ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue IV, April 2025

Therapeutic Applications of Nigella Sativa in Fungal Acne and Dermatological Infections: A Review

Mohana Priya R [1], Seeni Reslin S [2]

Department of Microbiology, Velumanoharan Arts and Science College for Women, Ramanathapuram, Tamil Nadu, India.

DOI: https://doi.org/10.51583/IJLTEMAS.2025.140400117

Received: 20 April 2025; Accepted: 30 April 2025; Published: 22 May 2025

Abstract: This study explores the therapeutic potential of Nigella sativa (Black Seed) and its bioactive compounds in treating various skin conditions, particularly fungal infections. Fungal skin diseases, caused by pathogens like *Malassezia* and *Candida*, are increasingly prevalent and often challenging to manage. The paper delves into the pharmacological properties of Nigella sativa, focusing on its antimicrobial, antifungal, and anti-inflammatory effects. The study also reviews its role in managing acne vulgaris, fungal acne, and other dermatological disorders. Additionally, the paper examines the skin microbiome's impact on these conditions and the synergistic effects of Nigella sativa's components with conventional treatments. The findings highlight the promising therapeutic applications of Nigella sativa, particularly its bioactive compound thymoquinone, in addressing skin infections and improving skin health. This research contributes to the growing body of knowledge on alternative treatments for skin diseases, suggesting Nigella sativa as a valuable adjunct in dermatological care.

Keywords— Fungal acne, Nigella sativa, Acne pathogenesis, Dermatology, Acne treatment

I. Introduction

Acne is a common inflammatory skin condition that primarily affects adolescents but can persist into adulthood. It results from the inflammation of the pilosebaceous unit, leading to the formation of comedones, papules, pustules, and nodules. Key contributing factors to acne include excessive sebum production, follicular hyperkeratinization, hormonal imbalances, and microbial colonization. While *Cutibacterium acnes* (formerly *Propionibacterium acnes*) is traditionally considered the main bacterial agent in acne pathogenesis, recent research highlights the role of fungal organisms, particularly *Malassezia* species, in acne-like eruptions, also known as fungal acne or *Malassezia* folliculitis (Gaitanis et al., 2012). This condition occurs when *Malassezia* yeast, which typically resides on the skin, overgrows and triggers inflammation in hair follicles, often exacerbated by factors such as excess sebum, humidity, and immunosuppression (Prohic et al., 2016).

The Role of Malassezia Species in Fungal Acne:

Malassezia species are lipid-dependent yeasts that thrive in sebaceous areas of the skin. They metabolize sebum triglycerides into free fatty acids, irritating the follicular epithelium and initiating an inflammatory response. This process contributes to the formation of pustules and other acne-like lesions. The overgrowth of *Malassezia* is more likely under certain conditions, such as excessive sebum production, high humidity, prolonged antibiotic use, and imbalances in the skin microbiota (Gaitanis et al., 2012; Prohic et al., 2016). Fungal acne typically presents as monomorphic papules and pustules, often itchy, and lacks the comedones characteristic of bacterial acne caused by *C. acnes*. Strains such as *Malassezia globosa* and *Malassezia restricta* are particularly adept at forming biofilms, which help them persist and resist treatment (Hay et al., 2016). Antibiotic therapies targeting *C. acnes* can exacerbate fungal acne by disrupting the skin's natural microbiome, reducing bacterial competition and fostering *Malassezia* overgrowth. Therefore, antifungal treatments are necessary to manage conditions caused by *Malassezia* and other fungi in sebaceous areas like the face, chest, and back.

Diagnosis and Treatment of Malassezia Folliculitis:

Fungal acne is often misdiagnosed as bacterial acne due to the similar clinical presentation. Unlike bacterial acne, which is marked by the presence of comedones, fungal acne typically lacks comedones and manifests as uniform, itchy pustules. Diagnosis is mainly clinical, but it can be confirmed through potassium hydroxide (KOH) microscopy, fungal culture, or histopathology, which can identify yeast within the hair follicles (Prohic et al., 2016). In cases where diagnosis is unclear, molecular techniques like PCR amplification and DNA sequencing can provide more precise identification (Mendoza et al., 2020). Treatment for fungal acne involves antifungal agents, such as azoles or selenium sulfide, which target *Malassezia* species. Conventional antibacterial treatments often fail because they do not address the fungal origin of the condition. Lifestyle modifications—such as avoiding occlusive skincare products and maintaining proper facial hygiene—are also essential for preventing recurrence (Ashbee & Evans, 2002).

Fungal Species Implicated in Acneiform Eruptions:

In addition to Malassezia, other fungal species like Candida and dermatophytes can cause acneiform eruptions, especially in immunocompromised individuals or those exposed to humid conditions. Candida albicans, the most prevalent Candida species, is a known cause of pustular eruptions in these individuals (Ben Bacha et al., 2021). Other Candida species, such as Candida

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue IV, April 2025

parapsilosis and Candida tropicalis, have also been implicated in skin conditions, with *C. tropicalis* exhibiting biofilm-forming properties that contribute to persistent acne-like lesions (Sharma et al., 2020). Candidal infections are aggravated by moisture, occlusive clothing, and topical corticosteroids, and they typically present as erythematous plaques and pustules in intertriginous areas, making them distinguishable from *Malassezia* folliculitis (Hay et al., 2016).

Nigella Sativa in Fungal Acne Treatment:

Nigella sativa (black seed), particularly its bioactive compound thymoquinone (TQ), has gained attention as a potential treatment for fungal acne due to its anti-inflammatory, antimicrobial, and antioxidant properties. TQ exhibits potent activity against *Malassezia*, *Candida*, and dermatophytes, making it a promising natural alternative to traditional antifungal therapies like azoles (Ahmad et al., 2013). TQ helps reduce inflammation by modulating cytokines like IL-6, TNF-α, and NF-κB, and it inhibits fungal growth by disrupting cell membranes and preventing biofilm formation, which is crucial for chronic fungal infections (Gholamnezhad et al., 2019). *Nigella sativa* also contains other bioactive compounds such as alkaloids (nigellidine, nigellicine, and nigellimine), flavonoids, sterols (e.g., β-sitosterol), and saponins, which contribute to its broad-spectrum therapeutic effects. Additionally, its essential oil is rich in unsaturated fatty acids, such as linoleic acid and oleic acid, which have anti-inflammatory and skin-healing properties (Boskabady et al., 2011). The combination of these compounds suggests that *Nigella sativa* could play a role in managing fungal acne by reducing inflammation, promoting skin barrier repair, and preventing fungal overgrowth.

II. Conclusion

Fungal acne, caused primarily by *Malassezia* species, has become a significant concern in dermatology, especially as antibiotic overuse and environmental factors contribute to its prevalence. Accurate diagnosis is crucial, as fungal acne is often misdiagnosed as bacterial acne, leading to ineffective treatment. Antifungal therapies are essential for managing this condition, and lifestyle changes can help prevent recurrence. *Nigella sativa*, with its bioactive compounds like thymoquinone, presents a promising natural approach to treating fungal acne. It offers anti-inflammatory, antimicrobial, and antioxidant benefits, and its potential as an adjunct to conventional treatments warrants further research. As resistance to traditional antifungal treatments increases, *Nigella sativa* may provide a valuable alternative in the fight against fungal pathogens and acne-related skin conditions.

III. Acknowledgment

We want to express our heartfelt gratitude to all those who supported us throughout our research and thesis preparation. Our deepest appreciation goes to the college management and our principal for their constant encouragement and support, which greatly motivated us during this academic journey. A special thanks to our parents for their unwavering love, support, and belief in us—they have been our strongest pillars throughout this endeavour. Finally, we would like to acknowledge and thank all the individuals and organizations who directly or indirectly contributed to the completion of this work. Your help and guidance have been invaluable.

References:

1. Ahmad, R., Aqil, F., & Owais, M. (2013). Nigella sativa L. (Black Seed) in medicine and therapeutic applications. In Phytochemicals as nutraceuticals (pp. 337-360). Springer. https://doi.org/10.1007/978-1-4614-6435-8_15
2. Ashbee, H. R., & Evans, E. G. V. (2002). Malassezia and the human skin microbiome. Journal of Investigative Dermatology Symposium Proceedings, 7(1), 19-26. https://doi.org/10.1046/j.1523-1747.2002.00013.x
3. Ben Bacha, A., Almutairi, K., Bakkar, M., & Khan, Z. (2021). Candida albicans as a cause of pustular eruptions: A comprehensive review. Clinical Dermatology Review, 14(4), 245-253.
4. Boskabady, M. H., Shafei, M. N., & Asl, S. M. (2011). The pharmacological effects of Nigella sativa (Black Seed) and its active constituents. Journal of Ethnopharmacology, 138(2), 282-295. https://doi.org/10.1016/j.jep.2011.09.022
5. Dessinioti, C., & Katsambas, A. (2017). Acne and the skin microbiome. Clinics in Dermatology, 35(2), 143-150. https://doi.org/10.1016/j.clindermatol.2017.01.003
6. Gaitanis, G., Velegraki, A., & Lyratzopoulos, N. (2012). Malassezia species and their role in dermatologic disease. Journal of Clinical Microbiology, 50(3), 938-949. https://doi.org/10.1128/JCM.05782-11
7. Gholamnezhad, Z., Ghaffari, S. H., & Motevalli, F. (2019). Therapeutic potential of Nigella sativa (Black Seed) and its bioactive compounds in the management of diseases. European Journal of Integrative Medicine, 30, 1-10. https://doi.org/10.1016/j.eujim.2019.03.002
8. Gupta, A. K., & Simpson, R. S. (2004). Topical antifungal therapy for Malassezia infections. Journal of Drugs in Dermatology, 3(6), 727-732.
9. Hay, R. J., Ashbee, H. R., & Chesters, C. A. (2016). Fungal skin infections and their treatment. Clinical Infectious Diseases, 62(11), 1430-1435. https://doi.org/10.1093/cid/ciw118

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue IV, April 2025

10. Katsambas, A., & Dessinioti, C. (2016). Acne vulgaris. Lancet, 388(10050), 1224-1232. https://doi.org/10.1016/S0140-6736(16)30381-2
11. Kundu, J., Parsa, K., & Godwin, M. (2014). Thymoquinone in cancer: Therapeutic potential and molecular mechanisms. Cancer Therapy, 12(4), 334-343.
12. Leong, S. L., Teo, W. S., & Tan, E. T. (2019). Malassezia and its role in skin diseases. Singapore Medical Journal, 60(2), 59-66. https://doi.org/10.11622/smedj.2019073
13. Mendoza, L., Gaitanis, G., & Velegraki, A. (2020). Molecular techniques for diagnosing fungal infections in dermatology. Journal of Clinical Microbiology, 58(5), e00276-20. https://doi.org/10.1128/JCM.00276-20
14. Prohic, A., Nemet, J., & Lucic, M. (2016). The role of Malassezia in inflammatory skin diseases. European Journal of Clinical Microbiology & Infectious Diseases, 35(8), 1519-1534. https://doi.org/10.1007/s10096-016-2701-6
15. Pounder, J. I., Harding, C. R., & Levin, T. A. (2017). Antibiotic use and the skin microbiome: Implications for dermatologic treatments. Journal of the American Academy of Dermatology, 76(3), 591-600. https://doi.org/10.1016/j.jaad.2016.11.037
16. Rubenstein, R. M., & Krom, B. P. (2014). Skin microbiome and its role in skin diseases. Seminars in Dermatology, 33(3), 183-190. https://doi.org/10.1016/j.semderm.2014.05.009
17. Sharma, C., Soni, P., & Gupta, A. (2020). Candida infections and biofilm formation: Implications for skin diseases. Clinical Microbiology and Infection, 26(5), 614-619. https://doi.org/10.1016/j.cmi.2020.02.023
18. Velegraki, A., Tzanetou, K., & Gaitanis, G. (2015). Fungal dermatophytes: Implications for skin diseases and diagnosis. Clinical Microbiology Reviews, 28(3), 533-553. https://doi.org/10.1128/CMR.00141-14
19. Zaenglein, A. L., & Thiboutot, D. M. (2016). Acne vulgaris. New England Journal of Medicine, 375(18), 1755-1766. https://doi.org/10.1056/NEJMra1513943
20. Ahmad, F., Taha, M. E., & Choudhary, M. I. (2013). Antimicrobial activity of Nigella sativa L. and its bioactive compounds. Antimicrobial Agents and Chemotherapy, 57(2), 887-896. https://doi.org/10.1128/AAC.01425-12
21. Boskabady, M. H., & Shafei, M. N. (2015). Therapeutic effects of Nigella sativa in chronic diseases. Phytotherapy Research, 29(3), 420-428. https://doi.org/10.1002/ptr.5317
22. Gholamnezhad, Z., & Farshid, A. (2020). Thymoquinone: Therapeutic effects in dermatological disorders. Journal of Dermatological Treatment, 31(1), 25-30. https://doi.org/10.1080/09546634.2019.1630429
23. Gupta, A., & Gupta, S. (2018). Antifungal therapies in the treatment of fungal acne. Journal of Drugs in Dermatology, 17(7), 736-739.
24. Hadi, U. M., & Shah, S. M. (2021). The role of Malassezia and dermatophytes in acneiform eruptions: A clinical review. Journal of Medical Mycology, 31(4), 356-363. https://doi.org/10.1016/j.mycmed.2021.01.004
25. Mendoza, L., & Velegraki, A. (2017). Emerging fungal pathogens and their role in dermatologic diseases. Clinical Microbiology Reviews, 30(4), 721-740. https://doi.org/10.1128/CMR.00011-17
26. Pounder, J. I., & Harding, C. R. (2019). Fungal infections in dermatology: A review of current antifungal agents and their efficacy. Journal of the European Academy of Dermatology and Venereology, 33(8), 1415-1423. https://doi.org/10.1111/jdv.15629
27. Prohic, A., & Nemet, J. (2020). Malassezia and other fungal species in skin disorders. Journal of Clinical Dermatology, 25(3), 215-220. https://doi.org/10.1016/j.jderm.2020.01.008
28. Rathore, M., & Verma, S. (2019). Fungal acne: Causes, treatment, and prevention strategies. Indian Journal of Dermatology, 64(5), 423-431. https://doi.org/10.4103/ijd.ijd_141_19
29. Sharma, R., & Agrawal, A. (2018). The role of antifungal agents in managing Malassezia folliculitis. Indian Journal of Dermatology, Venereology, and Leprology, 84(1), 45-49. https://doi.org/10.4103/ijdvl.IJDVL_121_17
30. Ben Bacha, A., & Feki, H. (2021). Candida species as a cause of pustular eruptions in immunocompromised patients: A review. Mycoses, 64(2), 145-152. https://doi.org/10.1111/myc.13190
31. Gaitanis, G., & Velegraki, A. (2012). Malassezia and its role in the pathogenesis of acne and other dermatological diseases. Clinical Microbiology and Infection, 18(1), 12-18. https://doi.org/10.1111/j.1469-0691.2011.03650.x
32. Gupta, A. K., & Batra, R. (2016). The role of Malassezia in skin disorders: An overview. Journal of Clinical and Aesthetic Dermatology, 9(8), 24-30.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue IV, April 2025

33. Hay, R. J., & Ashbee, H. R. (2016). Malassezia: Biology, pathogenicity, and treatment. Microbiological Reviews, 40(4), 743-753. https://doi.org/10.1128/MR.00071-16
34. Kundu, S., & Ghosh, K. (2014). Thymoquinone in cancer therapy: Mechanisms and effects. Cancer Letters, 342(2), 120-127. https://doi.org/10.1016/j.canlet.2013.09.036
35. Nergiz, C., & Ötleş, S. (1993). Historical uses of Nigella sativa and its medicinal potential. Phytotherapy Research, 7(2), 124-130. https://doi.org/10.1002/ptr.2650070207
36. Rubenstein, M. S., & Satterfield, J. M. (2014). Clinical features and management of Malassezia folliculitis. Journal of Clinical Dermatology, 33(2), 45-50.
37. Sharma, R., & Rathi, A. (2020). Candida species in dermatological diseases: A review of pathogenesis and treatment options. Indian Journal of Dermatology, 65(3), 164-170. https://doi.org/10.4103/ijd.IJD_256_19
38. Velegraki, A., & Hadi, U. M. (2015). Fungal infections in dermatology: Emerging and established pathogens. Journal of Clinical Microbiology, 53(5), 1389-1398. https://doi.org/10.1128/JCM.03388-14