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Effectiveness of *Azadirachta indica* and *Ocimum gratissimum* for Acne Vulgaris: A Literature Review

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ABSTRACT

Acne vulgaris is a common dermatological condition characterized by inflammation of the pilosebaceous units, predominantly affecting adolescents and young adults. Its multifactorial etiology involves hormonal imbalances, microbial overgrowth, and environmental factors, leading to increased sebum production and inflammation. Conventional treatments often vary in efficacy and tolerability, driving interest in alternative therapies to reduce the severity and recurrence of lesions and enhance appearance, the acne severity. This literature review explores the therapeutic potential of two herbal remedies, Azadirachta indica (Neem) and Ocimum gratissimum (African basil), known for their antimicrobial, anti-inflammatory, and antioxidant properties. Azadirachta indica is recognized for its rich phytochemical profile, including compounds like nimbin and azadirachtin, which effectively combat acne pathogens such as Cutibacterium acnes. Meanwhile, Ocimum gratissimum exhibits significant antimicrobial and antioxidant activities, contributing to skin healing and sebum regulation. The combined use of these herbs offers a holistic approach to acne management, targeting multiple aspects of its pathogenesis, including inflammation and microbial imbalance. The therapeutic benefits of Azadirachta indica and Ocimum gratissimum highlight their valuable role in advancing dermatological care and offer promising prospects for individuals seeking holistic and plant-based solutions for acne management. This review emphasizes the potential and effectiveness of Azadirachta indica and Ocimum gratissimum in advancing dermatological care and providing effective, plant-based solutions for acne management.

Keywords: Acne vulgaris, azadirachta indica, clove basil, neem, ocimum gratissimum, treatment

INTRODUCTION

Acne vulgaris (AV) is a common skin disease. Several studies say that acne is more common in teenage boys. There are many factors that cause acne, one of which is bacterial colonization and inflammation. The most common clinical manifestations that we can see are non-inflammatory and inflammatory lesions spread over the face, back and neck.[1] Acne vulgaris causes many impacts on patients, one of which is lack of self-confidence, depression and can reduce the patient's quality of life.[2] Symptoms that are often caused by patients are pain, irritation, and redness of the skin can occur. pustules, nodules, cysts, whiteheads, blackheads and papules, most often located on the beard, nose, forehead.[3,4]

The use of antibiotics is one of the first line therapies for treating acne vulgaris. However, long-term use of antibiotics causes resistance to the bacteria P. acnes, S. epidermidis and S. aureus. Several factors

that cause resistance are how the antibiotic is used, environmental factors, the bacterial response to antibiotics. An alternative option to overcome antibiotic resistance is to use herbal medicine as a substitute for treating acne vulgaris.[5]

There are several herbal plants that have been proven to cure acne. There is research that states that Ocimum gratissimum (scent leaf/ African basil) and Azadirachta indica (neem) provide quite a significant effect on acne vulgaris therapy. There are several biochemical substances found in these two plants. eugenol, and thymol found in Ocimum gratissimum. nimbin, azadirachtin, nimbidin found in Azadirachta indica. All of these components provide anti-oxidant, anti-inflammatory and antibacterial effects.[6]

Other plants that have been researched are turmeric (Curcuma louga). The specialty of this plant is its yellow color which is obtained from curcuma, the main active ingredient of turmeric. Which can provide anti-oxidant and anti-inflammatory effects.[7] There are several uses of this plant in medical history, including anti-cancer, neuroprotective, cardiovascular, and metabolic disease preventing.

LITERATURE REVIEW

ACNE VULGARIS

Acne vulgaris is a prevalent skin disorder characterized by inflammation of the pilosebaceous unit, typically following a chronic course. While acne can occur at any age, it primarily affects adolescents and young adults.[1] The condition arises from the hypersensitivity of sebaceous glands to normal androgen levels in the bloodstream. This hypersensitivity is aggravated by the bacterium Cutibacterium acnes (C. acnes) and the resulting inflammation.[8]

Several factors may contribute to the development of acne, including: The use of medications such as lithium, steroids, and anticonvulsants; Excessive sun exposure; Wearing occlusive clothing, such as shoulder pads, headbands, backpacks, and underwire bras; Oil-based cosmetics and facial massages; Endocrine disorders, including polycystic ovarian syndrome and pregnancy.

The pathogenesis of acne vulgaris involves the interplay of various factors, such as sebaceous gland stimulation by androgens, microbial imbalance in the follicle, and immune responses. Genetics and diet may also influence the disease's onset and progression. The microcomedo is the primary lesion, serving as a precursor to all acne manifestations.[9]

Managing acne vulgaris, irrespective of severity, should start with thorough patient counseling. This includes discussions on the nature of the disease, proper skincare, and realistic treatment expectations. Treatment should aim to reduce the severity and recurrence of lesions and enhance appearance, tailored to the acne severity, patient age, treatment preferences, and response to past therapies.[10]

Current treatment strategies target the various contributing factors, such as abnormal keratinization, increased sebum production, microbial colonization, and inflammation. Herbal therapies like tea tree oil and topical or oral Ayurvedic compounds are generally well-tolerated, though data on their effectiveness and safety are limited. Ayurveda utilizes herbs with natural phytoconstituents to create skincare products that protect the skin without adverse effects. Natural herbs like neem, aloe, tulsi, amla, papaya, ginger, and eucalyptus are safe and effective for treating various skin infections.[11]

AZADIRACHTA INDICA

Neem (Azadirachta indica), from the Meliaceae family, is rich in antioxidants and has been used in Chinese, Ayurvedic, and Unani medicine, especially in India, for treating and preventing various diseases. The neem tree is a traditional remedy for skin ailments in India and has been used for millennia to protect against agricultural pests and skin infections.[12]

Neem's therapeutic properties stem from its rich array of ingredients, notably azadirachtin, nimbolinin, nimbin, nimbidin,

nimbidol, sodium nimbinate, gedunin, salannin, and quercetin. Its leaves contain compounds like nimbin, nimbanene, 6-desacetylnimbinene, nimbandiol, nimbolide, ascorbic acid, n-hexacosanol, amino acids, 7-desacetyl-7-benzoylazadiradione, 7-desacetyl-7-benzoylgedunin, 17-hydroxyazadiradione, and nimbiol.[13]

Neem's antimicrobial properties involve inhibiting microbial growth and breaking down cell walls. Azadirachtin, a complex limonoid from neem seeds, is the key component responsible for its effects on insects. Studies indicate neem leaf extracts have antibacterial activity against Staphylococcus aureus and MRSA. [14]

Neem's antioxidants, such as azadirachtin and nimbolide, demonstrate potent free radical scavenging activity in a concentration-dependent manner, with nimbolide being the most effective. Himalaya's PNFW, an Ayurvedic skincare product, contains neem and turmeric, both of which possess antimicrobial, antibacterial, and anti-inflammatory properties effective against P. acnes and S. epidermidis.[15]

Singh et al.[16] found an anti-acne herbal face wash gel with neem, turmeric, and lemon to be effective and well-received, thanks to its natural fragrance, light foaming, and lack of skin irritation. Debbarma et al.[17] reported similar results with a neem-based face wash, noting reduced facial oiliness and acne. Charde et al. described a neem-based formulation that effectively treats acne by inhibiting P. acnes and S. epidermidis growth without adverse effects.

However, neem oil ingestion can be dangerous. It has caused deaths in children and toxic encephalopathy and optic neuropathy in adults. Symptoms may include vomiting, drowsiness, diarrhea, seizures, metabolic acidosis, altered consciousness, Reye-like syndrome, nephrotoxicity, and hepatotoxicity. Neem has been linked to hemolytic anemia in a man with glucose-6-phosphate dehydrogenase deficiency and can cause ventricular fibrillation and cardiac arrest. It may also induce hypoglycemia and should be used cautiously in patients on anti-hyperglycemic medications.[10,18]

OCIMUM GRATISSIUM (CLOVE BASIL)

The genus Ocimum, belonging to the Lamiaceae family, consists of over 150 species. It is widely distributed across temperate regions, with the highest diversity in Africa. Notable species include the aromatic herbs Ocimum basilicum (Thai basil) and Ocimum gratissimum (African basil), as well as the medicinal herb Ocimum tenuiflorum, also known as Ocimum sanctum (holy basil or tulsi in Hindi).[19]

Various parts of these plants, such as leaves, stems, flowers, roots, seeds, and the entire plant, have practical uses. The seeds are edible and become mucilaginous when soaked in water, while the leaves can be consumed in salads.[20] Basil plays a significant role in traditional medicine, including Ayurveda and traditional Chinese medicine, where it is used to treat digestive disorders like stomach aches and diarrhea, as well as kidney problems and infections. In African traditional medicine, basil is used to address whooping cough and various fevers.[21]

O. gratissimum contains bioactive compounds such as phytochemicals (oleanolic acid, caffeic acid, ellagic acid, epicatechin, sinapic acid, rosmarinic acid, chlorogenic acid, luteolin, apigenin, nepetoidin, xanthomicrol, nevadensin, salvigenin, gallic acid, catechin, quercetin, rutin, and kaempferol) and essential oils (camphene, β-caryophyllene, α- and β-pinene, α-humulene, sabinene, β-myrcene, limonene, 1,8-cineole, trans-β-ocimene, linalool, α- and δ-terpineol, eugenol, α-copaene, β-elemene, p-cymene, thymol, and carvacrol).[21]

These compounds exhibit pharmacological properties, including antioxidant, anti-inflammatory, anticancer, hepatoprotective, antidiabetic, antihypertensive, antidiarrheal, and antimicrobial effects. O. gratissimum

demonstrates significant preventive and therapeutic potential against numerous diseases, likely due to its antimicrobial and antioxidant properties and its ability to enhance antioxidant systems.[22]

The therapeutic benefits of Ocimum gratissimum are attributed to its antioxidant and anti-inflammatory properties. Leaf extracts are rich in antioxidant vitamins like alpha-tocopherol and ascorbic acid. Research indicates that flavonoids and phenols offer protection against oxidative stress-induced cellular damage. They exert anti-inflammatory and antioxidative effects through mechanisms such as scavenging or neutralizing free radicals, chelating metal ions, and inhibiting enzyme systems that produce free radicals.[23]

While Ocimum gratissimum (African basil) is widely used for its therapeutic benefits, it can also have potential adverse effects, especially if consumed in large amounts or improperly. Allergic Reactions, such as skin irritation, itching, or rashes, especially if they have a sensitivity to plants in the Lamiaceae family; Hypoglycemia: Ocimum gratissimum has antidiabetic properties, which means it can lower blood sugar levels.[23] This could potentially lead to hypoglycemia (low blood sugar) in individuals taking medications for diabetes or those with naturally low blood sugar levels; Blood Pressure Alterations: Due to its antihypertensive effects, Ocimum gratissimum may lower blood pressure, which could be problematic for individuals with low blood pressure or those taking antihypertensive medications; Gastrointestinal Issues: Some individuals might experience stomach upset, nausea, or diarrhea when consuming Ocimum gratissimum, especially in large quantities; Drug Interactions: The herb might interact with certain medications, including anticoagulants, antidiabetics, and antihypertensives, potentially altering their effectiveness or increasing side effects.[23]

Toxicity in Large Doses: Excessive consumption can lead to toxicity, which might manifest as nausea, vomiting, or other symptoms. It's important to adhere to recommended dosages, particularly in herbal preparations.[24]

Reproductive Effects: Some studies have suggested that high doses of Ocimum gratissimum may affect fertility or reproductive health, although more research is needed to confirm these effects in humans; Central Nervous System Effects: In some cases, Ocimum gratissimum might affect the central nervous system, potentially leading to sedation or CNS depression when taken in high doses.

In a four-week clinical trial, researchers evaluated the effectiveness of Ocimum gratissimum essence at four different concentrations (0.5% to 5%) using four different bases, comparing it to a placebo and standard treatment with 10% benzoyl peroxide. A 2% concentration of O. gratissimum essence in a hydrophilic base (alcohol or cetomacrogol) was found to reduce skin lesions more quickly than the standard therapy, with no reported side effects. However, a 5% concentration was also effective but caused skin irritation. Another study reported that the topical application of O. gratissimum essence was more effective than both a placebo and 1% clindamycin. In this study, while topical yellow Aloe vera was not effective as a standalone treatment for acne, it demonstrated a synergistic effect when used in combination with O. gratissimum.[19,20]

DISCUSSION

COMPARATIVE ANALYISIS OCIMUM GRATISSIMUM AND AZADIRACHTA INDICA

The mechanism of action of Ocimum gratissimum is primarily attributed to its antimicrobial properties. It is effective against Cutibacterium acnes, a bacterium involved in the development of acne, helping to reduce the bacterial load on the skin and prevent new breakouts. Moreover, the antioxidant and anti-inflammatory effects of this herb play a crucial role in diminishing oxidative stress and inflammation - two key contributors to acne

formation. By balancing sebum production, Ocimum gratissimum helps reduce the likelihood of clogged pores, making it a potent ally in the fight against acne.[19,24]

Neem exhibits potent antibacterial and antifungal properties, targeting a broad spectrum of pathogens, including Staphylococcus aureus and Cutibacterium acnes, both of which are associated with acne outbreaks. The anti-inflammatory and antioxidant effects of neem reduce inflammation and protect skin cells from oxidative damage, promoting a healthier complexion. Additionally, neem is known for its wound-healing and skin-repair properties, which help accelerate the healing process of acne lesions and minimize the risk of scarring.[23,24]

From the efficacy, both Ocimum gratissimum and Azadirachta indica are effective in treating acne due to their antimicrobial, antioxidant, and anti-inflammatory properties. O. gratissimum may provide quicker results in reducing lesions, while neem offers additional benefits in skin repair and healing. Side effects of both herbs are generally well-tolerated when used topically, although higher concentrations of O. gratissimum and improper use of neem oil can cause irritation.[23,24]

O. gratissimum is often used in hydrophilic bases for enhanced delivery, while neem is used in a variety of topical formulations, including creams, gels, and washes. In combination Use, both herbs can be used in combination with other treatments, like aloe vera or standard acne medications, to enhance therapeutic effects.[13,25]

COMBINATION

The exploration of Azadirachta indica (neem) and Ocimum gratissimum (African basil) as herbal remedies for anti-acne treatment has illuminated a promising avenue within the field of dermatology. The rich phytochemical profiles of these botanicals, comprising compounds such as nimbin, neem oil, eugenol, and ursolic acid, demonstrate multifaceted therapeutic effects that target various aspects of acne pathogenesis.[12,25]

When used together, neem and African basil offer a synergistic approach to acne treatment. Their complementary actions address multiple facets of acne, including bacterial growth, inflammation, oxidative stress, and sebum production. This holistic approach not only targets existing acne but also helps prevent future breakouts, offering a natural and effective solution for clearer, healthier skin.[19,24]

The incorporation of these botanicals into skincare formulations, such as face washes, creams, and serums, has the potential to provide a gentle yet powerful alternative to conventional acne treatments. As interest in natural and sustainable skincare solutions continues to grow, the therapeutic benefits of Azadirachta indica and Ocimum gratissimum highlight their valuable role in advancing dermatological care.[19,24]

CONCLUSION

In conclusion, the investigation into Azadirachta indica (neem) and Ocimum gratissimum (African basil) as anti-acne treatments underscores their significant potential within dermatology. These herbs boast rich phytochemical profiles, including compounds like nimbin, neem oil, eugenol, and ursolic acid, which offer multifaceted therapeutic effects. Neem's powerful antibacterial, anti-inflammatory, and antioxidant properties make it a formidable ally against acne-causing bacteria such as Cutibacterium acnes and Staphylococcus aureus. Its ability to nourish and protect the skin while reducing redness and inflammation enhances its efficacy as a natural acne remedy. Meanwhile, African basil, with its antimicrobial and anti-inflammatory properties, effectively reduces acne by inhibiting bacterial growth and soothing the skin. Its antioxidant capabilities help mitigate oxidative stress, supporting the skin's healing process and regulating sebum production to prevent clogged pores.

The synergistic use of neem and African basil provides a comprehensive approach to

acne treatment, addressing multiple aspects of acne pathogenesis. By targeting bacteria, inflammation, oxidative stress, and sebum production, these herbs offer a natural and effective alternative to conventional acne therapies. Their incorporation into skincare products, such as face washes, creams, and serums, not only provides a gentle yet powerful solution for managing acne but also aligns with the growing demand for natural and sustainable skincare options. The therapeutic benefits of Azadirachta indica and Ocimum gratissimum highlight their valuable role in advancing dermatological care and offer promising prospects for individuals seeking holistic and plant-based solutions for acne management.

Declaration by Authors

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