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Original Research Article

Clinical and Mycological Patterns of Dermatophyte Infections in Patients Attending a Tertiary Care

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Abstract:

Background: Dermatophytosis is a common superficial fungal infection caused by dermatophytes of the genera Trichophyton, Microsporum, and Epidermophyton, affecting keratinized tissues such as skin, hair, and nails. Changing epidemiological trends and increasing chronicity necessitate regular evaluation of clinical and mycological patterns in tertiary care settings.

Aim: To determine the clinical and mycological patterns of dermatophyte infections and to correlate clinical diagnosis with potassium hydroxide (KOH) microscopy and culture findings among patients attending a tertiary care center.

Methodology: This hospital-based descriptive observational study included 134 clinically diagnosed cases of dermatophytosis over one year. Detailed clinical evaluation was performed, and specimens were subjected to KOH mount and fungal culture on Sabouraud's dextrose agar. Species identification was based on colony morphology and lactophenol cotton blue mount findings.

Results: The majority of cases occurred in the 11–20 and 21–30 year age groups. Tinea corporis was the most common presentation, followed by tinea cruris, with annular morphology predominating. More than half of the cases were both KOH and culture positive. Among 82 culture-positive isolates, Trichophyton mentagrophytes was the predominant species, followed by Trichophyton rubrum.

Conclusion: Dermatophytosis predominantly affects young individuals, with tinea corporis as the leading clinical form. Combined clinical and mycological evaluation enhances diagnostic accuracy, and Trichophyton species remain the principal etiological agents in this setting.

Keywords: Dermatophytosis, Tinea corporis, KOH mount, Fungal culture, Trichophyton mentagrophytes, Tertiary care center.

Introduction

Dermatophytosis is a very common superficial fungal infection in the world, the causative agents of which are the dermatophytic fungi of the genera Trichophyton, Microsporum and Epidermophyton, which have colonies in the world through keratinous tissues including the skin, hair and nails [1]. These are the only organisms capable of invading and making use of keratin as a source of nutrients, which causes infections known as a group of tineae, also known as ringworm. Though these infections are normally confined to the non-living cornified layers of the epidermis since they cannot invade the deep tissues in immunocompetent persons, they still pose a great health problem to the population due to their high prevalence rates, chronicity and recurrence [2]. Around the world, foot (tinea pedis) dermatophytic infections are the most commonly reported types of infections with an estimated lifetime prevalence of 1020% [3]. Dermatophytosis has a wide range of clinical presentation, and it is based on the location of infection, host response, and environmental factors and the virulence of the infecting organism. The most common presenting complaint is pruritus that most patients present to the doctor. The mild cases can range to inflammatory reactions characterized by mild conditions resembling seborrheic dermatitis, and severe and chronic manifestations where the favus can cause scarring alopecia in case of non-treatment. This can create a diagnostic difficulty, especially in those parts of the

world where empirical treatment is practiced normally without laboratory confirmation [4].

Over the past years, the epidemiological change in the tendency of dermatophyte infections has been witnessed. The evolving trends consist of alterations in the most common species of infection, there is also an augmentation in chronicity, unusual clinical manifestations and augmentation in recalcitrant dermatophytosis [5]. A number of aspects have been attributed to this change such as climatic changes, urbanization, overpopulation, lack of hygienic practices, and the use of clothes that are not permeable. Also, the frequent and tendencies to use powerful topical antifungals with or without corticosteroids have led to partial therapy, morphological changes of lesions, and development of drug-resistant strains [6]. The genetic change in evolution of dermatophytes can also increase their virulence and survival that enables them to survive in the host and environment over a long period.

Humidity and temperature are high in India and other tropical countries promoting the growth and transmission of dermatophytes. Sweat generated often, physical contact, and sharing of personal belongings also help in transmission. Dermatophytosis takes up a significant percentage of dermatology outpatient visits in tertiary care environment [7]. It is not just a medical, but also psychosocial burden since visible skin lesions are likely to lead to embarrassment, stigma and poor quality of life. Constant or repeated infections can frustrate, cause economic burden by the long medication, and reduce productivity, particularly in working-age people.

Dermatophytosis can clinically present with numerous other dermatoses, including eczema, psoriasis, candidiasis, and seborrheic dermatitis, and therefore the clinical diagnosis could not be trusted in some cases [8]. A wrong diagnosis may lead to incorrect treatment that will only worsen the infection as it also leads to resistance. Laboratory confirmation is thus very essential in arriving at a correct diagnosis. Potassium hydroxide (KOH) mount is a simple, quick and inexpensive method of diagnosis to identify fungal elements in clinical specimen by a direct microscopic examination. Cultures on suitable media do not only confirm the diagnosis but also allow determining the exact dermatophyte species that caused the infection, which can help monitor the epidemiology and inform antifungal treatment.

In the modern situation of evolving epidemiology and treatment issues, it is crucial to understand the clinical patterns and correlate them with mycological results. The differences in the distribution of species could have a clinical morphology, predilection location, and responsiveness to treatment effects [9]. Moreover, the identification of the agreement between clinical diagnosis, KOH positivity, and culture findings will be useful in evaluating the reliability of clinical diagnosis and the validity of laboratory tests in the everyday practice. These data are mainly useful in tertiary care units whereby different groups of patients with different levels of diseases are presented to be dealt with under special care.

Although dermatophytosis is frequently a simple and easy-to-treat infection, its widespread prevalence worldwide, recurring nature, and quality-of-life effects make it a serious health problem of the population. The growing number of chronic and treatment-resistant cases demonstrates the importance of monitoring the clinical and mycological trends continuously. Correct diagnosis of infecting species and knowledge of current clinical trends can also help clinicians choose the right antifungal regimen and the use of preventive measures.

The aim of the current study in this respect is to identify the clinical and mycological trends of dermatophyte infection in patients at the dermatology outpatient department of a tertiary care center. Also, the research aims to provide the correlation of the provisional clinical diagnosis with the KOH positivity and culture positivity, to determine the diagnostic precision and emphasize the role of laboratory confirmation in the treatment of dermatophytosis. In such a way, the study will aim to fill the gaps in the existing knowledge of the changing situation with dermatophyte infections and contribute to evidence-based clinical practice.

Methodology

Study Design: This hospital-based descriptive observational study was undertaken to evaluate the clinical and mycological patterns of dermatophyte infections among patients attending a tertiary care center. The study was designed to correlate clinical presentations of dermatophytosis with laboratory findings, including direct microscopic examination and fungal culture, to determine the spectrum of dermatophyte species prevalent in the region.

Study Area: The study was conducted in the Department of Skin and VD at Darbhanga Medical College and Hospital, Darbhanga, Bihar, India.

Study Duration: The study was carried out over a period of one year from April 2023 to March 2024.

Sample Size: A total of 134 patients clinically diagnosed with dermatophytosis were included in the study (N = 134). The sample size comprised consecutive eligible patients who attended the outpatient department during the study period and consented to participate.

Study Population: The study population included patients of all age groups and both genders

presenting with signs and symptoms suggestive of dermatophytosis. Pediatric patients were included after obtaining consent from parents or legal guardians. The population represented a diverse demographic background in terms of occupation, socioeconomic status, and hygiene practices, allowing for comprehensive evaluation of clinical patterns.

Inclusion Criteria

- Patients of any age and gender clinically diagnosed with dermatophytosis.
- Patients willing to participate and provide written informed consent.
- Newly diagnosed and untreated cases.

Exclusion Criteria

- Patients who had applied any topical medications including steroids, antifungals, antibacterials, antiseptics, or native medications within the past one month or were currently on such treatment.
- Patients unwilling to provide consent.

Data Collection: After obtaining written informed consent, detailed demographic and clinical information was collected using a structured proforma. Data included age, gender, occupation, duration and type of symptoms, site and morphology of lesions, personal hygiene practices, type of clothing, footwear habits, sharing of fomites, contact with pets, associated systemic illnesses, history of recurrence, previous similar episodes, treatment history (over-the-counter or prescribed), duration of prior treatment, and presence of any symptom-free interval. All patients underwent thorough dermatological examination to document the type and distribution of lesions.

Species Identification: Fungal isolates were identified based on macroscopic colony characteristics and microscopic morphology using lactophenol cotton blue (LPCB) mount and slide culture techniques. Identification criteria included the arrangement and morphology of hyphae (coiled, septate), presence and type of microconidia and macroconidia (pencil, spindle, club-shaped), and pattern of sporulation.

Where necessary, additional biochemical tests such as urea hydrolysis test and hair perforation test were performed to confirm species identification. Tubes were examined for growth at the end of four weeks before declaring negative results.

Procedure: Clinically suspected cases were evaluated in the outpatient department, and appropriate specimens were collected depending on the site of infection. For skin lesions, scrapings were obtained from the active margin after cleansing with 70% isopropyl alcohol and allowing the area to dry. In cases of nail involvement, nail clippings and subungual debris were collected. For scalp infections, affected hairs were plucked from the base using sterile forceps along with scalp scrapings. Direct microscopic examination was performed using 10% potassium hydroxide (KOH) preparation for skin and hair samples and 40% KOH for nail samples to detect fungal elements such as hyphae and arthrospores. Specimens were cultured on Sabouraud's Dextrose Agar (SDA) in two sets—one containing chloramphenicol and another containing chloramphenicol with cycloheximide. One set was incubated at 25°C and the other at 37°C for up to four weeks, with periodic observation. Colony characteristics such as growth rate, texture, and pigment production were noted. Species identification was carried out using lactophenol cotton blue mount and slide culture techniques, assessing hyphal arrangement, type of conidia, and sporulation patterns. Additional biochemical tests such as urea hydrolysis and hair perforation tests were performed when required for confirmation.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using IBM SPSS version 25. Descriptive statistics were expressed as mean and variance for quantitative variables and as frequencies and percentages for categorical variables. Data were presented using suitable graphical representations such as pie charts and box plots. The association between clinical diagnosis, KOH positivity, and culture positivity was assessed using cross-tabulation and percentage comparison. The Chi-square test was applied to determine statistical significance, and a p-value of less than 0.05 was considered statistically significant."

Result

Table 1 presents the age-wise distribution of cases in the study population (N = 134). The highest proportion of cases was observed in the 11–20 years age group, accounting for 38 cases (28.40%), followed closely by the 21–30 years group with 36 cases (26.90%). Together, these two age groups comprised more than half of the total study population, indicating a higher burden of dermatophytic infections among adolescents and young adults. The 31–40 years group contributed 22 cases (16.40%), while 41–50 years accounted for 14 cases (10.40%). Fewer cases were seen in the extremes of age, with 10 cases (7.50%) in children up to 10 years, 8 cases (6.00%) in the 51–60 years group, and only 6 cases (4.40%) among those aged 61 years and above. Overall, the findings demonstrate a peak incidence in the second and third decades of life, with a gradual decline in frequency in older age groups.

Table 1: Descriptive analysis of age group in the study population (N = 134)		
Age group	**No. of cases**	**Percentage**
Up to 10	10	7.50%
11 to 20	38	28.40%
21 to 30	36	26.90%
31 to 40	22	16.40%
41 to 50	14	10.40%
51 to 60	8	6.00%
61 and above	6	4.40%
Total	**134**	**100%**

Table 2 illustrates the distribution of morphological patterns according to the site of involvement among the study population (N = 134). Tinea corporis was the most common presentation (N = 42), with the annular type being predominant (34 cases; 25.40%), followed by eczematous (2.20%), plaque (1.50%), crusted (1.50%), and psoriasiform types (0.70%). Among Tinea capitis cases (N = 12), the black dot variant was most frequent (4.50%), followed by grey patch (3.00%) and kerion (1.50%). In Tinea barbae (N = 6), the superficial type (3.00%) was more common than the circinate type (1.50%). Tinea pedis (N = 8) mainly presented as the chronic intertriginous type (3.70%), with vesicular/vesiculobullous type accounting for 2.20%. Of the Tinea unguium cases (N = 7), distal lateral subungual onychomycosis (DLSO) was predominant (3.70%), followed by total dystrophic onychomycosis (1.50%). All Tinea manuum cases (N = 5) presented as the non-inflammatory squamous form (3.70%). Tinea cruris (17.90%) and Tinea faciei (7.50%) were also commonly observed. Mixed infections (N = 20) accounted for 14.90% overall, with the most frequent combination being Tinea corporis with Tinea cruris (6.00%). Overall, annular Tinea corporis and isolated Tinea cruris were the most common clinical presentations in the study population.

Table 2: Descriptive analysis of morphological patterns with the site of involvement of the disease in the study population (N = 134)		
Subtype	**No. of cases**	**Percentage**
Tinea corporis (N = 42)		
Annular type	34	25.40%
Eczematous type	3	2.20%
Plaque type	2	1.50%
Crusted type	2	1.50%
Psoriasiform type	1	0.70%
Tinea capitis (N = 12)		
Black dot	6	4.50%
Grey patch	4	3.00%
Kerion	2	1.50%
Tinea barbae (N = 6)		
Superficial type	4	3.00%
Circinate type	2	1.50%
Tinea pedis (N = 8)		
Chronic intertriginous type	5	3.70%
Vesicular/vesiculobullous type	3	2.20%
Tinea unguium (N = 7)		
DLSO	5	3.70%
Total dystrophic onychomycosis	2	1.50%
Tinea manuum (N = 5)		
Non-inflammatory squamous form	5	3.70%
Tinea cruris (N = 24)	24	17.90%
Tinea faciei (N = 10)	10	7.50%
Mixed types (N = 20)		
Tinea corporis + Tinea cruris	8	6.00%
Tinea corporis + Tinea pedis	4	3.00%
Tinea cruris + Tinea pedis	3	2.20%
Tinea cruris + Tinea manuum	2	1.50%
Others (various combinations)	3	2.20%
Total	**134**	**100%**

Table 3 presents the descriptive analysis of potassium hydroxide (KOH) microscopy and culture results among the study population (N = 134). The majority of cases, 70 (52.20%), were both KOH positive and culture positive, indicating concordant diagnostic findings. A smaller proportion, 12 cases (9.00%), were KOH negative but culture positive, suggesting that culture detected additional cases missed by microscopy. Conversely, 46 cases (34.30%) were KOH positive but culture negative, reflecting possible nonviable organisms or false-negative culture results. Only 6 cases (4.50%) were negative by both KOH and culture. Overall, more than half of the cases showed agreement between KOH and culture positivity, while a considerable proportion demonstrated discordant results, highlighting the complementary role of both diagnostic methods.

Table 3: Descriptive analysis of KOH and culture in the study population (N = 134)

KOH and culture	No. of cases	Percentage
KOH positive + Culture positive	70	52.20%
KOH negative + Culture positive	12	9.00%
KOH positive + Culture negative	46	34.30%
KOH negative + Culture negative	6	4.50%
Total	**134**	**100%**

Table 4 shows the distribution of dermatophyte species isolated among the 82 culture-positive cases. Trichophyton mentagrophytes was the most frequently isolated species, accounting for 34 cases (41.50%), followed by Trichophyton rubrum with 24 cases (29.30%). Trichophyton violaceum was identified in 12 cases (14.60%). Less commonly isolated species included Microsporum canis in 8 cases (9.80%) and Epidermophyton floccosum in 4 cases (4.80%). Overall, the findings indicate that species of the genus Trichophyton predominated among the culture-positive dermatophyte isolates, collectively contributing to the majority of infections.

Table 4: Distribution of dermatophyte species isolated on culture (N = 82 culture positive cases)

Species isolated	No. of cases	Percentage
Trichophyton mentagrophytes	34	41.50%
Trichophyton rubrum	24	29.30%
Trichophyton violaceum	12	14.60%
Microsporum canis	8	9.80%
Epidermophyton floccosum	4	4.80%
Total	**82**	**100%**

Discussion

In the current research, the age groups that showed the largest burden of infection were 11-20 years (28.4) and 21-30 years (26.9) which collectively represented over fifty percent of the cases. These results are simila1r to the ones by Singh et al. (2003) [10] who reported the highest prevalence at the age group of 1630 years and are also similar to those of Singh BSTP et al. (2019) who had reported the highest prevalence among young adults in a tertiary care environment in Eastern India [7]. The same tendencies have been pointed out in epidemiological research in Himachal Pradesh and Tamil Nadu, where economically productive age groups were mostly impacted by the augmented sweating, work-related exposure, and close contact (Bhatia and Sharma, 2014; Balakumar et al., 2012) [1, 2]. Our study (Osman et al., 2022) is consistent with worldwide epidemiological patterns when it comes to the relatively lower prevalence in pediatrics and the elderly [11]."

As far as clinical presentation is concerned, the most common manifestation of tinea was tinea corporis (31.3), then tinea cruris (17.9). This finding is in agreement with Das et al. (2007) who described tinea corporis (21.4) as the clinical presentation most common [12] and Kucheria et al. (2016) who also indicated tinea corporis as the most common clinical presentation in North India [13]. However, conversely, Maraki et al. (2007) recorded tinea unguium and tinea pedis as the most common presentations in Greece, which shows geographical variation in site predilection [14]. The prevalence of an annular morphology in our patients aligns with the traditional description of dermatophytosis and is consistent with the diagnostic role of morphological recognition, as pointed out in the study by Verma et al. (2021) [15]. Mixed infections (14.9%) in our study are also in line with recent reports in India of increasing extensive and multi-site involvement (Vanapalli et al., 2022) [9] perhaps due to steroid misuse and chronicity.

Our study showed that mycological correlation alone showed that 52.2% of the cases were both KOH and culture positive, 34.3% were KOH positive but culture negative, and 9% were KOH negative and culture positive. These results are

similar to the study of Deepasri et al. (2018), who achieved 63% dual positivity and similar values of discordant outcomes [16]. The non-culture positive, as high as the prevalence of the KOH, could be attributed to nonviable hyphae or a prior antifungal therapy, which Begum et al. (2020) in their review about the developing diagnostic capabilities discusses [6]. The low percentage of KOH-negative but culturally positive cases of our study highlights the complementary nature of fungal culture, which is also consistent with the previous Indian tertiary care research (Singh BSTP et al., 2019) [7].

On the issue of species distribution, our work showed that Trichophyton mentagrophytes (41.5) were predominant, then Trichophyton rubrum (29.3). This trend is opposed to older Indian research, including Kucheria et al. (2016) [13] and Maraki et al. (2007) [14], in which Trichophyton rubrum comprised 46.4% and 48% of the isolates, respectively. It is stated that Trichophyton verrucosum (35.5%) was the predominant isolate in Eastern Uttar Pradesh and Bihar (Gupta et al., 2018) [17], which also varied depending on the region. Nonetheless, the more recent Indian literature shows a slow epidemiological change, as the Trichophyton mentagrophytes become more and more isolated, which corroborates our findings (Vanapalli et al., 2022; Verma et al., 2021) [9,15]. This shift can be attributed to changing fungal virulence, patterns of antifungal resistance, environmental adaptation, and host-specific reasons as indicated in wider epidemiological research (Osman et al., 2022) [11].

In spite of the differences in the proportional distribution of the dermatophyte's species among different regions and at different points in time, Trichophyton rubrum and Trichophyton mentagrophytes always come to the forefronts as the preeminent etiological agents, and this supports its predominantly anthropophilic characteristic. The fact that Microsporum canis has been isolated in a subset of our patients points to the authorship of zoophilic cases of transmission that coincides with the dermatophyte ecology being reviewed world over (Nweze, 2010) [5].

Generally, the results of the current research are quite similar to the current Indian and global statistics, especially in terms of the prevalence of young adults, the most common manifestation of tinea corporis, and the increased popularity of Trichophyton mentagrotes. The dynamic epidemiology of dermatophytosis is highlighted by small variations in clinical conditions and distribution of the species relative to previous reports. This thus requires constant monitoring and regular clinico-mycological assessment to get to know what is going on in the region as well as guide the use of proper therapeutic approaches.

Conclusion

The current research demonstrates that dermatophyte infection in patients in a tertiary care centre is mostly common among adolescents and young adults, which makes the active and socially mobile segments of the population the most susceptible. Clinically, tinea corporis and tinea cruris turned out to be the most common manifestations, and annular lesions were the most common morphological forms, and mixed-location manifestation was also prominent, which suggests the variability of clinical patterns and likely chronicity or autoinoculation. A laboratory analysis proved that direct microscopy with potassium hydroxide mount is still a useful rapid diagnostics method, but fungal culture will help confirm and identify the species. The species of the genus Trichophyton were the most frequent, most notable Trichophyton mentagrophytes and Trichophyton rubrum, highlighting their leading position in the contemporary epidemiological trends. The results highlight the significance of integrated clinical and mycological evaluation in making correct diagnosis, prescribing correct antifungal treatment, and better management approaches in dermatophytosis at the tertiary care units.

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