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A REVIEW OF HERBAL BIOACTIVE COMPOUNDS IN THE MANAGEMENT OF SEBORRHEIC DERMATITIS

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ABSTRACT

Seborrheic dermatitis (SD) is a chronic, relapsing inflammatory skin disorder that primarily affects areas rich in sebaceous glands, such as the scalp, face, and chest. It is characterized by erythema, scaling, and may contribute to alopecia. Conventional treatments, including antifungal agents, anti-inflammatory drugs, keratolytics, and coal tar preparations, are effective but may present limitations such as side effects and recurrence. This review aims to evaluate the therapeutic potential of plant-derived bioactive compounds in the management of seborrheic dermatitis. Various medicinal plants, including *Solanum chrysotrichum*, *Cirsium eriophorum*, *Serratula coronata*, *Quassia amara*, *Scutellaria baicalensis*, *Urtica dioica*, *Salvia officinalis*, and *Glycyrrhiza glabra*, have demonstrated significant antifungal, anti-inflammatory, and sebum-regulating properties. These bioactive compounds target key pathogenic factors such as *Malassezia* species, excessive sebum production, and inflammatory responses. Evidence from in vitro studies and limited clinical trials suggests that herbal formulations may offer effective and safer alternatives or adjuncts to conventional therapies. However, further well-designed clinical studies are required to establish their efficacy, safety, and mechanisms of action for integration into modern dermatological practice.

KEYWORDS: Seborrheic dermatitis, plant derived bioactive compounds, antifungal activity, anti-inflammatory activity, sebum regulation, Malassezia, dermatological disorder.

1. INTRODUCTION

Dermatitis is an inflammatory condition of the skin characterized by erythema, irritation, and discomfort. Among its various forms, seborrheic dermatitis (SD) is a common, chronic, and relapsing inflammatory disorder that primarily affects areas rich in sebaceous glands, including the scalp, face, and chest. **(Fig 1)** It has a global prevalence of approximately 3–5% and occurs across different age groups, with two distinct clinical presentations: infantile seborrheic dermatitis (ISD) and adolescent/adult seborrheic dermatitis (ASD). Although not life-threatening, SD significantly impacts quality of life due to persistent symptoms such as scaling, itching, erythema, and, in some cases, hair loss. [1] The exact aetiology of seborrheic dermatitis remains unclear; however, its pathogenesis is considered multifactorial. Key contributing factors include increased sebaceous gland activity influenced by androgens, colonization by *Malassezia* species, immune response abnormalities, and environmental triggers. [2] These factors lead to hyperproliferation and abnormal differentiation of keratinocytes in the stratum corneum, resulting in impaired skin barrier function and increased trans epidermal water loss. Consequently, this altered environment promotes microbial growth and inflammation, perpetuating the disease cycle. Conventional management of seborrheic dermatitis involves the use of antifungal agents, anti-inflammatory drugs, keratolytic, and coal tar preparations. While these treatments are effective in controlling symptoms, their long-term use may be associated with side effects, recurrence, and reduced patient compliance. This has prompted increasing interest in alternative therapeutic approaches, particularly those derived from natural sources. [3] Medicinal plants are rich in bioactive compounds such as flavonoids, alkaloids, terpenoids, and saponins, which possess diverse pharmacological activities including antifungal, anti-inflammatory, antioxidant, and sebum-regulating effects. Several herbal extracts have shown promising efficacy in targeting the underlying mechanisms of SD, including inhibition of *Malassezia* growth, reduction of inflammation, and normalization of sebum production. [4] Therefore, this review aims to comprehensively evaluate plant-derived bioactive compounds with potential anti-seborrheic activity and to analyse current evidence regarding their therapeutic effectiveness. The study also seeks to highlight their potential role as safer and more sustainable alternatives or adjuncts to conventional dermatological treatments.



Figure 1: Common Sites of Seborrheic Dermatitis in the Human Body.

2. Pathophysiology

Seborrheic dermatitis is a multifactorial inflammatory skin disorder involving the interaction of sebaceous gland activity, *Malassezia* species, epidermal barrier dysfunction, and host immune response. Increased sebum production creates a lipid-rich environment that supports the proliferation of lipophilic yeasts such as *Malassezia*. These organisms secrete lipases that hydrolyse sebum triglycerides into free fatty acids, particularly oleic acid, which irritate the skin and disrupt the stratum corneum barrier. This barrier impairment leads to increased trans epidermal water loss and facilitates the penetration of microbial metabolites and antigens into deeper layers of the skin. Consequently, keratinocyte proliferation and differentiation become abnormal, resulting in the formation of characteristic scales and dandruff. Simultaneously, the penetration of irritants and microbial products activates antigen-presenting cells and T-lymphocytes, leading to the release of pro-inflammatory cytokines and the development of inflammation. [5] This immune response manifests clinically as erythema, pruritus, and greasy scaling. **(Fig 2)** Although sebum is not the primary cause, it plays a permissive role in disease progression, while immune dysfunction—particularly altered cell-mediated immunity—contributes to disease severity, especially in immunocompromised individuals. [6,7] Additionally, systemic factors such as genetic predisposition, neurological conditions, and environmental influences further modulate the onset and progression of seborrheic dermatitis. Overall, the condition arises from a complex interplay of microbial activity, epidermal dysfunction, and immune dysregulation.

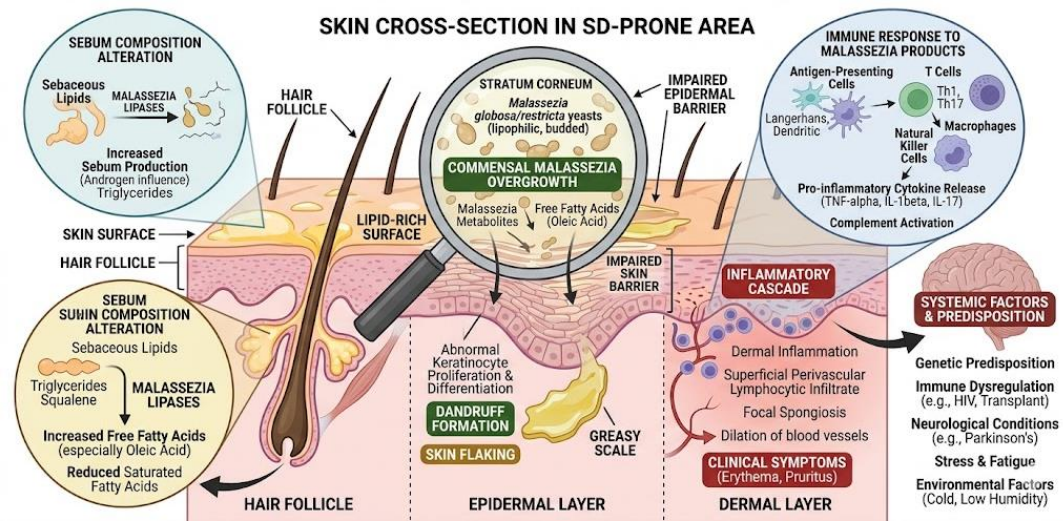


Figure 2: Pathophysiology of Seborrheic Dermatitis.

3. Herbal Plants Used in the Treatment of Seborrheic Dermatitis (Tabel 1)

3.1 Giant Devil's Fig (*Solanum chrysotrichum*)

Giant Devil's Fig (*Solanum chrysotrichum*), **(Fig 3)** commonly known as "Malaisundai" in Tamil, belongs to the family Solanaceae. It has been traditionally used in Mexico for the treatment of skin mycoses. The antifungal activity of *S. chrysotrichum* is primarily attributed to the presence of steroidal saponins in its leaves, which exhibit potent antimycotic effects against dermatophytes and yeasts, including *Malassezia* species. In vitro and clinical studies have demonstrated that a cream containing 5% methanolic leaf extract of *S. chrysotrichum* effectively inhibits fungal growth associated with conditions such as *tinea pedis* and *pityriasis capitis* (dandruff). A double-blind randomized clinical trial further confirmed its therapeutic efficacy, showing comparable or improved outcomes relative to conventional antifungal agents like ketoconazole. [8] These findings support the potential of *S. chrysotrichum* as a natural antifungal agent in the management of seborrheic dermatitis, particularly due to its activity against *Malassezia*, a key contributor to disease pathogenesis.



Figure 3: Giant Devil's Fig. (*Solanum chrysotrichum*)

3.2 Woolly Thistle (*Cirsium eriophorum*)

Cirsium eriophorum, **(Fig 4)** commonly known as woolly thistle and belonging to the family Asteraceae, has shown promising potential in the management of seborrheic dermatitis. The plant-derived bioactive compounds are known to regulate sebaceous gland activity by inhibiting the enzyme 5α-reductase, thereby reducing excessive sebum production, which is a key factor in the pathogenesis of the condition. Topical formulations containing approximately 5% extract have been reported to restore normal sebum levels, reduce pore size, and improve skin barrier function. [8] These effects collectively contribute to the reduction of symptoms such as oiliness, irritation, and inflammation. [9] In addition, the extract exhibits notable anti-inflammatory properties, further supporting its role as a potential natural therapeutic agent for seborrheic dermatitis management.



Figure 4: Woolly Thistle. (*Cirsium eriophorum*)

3.3 Crowned saw-wort (*Serratula coronata*)

Crowned saw-wort (*Serratula coronata*), **(Fig 5)** also known as plumeless saw-wort and belonging to the family *Asteraceae*, has shown notable potential in the management of seborrheic dermatitis. The primary bioactive compounds identified in *S. coronata*, including 20 hydroxyecdysone, polypodine B, and ajugasterone C, are phytoecdysteroids with well-documented anti-inflammatory activity. [10] These constituents contribute to the reduction of skin inflammation, relief from itching and burning sensations, and normalization of keratinocyte differentiation, thereby supporting skin barrier restoration in seborrheic dermatitis. The results demonstrated that this concentration was effective in reducing key clinical symptoms such as itching and burning associated with seborrheic dermatitis. [11,12]

Collectively, these findings highlight the therapeutic potential of *S. coronata* as a natural anti-inflammatory agent in dermatological applications.



Figure 5: *Crowned saw-wort.* (*Serratula coronata*)

3.4 Bitter-wood (*Quassia amara*)

Quassia amara, commonly known as bitter-wood and belonging to the family *Simaroubaceae*, has shown promising potential in the management of seborrheic dermatitis. **(Fig 6)** The plant is rich in quassinoids and their derivatives, which are responsible for a wide range of pharmacological activities, particularly anti-inflammatory and antimicrobial effects. These bioactive compounds contribute to the reduction of skin inflammation and are also associated with therapeutic benefits in several diseases, including dermatitis. Traditional and experimental evidence further supports its use in conditions such as malaria, diabetes, ulcers, and inflammatory disorders, highlighting its broad medicinal relevance. A clinical study evaluating a 3% *Q. amara* gel in patients with facial skin conditions demonstrated significant improvement in symptoms. When compared with ketoconazole and ciclopirox olamine gels, *Q. amara* showed superior efficacy in reducing lesion severity and was well tolerated without any reported side effects. [13] In conclusion, *Quassia amara* represents a promising herbal candidate for seborrheic dermatitis management due to its anti-inflammatory and skin-modulating properties. However, further detailed clinical investigations are required to establish its long-term safety, efficacy, and standardized therapeutic application.



Figure 6: Bitter-wood. [*Quassia amara*]

3.5 Baikal skullcap root (*Scutellaria baicalensis*)

Baikal skullcap root (*Scutellaria baicalensis*), **(Fig 7)** belonging to the family *Lamiaceae*, is a well-known traditional Chinese medicinal plant with notable dermatological relevance. Its extracts have demonstrated inhibitory activity against *Malassezia* spp., a key fungal organism involved in the pathogenesis of seborrheic dermatitis, suggesting its potential role in managing fungal-associated skin disorders. Although large-scale clinical trials specifically targeting seborrheic dermatitis are still limited, the antifungal and anti-inflammatory properties of *S. baicalensis* support its potential topical application. Clinical findings indicate that Scutellaria baicalensis extract injectable/extract-based interventions (SBEIEs) may improve skin conditions by enhancing moisture retention, reducing sebum production, and alleviating inflammation. [14,15] At the cellular level, these extracts are also reported to stimulate exosome production, which may contribute to skin repair and regeneration, further supporting their potential in the management of inflammatory skin diseases such as seborrheic dermatitis.



Figure 7: Baikal skullcap root. (*Scutellaria baicalensis*)

3.6 Nettle (*Urtica dioica*)

Nettle (*Urtica dioica*), **(Fig 8)** known as "Kuppaimeni" in Tamil and belonging to the family *Urticaceae*, is a traditionally used medicinal plant widely incorporated in hair care formulations. It has gained attention for its potential role in the management of seborrheic dermatitis due to its multifaceted biological activities. The plant is reported to inhibit the activity of the enzyme 5α-reductase, which is involved in the conversion of testosterone to dihydrotestosterone (DHT). By modulating this pathway, nettle helps regulate sebaceous gland activity and reduce excessive sebum production, a key contributing factor in dandruff and seborrheic dermatitis. In addition, *U. dioica* exhibits anti-inflammatory and antimicrobial properties, including inhibitory effects against *Malassezia* species and other skin-associated pathogens. These combined actions contribute to the reduction of inflammation, microbial load, and scalp irritation, thereby supporting its traditional use in managing seborrheic dermatitis. [16,17]



Figure 8: Nettle. (*Urtica dioica*)

3.7 Sage (*saliva officinalis*)

Sage (Salvia officinalis), **(Fig 9)** belonging to the family *Lamiaceae*, exhibits notable anti-inflammatory and antimicrobial properties that support its potential use in the management of seborrheic dermatitis. Studies show that formulations containing sage extract (0.15 w/w%) with carnosol can reduce pro-inflammatory mediators in skin cells, indicating its ability to alleviate inflammation. Additionally, sage demonstrates antimicrobial activity against both Gram-positive and Gram-negative bacteria, helping to limit microbial growth associated with skin disorders. These combined effects suggest its usefulness in reducing inflammation and microbial imbalance in seborrheic dermatitis. In conclusion, *Salvia officinalis* may serve as a

promising herbal agent for seborrheic dermatitis management, although further clinical validation is required. [18]



Figure 9: Sage. (*saliva officinalis*)

3.8 Licorice root (*Glycyrrhiza glabra*)

Licorice root (*Glycyrrhiza glabra*), known as "Athimathuram" in Tamil and belonging to the family *Fabaceae*, is a widely used medicinal plant with significant dermatological relevance. Its primary bioactive compound, glycyrrhizin acid, exhibits strong antioxidative, anti-inflammatory, anti-allergic, and antimicrobial properties. [19] Clinical evidence has shown that a shampoo containing 6% glycyrrhizin acid is effective in managing scalp seborrheic dermatitis, supporting the therapeutic potential of licorice-derived formulations for topical use. In addition, glycyrrhizin acid has been reported to be beneficial in various skin conditions, including pruritus, atopic dermatitis, acne vulgaris, skin aging, and hyperpigmentation. [19,20] In conclusion, *Glycyrrhiza glabra* demonstrates promising potential in the management of seborrheic dermatitis due to its multi-functional bioactive effects. However, further large-scale clinical studies are required to establish standardized formulations and confirm long-term efficacy and safety.



Figure 10: Licorice root. (*Glycyrrhiza glabra*)

Table 1: Herbal Plants and Bioactive Compounds Used in Seborrheic Dermatitis.

S. No	***Plant Name***	***Family***	***Major Bioactive Compounds***
1	*Solanum chrysotrichum* (Malaisundai)	Solanaceae	Steroidal saponins
2	*Cirsium eriophorum*	Asteraceae	Bioactive phytochemicals
3	*Serratula coronata*	Asteraceae	20-hydroxyecdysone, polypodine B, ajugasterone C
4	*Quassia amara*	Simaroubaceae	Quassinoids
5	*Scutellaria baicalensis*	Lamiaceae	Flavonoids
6	*Urtica dioica* (Kuppaimeni)	Urticaceae	Phytochemicals affecting 5α-reductase
7	*Salvia officinalis* (Sage)	Lamiaceae	Carnosol
8	*Glycyrrhiza glabra* (Athimathuram)	Fabaceae	Glycyrrhizin acid

CONCLUSION

Seborrheic dermatitis is a chronic, relapsing inflammatory skin disorder driven by a complex interplay of *Malassezia* colonization, altered sebaceous gland activity, epidermal barrier dysfunction, and immune dysregulation. Although conventional therapies such as antifungal agents, anti-inflammatory drugs, and keratolytics are effective, their long-term use may be associated with side effects and recurrence, necessitating safer and more sustainable alternatives.

This review highlights the significant therapeutic potential of plant-derived bioactive compounds in the management of seborrheic dermatitis. Medicinal plants such as *Solanum chrysotrichum, Cirsium eriophorum, Serratula coronata, Quassia amara, Scutellaria baicalensis, Urtica dioica, Salvia officinalis,* and *Glycyrrhiza glabra* exhibit diverse pharmacological activities, including antifungal, anti-inflammatory, antioxidant, and sebum-regulating effects. These mechanisms collectively target key pathogenic factors such as *Malassezia* proliferation, excessive sebum production, and inflammatory responses. Evidence from in vitro and limited clinical studies suggests that these herbal agents may act as effective and well-tolerated alternatives or adjuncts to conventional therapy. However, further large-scale clinical studies are needed to confirm their efficacy and safety.

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