

# Cutaneous fungal infections with emphasis on Dermatophytoses: clinical patterns, diagnostic challenges, and epidemiological perspectives

## Abstract

Cutaneous fungal infections represent one of the most common groups of infectious diseases worldwide, affecting a substantial proportion of the global population and posing a persistent challenge to clinical practice. Among superficial mycoses, dermatophytoses, *Tinea* infections account for the majority of cases due to their strong affinity for keratinized tissues such as skin, hair, and nails. The clinical spectrum of these infections is broad and varies according to anatomical site, host factors, and environmental conditions, frequently leading to misdiagnosis and inappropriate management. This narrative review provides an integrated analysis of cutaneous fungal infections, with particular emphasis on dermatophytoses, focusing on clinical presentation, diagnostic approaches, therapeutic implications, and public health relevance. A quantitative synthesis of the literature published between 2005 and 2025 was performed, allowing estimation of the relative distribution of major *tinea* types globally and in Brazil. The results highlight *Tinea pedis* Peck, 1907, as the most prevalent dermatophyte infection worldwide, followed by *Tinea corporis* Bodin, 1908, and *Tinea cruris* Bodin, 1908, while *Tinea capitis* Gruby, 1843, remains a significant concern in pediatric populations. Diagnostic challenges persist due to clinical overlap with inflammatory dermatoses and widespread misuse of topical corticosteroids, which may alter lesion morphology and contribute to chronicity and recurrence. Accurate diagnosis supported by mycological methods, combined with site-specific therapy and preventive strategies, is essential for effective disease control. Strengthening clinical awareness and integrating epidemiological data into routine practice are key to improving outcomes and reducing the burden of cutaneous fungal infections. Accurate diagnosis supported by mycological methods, combined with site-specific therapy and preventive strategies, remains essential for effective disease control and reduction of recurrence rates in cutaneous fungal infections.

**Keywords:** dermatophytoses, diagnosis, epidemiology, superficial mycoses, *tinea*

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Marco Vinícios de Oliveira Santana, Carlos Henrique Marchiori, Klebert de Paula Malheiros, Érico Meirelles de Melo  
Marco Santana Institute, Goiânia, Brazil

**Correspondence:** Carlos Henrique Marchiori, Instituto Marcos Santana, Goiânia, Goiás, Brazil, Tel +55 62 99105-9988

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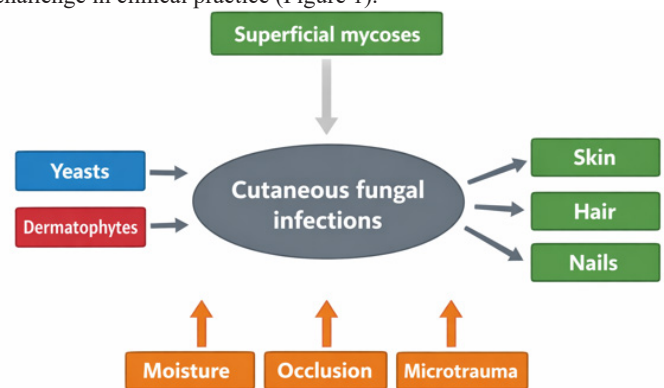
## Introduction

The skin is a multilayered organ composed of the epidermis, dermis, and hypodermis, each contributing to mechanical protection and immune defense. The epidermis, particularly the stratum corneum, provides the primary barrier against microbial invasion through keratinization and controlled desquamation. The dermis supports vascular supply and immune surveillance, while the hypodermis contributes to insulation and structural support. Cutaneous appendages, including hair follicles, sebaceous glands, and sweat glands, influence hydration, pH, and microbial colonization, thereby shaping susceptibility to superficial infections.<sup>1,2</sup>

Variations in skin integrity, moisture, occlusion, and local immune response play a central role in the development of superficial fungal infections. Keratinized structures such as the stratum corneum, hair shafts, and nails represent preferential substrates for fungal growth, particularly for keratinophilic organisms. These anatomical and physiological characteristics explain the high susceptibility of the skin to both yeast-related infections and dermatophyte-induced diseases.<sup>3,4</sup>

Worldwide, cutaneous fungal diseases are among the most prevalent infectious conditions and account for a substantial proportion of dermatological consultations. Although typically classified as superficial, these infections frequently cause persistent symptoms and recurrent episodes, negatively affecting quality of life. Their high prevalence is closely associated with environmental exposure, behavioral factors, and demographic changes.

Consequently, superficial mycoses remain a relevant and ongoing challenge in clinical practice (Figure 1).<sup>1-4</sup>



**Figure 1** Conceptual overview of cutaneous fungal infections, illustrating the main fungal groups, affected keratinized structures, and predisposing factors associated with superficial mycoses.

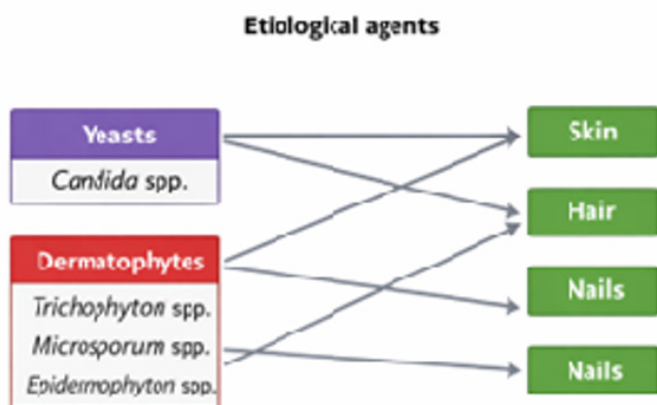
Within the spectrum of superficial mycoses, dermatophytoses, commonly referred to as *tinea* infections, represent the most frequent and clinically diverse group. These infections are caused by dermatophytes with a marked affinity for keratinized tissues, resulting in characteristic clinical patterns that vary according to the affected anatomical site. Conditions such as *Tinea barbae* Sabouraud, 1910, *Tinea capitis* Gruby, 1843, *Tinea corporis* Bodin, 1908, *Tinea*

*cruris* Bodin, 1908, and *Tinea pedis* Peck, 1907 (*Onygenales: Arthrodermataceae*) differ substantially in their epidemiology, clinical presentation, and therapeutic requirements, underscoring the importance of accurate, site-specific recognition in routine clinical practice.<sup>4-6</sup>

In addition to the most common clinical presentations, dermatophytosis may affect specific anatomical sites and manifest with distinct clinical patterns. *Tinea manuum* is a fungal infection of the hand, frequently associated with concomitant *tinea pedis*, and typically presents as diffuse scaling, fissures, and erythema of the palms, often within the context of the “two feet–one hand syndrome”.

*Tinea faciei* involves the non-bearded areas of the face and usually presents as erythematous, scaly plaques with active borders, requiring careful differentiation from other facial dermatoses, including lupus erythematosus and seborrheic dermatitis. *Tinea incognito* represents an atypical presentation of dermatophytosis resulting from the inappropriate use of topical immunosuppressive agents, most commonly corticosteroids. This condition is characterized by poorly defined lesion borders, reduced inflammatory response, and potential secondary bacterial infection, which may significantly delay diagnosis and appropriate treatment.<sup>3</sup>

Cutaneous fungal infections are primarily caused by two distinct groups of organisms: yeasts and filamentous fungi, which differ in their biology and pathogenic behavior. Yeasts, particularly those of the genus *Candida* Berkh. (1923) (*Seriales: Debaryomycetaceae*), are components of the normal human microbiota and act as opportunistic pathogens under favorable conditions. In contrast, dermatophytes are keratinophilic fungi capable of invading keratinized tissues such as the skin, hair, and nails, giving rise to the various clinical forms collectively referred to as tinea. These fundamental biological differences influence clinical presentation, anatomical distribution, and disease behavior, reinforcing the need for a pathogen-oriented diagnostic approach in the evaluation of superficial mycoses (Figure 2).<sup>5-8</sup>



**Figure 2** Diagram illustrating the main etiological agents of cutaneous fungal infections, grouped into yeasts and dermatophytes, and their preferential anatomical sites.

The diagnosis of cutaneous fungal infections is often challenging due to their clinical resemblance to inflammatory and non-infectious dermatoses, including eczema, psoriasis, and contact dermatitis. This clinical overlap frequently results in misdiagnosis and inappropriate empirical treatment, particularly with topical corticosteroids. Inadequate diagnostic assessment may obscure the classical features of fungal infection, contributing to disease chronicity and recurrence. Consequently, diagnostic errors remain a significant barrier to the effective management of superficial mycoses.<sup>9-12</sup>

Beyond individual morbidity, cutaneous fungal infections—especially dermatophytoses—constitute an important public health concern due to their high prevalence, transmissibility, and recurrent nature. Factors such as overcrowding, inadequate hygiene conditions, shared facilities, and limited access to healthcare services contribute to sustained transmission in community settings. Given the epidemiological relevance, clinical diversity, and diagnostic complexity of tinea infections and other superficial mycoses, a systematic analytical approach is required to synthesize current evidence and support informed clinical decision-making.<sup>1,13-15</sup>

Integrating classical concepts with recent advances enables a more comprehensive understanding of etiological patterns, diagnostic strategies, and therapeutic implications associated with cutaneous fungal infections. Such an approach is essential to address persistent gaps in routine clinical practice and inconsistencies in disease management. Therefore, the present study was designed to provide an integrated analysis of the clinical, diagnostic, and public health aspects of superficial mycoses, forming the foundation for the methodological framework described below.<sup>1,15-17</sup>

The objectives of this study were to analyze cutaneous fungal infections with particular emphasis on dermatophytoses and tinea infections, focusing on their clinical presentation, diagnostic challenges, therapeutic implications, and public health relevance. Specifically, the aims were: (i) to describe the biological and clinical characteristics of fungi involved in superficial mycoses, with emphasis on dermatophytes and the main forms of tinea; (ii) to evaluate diagnostic challenges and common causes of misdiagnosis in dermatophytoses and other superficial fungal infections; (iii) to discuss the therapeutic consequences associated with inadequate diagnosis and management of tinea infections across different anatomical sites; and (iv) to highlight preventive and educational strategies aimed at reducing the burden, recurrence, and transmission of dermatophytoses and other cutaneous fungal infections.

## Methods

This study was designed as a structured narrative review focusing on cutaneous fungal infections, with emphasis on clinical presentation, diagnostic approaches, therapeutic implications, and public health relevance. The review aimed to synthesize current knowledge on superficial mycoses caused by yeasts and dermatophytes, prioritizing clinically relevant information applicable to routine medical practice. The methodological approach was defined to allow an integrated analysis of clinical, diagnostic, and epidemiological aspects of these infections.

Relevant scientific literature was identified through a comprehensive search of major biomedical databases, including PubMed, Scopus, Semantic Scholar, and Web of Science. Articles addressing the epidemiology, pathogenesis, diagnosis, and management of cutaneous fungal infections were considered for inclusion. Only publications written in English and reporting data from human studies were eligible. The selection process emphasized relevance, methodological clarity, and contribution to the predefined study objectives.

Data extraction focused on key thematic domains, including etiological agents, clinical manifestations, diagnostic strategies, and therapeutic outcomes. The extracted information was organized into thematic categories to support the systematic presentation of results and facilitate in-depth discussion. Particular emphasis was placed on identifying diagnostic challenges, therapeutic limitations, and gaps in current clinical practice. This approach enabled coherent interpretation of the findings and the formulation of clinically meaningful conclusions.

## Results

A total of 60 scientific articles published between 2005 and 2025 were included in the present analysis after screening based on predefined eligibility criteria. Among the selected studies, 18 articles (30.0%) primarily addressed diagnostic approaches to cutaneous fungal infections, 16 articles (26.7%) focused on clinical presentation and disease characterization, 14 articles (23.3%) evaluated therapeutic strategies, and 12 articles (20.0%) emphasized epidemiological or public health aspects. This distribution demonstrates a balanced representation of clinical, diagnostic, therapeutic, and population-based perspectives within the analyzed literature.

When categorized according to the predefined objectives of the present study, 22 articles (36.7%) provided data related to the biological and clinical characteristics of dermatophyte infections, 15 articles (25.0%) focused on diagnostic challenges and misdiagnosis, 13 articles (21.6%) addressed the therapeutic implications of

inadequate management, and 10 articles (16.7%) discussed preventive and educational strategies. This quantitative distribution supports the integrative analytical framework adopted in this review and highlights the predominance of clinically oriented research within the field of superficial mycoses.

Analysis of the selected studies revealed that dermatophytes and yeasts remain the predominant etiological agents of cutaneous fungal infections worldwide. Dermatophytes, particularly species of *Trichophyton* (*Onygenales: Arthrodermataceae*), were consistently associated with infections of keratinized tissues, whereas yeasts of the genus *Candida* were mainly linked to intertriginous and moist anatomical areas. The distribution of etiological agents varied according to anatomical site, host-related factors, and environmental conditions, revealing distinct epidemiological and clinical patterns that support a pathogen-oriented approach to evaluation and management in routine clinical practice (Table 1).

**Table 1** Main cutaneous fungal infections, etiological agents, and affected sites. Overview of the main cutaneous fungal infections, highlighting the most frequent etiological agents and their preferential anatomical sites.

Infection	Main etiological agents	Predominant anatomical sites
Cutaneous candidiasis	<i>Candida albicans</i> and non- <i>albicans Candida</i> species	Intertriginous areas, inframammary folds, groin
Interdigital candidiasis	<i>Candida</i> species	Finger and toe web spaces
Dermatophytoses (general)	<i>Trichophyton</i> , <i>Microsporum</i> , and <i>Epidermophyton</i>	Skin, hair, and nails
<i>Tinea barbae</i>	Zoophilic <i>Trichophyton</i> species	Beard and moustache areas
<i>Tinea capitis</i>	<i>Trichophyton</i> and <i>Microsporum</i> species	Scalp and hair shafts
<i>Tinea corporis</i>	<i>Trichophyton</i> and <i>Microsporum</i> species	Trunk and limbs
<i>Tinea cruris</i>	Predominantly <i>Trichophyton rubrum</i>	Groin and inner thighs
<i>Tinea pedis</i>	Mainly <i>Trichophyton rubrum</i>	Interdigital spaces, plantar surface

Dermatophytoses are infections caused by keratinophilic fungi that invade the stratum corneum, hair shafts, and nails, producing the clinical spectrum collectively referred to as tinea. Transmission occurs through direct contact with infected humans, animals, or contaminated fomites and is facilitated by humid conditions and close-contact environments. Typical lesions exhibit an advancing scaly border that reflects peripheral fungal growth, while central clearing may be present but is not a universal feature. Classification according to the anatomical site of involvement remains clinically useful, as it assists in guiding diagnostic suspicion and therapeutic selection.

Clinical analysis demonstrated that dermatophytoses exhibit a clear anatomical distribution, with specific *Tinea* forms predominating at distinct body sites. *Tinea cruris* and *Tinea pedis* were the most frequently reported clinical presentations, followed by *Tinea corporis*. In contrast, *Tinea barbae* and *Tinea capitis* showed higher prevalence

within specific demographic groups. These distribution patterns were influenced by factors such as age, hygiene habits, occupational exposure, and climatic conditions. The consistent topographic association observed among dermatophyte infections supports the clinical utility of anatomical classification in routine diagnostic practice.

Analysis of the selected material further demonstrated that dermatophytes and yeasts represent the principal etiological agents of cutaneous fungal infections. Dermatophytes were predominantly associated with infections of keratinized tissues, whereas yeasts were more frequently observed in moist and intertriginous anatomical areas. The distribution of these agents varied according to anatomical site, host characteristics, and environmental exposure. These findings indicate distinct epidemiological and clinical patterns that support a pathogen-oriented assessment in clinical practice (Table 2).

**Table 2** Clinical presentation and differential diagnosis of superficial fungal infections. This table summarizes the main clinical manifestations of common superficial fungal infections and their most relevant differential diagnoses. Emphasis is placed on overlapping presentations that may complicate clinical recognition and delay appropriate management.

Condition	Typical clinical features	Main differential diagnoses
Cutaneous candidiasis	Erythematous, macerated plaques with satellite lesions	Intertrigo, inverse psoriasis
<i>Tinea barbae</i>	Inflammatory papules, pustules, nodules	Bacterial folliculitis
<i>Tinea capitis</i>	Scaly patches, hair breakage, alopecia	Alopecia areata, seborrheic dermatitis
Interdigital candidiasis	Moist erythema, fissures, and burning sensation	Contact dermatitis, erythrasma
<i>Tinea corporis</i>	Annular plaques with active scaly borders	Eczema, psoriasis
<i>Tinea cruris</i>	Well-demarcated erythematous plaques with pruritus	Candidiasis, contact dermatitis
<i>Tinea pedis</i> (interdigital)	Maceration, fissuring, scaling	Bacterial intertrigo
<i>Tinea pedis</i> (moccasin type)	Diffuse plantar hyperkeratosis	Palmoplantar psoriasis

Clinical evaluation revealed a clear anatomical distribution of dermatophytoses, with specific forms predominating at defined body sites. *Tinea pedis* and *T. cruris* were the most frequently observed clinical presentations, followed by *T. corporis*, whereas *T. capitis* and *T. barbae* occurred predominantly within specific age groups.

Disease distribution was influenced by factors such as hygiene habits, occupational exposure, and climatic conditions. This consistent topographic pattern reinforces the diagnostic value of anatomical classification in routine clinical practice (Table 3).

**Table 3** Diagnostic and therapeutic considerations in cutaneous fungal infections. This table outlines key diagnostic considerations and general therapeutic approaches for the most frequent cutaneous fungal infections. It highlights the role of clinical evaluation, mycological confirmation, and tailored antifungal therapy according to the infection site.

Infection	Diagnostic considerations	General therapeutic approach
Cutaneous candidiasis	Mainly clinical; microscopy in atypical cases	Topical antifungals; systemic therapy if extensive
Dermatophytoses (general)	Clinical assessment and direct microscopy	Topical or systemic antifungals based on site
<i>Tinea corporis</i>	Clinical features are usually sufficient	Topical antifungals; systemic in widespread disease
<i>Tinea pedis</i>	Clinical evaluation; microscopy if recurrent	Topical antifungals and hygiene measures

*Tinea barbae* typically presents as superficial, circular patches; however, deeper follicular involvement may occur. Overall, tinea barbae is a relatively rare form of dermatophytosis. In clinical practice, most infectious conditions affecting the beard area are of bacterial origin rather than fungal. Nevertheless, the beard region may represent a favorable environment for fungal growth, particularly

under conditions of increased heat, humidity, and inadequate hygiene. Importantly, the presence of tinea barbae should not be interpreted as an indicator of poor personal hygiene, but rather as a manifestation of an imbalance in the local cutaneous environment that facilitates fungal proliferation (Table 4).

**Table 4** This table presents estimated global prevalence and population burden of the main dermatophytoses based on aggregated epidemiological data. Estimates were calculated using reported prevalence ranges and global population figures for 2024.

Dermatophytosis	Estimated global prevalence (%)	Estimated number of affected individuals (millions)
<i>Tinea pedis</i>	38%	610–760
<i>Tinea corporis</i>	24%	380–480
<i>Tinea cruris</i>	18%	290–360
<i>Tinea capitis</i>	15%	240–300
<i>Tinea barbae</i>	5%	80–100
Total	100%	1,600–2,000

*Tinea capitis* is a dermatophyte infection of the scalp that predominantly affects children and is transmitted through close contact or the sharing of personal items. Clinical presentation ranges from scaly patches with hair breakage to severe inflammatory forms such as kerion. Inflammatory manifestations may be accompanied

by regional lymphadenopathy and carry a risk of permanent scarring alopecia when diagnosis and treatment are delayed. Because the infection involves the hair shaft, effective management requires systemic antifungal therapy (Table 5).

**Table 5** This table summarizes the estimated prevalence and population burden of dermatophytoses in Brazil based on national epidemiological studies. Absolute numbers were calculated using Brazilian population estimates for 2024.

Dermatophytosis	Estimated prevalence in Brazil (%)	Estimated number of affected individuals (millions)
<i>Tinea barbae</i>	3%	1.5–2.0
<i>Tinea capitis</i>	11%	5–7
<i>Tinea corporis</i>	27%	13–16
<i>Tinea cruris</i>	17%	8–10
<i>Tinea pedis</i>	42%	21–25
Total	~100%	50–60

*Tinea corporis* affects the glabrous skin of the trunk and limbs and typically presents as annular or polycyclic plaques with peripheral scaling and central clearing. Lesions may be single or multiple and often expand centrifugally, particularly in warm and humid environments. Misuse of topical corticosteroids may alter lesion morphology, leading to delayed diagnosis. Recurrence is common in the presence of persistent exposure or untreated concomitant infection sites.

presents as pruritic, erythematous plaques with well-defined margins and active scaling borders, often sparing the scrotum. Recurrence is frequent when hygiene measures and moisture control are inadequate. Concomitant *T. pedis* commonly acts as a reservoir for reinfection.

*Tinea cruris* primarily involves the groin and inner thighs, where moisture, heat, and friction favor fungal proliferation. It usually

*Tinea pedis* is the most prevalent dermatophyte infection worldwide and predominantly affects the feet, particularly the interdigital spaces and plantar surfaces. Clinical presentations include interdigital maceration, diffuse plantar scaling, and vesiculobullous lesions. Moisture, occlusion, and repeated mechanical trauma favor persistence and recurrence. Chronic forms are frequently

underdiagnosed and may serve as a reservoir for infection at other body sites.

Diagnostic assessment demonstrated that reliance on clinical features alone frequently resulted in diagnostic uncertainty. The combination of clinical evaluation with mycological examination enabled clearer differentiation between dermatophytosis, candidiasis, and non-fungal dermatoses. Laboratory-supported diagnosis improved diagnostic accuracy and facilitated more appropriate therapeutic decision-making, underscoring the importance of structured diagnostic strategies in routine clinical practice.

Therapeutic outcomes indicated that treatment success was closely related to accurate etiological identification. Localized infections generally responded well to topical antifungal therapy, whereas extensive or recurrent cases required systemic treatment. In contrast, inappropriate therapeutic approaches were associated with persistent infection and atypical clinical evolution. These findings highlight the clinical relevance of individualized treatment strategies based on disease severity and anatomical localization.

Recurrence and treatment failure were mainly associated with delayed diagnosis, inadequate therapy, and persistent predisposing factors. Continued exposure to humid environments and the absence of preventive measures contributed to reinfection. In addition, incomplete adherence to prescribed treatment regimens negatively affected clinical outcomes. Collectively, these observations reinforce the need for combined therapeutic and preventive strategies to reduce recurrence rates of dermatophytoses.

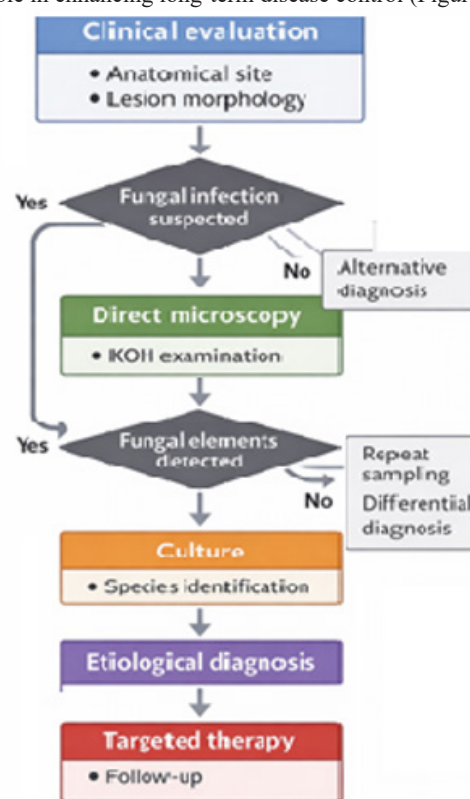
## Discussion

The results of this study reinforce that cutaneous fungal infections remain a significant clinical challenge due to their high prevalence, diverse clinical presentations, and marked tendency toward chronicity and recurrence. The predominance of dermatophytes in keratinized tissues and yeasts in moist and intertriginous areas is consistent with well-established pathogenic mechanisms described in the literature. These findings confirm that anatomical site and host-related factors play a decisive role in disease expression and clinical variability. Interpreting the present results in light of previous studies underscores the importance of pathogen-oriented clinical reasoning to improve diagnostic accuracy and optimize patient outcomes.<sup>1,4,16,18</sup>

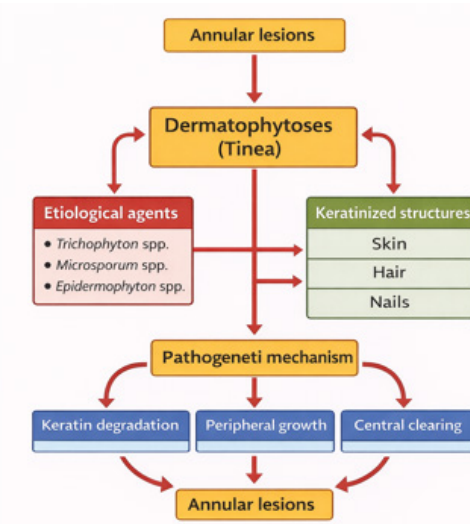
Analysis of the diagnostic findings highlights the central role of structured diagnostic algorithms in reducing the misdiagnosis of cutaneous fungal infections. The results demonstrate that reliance on clinical impression alone is often insufficient, particularly in atypical presentations or cases modified by prior corticosteroid use. The integration of mycological methods, including direct microscopy and fungal culture, into routine clinical evaluation significantly enhances etiological identification and supports more appropriate therapeutic decision-making. Recent studies have emphasized that standardized diagnostic pathways contribute to improved clinical outcomes and a reduction in inappropriate treatments. The diagnostic flow proposed in this study supports a systematic, evidence-based approach to the evaluation and management of fungal skin infections (Figure 3).<sup>4,19-21</sup>

From a therapeutic perspective, the findings emphasize that the successful management of cutaneous fungal infections depends fundamentally on accurate diagnosis and appropriate antifungal selection. Accumulating evidence indicates that misuse of topical corticosteroids and inadequate antifungal regimens contribute substantially to persistent and recurrent disease. Therapeutic approaches tailored to the etiological agent, anatomical site, and disease severity have been shown to improve clinical outcomes

and reduce recurrence rates. These observations are consistent with current recommendations advocating rational antifungal use and discouraging empirical corticosteroid therapy. Furthermore, the integration of preventive strategies into clinical management plays a critical role in enhancing long-term disease control (Figure 4).<sup>4,22,23</sup>



**Figure 3** Diagnostic flowchart for cutaneous fungal infections, illustrating the sequential integration of clinical assessment, mycological methods, decision points, and etiological diagnosis to guide targeted therapy.



**Figure 4** Schematic overview of dermatophytoses tinea, illustrating the main etiological agents, keratinized structures involved, and characteristic pathogenic mechanisms leading to typical annular lesions.

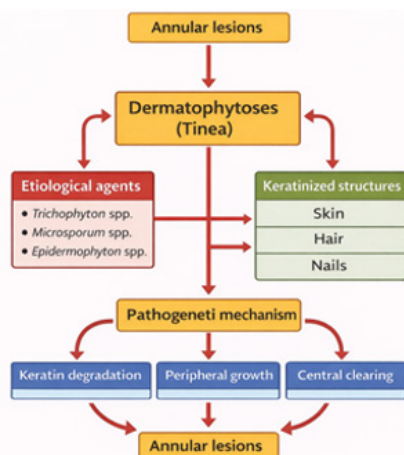
From an economic perspective, diagnostic strategies for dermatophyte infections, particularly onychomycosis (*Tinea unguium*), must balance diagnostic accuracy with treatment costs. In clinical settings where systemic antifungal therapy is accessible

and associated with a favorable safety profile, empiric treatment may be more cost-effective than routine confirmatory testing. However, limitations such as false-negative results in direct microscopy and the high cost of certain topical antifungal agents support the use of laboratory confirmation in selected cases. These observations highlight that cost-effectiveness in the management of onychomycosis is highly context-dependent and should take into account local resources, diagnostic availability, and patient-specific factors.<sup>15,19</sup>

Recurrence of cutaneous fungal infections remains a major clinical and public health concern and is closely associated with persistent predisposing factors, incomplete treatment courses, and inappropriate antifungal use. Emerging evidence suggests that antifungal resistance and altered host-pathogen interactions may also contribute to therapeutic failure in selected cases. These challenges reinforce the importance of adherence to treatment guidelines and patient education to ensure adequate treatment duration and compliance. From a public health perspective, recurrent infections increase healthcare utilization and economic burden. Recent studies emphasize integrated strategies combining clinical management, preventive measures, and educational interventions to effectively reduce recurrence rates.<sup>10,18,20,21,24</sup>

*Tinea pedis* is the most common dermatophyte infection in adults and represents a major reservoir for transmission to other body sites and to other individuals. Its distinct clinical patterns, including interdigital, moccasin-type, and vesiculobullous forms, reflect variations in host immune response, moisture exposure, and disease chronicity. Chronic hyperkeratotic presentations are frequently underdiagnosed and often mismanaged as inflammatory dermatoses, leading to prolonged disease duration. These observations underscore the importance of recognizing specific clinical patterns to guide targeted therapy and prevent recurrence.<sup>4,22,23</sup>

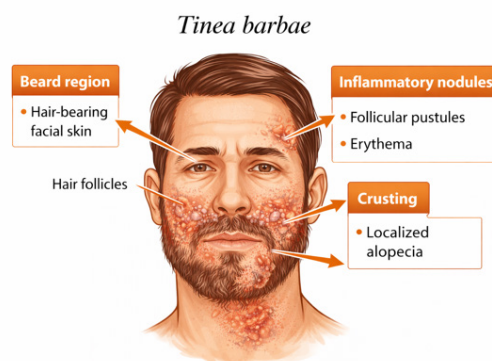
The findings presented in this study have limitations inherent to its structured narrative design, including reliance on published data and variability in diagnostic and therapeutic approaches across the included studies. Nevertheless, integrating clinical, diagnostic, therapeutic, and public health perspectives provides a comprehensive overview applicable to routine clinical practice. The results underscore the importance of continued professional education and adherence to updated clinical guidelines. Future research should prioritize the development of standardized diagnostic strategies and the monitoring of emerging patterns of antifungal resistance. Strengthening evidence-based practices remains essential to improve outcomes in patients with cutaneous fungal infections (Figure 5).<sup>18,20,25,26</sup>



**Figure 5** Schematic overview of dermatophytes (*Tinea*), illustrating the main etiological agents, keratinized structures involved, and characteristic pathogenetic mechanisms leading to typical annular lesions

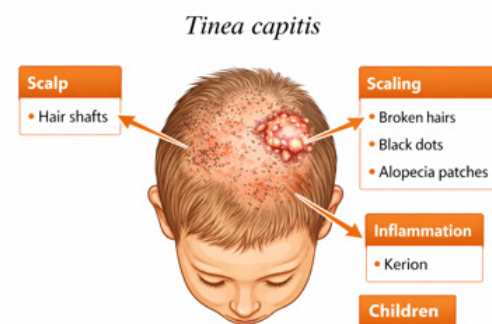
General considerations (*Tinea*). Dermatophytes are infections caused by keratinophilic fungi that invade the stratum corneum, hair shafts, and nails, producing the clinical spectrum collectively referred to as tinea. Transmission occurs through direct contact with infected humans, animals, or contaminated fomites and is facilitated by humid conditions and close-contact environments. Typical lesions exhibit an advancing scaly border that reflects peripheral fungal growth, whereas central clearing may be present but is not a universal feature. Classification according to the anatomical site of involvement remains clinically useful, as it assists in guiding diagnostic suspicion and treatment selection.

*Tinea barbae* is a dermatophyte infection involving the beard and moustache regions, frequently associated with animal exposure or contact with infected individuals. It typically presents as inflammatory follicular papules, pustules, or nodules, occasionally accompanied by hair breakage and localized alopecia. The inflammatory form may clinically resemble bacterial folliculitis, and pain or tenderness can be prominent due to deeper follicular involvement. Because hair follicles are affected, systemic antifungal therapy is commonly required to achieve complete resolution (Figure 6).<sup>17,18,27</sup>



**Figure 6** Schematic illustration of *Tinea barbae*, showing inflammatory involvement of the beard region with follicular pustules, erythema, crusting, and localized alopecia affecting hair-bearing.

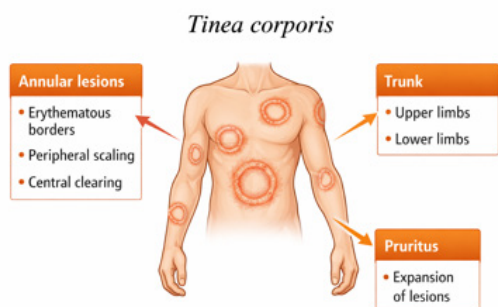
*Tinea capitis* remains a significant concern in pediatric populations and is characterized by invasion of the hair shaft, leading to alopecia and, in severe cases, potential scarring if left untreated. Inflammatory forms, such as kerion, represent intense host immune responses and require prompt clinical recognition. The schematic overview presented in Figure 7 underscores the importance of early diagnosis, as delayed treatment may result in permanent hair loss. These findings support current recommendations that favor systemic antifungal therapy and the implementation of school-based prevention strategies to reduce transmission.<sup>18,25-27</sup>



**Figure 7** Schematic illustration of *Tinea capitis*, showing involvement of the scalp and hair shafts, with characteristic scaling, broken hairs, alopecic patches, and inflammatory manifestations such as kerion, predominantly affecting children.

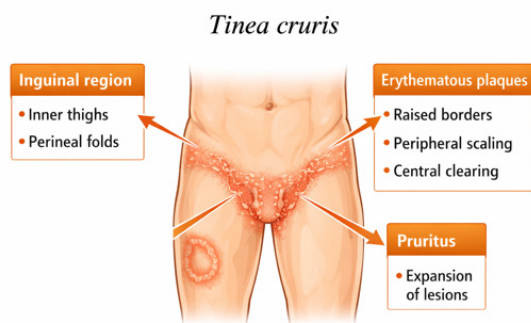
Children are more commonly affected by *Tinea capitis*, athletes by *Tinea pedis*, and individuals with diabetes mellitus or obesity exhibit increased susceptibility to dermatophytosis. Additional clinical findings may include interdigital scaling and fissuring of the feet, erythematous scaly plaques in the groin that characteristically spare the scrotum, thickened and brittle nails with distal onycholysis, and, less commonly, smooth brown or black macules on the palms or soles consistent with *Tinea nigra*. Accurate clinical recognition is essential to differentiate tinea infections from other dermatoses, such as atopic dermatitis, psoriasis, and impetigo, as inappropriate treatment with topical corticosteroids alone may exacerbate fungal infections and lead to *tinea incognito*.<sup>3</sup>

*Tinea corporis* typically presents with annular lesions characterized by active, erythematous borders and central clearing, features that are strongly associated with dermatophyte proliferation at the periphery of the lesion. Despite its classic appearance, atypical forms are increasingly reported, particularly in patients exposed to topical corticosteroids. Such presentations may obscure diagnostic clues and delay appropriate treatment. Figure 8 illustrates the characteristic morphology and anatomical distribution of *Tinea corporis*, reinforcing its differentiation from eczema and psoriasis in routine clinical practice.<sup>17,18,20</sup>



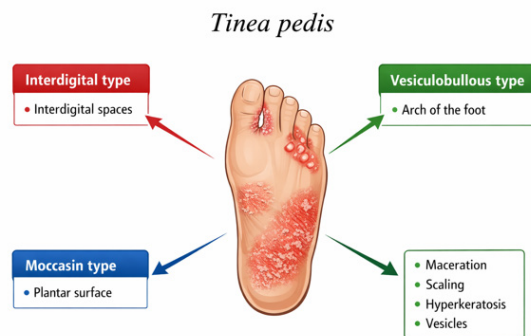
**Figure 8** Schematic illustration of *Tinea corporis*, showing typical annular lesions with erythematous borders, peripheral scaling, and central clearing, as well as the most commonly affected anatomical regions of the trunk and limbs.

*Tinea cruris* predominantly involves the groin, inner thighs, and perineal region and is favored by conditions such as excessive sweating, friction, and the use of tight clothing. Lesions classically present as erythematous, well-demarcated plaques with active scaling borders and relative sparing of the scrotum, a feature that may aid in distinguishing this condition from candidiasis. Pruritus is a common symptom, and recurrence is frequent when moisture control and hygiene measures are inadequate. Concomitant *tinea pedis* is common and may act as an important reservoir for reinfection (Figure 9).<sup>17,18,20</sup>



**Figure 9** Schematic illustration of *Tinea cruris*, highlighting the typical involvement of the inguinal region and inner thighs, with erythematous plaques, raised borders, peripheral scaling, central clearing, and associated pruritus.

*Tinea pedis* is the most common dermatophyte infection in adults and represents a major reservoir for transmission to other body sites and individuals. Its distinct clinical patterns, including interdigital, moccasin-type, and vesiculobullous forms, reflect variations in host response, moisture exposure, and disease chronicity. Chronic hyperkeratotic presentations are frequently underdiagnosed and often mismanaged as inflammatory dermatoses, resulting in prolonged disease duration and persistence. The schematic representation in Figure 10 highlights the importance of recognizing these clinical patterns to guide targeted therapy and prevent recurrence.<sup>4,22,23</sup>



**Figure 10** Schematic representation of *Tinea pedis*, illustrating its main clinical patterns and characteristic anatomical distribution on the foot.

*Tinea* infections are superficial fungal infections caused by dermatophytes that affect keratinized tissues, including the skin, scalp, and nails. Their clinical presentation varies according to the anatomical site involved, but typically follows recognizable morphological patterns. Cutaneous tinea most commonly presents as round or annular plaques with an active, erythematous, scaly border and central clearing, frequently accompanied by pruritus. In *Tinea capitis*, clinical manifestations include scalp scaling, patchy alopecia, and, in inflammatory forms, the development of a painful kerion. Predisposing factors include warm and humid environments, retained sweat, tight clothing, and exposure in communal settings such as gyms and swimming pools.<sup>3</sup>

Overall, the findings of this study emphasize that cutaneous fungal infections require an integrated approach that combines accurate diagnosis, appropriate therapy, and effective preventive strategies. Interpretation of the results in light of recent evidence highlights the need for continuous updating of clinical practices to address evolving epidemiological patterns and emerging therapeutic challenges. Advances in diagnostic methods and the growing recognition of antifungal resistance further reinforce this need. Aligning clinical management with current evidence is essential to reduce recurrence rates and improve patient outcomes. These considerations provide a solid foundation for the conclusions drawn from this study.<sup>17,19,27</sup>

Future research on cutaneous fungal infections, particularly dermatophytoses, should prioritize the standardization of diagnostic strategies to improve comparability across epidemiological studies. Despite advances in mycological techniques, access to laboratory confirmation remains limited in many clinical settings, especially in low- and middle-income countries. The development and validation of rapid, cost-effective diagnostic tools may facilitate earlier detection and reduce inappropriate empirical treatment. In parallel, harmonized surveillance systems are needed to generate more accurate global and regional estimates of dermatophyte distribution and disease burden.<sup>4,17,23</sup>

Another important perspective involves the growing concern regarding antifungal resistance and therapeutic failure in

dermatophytoses. Emerging reports of reduced susceptibility to commonly used antifungal agents underscore the need for continuous monitoring of resistance patterns and rational antifungal use. Future studies should focus on optimizing treatment duration, evaluating combination therapies, and identifying host- and pathogen-related factors associated with recurrence. In addition, integrating preventive strategies, patient education, and public health interventions into routine care may contribute to sustained disease control. Strengthening interdisciplinary collaboration among clinicians, microbiologists, and public health professionals will be essential to address the evolving challenges posed by cutaneous fungal infections.<sup>18,19,21</sup>

Although dermatophytoses account for the majority of conditions traditionally referred to as tinea infections, the term has historically been applied to other superficial mycoses with distinct etiologies. *Tinea unguium* represents a true dermatophyte infection of the nails and constitutes a major proportion of chronic superficial mycoses worldwide. In contrast, *Tinea nigra* is caused by a dematiaceous fungus and remains a rare superficial condition primarily affecting the palms and soles. *Tinea versicolor*, on the other hand, results from *Malassezia* species and reflects a dysbiosis of the normal cutaneous microbiota rather than dermatophyte invasion. Distinguishing these entities based on etiological and pathogenic criteria is essential for accurate diagnosis, effective management, and proper interpretation of epidemiological data.<sup>4-6,16</sup>

## Conclusion

This study demonstrates that the effective management of cutaneous fungal infections, particularly dermatophytoses, requires an integrated approach that extends beyond antifungal treatment alone. Accurate diagnosis, rational selection of antifungal agents, and patient adherence to prescribed therapy are essential to prevent chronicity and recurrence. Equally important are preventive measures and patient education aimed at addressing predisposing factors such as moisture, occlusion, and inadequate hygiene.

From a broader perspective, improvements in diagnostic accuracy and the consistent application of evidence-based practices contribute to reducing disease burden, healthcare costs, and transmission within communities. Continuous professional education and adherence to updated clinical guidelines remain fundamental to achieving sustainable control of superficial mycoses and improving long-term patient outcomes.

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## Conflicts of interest

The authors declare that there are no conflicts of interest.

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