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Dermatophytosis: A Comprehensive Review Integrating Modern and Unani Medical Perspectives

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Abstract: Background: Dermatophytosis is one of the most prevalent fungal infections worldwide, affecting the keratinized tissues — skin, hair, and nails — of humans and animals. The global burden of superficial fungal infections is enormous, with an estimated 20–25% of the world population affected at any given time. Objectives: This review aims to provide a comprehensive account of dermatophytosis from both modern biomedical and classical Unani medical perspectives, covering epidemiology, etiopathogenesis, clinical manifestations, diagnosis, and therapeutic approaches. Methods: A systematic literature search was conducted across PubMed, Scopus, Google Scholar, and classical Unani texts including Al-Qanun fil-Tibb (Canon of Medicine), Kitab al-Kulliyat, Zakhira-e-Khwarazmshahi, Bayaz-e-Kabeer, and Qarabadeen-e-Majeedi. Both English and Urdu/Arabic language sources were included. Results: Dermatophytosis corresponds to the Unani concepts of Quba (ringworm/tinea), Sa'fas (tinea capitis), and Daud (herpes circinatus). Unani scholars have described these conditions extensively, attributing them to imbalances in Sue-e-Mizaj (dyscrasia) and corrupted Akhlat (humours). Classical treatment modalities — including herbal formulations such as Roghan-e-Kalonji, Turmeric, Neem, and compound preparations like Marham-e-Namak and Roghan-e-Zard — demonstrate significant antifungal activity corroborated by contemporary pharmacological research. Conclusion: An integrative approach combining evidence-based modern antifungal therapy with validated Unani phytomedicines may offer synergistic benefits, reduce drug resistance, and improve patient outcomes. Further clinical trials are warranted to standardize Unani formulations for dermatophytosis management.

Keywords: *Dermatophytosis, Tinea, Quba, Sa'fas, Daud, Unani Medicine, Antifungal, Ringworm, Phytotherapy, Integrative Medicine.*

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I. INTRODUCTION

Dermatophytosis, commonly referred to as *'ringworm'* despite the absence of any parasitic worm, represents a group of superficial fungal infections caused by a specialized group of keratinophilic fungi called *dermatophytes*. These organisms possess a unique ability to invade and colonize the keratinized tissues of the epidermis, hair, and nails, producing enzymes such as keratinases that degrade keratin as a nitrogen source.[1]

Dermatophytosis ranks among the most common infectious diseases globally. The World Health Organization (WHO) estimates that superficial mycoses affect approximately 20–25% of the world's population, making dermatophytosis the fourth most common non-fatal disease globally.[2] In tropical and subtropical countries including India, the prevalence is disproportionately higher owing to hot and humid climatic conditions, overcrowding, poor socioeconomic status, and limited access to healthcare.[3]

In Unani medicine — the classical Greco-Arabic system of medicine practiced widely in South Asia and the Middle East — dermatophytosis has been recognized for centuries under various nomenclatures. The term *Quba* described in classical Unani texts corresponds broadly to ringworm of the body (tinea corporis), while *Sa'fas* refers to scalp ringworm (tinea capitis), and *Daud* to circinate or herpes-like skin

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eruptions. Eminent Unani scholars including Ibn Sina, Jurjani, and Ali Ibn Abbas Al-Majusi have provided detailed clinical descriptions and treatment protocols for these dermatological conditions.[4,5]

This comprehensive review aims to amalgamate the rich classical Unani medical heritage with contemporary biomedical knowledge on dermatophytosis. By examining etiology, pathophysiology, clinical features, diagnosis, and treatment from both perspectives, this article seeks to provide a scholarly resource for clinicians, researchers, and academicians interested in integrative dermatology.

II. METHODOLOGY

A comprehensive literature search was conducted using electronic databases including PubMed/MEDLINE, Scopus, Embase, Cochrane Library, and Google Scholar. Search terms included 'dermatophytosis,' 'tinea,' 'dermatophytes,' 'ringworm,' 'onychomycosis,' combined with 'Unani,' 'Quba,' 'Sa'fas,' 'Islamic medicine,' 'Greco-Arabic medicine,' 'phytotherapy,' and 'antifungal.' Articles published from 1970 to June 2025 were included.

Classical Unani textbooks reviewed included: Al-Qanun fil-Tibb (Canon of Medicine) by Ibn Sina, Zakhira-e-Khwarazmshahi by Jurjani, Kitab al-Kulliyat by Ibn Rushd (Averroes), Al-Hawi fil Tibb by Razi, Bayaz-e-Kabeer, Makhzan-ul-Mufradat by Hakeem Kabiruddin, and Qarabadeen-e-Majeedi. Both English-language biomedical literature and Urdu/Arabic Unani classical texts were incorporated. Case reports, case series, in vitro studies, animal studies, clinical trials, systematic reviews, and meta-analyses were included.

III. TAXONOMY AND ETIOLOGY OF DERMATOPHYTES

➢ *Modern Classification*

Dermatophytes are classified under the phylum *Ascomycota*, class *Eurotiomycetes*, order *Onygenales*, and family *Arthrodermataceae*. Three anamorphic (asexual) genera are clinically significant: *Trichophyton*, *Microsporum*, and *Epidermophyton*. The teleomorphic (sexual) genus is *Arthroderma*.[6]

Based on their primary ecological niche, dermatophytes are classified into three groups: (1) Anthropophilic species — primarily infecting humans (e.g., Trichophyton rubrum, T. tonsurans, T. violaceum, T. mentagrophytes var. interdigitale, Epidermophyton floccosum); (2) Zoophilic species — primarily infecting animals but transmissible to humans (e.g., Microsporum canis, T. verrucosum, T. equinum); and (3) Geophilic species — soil-inhabiting fungi that occasionally infect humans and animals (e.g., Microsporum gypseum, M. fulvum).

Table 1: Clinically Important Dermatophyte Species and Associated Clinical Forms

Species	Ecotype	Primary Host	Common Clinical Form
Trichophyton rubrum	Anthropophilic	Humans	Tinea pedis, onychomycosis, tinea corporis
T. tonsurans	Anthropophilic	Humans	Tinea capitis (endothrix)
T. violaceum	Anthropophilic	Humans	Tinea capitis, tinea corporis
T. mentagrophytes	Zoophilic/Anthropophilic	Rodents, humans	Tinea pedis, tinea corporis
Microsporum canis	Zoophilic	Cats, dogs	Tinea capitis (ectothrix), tinea corporis
M. gypseum	Geophilic	Soil	Tinea corporis, tinea capitis
Epidermophyton floccosum	Anthropophilic	Humans	Tinea cruris, tinea pedis

➢ *Unani Perspective on Etiology (Asbab)*

In Unani medicine, the etiology of skin diseases including dermatophytosis is understood through the framework of *Asbab-e-Sitta Zarooriya* (six essential etiological factors) and humoral theory. Skin diseases are classified as *Amraz-e-Jild* and attributed to derangement of *Akhlat* (humours) — predominantly Safra (yellow bile) and Balgham (phlegm) — leading to *Sue-e-Mizaj Haar Ratab* (hot-moist dyscrasia).[7]

Ibn Sina in *Al-Qanun fil-Tibb* described *Quba* as a condition caused by *Khilt-e-Murra Safra* (yellow bile) mixed with *Khilt-e-Balgham* (phlegm) settling in the skin, producing circular, scaly, pruritic eruptions. The causative *Madda* (pathogenic material) is considered to corrupt the *Ruh-e-Nafsani* (animal spirit) and impair skin nutrition.[8]

Jurjani in Zakhira-e-Khwarazmshahi described Sa'fas (tinea capitis) as resulting from a hot, moist morbid material (Madda-e-Haar Ratab) affecting the scalp, causing hair loss, scaling, and inflammation — a description remarkably consistent with modern understanding of tinea capitis.

IV. EPIDEMIOLOGY

➢ *Global Burden*

Dermatophytosis collectively affects approximately 1.5 billion people worldwide, constituting roughly 20% of the global population.[9] Global epidemiological studies estimate

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that tinea pedis alone affects up to 15% of the world population.[10] Onychomycosis, the most prevalent nail disorder globally, accounts for about 50% of all nail diseases with a prevalence of 5.5% in the general population.[11]

➢ *Epidemiology in India*

India bears a substantial burden of dermatophytosis. Hospital-based studies indicate that dermatophytosis accounts for 30–40% of all dermatological consultations in dermatology outpatient departments in India.[12] A multicenter study by Dogra et al. (2017) highlighted an epidemic-level surge of difficult-to-treat, chronic, relapsing tinea infections in India, largely driven by *T. indotineae*, a newly described species resistant to terbinafine.[13]

➢ *Risk Factors*

Well-established risk factors for dermatophytosis include: humid and tropical climate, overcrowding and poor living conditions, diabetes mellitus (2–3 fold increased risk), immunosuppression (HIV/AIDS, organ transplantation, prolonged corticosteroids), occupational exposure (athletes, farmers, healthcare workers), sharing of fomites (combs, towels, footwear), tinea in household contacts, and excessive sweating (hyperhidrosis).

V. PATHOGENESIS

➢ *Modern Pathogenesis*

Dermatophyte infection involves a sequential process: adhesion of arthroconidia or hyphal elements to keratinized host tissue, germination and invasion, and eventual immune activation. Dermatophytes produce an array of proteolytic enzymes — keratinases, elastases, collagenases, and lipases — that facilitate penetration and utilization of keratin as a nutrient source.

The virulence factors include: Sub3 serine protease, Dpp IV (dipeptidyl peptidase IV), Mep3 metalloprotease, LysM domain-containing proteins that mask fungal cell walls from immune recognition, and mannan — a cell wall component that suppresses lymphocyte proliferation and modulates the host immune response.[14]

Host immunity involves both innate and adaptive arms. Keratinocytes produce defensins and cytokines (IL-1β, IL-6, IL-8, TNF-α) upon fungal recognition via pattern recognition receptors (PRRs), particularly Dectin-1. CD4+ Th1-mediated immunity is protective; defects in cell-mediated immunity predispose to chronic or disseminated infections.

➢ *Unani Pathogenesis (Tashreeh-o-Amraze Jild)*

Unani pathogenesis centers on the concept of *Sue-e-Mizaj* (dyscrasia) and *Fasad-e-Akhlat* (corruption of humours). The skin *(Jild)* receives its nutrition from *Khoon* (blood) through the *Urooq* (vessels). When Safra or Balgham accumulates excessively, it reaches the superficial tissues and corrupts the *Mizaj-e-Jild*. This leads to *Haar Ratab* (hot-moist temperament) of the skin, creating conditions analogous to the warm, moist environment favourable to fungal growth.[7,8]

The concept of Madda-e-Fasida (putrefied morbid matter) settling in the skin aligns with the modern understanding of fungal colonization. The Unani concept of Quwa-e-Dafe'a (expulsive faculty) parallels the host immune response, wherein impairment of this faculty results in inability to expel the morbid matter, leading to chronic infection.

VI. CLINICAL MANIFESTATIONS

➢ *Classification and Clinical Forms (Modern)*

Dermatophytosis is traditionally classified based on anatomical location, preceded by the prefix 'tinea':

Table 2: Clinical Forms of Dermatophytosis with Unani Equivalents

Clinical Form	Causative Species	Clinical Features	Unani Nomenclature	Unani Description
Tinea capitis	*T. tonsurans, T. violaceum, M. canis*	Scalp scaling, alopecia, kerion in severe cases	*Sa'fas*	Scalp hot-moist eruption with hair loss
Tinea corporis	*T. rubrum, T. mentagrophytes*	Annular erythematous scaly plaques, central clearing	*Quba*	Circular scaly pruritic lesion
Tinea cruris	*T. rubrum, E. floccosum*	Groin: erythema, scaling, pruritus, spares scrotum	*Daud*	Moist, pruritic groin eruption
Tinea pedis	*T. rubrum, T. mentagrophytes*	Interdigital maceration, scaling, vesicles	*Quba Qadam*	Foot ringworm (foot-related Quba)
Tinea unguium (Onychomycosis)	*T. rubrum, T. mentagrophytes*	Subungual hyperkeratosis, onycholysis, nail dystrophy	*Bukhaar al-Zufr*	Nail discolouration and brittleness
Tinea barbae	*T. verrucosum, T. mentagrophytes*	Beard area folliculitis, nodules, boggy plaques	*Quba Lihya*	Beard area eruption

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Tinea manuum	*T. rubrum*	Unilateral palmar scaling, hyperkeratosis	*Quba Kaff*	Hand ringworm

➢ *Special Clinical Presentations*

In contemporary India, a novel epidemic pattern has emerged: *tinea incognito* — infections modified by topical corticosteroids and antifungal-steroid combination creams — producing atypical, extensive, non-annular, steroid-modified lesions. This is now among the most common presentations encountered in Indian dermatology practice.[13,15]

Majocchi's granuloma, a deep follicular dermatophytosis caused predominantly by *T. rubrum*, occurs in immunocompromised hosts or following topical steroid use. *T. indotineae*, first identified in 2019, represents a terbinafine-resistant species causing widespread, treatment-refractory infections in India and Southeast Asia.[16]

VII. DIAGNOSIS

➢ *Modern Diagnostic Methods*

- *Direct Microscopy (KOH Mount)*

Potassium hydroxide (KOH) preparation (10–20% KOH) of skin scrapings, nail clippings, or hair is the cornerstone of rapid diagnosis, demonstrating branching septate hyphae or arthrospores. The sensitivity ranges from 47–90% depending on the specimen quality and examiner expertise. Calcofluor white stain enhances sensitivity using fluorescence microscopy.

- *Fungal Culture*

Sabouraud's dextrose agar (SDA) with cycloheximide and chloramphenicol remains the gold standard for definitive identification of dermatophyte species. Cultures typically require 1–3 weeks at 25–28°C. Macroscopic colony morphology and microscopic features (macro- and microconidia) enable species-level identification.

- *Molecular Diagnostics*

PCR-based methods targeting the ITS (Internal Transcribed Spacer) region of rDNA, MALDI-TOF mass spectrometry, and next-generation sequencing (NGS) offer rapid, highly sensitive and specific identification, particularly valuable for identifying T. indotineae and distinguishing cryptic species.

- *Wood's Lamp*

Wood's lamp (UV-A, 365 nm) examination produces characteristic fluorescence: bright green fluorescence with *M. canis* and *M. audouinii* (ectothrix). *T. tonsurans* (endothrix) and *T. rubrum* do not fluoresce.[17]

➢ *Diagnosis in Unani Medicine (Tashkhees)*

Unani diagnosis of skin diseases relies on Nazra (visual inspection), Jass (palpation), and Shu'ur (patient symptoms). Classical texts describe the morphological features of Quba as: circular (Mustadeer) scaly lesions, centrifugal spread with clearing at center, intense pruritus, redness, and occasional vesiculation — features consistent with modern dermatological criteria.

Mizaj (temperament) assessment through pulse examination *(Nubz)*, urine examination *(Baul)*, and stool analysis *(Baraz)* helps determine the predominant corrupted humour (Khilt), guiding therapeutic choices. Ibn Sina distinguished between Haar (hot), Barid (cold), Ratab (moist), and Yabis (dry) forms of skin diseases, each requiring specific treatment.[8]

VIII. TREATMENT

➢ *Modern Pharmacological Treatment*

- *Topical Antifungals*

Topical antifungals remain first-line therapy for limited tinea corporis, tinea cruris, tinea pedis, and tinea manuum. Commonly used agents include: Azoles (clotrimazole 1%, miconazole 2%, ketoconazole 2%, luliconazole 1%, efinaconazole 10%) — mechanism: inhibition of ergosterol synthesis via lanosterol 14α-demethylase (CYP51); Allylamines (terbinafine 1%, naftifine 1%) — mechanism: squalene epoxidase inhibition; Ciclopirox 8% nail lacquer; Amorolfine 5% nail lacquer for onychomycosis. Treatment duration: 2–4 weeks for tinea corporis/cruris; 4–6 weeks for tinea pedis.

- *Systemic Antifungals*

Systemic therapy is indicated for tinea capitis, onychomycosis, tinea unguium, extensive tinea corporis, immunocompromised hosts, or treatment failures. Terbinafine (250 mg/day for 6 weeks for fingernails, 12 weeks for toenails) remains the drug of choice for onychomycosis. Itraconazole (200–400 mg/day) is effective for azole-susceptible species and Candida co-infections. Griseofulvin — the oldest oral antifungal — remains preferred for pediatric tinea capitis (15–20 mg/kg/day for 6–8 weeks). Fluconazole (150–300 mg weekly) offers an alternative for tinea corporis and onychomycosis.

- *Emerging Resistance — T. indotineae*

The emergence of *T. indotineae*, characterized by high-level terbinafine resistance (MIC ≥ 4 μg/mL), poses a significant therapeutic challenge. Recommended alternatives include itraconazole, voriconazole, and — investigationally — olorofim.[16,18]

➢ *Unani Treatment Approach*

- *Principles of Unani Treatment*

Unani treatment follows four sequential principles: (1) *Ilaj-bil-Tadbeer* (regimenal therapy) — including *Hammam* (medicinal bath), *Dalk* (massage), and *Taleeq* (local application); (2) *Ilaj-bil-Ghiza* (dietotherapy); (3) *Ilaj-bil-Dawa* (pharmacotherapy) — using Mufrad (single) and Murakkab (compound) formulations; and (4) *Ilaj-bil-Yad* (surgery/cautery) — rarely used.[4]

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- *Single Drug Formulations (Mufradat) with Antifungal Evidence*

Table 3: Unani Single Drug Formulations (Mufradat) Used in Dermatophytosis with Modern Evidence

Unani Name	Botanical Name	Part Used / Formulation	Unani Action	Scientific Evidence
Kalonji	*Nigella sativa L.*	Seeds / Roghan-e-Kalonji (oil)	Muharrik, Munaqqi, Qatil-e-Deedan	Thymoquinone inhibits dermatophyte growth; MIC 0.25–1 mg/mL
Zard Chob (Haldi)	*Curcuma longa L.*	Rhizome / Paste, Roghan	Dafae Taffun, Muhallil	Curcumin antifungal vs T. rubrum; MIC 16 µg/mL; disrupts ergosterol
Neem	*Azadirachta indica A.Juss.*	Leaves, seed oil / Roghan, paste	Dafae Taffun, Qatil Harashat	Neem oil/limonoids inhibit T. rubrum, M. canis; antifungal MIC 0.5–4 mg/mL
Lahsun	*Allium sativum L.*	Bulb / Juice, oil	Muqawwi Harara, Qatil Harashat	Allicin: broad antifungal; MIC 0.006–0.013 mg/mL against T. rubrum
Sumbul-ut-Teeb / Jatamansi	*Nardostachys jatamansi DC.*	Roots / Powder, oil	Muhallil, Musakkin	EO with antifungal activity vs T. mentagrophytes, M. canis
Aak (Madar)	*Calotropis procera (Aiton) W.T.Aiton*	Latex / Topical	Dafae Taffun, Qatil Harashat	Calotropin and calactin show antidermatophytic activity
Suranjan (Colchicum)	*Colchicum autumnale L.*	Corm / Decoction, paste	Muhallil Awraam, Dafae Taffun	Antifungal activity reported in preliminary studies
Roghan-e-Zard (Ghee)	*Butyrum (clarified butter)*	Topical base / Compound preparations	Mulayyin, carrier	Vehicle for lipophilic antifungal components; emollient

- *Classical Compound Formulations (Murakkabat)*

Several compound Unani formulations are prescribed for *Quba* in classical texts and National Formulary of Unani Medicine (NFUM):[19]

Marham-e-Namak: A classical ointment containing salt (Namak), ghee, and other adjuvants, described in Bayaz-e-Kabeer for Quba. Roghan-e-Zard Murakkab: Compound preparation incorporating turmeric, neem, and clarified butter for topical application. Marham-e-Khoobaan: Indicated for chronic, scaly dermatological conditions. Roghan-e-Sheeh (Artemisia oil-based preparation): Applied topically for tinea corporis. Zimad-e-Hulba: A poultice preparation of fenugreek for skin infections. Habb-e-Mussaffi-ud-Dam: An oral blood purifier formulation for chronic skin diseases with humoral toxicity.

- *Regimenal Therapy (Ilaj-bil-Tadbeer)*

Hammam (medicated steam bath): Steam baths with Neem leaves, Eucalyptus, and Pudina open pores and facilitate drug penetration, analogous to hydration-enhanced topical drug delivery. Dalk (massage): Vigorous massage with medicated oils improves local circulation (Hararat Ghareezi) and enhances drug absorption. Hijamat (wet cupping): Used in chronic cases for blood purification and removal of Fasid Akhlat (morbid humours). Tilaa (local application): Vigorous rubbing of medicated pastes directly on lesions — a practice endorsed in classical texts for Quba.

IX. PHARMACOLOGICAL BASIS OF UNANI ANTIFUNGAL PLANTS

➢ *Mechanisms of Action of Key Unani Plants*

The antifungal mechanisms of key Unani plants have been elucidated through modern pharmacological studies:[20,21,22]

- Nigella sativa (Kalonji): Thymoquinone (TQ), the principal bioactive compound, disrupts fungal cell membrane integrity by inhibiting ergosterol synthesis. TQ also inhibits mitochondrial function in fungal cells. Studies have demonstrated that TQ-based formulations inhibit *T. rubrum*, *T. mentagrophytes*, and *M. canis* at MICs of 0.25–2 mg/mL.[23]

- Curcuma longa (Zard Chob/Haldi): Curcumin demonstrates antifungal activity through disruption of fungal plasma membrane structure, downregulation of ergosterol biosynthesis genes (*ERG11*, *ERG3*), and inhibition of germ tube formation. A randomized controlled trial (RCT) by Agarwal et al. (2008) demonstrated comparable efficacy of curcumin gel vs. clotrimazole cream in tinea corporis.[24]

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- Azadirachta indica (Neem): Azadirachtin, nimbolide, and gedunin — limonoid terpenoids — disrupt fungal cell wall synthesis and inhibit biofilm formation. Neem leaf extract has shown potent activity against *T. rubrum*, *T. tonsurans*, and *E. floccosum* in multiple in vitro studies.[25]

- Allium sativum (Lahsun/Garlic): Allicin (diallyl thiosulfinate) exerts potent antifungal activity by inhibiting thiol-containing enzymes of fungi, disrupting acetyl-CoA metabolism, and damaging fungal membranes. Garlic oil demonstrates MIC values of 0.006–0.025 mg/mL against *T. rubrum* — comparable to fluconazole.[26]

X. COMPLICATIONS

Untreated or inadequately treated dermatophytosis can lead to: secondary bacterial infection (cellulitis, abscess); id reaction (dermatophytid) — distant vesicular or papular eruption representing hypersensitivity; kerion celsi — severe suppurative form of tinea capitis with permanent alopecia; Majocchi's granuloma — deep follicular granulomatous infection; permanent nail dystrophy in untreated onychomycosis; and septic arthritis or osteomyelitis in severely immunocompromised patients with disseminated infection.

From a Unani perspective, untreated Quba leads to Imtidad (extension of disease), Taqeed (chronicity), and systemic humoral imbalance affecting internal organs — concepts alignable with the modern understanding of local spread and dissemination in immunocompromised hosts.

XI. PREVENTION AND PUBLIC HEALTH MEASURES

Prevention of dermatophytosis requires both individual and public health interventions. Individual measures include: maintaining skin hygiene and dryness, especially in intertriginous areas; wearing breathable footwear and moisture-wicking clothing; avoiding sharing personal items (towels, combs, footwear); treating household contacts and pet infections simultaneously; and early treatment of athlete's foot to prevent nail involvement.

Public health measures include: health education in schools regarding tinea capitis; screening of school-age children in endemic areas; treatment of infected pets (particularly cats and dogs) as reservoirs of M. canis; improvement of sanitation and living conditions; and dermatological screening of migrant workers in high-risk occupations.

In Unani preventive medicine (Hifzane Sihat), emphasis is placed on: dietary regulation (Tadbeer Ghiza) to maintain Itidal-e-Mizaj (humoral equilibrium); regular bathing and skin care (Nizafat-e-Badan); use of preventive aromatic fumigants (Bukhoor) with antifungal plants; and strengthening of Quwa Tabiyya (vital force) through proper lifestyle.

XII. INTEGRATIVE APPROACH: UNANI AND MODERN MEDICINE

The integrative management of dermatophytosis combining evidence-based modern antifungal therapy with validated Unani phytomedicines represents a promising approach, particularly in the context of rising antifungal resistance, adverse effects of systemic antifungals (hepatotoxicity with itraconazole, terbinafine-induced taste disturbance), and the high relapse rates seen in chronic dermatophytosis.

A scientifically rational integrative protocol may include: first-line oral antifungal (terbinafine or itraconazole per susceptibility) combined with topical curcumin or Nigella sativa oil to enhance local fungistatic effect; dietary modifications per Unani principles to reduce sugar intake (reducing fungal substrate); regimenal therapies (Hammam, Dalk) to improve drug penetration; and blood-purifying Unani formulations (Habb-e-Mussaffi-ud-Dam) for humoral correction in chronic refractory cases.

Evidence from systematic reviews suggests that several Unani plants — particularly *Nigella sativa*, *Curcuma longa*, *Allium sativum*, and *Azadirachta indica* — demonstrate genuine antifungal activity in vitro and in limited clinical studies, providing a scientific rationale for their integration into mainstream dermatophytosis management.[20,21,22,23,24,25,26]

XIII. FUTURE DIRECTIONS AND RESEARCH GAPS

Several research priorities remain unaddressed: (1) Large-scale randomized controlled trials (RCTs) comparing Unani formulations vs. standard antifungals for tinea corporis and tinea capitis; (2) Standardization and quality control of Unani compound formulations using HPLC, GC-MS, and pharmacopoeal methods; (3) Pharmacokinetic and pharmacodynamic studies of Unani active phytochemicals (thymoquinone, curcumin, allicin) in dermatophytosis models; (4) Investigation of synergistic combinations of Unani phytochemicals with conventional antifungals to combat T. indotineae resistance; (5) Development of standardized topical Unani formulations (nanoparticle-encapsulated, transdermal patches) with enhanced bioavailability; and (6) Epidemiological studies correlating Unani Mizaj (temperament) with susceptibility patterns to dermatophytosis.

XIV. CONCLUSION

Dermatophytosis represents a significant global dermatological burden with considerable morbidity, particularly in tropical countries including India. The convergence of modern mycological understanding and classical Unani medical knowledge offers a unique perspective on this ancient yet contemporary disease.

Unani medicine has recognized and described dermatophytosis for over a millennium, with detailed clinical descriptions, humoral etiopathogenesis, and multi-modal

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therapeutic protocols that exhibit remarkable clinical insight. Contemporary pharmacological research has validated the antifungal efficacy of numerous Unani medicinal plants, providing a scientific foundation for their therapeutic use.

The alarming emergence of terbinafine-resistant T. indotineae and the epidemic of steroid-modified tinea in India underscores the urgent need for alternative and adjunctive therapeutic strategies. An evidence-based integrative approach, grounding Unani phytotherapy within the framework of modern clinical practice, holds promise for improving treatment outcomes, reducing resistance, and providing cost-effective solutions for dermatophytosis management, particularly in resource-limited settings.

- *Conflicts of Interest*

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