Exploring Botanical Solutions against Malassezia: Future Prospective for Dermatological Health

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ABSTRACT

This review examines the current research landscape surrounding botanical solutions as potential interventions against Malassezia-associated dermatological conditions. Malassezia, a genus of lipophilic fungi, is implicated in various skin disorders, including dandruff and certain forms of dermatitis. With an increasing interest in natural remedies, botanicals have emerged as promising candidates due to their diverse bioactive compounds. Investigation of the antifungal properties of Ginger, Clove, clove, cinnamon, Henna, and hemp extract against Malassezia and a report their efficacy is done. The regulatory approval of hemp in India has facilitated the integration of its antimicrobial properties in the cosmetic industry. The discussion explores the potential of plant-derived agents in mitigating Malassezia proliferation and associated clinical manifestations. We look into botanicals that exhibit potent activity comparable or greater than conventional antifungal agents. The potential for a polyherbal oil combating Malassezia-associated dandruff is also discussed. Insights from this review contribute to the understanding of the current botanical research against Malassezia, providing a foundation for future studies and potential therapeutic applications in dermatology.

KEYWORDS: Phytochemistry, Malasezzia, Dandruff, Dermatitis, Herbal Dermatology, Polyherbal Formulation

INTRODUCTION:

Dermatological conditions associated with the lipophilic fungus Malassezia pose a significant challenge, with manifestations ranging from dandruff to more severe forms of dermatitis. Amidst the conventional treatments, the exploration of botanical solutions has garnered attention due to their diverse bioactive compounds. This review delves into the current landscape of research surrounding the application of botanical interventions against Malassezia. From Ginger and Clove to hemp oil and beyond, these botanicals are scrutinized for their potential antifungal properties, aiming to unravel nature's therapeutic prowess in the realm of dermatological health.

Objective: The review comprehensively explores and elucidates the antifungal properties of select botanicals— Henna, Ginger, Clove, Cinnamon, and hemp—against Malassezia-associated dermatological conditions. The review aims to link traditional herbal knowledge with modern dermatology, helping to create detailed and effective plant-based treatments for Malassezia-related skin problems.

METHODOLOGY:

1. **Literature Selection:** Systematic review of relevant databases.
   Inclusion criteria: Studies on botanicals against Malassezia.
   Exclusion criteria: Irrelevant or insufficient studies.
2. **Botanical Analysis:** Identified key botanicals (Ginger, Clove, Cinnamon, Henna, hemp) based on historical and scientific significance and analysed their antifungal properties
3. **Mechanism of Action**: Explored molecular mechanisms of antifungal activity for each botanical.
4. **Data Synthesis:** Compiled and synthesized efficacy data by Comparing MICs
5. **Polyherbal Formulation:** Investigated potential synergies among botanicals for a polyherbal formulation.
6. **Regulatory Analysis:** Explored regulatory status of Botanicals with an emphasis on hemp in India and its integration into the cosmetic industry.

Botanical targets:

Malassezia's virulence factors include the formation of hyphae, enabling tissue penetration, and the action of lipases that degrade host lipids, compromising the skin barrier. The botanical targets are as follows:

Henna (*Lawsonia inermis*): Acetone and ethanolic extracts with their major constituent fraxetin exhibited effective antifungal activity by structural changes including collapsing, distortion, inflating, crushing of hyphae with corrugation of walls, and depressions on hyphal surfaces. Imidazole from crude extract of Henna leaves inhibits lanosterol 14-α-demethylase involved in conversion of lanosterol to ergosterosterol.

Cinnamon (*Cinnamomum verum*): The methanolic extract of Cinnamon bark, rich in cinnamaldehyde, demonstrates anti-Malassezia activity by reducing ergosterol levels and disrupting the fungal cell membrane, countering the fungus's ability to form hyphae and compromising its lipid-rich environment. Phenyl acetaldehyde, CJEO oil and eugenol in Cinnamon may either inhibit biosynthesis or bind to ergosterol to disrupt membrane integrity.

Hemp extract: Cannabigerol, a cannabinoid compound found in hemp, exhibits antifungal properties by inhibiting lipase activity and reducing ergosterol. Cannabidiol (CBD) exhibits suppressive effects on human keratinocyte proliferation, attributed to its antiproliferative and anti-inflammatory properties. CBD's potential to inhibit the enzyme 5-α-reductase may contribute to the regulation of skin sebum secretion, improving skin elasticity and hydration, with high lipophilicity aiding its accumulation in sebaceous glands through trans follicular delivery for a sustained therapeutic effect.

Ginger (*Curcuma xanthorhizza*): Gingerol and Shogaol, active compounds in ginger, may disrupt fungal cell membranes, inhibit fungal enzymes, and interfere with essential cellular processes. XNT exhibits antifungal activity against planktonic cells of Malassezia species. Its anti-Malassezia effects are reported for M. furfur and M. pachydermatis, and it inhibits the

conidial germination of various filamentous fungi, implying possible antifungal effect on Malassezia spps. While the antimicrobial mechanisms are not fully understood, XNT is believed to potentially suppress nuclear factor kappaB (NF-kB) and mitogen-activated protein kinase (MAPK) pathways induced by Malassezia infection.

Clove (*Syzygium aromaticum*): Clove powder, containing the antimicrobial compound eugenol, effectively inhibits the growth of Malassezia furfur. Eugenol disrupts fungal cell membranes, causing changes in permeability and leakage of cell contents. Additionally, it damages the inner mitochondrial membrane and cell walls, blocking energy and food production, ultimately leading to the death of fungi.

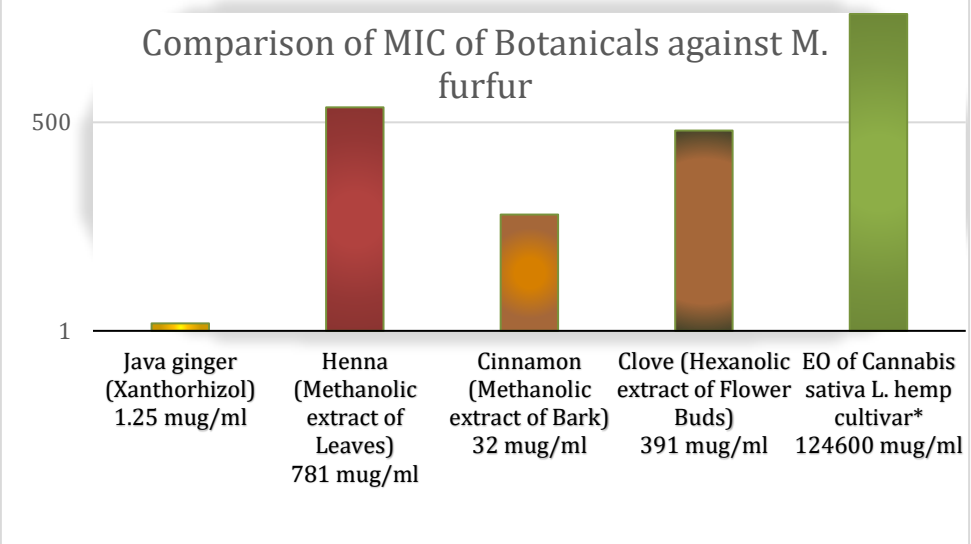

Fig. 1. Bar Graph illustrating the efficacy of botanicals against Malassezia furfur through Minimum Inhibitory concentration (MIC) values.

The mentioned botanicals, including Henna, Ginger, Clove, Cinnamon, and hemp, exhibit efficacy not only against Malassezia furfur but also against other species such as M. globosa, M. pachydermatis and M. restricta. Through mechanisms like lipase inhibition, hyphae destruction, and interference with essential cellular processes, these botanicals demonstrate potential in addressing a spectrum of skin and hir conditions associated with Malassezia, including seborrheic dermatitis and various dermatological manifestations.

Polyherbal Formulation:

The following properties make these botanicals suitable for a polyherbal formulation that can be potentially included in hair and skincare products to target Malassezia as a dermatological pathogen and also tackle the increasing resistance of Malassezia spps to conventional antifungal agents like Ketoconazole, that is most commonly used to treat scalp infections, mainly dandruff.

Antifungal Synergy:
Combining antifungal compounds from Clove, Cinnamon, and hemp may create a synergistic effect, potentially increasing the overall effectiveness against Malassezia, the fungus associated with dandruff.

Anti-Inflammatory Properties:
Ginger and hemp oil both possess anti-inflammatory properties. Their combination could offer a synergistic anti-inflammatory effect, helping to soothe the scalp and alleviate symptoms associated with dandruff.

Moisturizing and Conditioning:
Henna is known for its moisturizing and conditioning properties. When combined with other botanicals, it may enhance the overall moisturizing effect of the formulation, contributing to a healthier scalp.

Aroma and Sensory Benefits:
Clove and Cinnamon contribute aromatic qualities. Their combination, along with other botanicals, can potentially provide a pleasant fragrance to the formulation, enhancing the sensory experience of using the product**.**

Hence, including these botanicals in an ‘organic formulation’ would give a boost to the Ayurvedic aspect of cosmetology field in India.

Regulatory Status:

The regulatory status of these botanicals in Indian cosmetic formulations falls under the Food Safety and Standards Authority of India (FSSAI) and Central Drugs Standard Control Organization (CDSCO). Compliance with their standards is crucial, encompassing adherence to permissible limits, safety protocols, and good manufacturing practices. In India, hemp in cosmetics faced regulatory shifts in 1985, classifying cannabis with over 0.3% THC as a narcotic drug. Currently, hemp formulations undergo scrutiny, requiring adherence to the 0.3% THC limit. Ongoing advocacy by groups like the Great Legalisation Movement India and the Indian Industrial Hemp Association hints at evolving attitudes and potential regulatory changes. Top hemp manufacturers in India include Satliva and Cannavedic and Hemp and Co.

CONCLUSION :

In conclusion, this review has provided a comprehensive examination of botanical interventions against Malassezia-associated dermatological conditions, highlighting the potential of natural remedies in addressing challenges ranging from dandruff to severe forms of dermatitis. The exploration of botanicals such as Henna, Ginger, Clove, Cinnamon, and hemp has revealed diverse bioactive compounds with promising antifungal properties. The identified botanical targets, including Henna's structural changes, Cinnamon's disruption of the fungal cell membrane, and hemp’s suppressive effects on keratinocyte proliferation, offer

insights into their potential mechanisms of action. Moreover, the discussion on a polyherbal formulation emphasizes the synergistic benefits of combining botanicals, providing a promising avenue for the development of effective and natural skincare and haircare products targeting Malassezia.

Despite regulatory challenges, ongoing advocacy efforts suggest evolving attitudes and potential adjustments in the regulatory landscape. The integration of these botanicals, rich in antifungal and anti-inflammatory properties, holds promise for the development of detailed and effective plant-based treatments for Malassezia-related skin problems. This review contributes to the understanding of current botanical research, paving the way for future studies and potential therapeutic applications in the field of dermatology.

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