. They are substances that can be dissolved in vegetable oils, alcohol, and other organic solvents because they are

complex natural chemical compounds consisting of Carbon-Hydrogen-Oxygen molecular bonds [13]. *Melaleuca alternifolia* is the most important and representative species of the Melaleuca genus (*Myrtaceae*), which contains approximately 230 species. It is a native tree of Australia found in swampy regions and can grow up to 6 meters in height. Its essential oil is extremely volatile, known as "Tea Tree oil." This oil is a yellow liquid with a characteristic odor extracted by steam distillation from the leaves and terminal branches of this plant. It is composed of terpene hydrocarbons, mainly monoterpenes, sesquiterpenes, and their associated alcohols [10]. The tree grows in swamps, where it has developed a fungicidal essential oil to defend against fungi and parasites in that environment [13].

Terpenes are volatile aromatic hydrocarbons and can be considered polymers of isoprene. The biological activity of Melaleuca essential oil is mainly attributed to terpinen-4-ol, which is the main component of the oil responsible for its antifungal and antibacterial properties [15]. According to Amaral (2015), the main molecular group present in Melaleuca essential oil is terpenes, and the main substance is 4-terpineol, accounting for 38% of the molecule in the oil. It plays a key role in healing and fungicidal activity, controlling the local immune system. Terpinen-4-ol acts on membrane disruption, interfering with the integrity and physiology of the microorganism's cell. It exhibits a broad spectrum of antimicrobial activity and anti-inflammatory properties [13].

Indeed, the mechanisms of action of essential oils include cell wall degradation, damage to the cytoplasmic membrane, cytoplasm coagulation, damage to membrane proteins, increased permeability leading to cell content leakage, reduction in proton motive force, reduction in intracellular ATP (adenosine triphosphate) pool through decreased ATP synthesis, and increased hydrolysis, reducing membrane potential through increased permeability [16]. Tea Tree Oil is used in shampoos, conditioners, creams, lotions, soaps, topical oils, gels, and surgical asepsis products. It has germicidal properties, capable of eliminating various microorganisms, some viruses (such as herpes), bacteria, and fungi without causing irritation or inhibiting the normal growth and rejuvenation of cells [17].

Essential oils can be dissolved in vegetable oils or added to topical pharmaceutical forms. They can be used for burns, acne, viral and fungal infections (such as herpes, boils, athlete's foot), gynecological infections (such as candidiasis), insect bites, gingivitis, canker sores, psoriasis, impetigo, skin irritation, various rashes, and are indicated for the treatment of dandruff and acne [18].

This mini-review addresses the use of Melaleuca essential oil, also known as Tea Tree Oil, in controlling the symptoms of seborrheic dermatitis. The research highlights the oil's antibacterial and antifungal properties, focusing on its application in topical products for the treatment of the skin condition. The study also reviews the chemical composition of Melaleuca alternifolia and discusses the mechanisms of action of the essential oil, emphasizing its therapeutic potential in reducing symptoms associated with seborrheic dermatitis.

2. Materials and Methods

For the bibliographic survey of scientific studies on the pathology and the mentioned species, the use of databases such as Google Scholar, SciELO, and Scopus was necessary. Various combinations of keywords were used: Seborrheic Dermatitis; Seborrheic Eczema; Melaleuca alternifolia; Tea Tree Oil. A total of 24 articles were selected. The inclusion criteria were: works written in Portuguese and English, from the period of 1998 to 2021, with a specific theme according to the keywords, indexed and available articles. Among the exclusion criteria were: non-scientific materials and those not in line with the proposed theme. This research was conducted between May and October 2022.

3. Discussion

Seborrheic Dermatitis is a chronic, non-contagious, and recurrent dermatosis that ranges from mild to moderate erythema to papular, exudative, and/or scaly lesions. The affected areas are typically located in oilier regions such as the scalp, face, neck, and back. Other areas like the groin, armpits, breast region, and buttocks can also be affected. These lesions are round, yellowish, and are influenced by intrinsic and environmental factors, including sebaceous secretions, fungal colonization of the skin surface, individual susceptibility, and interactions between these factors, all contributing to the pathogenesis (origin of the disease) of seborrheic dermatitis and dandruff [1-6].

The Research Committee on Skin Diseases at a university hospital in Qazvin, Iran, conducted a double-blind, randomized study from September 2013 to December 2013 involving fifty-four patients aged 18 to 45 with mild to moderate facial seborrheic dermatitis. They were randomly divided into two groups: one group treated with 5% Melaleuca alternifolia essential oil gel and another group with a placebo in the form of inert gel three times a day for 4 weeks. Patient follow-ups were conducted in both groups after 2 and 4 weeks, evaluating erythema, scaling, itching, and greasy crusts. As a result of this research, forty-two patients completed the treatment course. There were significant differences in the Melaleuca gel group, and no allergic side effects were reported. This study demonstrated that 5% Melaleuca alternifolia gel is effective in treating mild to moderate facial seborrhea [19].

Another study, conducted at the Department of Dermatology at Royal Prince Alfred Hospital, Camperdown, and the Australian Tea Tree Oil Research Institute, involved a randomized, double-blind, parallel-group trial of one hundred twenty-six male and female patients aged 14 and older. They were randomly assigned to receive 5% Melaleuca oil shampoo or a placebo, which was used daily for 4 weeks. Seborrheic dermatitis was scored on a scale of moderate to severe severity, assessed by quadrant area and patient self-assessment scores for scaling, itching, and oiliness. Participants were instructed not to wash their hair on the day of the examination to prevent the odor of Melaleuca oil from influencing the investigator's ability to identify the patient group. The 5% Melaleuca oil shampoo group showed a 41% improvement compared to 11% in the placebo group. Statistically significant improvements were also observed in the itching and oiliness components of patient self-assessments. The scaling component of patient self-assessment improved but was not statistically significant. No adverse effects were reported [19].

A bibliographic survey conducted in 2021 on the mechanism of action and efficacy of Melaleuca essential oil in the treatment of acne vulgaris in Brazil at Salvador University in Bahia reviewed 22 articles. It was possible to evaluate that acne vulgaris affects 80% of the population between 11 and 30 years of age. The main causative agents of acne vulgaris are *Staphylococcus aureus*, *Propionibacterium acnes*, and *Malassezia furfur spp*. [20]. The article reports results obtained through clinical studies that demonstrate the efficacy of Melaleuca oil. The results showed a reduction in lesions caused by acne in all studies. Through this study, it is understood that the mechanism of action of Melaleuca oil is by inhibiting the respiration of microorganisms, causing damage to the membrane and loss of integrity.

The antimicrobial action of Melaleuca alternifolia essential oil, due to the predominance of the compound terpinen-4-ol, which makes up 40% of the oil, corresponds to the inhibitory effect on the growth and development of microorganisms, one of the responsible factors for the onset of acne. Terpinen-4-ol is capable of reducing skin oiliness and also possesses antifungal, antibacterial, and anti-inflammatory properties, thus reducing oiliness and bacterial growth due to its inhibitory effect on bacterial growth.

The essential oil acts on the inhibition of microbial respiration and anti-inflammatory action, reducing diapedesis that stimulates defense cells during the inflammatory process. Furthermore, the essential oil is presented in the pharmaceutical form of a gel, which is more suitable for oily and acne-prone skin [24]. *Melaleuca alternifolia* oil meets expectations as an antimicrobial agent against these main causative agents, due to the predominance of the compound terpinen-4-ol present in 30-40% of the composition. Its mechanism of action occurs through the breakdown and loss of integrity of the cell membrane, thereby reducing cytokine production and confirming its efficacy in the treatment of acne vulgaris. It has low negative occurrences such as scaling and itching, due to reduced oiliness and antimicrobial activity, making them tolerable [24].

3. Conclussion

Seborrheic dermatitis, a condition of a continuous spectrum, affects sebaceous areas of the body. Intrinsic and environmental factors, such as yeast, epidermal conditions, sebaceous secretion, and immune response, contribute to its pathogenesis. Effective management involves antifungal and anti-inflammatory treatment to eliminate symptoms and improve scalp health. Tea Tree Oil, proven effective in skin infections, is therapeutically explored on the scalp. Although there is no direct prevention, control of symptoms occurs with drug therapies, special hygiene, and phyto-cosmetics, including tea tree essential oil. Studies highlight the phytotherapeutic efficacy of tea tree oil, demonstrating germicidal, bacteriostatic, fungistatic, and anti-inflammatory action, indicating its potential in the treatment of seborrheic dermatitis.

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