

Original Research

Dermatophyte Prevalence and Antifungal Resistance in Central India: Insights from a Clinical and Mycological Study

Vaibhav Gupta¹, Chinithung Ngullie², Akshaya Khattri³, Harsha Gupta⁴, Kuldeep Singh⁵, Rajdeep Paul⁶

¹Senior Resident, Department of Medicine, Chirayu Medical College & Hospital, Bhopal, M.P., email- dr.vaibhav.afms@gmail.com,

²Tutor, Department of Microbiology, Nagaland Institute of Medical Sciences and Research, Nagaland, email- cngullie123@gmail.com,

³Junior Resident, Department of Microbiology, Chirayu Medical College & Hospital, Bhopal, M.P., email- akshay.khatri09@gmail.com,

⁴Associate Professor, Department of Anesthesiology, Chirayu Medical College & Hospital, Bhopal, M.P., email- harshagupta13@yahoo.com,

⁵Assistant Professor, Department of Microbiology, Chirayu Medical College & Hospital, Bhopal, M.P., email- kuldeeprbxy@gmail.com,

⁶Assistant Professor, Department of Microbiology, Chirayu Medical College & Hospital, Bhopal, M.P., email- rajdeepmicro20@gmail.com,

Corresponding Author

Dr. Harsha Gupta

Associate Professor, Department of Anesthesiology, Chirayu Medical College & Hospital, Bhopal, M.P., [email- harshagupta13@yahoo.com](mailto:harshagupta13@yahoo.com)

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Abstract:

Superficial fungal infections are among the most prevalent fungal diseases globally, especially in tropical regions like India. This study aimed to isolate, identify, and assess the antifungal susceptibility of fungal agents causing mycoses in patients at a tertiary care hospital in central India. Clinical samples from 200 patients were analyzed through KOH examination and culture isolation, with identification based on colony morphology, pigment production, and microscopic examination. Antifungal susceptibility was determined using the broth dilution method to find the minimum inhibitory concentration (MIC). Results showed that dermatophytes, particularly *Trichophyton mentagrophyte*, were the predominant isolates. Terbinafine exhibited the highest efficacy, with the lowest MIC value of 0.03 µg/ml, while fluconazole had the highest MIC value of 32 µg/ml.

Keywords: Dermatophytes, *Trichophyton mentagrophytes*, Terbinafine, Antifungal susceptibility, Superficial fungal infections

Introduction:

Superficial fungal infections represent a significant public health issue, especially in tropical and subtropical regions where high humidity and overcrowded living conditions prevail. Dermatophytes are the primary causative agents of cutaneous mycoses, affecting various age groups and often leading to chronic and recurrent infections. The global burden of dermatophytosis has been increasing, particularly in developing countries where healthcare access and hygiene practices may be inadequate [1,2]. This study seeks to provide a detailed analysis of the prevalence, identification, and antifungal susceptibility patterns of dermatophytes and other fungi in a tertiary care setting in central India. Previous studies have highlighted the prevalence of dermatophytes, with *Trichophyton* species being the most commonly isolated pathogens [3,4]. Additionally, there is a growing concern regarding antifungal resistance, necessitating continuous monitoring of susceptibility patterns [5].

Materials and Methods:

Study Design: This descriptive study was conducted at the Department of Microbiology, a tertiary care hospital in central India, over a period of one year, from January 2023 to January 2024. A total of 200 patients with clinically suspected superficial fungal infections were included.

Sample Collection and Processing: Skin scales, nail clippings, and hair fragments were collected based on infection site. Specimens were transported in sterile dark paper sachets and processed for direct microscopy using

potassium hydroxide (KOH) wet mounts (20% for hair and nail, 10% for skin). Cultures were grown on Sabouraud's dextrose agar with and without cycloheximide and gentamicin.

Identification of Fungal Isolates: Fungal growth was monitored at 28°C and 37°C, with cultures examined bi-weekly for up to six weeks. Identification was based on colony morphology, growth characteristics, pigment production, and microscopic examination using lactophenol cotton blue stain. Further differentiation of Trichophyton species was performed using urease and hair perforation tests. Candida species were identified using corn meal agar and CHRO Magar.

Antifungal Susceptibility Testing: Dermatophyte isolates underwent broth microdilution testing following CLSI guidelines. The antifungal agents tested included griseofulvin, fluconazole, itraconazole, and terbinafine. MICs were determined using a 96-well microtiter plate assay. For Candida species, susceptibility was assessed using the disk diffusion method with miconazole, fluconazole, itraconazole, and ketoconazole.

Results:

Out of 200 patients, 120 (60%) were males and 80 (40%) females. The majority of infections (31%) were in the 21-30 age group. Occupational distribution revealed that farmers (40%) and construction workers (32%) were most affected. Skin scrapings accounted for 54% of specimens, followed by hair samples (39%) and nail clippings (7%). KOH positivity was observed in 130 (65%) samples, while culture positivity was 110 (55%). Among the positive cultures, 98 (49%) were dermatophytes, predominantly Trichophyton mentagrophyte (62 isolates), followed by Trichophyton rubrum (22 isolates). Non-dermatophyte fungi included Candida albicans (5 isolates) and Candida non-albicans (7 isolates).

Table 1: Demographic and Clinical Characteristics of Study Population

Characteristic	Number (%)
Gender	
Male	120 (60%)
Female	80 (40%)
Age Group	
0-10 years	10 (5%)
11-20 years	40 (20%)
21-30 years	62 (31%)
31-40 years	48 (24%)
41-50 years	25 (12.5%)
51-60 years	10 (5%)
>60 years	5 (2.5%)
Occupation	
Farmers	80 (40%)
Construction Workers	64 (32%)
Others	56 (28%)
Type of Specimen	
Skin Scrapings	108 (54%)
Hair Samples	78 (39%)
Nail Clippings	14 (7%)

Table 2: Distribution of Fungal Isolates

Fungal Isolates	Number (%)
Dermatophytes	
Trichophyton mentagrophyte	62 (31%)
Trichophyton rubrum	22 (11%)
Others	14 (7%)
Non-Dermatophytes	
Candida albicans	5 (2.5%)
Candida non-albicans	7 (3.5%)
Negative Cultures	90 (45%)

Table 3: Antifungal Susceptibility Patterns (MIC values in µg/ml)

Antifungal Agent	Trichophyton mentagrophyte (n=62)	Trichophyton rubrum (n=22)	Candida albicans (n=5)	Candida non-albicans (n=7)
Terbinafine	0.03	0.06	-	-
Griseofulvin	0.25	0.5	-	-
Itraconazole	0.125	0.25	-	-
Fluconazole	32	16	1	2

Discussion:

The study reveals that superficial fungal infections, particularly those caused by dermatophytes, remain a prevalent issue in central India. Trichophyton mentagrophyte was identified as the predominant species, accounting for a significant portion of the infections. The high prevalence of dermatophytes observed in this study aligns with previous findings reported in South India, where dermatophytes were also found to be the most common causative agents of superficial mycoses [6]. A closer look at the demographic data shows a higher infection rate among males (60%) compared to females (40%), which is consistent with other studies that have reported a male predominance in dermatophytic infections [7]. This could be attributed to greater exposure to outdoor activities and physical labor among males, increasing their risk of contracting infections. The age distribution indicates that the 21-30 age group was most affected, which is similar to findings in studies conducted in other tropical regions [8]. This age group is generally more active and involved in occupations that may expose them to fungal pathogens. Occupational analysis shows that farmers and construction workers are the most affected groups, making up 40% and 32% of the cases, respectively. This is likely due to their constant exposure to soil and other environmental sources of dermatophytes, as well as the humid conditions prevalent in agricultural and construction sites [9]. The study found a KOH positivity rate of 65% and a culture positivity rate of 55%. These findings are within the expected range, as reported by previous research, which also highlighted the challenges in culturing dermatophytes, leading to lower culture positivity rates despite high clinical suspicion [10]. The antifungal susceptibility patterns revealed that terbinafine was the most effective agent, with the lowest MIC values (0.03 µg/ml), suggesting its superior efficacy against Trichophyton mentagrophyte. This finding corroborates the results of other studies, which have consistently reported terbinafine as the most potent antifungal agent for dermatophytic infections [11]. In contrast, fluconazole showed the highest MIC values (32 µg/ml), indicating reduced efficacy. This aligns with previous research indicating that dermatophytes are less susceptible to fluconazole, often requiring higher doses or alternative treatments [12]. Comparison with existing literature shows that the effectiveness of terbinafine against dermatophytes is well-documented. A study conducted in North-East India reported similar MIC values for terbinafine, further supporting its use as the first-line treatment for dermatophytic infections [13]. The lower efficacy of fluconazole found in this study is also consistent with global trends, where resistance to fluconazole among dermatophytes is an emerging concern [14]. Overall, the findings highlight the need for continuous surveillance of antifungal susceptibility patterns to ensure effective treatment regimens. The high prevalence of dermatophytic infections among specific occupational groups underscores the importance of targeted awareness and preventive measures in these populations.

Conclusion:

This year-long study underscores the significant prevalence of dermatophyte infections in central India, particularly among males and individuals engaged in outdoor occupations like farming and construction. Trichophyton mentagrophyte emerged as the most common pathogen. Notably, terbinafine proved highly effective against dermatophytes, showing promise as a first-line treatment. However, the high MIC values for fluconazole signal a need for cautious use and consideration of alternative antifungals. These findings highlight the importance of continuous surveillance and targeted public health strategies to manage and prevent superficial fungal infections effectively in the region.

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