



CLINICOMYCOLOGICAL AND EPIDEMIOLOGICAL PROFILE OF SUPERFICIAL FUNGAL INFECTIONS IN A TERTIARY CARE HOSPITAL OF RAIPUR/ CHHATTISGARH

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ABSTRACT

Superficial fungal infections (SFIs) are among the most common dermatological conditions worldwide, particularly in tropical regions.

Objectives: (i) To determine the prevalence and clinicomycological profile of superficial fungal infections in the study population attending the dermatology OPD of our institute. (ii) To identify host, socioeconomic, and epidemiological factors that affect disease occurrence. (iii) To isolate and identify etiological agents, including dermatophytes and non-dermatophytes, from clinically suspected cases and correlate their occurrence with clinical presentations.

Materials & Methods: A total of 121 specimens consisting of skin scrapings, nail clippings, and epilated hair were taken from clinically suspected cases of superficial fungal infections attending the OPD of a tertiary care hospital in Raipur, Chhattisgarh, India, between October 2023 and March 2025. Direct microscopic examination with KOH mount (10% for skin/hair and 40% for nails) was performed. Specimens were cultured on Sabouraud's Dextrose Agar (SDA) and Potato Dextrose Agar (PDA) and identified based on their macroscopic and microscopic morphologies and biochemical reactions, such as the urea hydrolysis test.

Results: Of the total 121 specimens, KOH positivity was 63.6% and culture positivity was 47.1%. Females (57.8%) were affected more than males (42.2%), with a female-to-male ratio of 1.4:1. The maximum cases were present in the 31–40 years (31.4%) age group. Housewives (28.9%) and office employees (20.7%) were the most inflicted occupational groups. Maximum specimens were from skin (85.2%), followed by nails (13.2%) and hair (1.6%). Tinea corporis (56.4%) and Tinea cruris (16.5%) were the commonest clinical types identified. Among 57 isolates, *Trichophyton rubrum* (33.3%) was the most common isolate, followed by *Trichophyton mentagrophytes* (17.5%) and *Candida* species (17.5%). Statistical significance was found for age ($p=0.02$), gender ($p<0.001$), and occupation ($p<0.001$) in relation to clinical types.

Conclusion: *Trichophyton rubrum* continues to be the predominant species causing superficial fungal infections in Chhattisgarh. However, a rising trend of non-dermatophytic infections (*Candida* and *Malassezia* species) was observed. Risk factors such as lower socioeconomic status, close family contact, and poor personal hygiene (sharing clothes, wearing

tight/damp clothing) are significantly associated with disease prevalence. Better practices of self-hygiene, such as proper drying after bathing and wearing comfortable clothing, can help reduce incidence along with community education.

KEYWORDS: Dermatophytes, Superficial Fungal Infections, Tinea, Culture.

Introduction

Superficial mycoses refer to diseases of the skin and its appendages caused by both yeast and filamentous fungi. These fungi possess the capability to produce keratinase, which allows them to metabolize and live on human keratin found in the skin, nails, and hair[1,2].

Such fungal infections can be caused by dermatophytes (such as tinea capitis, tinea unguium, tinea manuum and tinea pedis) and non dermatophytes (such as pityriasis versicolor, cutaneous candidiasis, tinea nigra, black Piedra and white Piedra)[3]. According to Emmon's morphological classification, dermatophytes are classified into three major genera, including Epidermophyton, Microsporum and Trichophyton on the basis of their conidial morphology[4]. The superficial fungal infections are usually presented as scaly patches with central clearing with sharply demarcated as annular, erythematous, sometimes with vesicles, blisters and pustules. These infections spread easily by direct contact with the infected humans and animals and through fomites[5,6,7]. Over the last three decades, an increasing number of filamentous fungi have been identified as agents that cause skin and nail infections producing skin lesions similar to those caused by dermatophytes[8]. While identification has historically relied on conidial morphology, the last three decades have seen an increasing number of filamentous fungi identified as infectious agents, alongside the use of advanced molecular techniques such as sequencing the ITS region of rDNA for precise speciation[9,10,11].

The global prevalence of superficial fungal infections is estimated by the World Health Organization to be between 20% and 25%[4,12]. In the Indian context, the prevalence is approximately 27.6%, with dermatophytosis accounting for the vast majority (75.6%) of these cases followed by infections due to non dermatophytes approximately 24.4%[13]. The catapulting incidence of these infections is often attributed to factors such as a high population density, poverty, lack of education, and poor sanitation, wide range of environmental and cultural factors like climate. Furthermore, an increasing population of immunocompromised individuals—including those with HIV, malignancies, and those undergoing immunosuppressive therapies—has further invited clinical attention to these mycoses[14,15].

The present study was undertaken to identify and characterize the various aetiological agents responsible for superficial fungal infections and their associated risk factors among patients in Raipur, Chhattisgarh. This region of Central India experiences tropical climatic factors of heat and humidity, which play a pivotal role in the distribution and proliferation of fungal pathogens. Such environmental

conditions, combined with local cultural and socioeconomic practices, serve as fertile nurseries for dermatophytes and non-dermatophytes alike. This study aims to establish the relationship between these epidemiological factors and the clinical presentations of tinea and other superficial mycoses to improve diagnostic accuracy and patient care

Methodology

A cross-sectional observational study was conducted in the Department of Microbiology at Pt. JNM Medical College and Dr. B.R.A. Ambedkar Memorial Hospital, Raipur, Chhattisgarh, from October 2023 to March 2025. Institutional Ethical Committee approval was obtained in November 2023. A total of 121 patients clinically diagnosed with superficial fungal infections were enrolled in the study.

Inclusion Criteria

All patients presenting with clinical signs of superficial fungal infections (such as scaly lesions, erythema, itching, or central clearing) attending the dermatology OPD were included.

Exclusion Criteria

Patients already receiving topical, oral, or systemic antifungal treatment for at most four weeks prior to presentation were excluded. Additionally, patients who refused to provide informed consent were excluded from the study

Sample Collection

Clinical specimens were collected from the hair, skin, or nails after a detailed history was recorded and a clinical examination was performed under a good light source

The procedures were explained to the patients, and informed consent was obtained

Specific collection methods included:

- **Skin Scrapings:** These were taken from the peripheral active advancing erythematous margin of the lesion. The site was thoroughly disinfected with 70% alcohol from the center to the periphery and allowed to dry. Scrapings were then taken firmly using a sterile blunt blade.
- **Nail Clippings:** After cleaning with 70% ethyl alcohol, nails were clipped close to the nail bed. Any deformed or discolored nail portions and subungual debris were also collected
- **Epilated Hair:** Lustreless hair and hair stubs were plucked using sterile tweezers, ensuring the base root section was securely collected. Skin scrapings from the adjacent basal portion of the infected hair were also taken.

All specimens were collected in sterile black paper, properly labeled with demographic and clinical data, and transported immediately to the microbiology laboratory for processing.

Procedure performed in the mycology lab Each specimen was subjected to both direct microscopic examination and culture. Direct microscopy was performed using a KOH mount (10% for skin and 40% for hair and nails) to visualize fungal hyphae, arthrospores, or yeast cells.

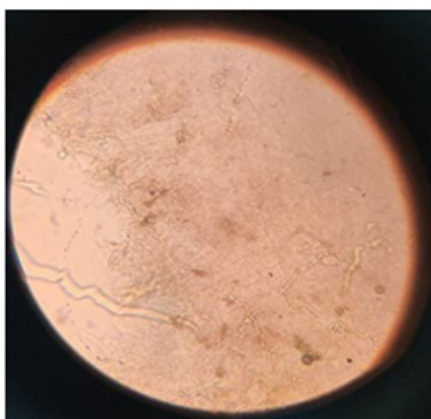
For isolation, specimens were inoculated in duplicate onto:

- Sabouraud's Dextrose Agar (SDA) supplemented with chloramphenicol and cycloheximide to inhibit bacterial and saprophytic fungal growth
- Potato Dextrose Agar (PDA) to enhance sporulation and conidiation

Cultures were incubated at 37°C and 25°C and monitored for up to three weeks before being reported as negative. Species identification was based on macroscopic colony characteristics and microscopic morphology using Lactophenol Cotton Blue (LPCB) mounts. Slide culture techniques were utilized to study in situ morphology, such as conidial and hyphal arrangements.

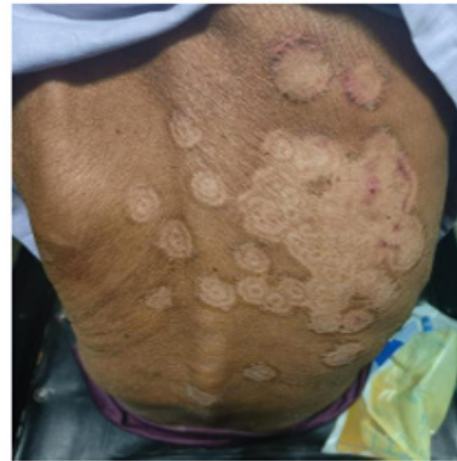
Biochemical identification included the urea hydrolysis test.

Isolates of *Candida* species were further identified via Gram stain and germ tube tests, with final speciation and antifungal susceptibility testing performed using the VITEK 2 system (YST08 card). Statistical analyses were performed to determine the significance of associations between clinical types and variables such as age, gender, and risk factors, with p-values < 0.05 considered statistically significant.



KOH Mount showing Spaghetti Meat Ball appearance

Image 1.KOH MOunt showing Sphagetti Meat Ball appearance

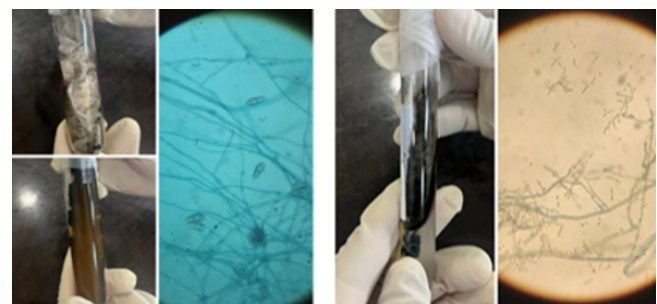


**PITYRIASIS VERSICOLOR
(Hypopigmented Macular Lesion)**

Image 2.Hypopigmented Macular lesion of Pityriasis Versicolor



T. rubrum with typical colony characteristics (LPCB mount showing bird on fence appearance)



Curvularia Species

Cladosporium Sprcies

Results

A total of 6,510 patients were screened. Among them 121 patients (1.9%) showed symptoms such as scaly lesions, erythema, itching, or central clearing and were diagnosed with superficial fungal infection and were enrolled.

Table 1: Socio-demographic characteristics of study participants (n=121)

Variable	Category	n (%)
Age Group	<10	03 (2.4)
	11-20	13 (10.8)
	21-30	25 (20.8)
	31-40	38 (31.4)
	41-50	28 (23.1)
	51-60	11 (9.1)
	>60	03 (2.4)
Gender	Male	51 (42.2)
	Female	70 (57.8)
Socioeconomic Status	Upper class	0 (0)
	Upper middle class	15 (12.4)
	Lower middle class	32 (26.4)
	Upper lower class	48 (39.7)
	Lower class	26 (21.5)
Occupation	Skilled	28 (23.1)
	Semi-skilled	24 (19.8)
	Unskilled	26 (21.5)
	Homemaker	32 (26.4)
	Student	11 (9.1)

Table 1, presents the socio-demographic profile of the study participants. The majority of participants belonged to the age group of 31–40 years (38/121, 31.4%), followed by 41–50 years (28/121, 23.1%) and 21–30 years (25/121, 20.8%). Females constituted a higher proportion of the study population (70/121, 57.8%) compared to males (51/121, 42.2%).

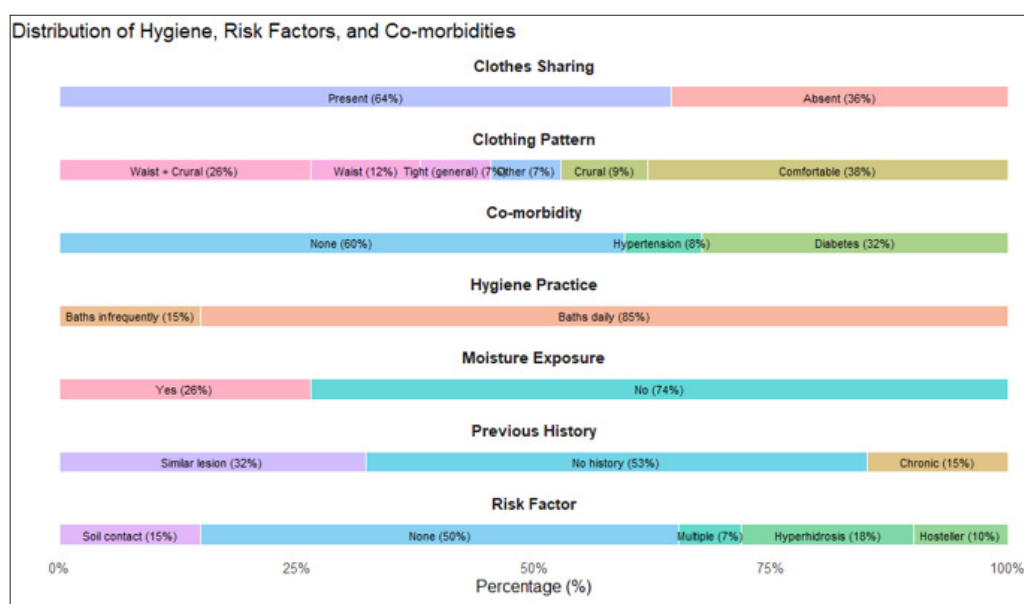


Figure 1. Distribution of Hygiene Practices, Clothing Habits, Risk Factors, Previous History, and Co-morbidities Among Study Participants

With respect to socioeconomic status, most participants belonged to the upper lower class (48/121, 39.7%), followed by lower middle class (32/121, 26.4%) and lower class (26/121, 21.5%), while no participants were from the upper class. In terms of occupation, homemakers (32/121, 26.4%) and skilled workers (28/121, 23.1%) formed the largest groups, followed by unskilled workers (26/121, 21.5%), semi-skilled workers (24/121, 19.8%), and students (11/121, 9.1%).

The distribution of hygiene practices among study participants revealed that the majority reported daily bathing (103/121, 85.1%), while a smaller proportion reported infrequent bathing (18/121, 14.9%), indicating generally good personal hygiene in the study population. Clothes sharing was reported by 78 participants (64.5%), whereas 43 participants (35.5%) did not engage in this practice, suggesting a substantial prevalence of this potential transmission-related behaviour.

With respect to clothing patterns, 46 participants (38.0%) reported wearing comfortable clothing. Tight clothing patterns were observed in smaller proportions, including general tight clothing in 9 (7.4%), waist-specific tight

clothing in 14 (11.6%), crural-specific in 11 (9.1%), and combined waist and crural involvement in 32 (26.4%) participants, while 9 (7.4%) reported other types of clothing patterns. Moisture exposure was reported by 32 participants (26.4%), whereas the majority, 89 participants (73.6%), reported no exposure.

Assessment of risk factors showed that most participants did not have any identifiable risk factors (61/121, 50.4%). Among those with risk factors, hyperhidrosis was present in 22 participants (18.2%), soil contact in 18 (14.9%), hostel residence in 12 (9.9%), and multiple risk factors in 8 (6.6%). Regarding previous history, 64 participants (52.9%) had no history of similar lesions, while 39 (32.2%) reported prior similar lesions and 18 (14.9%) had chronic lesions, indicating recurrence or persistence in a notable proportion of cases.

In terms of co-morbidities, the majority of participants had no associated conditions (72/121, 59.5%). Diabetes mellitus was present in 39 participants (32.2%), and hypertension in 10 participants (8.3%), suggesting a possible contributory role of these conditions in susceptibility to infection.

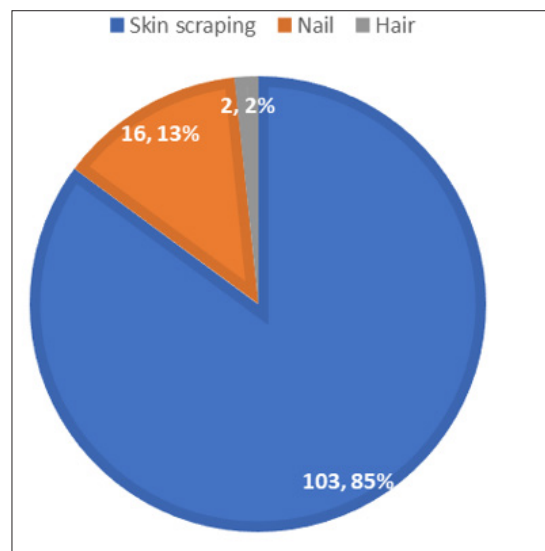


Figure 2. Distribution of Specimen Types Among Study Participants (n = 121)

Table 2: Distribution of Clinical Diagnosis by Specimen Type and Gender

Specimen	Clinical Diagnosis	Total n (%)	Males n (%)	Females n (%)
Skin scraping	Tinea corporis	58 (56.4)	15 (14.7)	43 (41.8)
	Tinea cruris	17 (16.5)	15 (14.7)	2 (1.9)
	Tinea mannum	3 (2.9)	0 (0.0)	3 (2.9)
	Tinea pedis	4 (3.9)	4 (3.9)	0 (0.0)
	Pityriasis versicolor	11 (10.8)	3 (2.9)	8 (7.8)
	Cutaneous candidiasis	10 (9.8)	6 (5.9)	4 (3.9)
Nail (n = 16)	Onychomycosis	16 (100)	6 (37.5)	10 (62.5)
Hair (n = 2)	Tinea capitis	2 (100)	2 (100)	0 (0.0)

Figure 2, distribution of specimen types collected from study participants, i.e Majority from skin scraping (85%), followed by nail (13%) and least from hair (2%).

Table 2 presents the distribution of clinical diagnoses across different specimen types along with gender-wise distribution. The majority of specimens were skin scrapings (103/121, 85.2%), followed by nail samples (16/121, 13.2%) and hair samples (2/121, 1.6%), indicating that skin infections constituted the predominant clinical presentation in the study population. Among skin specimens (n = 103), tinea corporis was the most common diagnosis (58/103, 56.4%), followed by tinea cruris (17/103, 16.5%), pityriasis versicolor (11/103, 10.8%), and cutaneous candidiasis (10/103, 9.8%). Tinea pedis (4/103, 3.9%) and tinea mannum (3/103, 2.9%) were less frequent.

Gender-wise analysis showed that tinea corporis was more prevalent among females (43/103, 41.8%) compared to males (15/103, 14.7%), whereas tinea cruris was

predominantly observed in males (15/103, 14.7%). Tinea pedis was exclusively seen in males, while tinea mannum was observed only in females.

All nail specimens (16/16, 100%) were diagnosed as onychomycosis, with a higher proportion among females (62.5%) compared to males (37.5%). Hair specimens (n = 2) were diagnosed as tinea capitis, exclusively observed in males.

Table 3 presents the results of direct KOH mount and fungal culture across different specimen types. Among skin specimens (n = 103), KOH positivity was observed in 64 cases (62.1%), while culture positivity was noted in 45 cases (43.7%). In nail specimens (n = 16), a higher proportion tested positive on KOH examination (12/16, 75.0%) and culture (11/16, 68.8%) compared to skin samples. Among hair/scalp specimens (n = 2), equal proportions showed positivity and negativity for both KOH mount and culture (50.0% each).

Table 3: KOH Mount and Culture Results by Specimen Type

Specimen	Total (n)	KOH Positive n (%)	KOH Negative n (%)	Culture Positive n (%)	Culture Negative n (%)
Skin	103	64 (62.1)	39 (37.9)	45 (43.7)	58 (56.3)
Nail	16	12 (75.0)	4 (25.0)	11 (68.8)	5 (31.2)
Hair/Scalp	2	1 (50.0)	1 (50.0)	1 (50.0)	1 (50.0)

Table 4: Comparison of KOH Mount with Culture (Gold Standard) for Diagnosis of Superficial Fungal Infections (n = 121)

KOH vs Culture	Culture Positive n (%)	Culture Negative n (%)	Total n (%)
KOH Positive	37 (30.6)	40 (33.1)	77 (63.6)
KOH Negative	20 (16.5)	24 (19.8)	44 (36.4)
Total	57 (47.1)	64 (52.9)	121 (100)

$\chi^2 = 0.07$, $p > 0.05$

$\kappa = 0.02$ (Poor agreement)

χ^2 : Chi-square test;

κ : Cohen's kappa; $p > 0.05$ indicates no statistically significant association; $\kappa = 0.02$ indicates poor agreement.

Table 5: Distribution of Culture Results and Fungal Isolates (n = 121 / 57)

Category	Subcategory	n (%)	Fungal Isolates (n=57)	n (%)
Culture Outcome (n=121)	Dermatophytosis	32 (26.4)	<i>Trichophyton rubrum</i> <i>T. mentagrophytes</i> <i>Microsporum canis</i>	19 (33.3) 10 (17.5) 3 (5.3)
	Non-dermatophytosis	25 (20.7)	<i>Malassezia furfur</i> <i>Candida albicans</i> <i>Candida tropicalis</i> <i>Aspergillus flavus</i> <i>Aspergillus fumigatus</i> <i>Curvularia</i> <i>Cladosporium</i>	5 (8.8) 6 (10.5) 4 (7.0) 3 (5.3) 2 (3.5) 4 (7.0) 1 (1.8)
	No Growth	64 (52.9)	NA	NA

Table 6: Antifungal Susceptibility Pattern of Candida Species (n = 10)

Antifungal Drug	Sensitive n (%)	Resistant n (%)
Fluconazole	6 (60)	4 (40)
Amphotericin B	10 (100)	0 (0)
Itraconazole	8 (80)	2 (20)
Voriconazole	10 (100)	0 (0)
Caspofungin	10 (100)	0 (0)

Overall, KOH mount demonstrated higher positivity rates than culture across specimen types, indicating its utility as a rapid screening tool, while culture provided confirmatory evidence in a relatively lower proportion of cases.

The association between KOH mount and culture was assessed using the chi-square test, which showed no statistically significant association ($\chi^2 = 0.07$, $p > 0.05$) as shown in table 4.

Out of 121 samples, dermatophytes were isolated in 26.4% of cases, while non-dermatophytes accounted for 20.7%. More than half of the specimens (52.9%) showed no growth on culture, indicating possible limitations of culture or prior subclinical infection.

The most commonly isolated organism was *Trichophyton rubrum* (33.3%), followed by *T. mentagrophytes* (17.5%). Among non-dermatophytes, *Candida* species (17.5% combined) and *Malassezia furfur* (8.8%) were frequently identified. Other opportunistic fungi such as *Aspergillus*, *Curvularia*, and *Cladosporium* were also isolated in smaller proportions.

Candida isolates showed complete sensitivity to Amphotericin B, Voriconazole, and Caspofungin (100%). Fluconazole demonstrated the highest resistance (40%), while Itraconazole showed good sensitivity (80%) with limited resistance.

Discussion

Superficial fungal infections (SFIs) are among the most common dermatological conditions worldwide, particularly in tropical and subtropical regions where heat and humidity favor fungal proliferation[16]. The present study provides a comprehensive clinicomycological and epidemiological assessment of SFIs in a tertiary care setting in Raipur, Chhattisgarh. In this study, the majority of patients belonged to the 31–40 years age group (31.4%), followed by 41–50 years (23.1%) and 21–30 years (20.8%), with a mean age of approximately 35.6 years. This predominance of the economically productive age group has been consistently reported in previous studies[17,18], likely due to increased outdoor activity, occupational exposure, and sweating.

Female preponderance (57.8%) was observed, with a female-to-male ratio of 1.4:1. Similar findings have been reported in other studies[11,18]. This may be attributed

to prolonged exposure to moisture during household activities, occlusive clothing, and limited ventilation, all of which create favorable conditions for fungal growth. The statistically significant association between gender and clinical type ($p < 0.001$) further emphasizes gender-related behavioral and environmental influences.

Substantial proportion of patients belonged to the upper lower (39.7%) and lower middle socioeconomic classes (26.4%), consistent with certain studies by[19,20]. Poor hygiene, overcrowding, and limited access to healthcare in these groups may contribute to higher disease burden.

Occupationally, homemakers (26.4%) and skilled workers (23.1%) were most affected. Housewives may be predisposed due to prolonged exposure to water and detergents, while office workers and students may be affected due to tight clothing, occlusive footwear, and

sedentary lifestyles. The strong association between occupation and clinical type ($p < 0.001$) highlights occupational exposure as a key determinant[1,21].

Skin scrapings constituted the majority of specimens (85.2%), followed by nail (13.2%) and hair samples (1.6%), which is comparable to previous studies[17,21].

Among clinical presentations, tinea corporis (56.4%) was the most common, followed by tinea cruris (16.5%), pityriasis versicolor (10.8%), and cutaneous candidiasis (9.8%). The predominance of tinea corporis may be due to its symptomatic nature (itching, erythema), leading to early healthcare seeking. Cultural practices such as wearing tight or occlusive clothing (e.g., sarees, synthetic garments) may also predispose to infections, particularly in the waist and groin regions. The study demonstrated higher KOH positivity (63.6%) compared to culture positivity (47.1%), consistent with previous literature[22]. KOH positivity alone was observed in a significant proportion (33.1%), while 16.5% were culture-positive but KOH-negative, highlighting the complementary role of both methods.

The absence of a statistically significant association ($p > 0.05$) and poor agreement ($\kappa = 0.02$) between KOH and culture indicates variability in diagnostic sensitivity. Factors such as prior antifungal use, inadequate sample collection, and low fungal load may contribute to discordance. These findings reinforce the importance of using both techniques

for accurate diagnosis. Among the 57 culture-positive isolates, dermatophytes accounted for 26.4% and non-dermatophytes for 20.7%, while 52.9% showed no growth.

The most common isolate was *Trichophyton rubrum* (33.3%), followed by *T. mentagrophytes* (17.5%), consistent with global and Indian trends. These organisms are well adapted to human hosts and are known for chronic and recurrent infections[1,17].

Notably, a rising trend of non-dermatophytes was observed, particularly *Candida* species (17.5%) and *Malassezia furfur* (8.8%). Opportunistic fungi such as *Aspergillus*, *Curvularia*, and *Cladosporium* were also isolated. This shift may reflect changing environmental conditions, host immunity, and widespread antifungal misuse[2,23,24].

Candida isolates demonstrated 100% sensitivity to Amphotericin B, Voriconazole, and Caspofungin, while fluconazole resistance was high (40%). Similar resistance patterns have been reported in previous studies[25,26]. The increasing resistance to commonly used azoles may be due to irrational use, over-the-counter availability, and incomplete treatment courses[27]. Key risk factors identified included Clothes sharing (64.5%), Tight/occlusive clothing, Moisture exposure, Diabetes mellitus (32.2%), Close contact history these are consistent with studies by[19,28]. Such behaviors facilitate fungal transmission and persistence, emphasizing the need for behavioral interventions.

This study is limited by its hospital-based design, which may restrict generalizability to the broader community. Additionally, antifungal susceptibility testing was not performed for dermatophytes and molds, limiting therapeutic insights.

Conclusion

The present study highlights the evolving clinicomycological pattern of superficial fungal infections in Central India. *Trichophyton rubrum* remains the predominant pathogen, followed by *T. mentagrophytes*; however, a notable rise in non-dermatophytic infections, particularly *Candida* and *Malassezia* species, was observed.

The study underscores the importance of combined diagnostic approaches, as reliance on either KOH or culture alone may lead to underdiagnosis. The observed discordance between KOH and culture results reinforces the need for integrated laboratory evaluation.

Emerging antifungal resistance, particularly to fluconazole, is a concerning trend and highlights the necessity for rational antifungal use and periodic surveillance.

Epidemiologically, modifiable risk factors such as poor hygiene, sharing of clothes, tight clothing, and moisture exposure play a crucial role in disease transmission. Public health interventions focusing on awareness, hygiene practices, and early treatment-seeking behavior are essential to reduce disease burden.

Further community-based studies and advanced mycological diagnostics, including molecular techniques and comprehensive antifungal susceptibility testing, are recommended to better understand disease dynamics and guide effective management strategies.

Conflicts of interest

The authors declare no conflicts of interest.

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