



Original Article

## Demographic, Clinical, and Mycological Features of Tinea Capitis in Pediatric Patients: A Hospital-Based Study from Northern India

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### ABSTRACT

**Background:** Tinea capitis is a common fungal infection of the scalp and hair in children, caused mainly by Trichophyton and Microsporum species, and manifests in different clinical forms. This study aims to characterize the demographic, clinical, and microbiological features of Tinea capitis among children in a district of Northern India.

**Materials and Methods:** A total of 128 pediatric patients with clinically diagnosed Tinea capitis were included. Data on demographic details and mycological characteristics were collected. All participants underwent KOH microscopy and fungal culture, with the mycological profile analyzed accordingly.

**Results:** Most children were between 6 and 10 years old (60.2%) and with a male predominance (66.4%). The most common complaints were itching (94.5%) and scaling (73.4%). The black dot form was the predominant clinical presentation (57%), with most children having 2–5 patches (74.2%). The KOH test was positive in 66.4% of cases. Fungal cultures yielded positive results in 68% of samples, with Trichophyton mentagrophytes (34.4%) and T. rubrum (11.7%) being the most frequently isolated species.

**Conclusion:** This study emphasizes key clinical factors for early diagnosis and offers region-specific data, but its hospital-based nature limits generalizability, indicating a need for broader population research to better understand tinea capitis prevalence.

**Keywords:** Tinea capitis, dermatophytes, clinical features, demographic factors, mycological profile.

### INTRODUCTION

Dermatophytes are filamentous fungi that thrive on keratin, mainly infecting keratin-rich tissues like nails, hair, and the outer skin layers in humans and animals. [1-3] Tinea capitis is a common dermatophyte infection that primarily affects the scalp and hair shafts. It is often referred to as ringworm of the head and most frequently occurs in children aged between 3 and 14 years. Clinically, it presents with hair loss (alopecia) and scaling of the affected scalp area [4,5].

Studies have cultured organisms responsible for Tinea capitis from various fomites such as combs, caps, pillowcases, toys, and even theatre seats. Additionally, hairs shed by infected individuals can harbor infectious fungi for over a year. The presence of asymptomatic carriers further complicates efforts to eradicate Tinea capitis completely.[6]

The clinical presentation of Tinea capitis can vary depending on the severity of the infection. In its mild, subclinical stages, it often appears as small areas of erythema accompanied by patches of scaly skin, with hairs broken at the skin surface, commonly known as "black dots," and crusting. More advanced or severe cases tend to exhibit intense inflammatory responses, including folliculitis. As the infection progresses, it may lead to the formation of kerions, which are inflamed,

boggy nodules that can result in scarring and expanding areas of hair loss. In some instances, systemic symptoms such as fever, malaise, and regional lymphadenopathy may be observed.[4,5]

The mycological spectrum of *Tinea capitis* is highly diverse, involving both *Trichophyton* and *Microsporum* genera.[5,7,8, 9] There is significant variation in the predominant fungal species across different geographical regions, climates, and time periods. Even within the same region, the dominant species and associated clinical and demographic features can differ notably.

In this study, we aim to describe the demographic, clinical, and microbiological characteristics of *Tinea capitis* among children in a district of Northern India.

## MATERIALS and METHODS

This cross-sectional study was conducted at the Department of Dermatology, Venereology & Leprosy, in collaboration with the Department of Microbiology at Era's Lucknow Medical College & Hospital, Lucknow.

The inclusion criteria encompassed children under 14 years of age with a clinical diagnosis of *Tinea capitis*, along with their legal guardians or parents. Children who were critically ill, those currently undergoing antifungal treatment, and individuals unwilling to participate were excluded from the study.

The sample size was estimated based on a previous study by Grover et al.[10]. Using the formula for sample size calculation, with a prevalence (p) of 41.5% and a Type I error ( $\alpha$ ) set at 10%, the initial calculation yielded a requirement of 80 participants. To account for an anticipated 30% loss to follow-up, the total sample size was adjusted to 104.

Sample Size Estimation: The projections for sample size were based on a study by Grover et al.[10] Sample size was calculated using the following formula:-

$$n = \frac{z_{\alpha}^2 p(1-p)}{L^2}$$

During the study period from January 2014 to June 2015, a total of 128 patients presenting to the outpatient department were enrolled, exceeding the minimum required sample size.

The study protocol received approval from the Institutional Ethics Committee (Letter No. ELMC/EC/R. Cell/2013; dated 22 Nov 2013). Prior to enrollment, detailed information about the study's purpose and procedures was explained to the parents, and informed consent was obtained. For children above 12 years of age, assent was also secured.

At the time of enrollment, demographic data were documented. For children exhibiting symptoms, details regarding the duration and nature of their complaints were recorded. A comprehensive clinical examination was performed on each child. The dermatological assessment involved a detailed skin examination, with clinical typing aided by Wood's lamp examination to evaluate lesion color, pattern, inflammation, and distribution.

Sample collection involved preparing a 20% potassium hydroxide (KOH) wet mount for direct microscopy. A small portion of skin scrapings was placed on a clean glass slide, treated with a drop of 10% KOH and dimethyl sulfoxide, covered with a cover slip, and gently heated to flatten the sample. After 15–20 minutes, the slide was examined under low power (10X or 40X) microscopy to identify hyphae and spores.

Fungal culture was performed by inoculating samples onto Sabouraud Dextrose Agar (SDA) plates containing chloramphenicol (0.5 mg/ml) and cycloheximide (0.5 mg/ml). Inoculation was carried out with a sterile L-shaped loop in the center of each plate. The cultures were incubated at 25°C in a BOD incubator and at room temperature (37°C). Plates were examined daily for growth and were discarded if no growth was observed after four weeks. Fungal isolates from positive cultures were further examined using lactophenol cotton blue (LCB) mounts under light microscopy. Species identification was refined through slide culture techniques to determine the precise genus and species of fungi.

Data collected was analyzed using the Statistical Package for Social Sciences (SPSS) version 21.0. The study was purely descriptive, and data were presented as numbers and percentages.

## RESULTS

A total of 1595 children falling in the sampling frame underwent clinical evaluation. Out of these 128 (8%) were found to be clinically positive for *T. Capitis*. The majority of cases were males (n=85; 66.4%), while there were 43 (33.6%) females. The male-to-female ratio among study subjects was approximately 1.98:1.

Regarding age distribution, the highest number of cases occurred in the 6–10 years age group (n=77; 60.2%), followed by those aged >10 years (n=41; 32.0%) and 0–5 years (n=10; 7.8%).

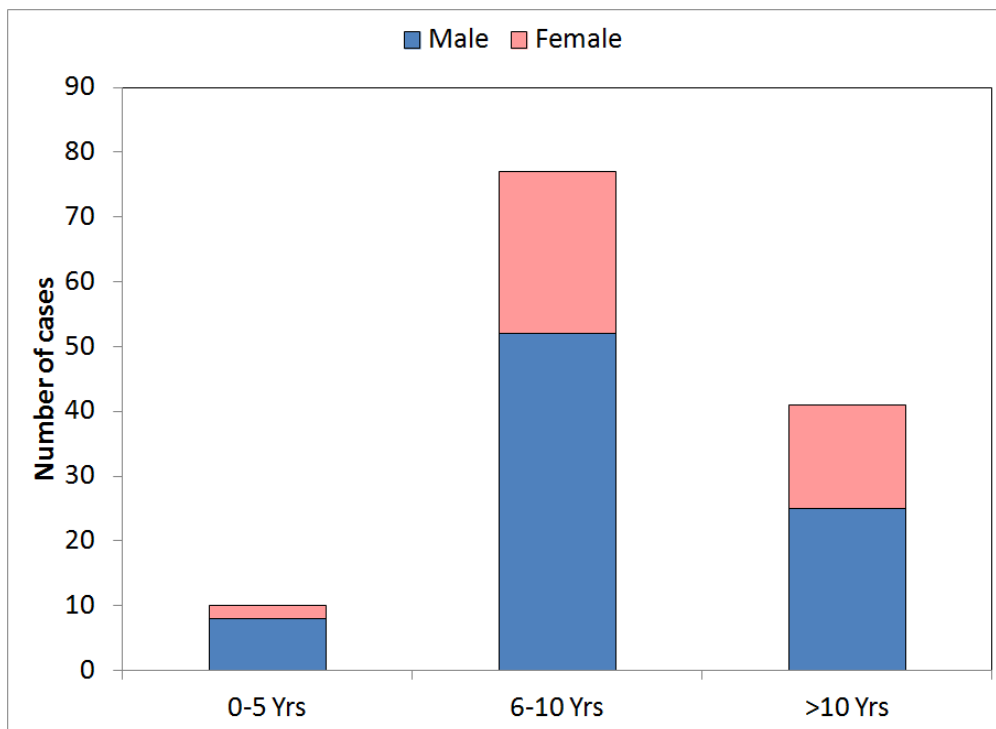
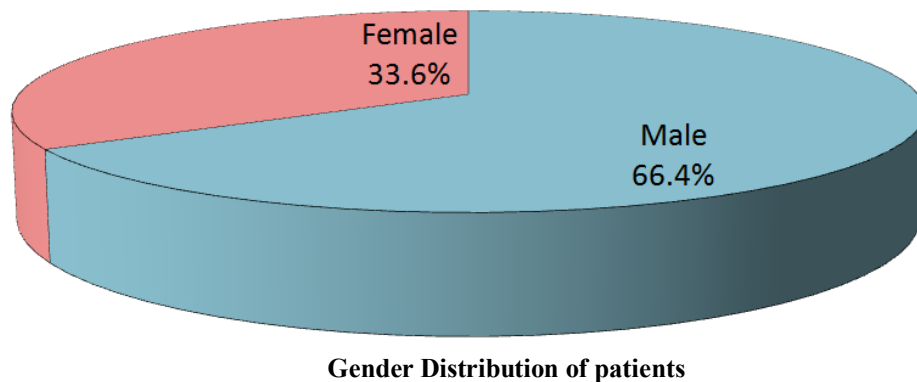


Figure 2: Age distribution of patients

Clinically, the most common type was the black dot type, observed in 57% of cases, followed by grey patch (38.3%) and inflammatory type (4.7%). Solitary lesions were present in only 14 (10.9%) cases. The majority of patients (74.2%) had 2–5 patches, while 19 (14.8%) had more than 5 patches. The predominant presenting complaints were itching (94.5%) and scaling (73.4%). Additionally, 52 (40.6%) cases reported hair loss, and 6 (5.7%) had lesions with discharge and erythema.

Table 2: Clinical Profiles of Patients

SN	Characteristic	Number of patients	Percentage
1.	Clinical Type		
	Black dot type	73	57.0
	Grey patch	49	38.3
	Inflammatory type	6	4.7
2.	No. of patches		
	Only 1 patch	14	10.9
	2-5 patches	95	74.2
	More than 5 patches	19	14.8
3.	Clinical Complaints		
	Itching	121	94.5
	Scaling	94	73.4

SN	Characteristic	Number of patients	Percentage
	Hair loss	52	40.6
	Lesions with discharge and erythema	6	4.7

On culture, 87 (68%) specimens were positive. The most common mycological pathogen was *T. mentagrophytes* (n=44; 34.4%), followed by *T. rubrum* (n=15; 11.7%), *T. verrucosum* (n=11; 8.6%), *M. audouinii* (n=8; 6.3%), and *M. canis* (n=4; 3.1%) (Figure 1).

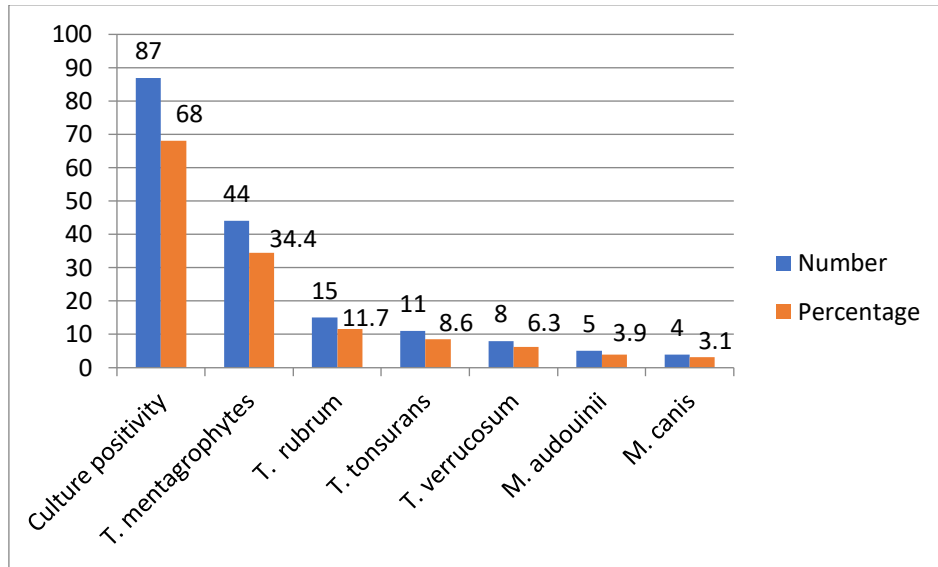


Figure 1: Cultural positivity and pattern among patients

A total of 85 (66.4%) specimens were KOH-positive for fungal strains. When evaluating the efficacy of KOH positivity against culture positivity, it was found to have a sensitivity of 72.4% and a specificity of 46.3%. The positive and negative predictive values of direct microscopy were 74.1% and 44.2%, respectively. The overall accuracy of KOH microscopy was 63.3% (Table 3).

Table 3: Association between KOH positivity and culture positivity

SN	KOH Positivity	Culture Positivity		Total
		Positive	Negative	
1.	Positive	63	22	85
2.	Negative	24	19	43

Sensitivity: 72.4%; Specificity: 46.3%; PPV: 74.1%; NPV: 44.2%; Accuracy: 63.3%

Table 4: Association of fungal element positivity with clinical presentation and duration of symptoms

SN	Parameter	Positive (n=87)		Negative (n=41)		Statistical significance	
		No.	%	No.	%	$\chi^2$	'p'
1.	Duration					0.871	0.832
	Asymptomatic	24	27.6	10	24.4		
	≤3 months	39	44.8	21	51.2		
	4-6 months	23	26.4	9	22.0		
	>6 months	1	1.1	1	2.4		
2.	Tonsuring	49	56.3	25	61.0	0.247	0.619
3.	Clinical type					2.601	0.272
	Black dot type	47	54.0	26	63.4		
	Grey patch	37	42.5	12	29.3		
	Inflammatory type	3	3.4	3	7.3		
4.	No. of patches					10.541	0.005
	Only 1 patch	9	10.3	5	12.2		
	2-5 patches	59	67.8	36	87.8		
	>5 patches	19	21.8	0	0.0		

5.	Complaints						
	Itching	79	90.8	35	84.6	0.846	0.358
	Scaling	70	80.5	24	58.5	6.866	0.009
	Hair loss	44	50.6	10	24.4	7.834	0.005
	Lesions with discharge and erythema	5	5.7	1	2.4	0.683	0.409

No significant association between fungal element positivity and duration, tonsuring and clinical type could be seen. However, increasing number of patches and complaints like scaling and hair loss were seen to be significantly associated with fungal element positivity ( $p < 0.05$ ).

## DISCUSSION

The current study found that the majority of patients were children aged 6-10 years (60.2%), and were males (66.4%). Tinea capitis is most frequently observed in children aged 3 to 14 years, accounting for up to 92.5% of dermatophyte infections in children under 10 [6]. Recent research by Kassem et al. revealed a predominance of children aged 4-6 years (81.6%) and males (72.4%) within an immigrant refugee population [11]. Similarly, Mohta et al. reported that male children aged 6-10 years (72.6%) were most affected [12]. A meta-analysis of 14 studies involving 9,465 schoolchildren also confirmed increased susceptibility among boys under 10 years [13]. Age-specific and site-specific variation in fungal species was observed, and some gender-related differences in pathogen distribution were also noted in a Poland study [14]. These findings align with the age and sex distribution observed in our study. Tinea capitis most frequently affects prepubertal children [15].

Clinically, itching, scaling, and hair loss were the most common presenting complaints, consistent with other studies [16,17]. Mohta et al. noted that itching and inflammation significantly impact children's quality of life, which may explain why symptomatic children in our study sought medical attention [12]. Interestingly, some asymptomatic children were diagnosed, emphasizing that even short-duration symptoms—averaging 2.33 months—can lead to noticeable clinical signs.

The most common clinical types identified were black dot and grey patch, with many children exhibiting multiple lesions. These findings are in line with other research indicating these as predominant clinical forms [12,18-20]. The grey patch type was also the most frequent presentation, (65% of cases) in a Telangana study by Pavani et al [21]. KOH examination identified fungal elements in all samples, while fungal cultures were positive in 40% of cases, with *T. violaceum* being the most common pathogen isolated in the Telangana study.

Diagnostic tests showed similar positivity rates: 66.4% for KOH preparation and 68% for fungal culture. Compared to Mohta et al., who reported lower rates (32.9% and 40.8%), our higher detection rates may reflect differences in techniques or patient populations [12]. While KOH examination is sensitive, it lacks specificity, making culture essential for definitive identification. Our study found direct microscopy was 63.3% accurate relative to culture, indicating that both methods are complementary [22].

Fungal culture predominantly yielded Trichophyton species (90.8%), with Microsporum species making up the remaining 9.2%. This pattern aligns with most previous studies [11,23,24]. However, Zeng et al. reported Microsporum dominance, indicating regional variations [20]. The main species identified were *T. mentagrophytes* and *T. rubrum* among Trichophyton, and *M. audouinii* and *M. canis* among Microsporum.

Reviewing regional literature from northern India, especially Lucknow, reveals variability in fungal profiles. Shukla et al. identified *T. tonsurans*, *T. mentagrophytes*, *M. ferrugineum*, *T. verrucosum*, and *M. audouinii* as common isolates in our setting [25]. Sahai and Mishra reported similar findings [18]. Conversely, Grover et al. and Ahmed et al. found *T. violaceum* to be prevalent, whereas our study did not identify this species [10, 17]. Such differences underscore the dynamic nature of fungal epidemiology, influenced by globalization and increased contact with carriers from diverse regions, which necessitate ongoing surveillance.

Strengths of this study include its focus on relevant clinical factors, which can aid in early diagnosis and management. Additionally, it provides valuable data specific to the local population, contributing to regional understanding of the condition. A limitation of this hospital-based study is that the findings may not reflect the broader community, and additional research is necessary to verify prevalence, as results may differ beyond our specific population in Lucknow.

## CONCLUSION

The present study showed that paediatric *Tinea capitis* in Lucknow city was characterized by younger age ( $\leq 10$  years) and male gender. Itching and scaling, multiple patches and black dot type were common clinical features. Culture positivity rate was 68% with dominance of *T. mentagrophytes* and *T. rubrum* as the mycological pathogens.

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