ORIGINAL RESEARCH

Investigation of Dermatophytosis at a Tertiary Healthcare Facility: A Clinico-Mycological Analysis

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ABSTRACT

Background: Dermatophytosis encompasses a collection of surface-level fungal infections affecting keratinized tissues, including the epidermis, hair, and nails. This research aims to explore the clinical characteristics of dermatophytosis and pinpoint the fungal species responsible for diverse clinical manifestations. **Methods**: Conducted within a hospital setting, this observational study involved the inclusion of 200 patients with clinically suspected dermatophytosis. The methodology encompassed a comprehensive approach, including the collection of patient histories, general physical examinations, and detailed assessments of skin lesions. Diagnostic procedures involved direct microscopy using 10% KOH (40% KOH for nail specimens) and fungal culture on Sabouraud Dextrose Agar (SDA) supplemented with 0.05% chloramphenicol and 0.5% cycloheximide for every participant. Statistical analysis utilized the Chi-square test and contingency coefficient test to establish significance in the data. **Results**: In the current investigation, tinea accounted for 22.68% of all cases, with males comprising 59% and females 41% of these cases. The average age of individuals affected was 38 years, with the majority falling within the 21-30 years age group, followed by the 31-40 years age group. Among the collected samples, 136 cases were positive in the potassium hydroxide (KOH) test, while 122 cases showed positive results in the fungal culture. Interestingly, four cases that were KOH negative turned out to be culture positive, and 18 cases negative in culture were found to be KOH positive.In the subset of 162 skin scraping samples, 108 were positive in the KOH test, and 94 were positive in the fungal culture. Among the 22 nail clipping samples, 16 were positive in both the KOH test and culture. Additionally, in the 16 hair pluck samples, 12 were positive in both the KOH test and culture. **Conclusion**: Dermatophytosis stands out as one of the most prevalent, if not the most widespread, dermatological conditions encountered. Its impact is notably pronounced in the younger demographic, showing a predilection for affecting individuals in the younger age groups rather than at the extremes of age.

Keywords: Dermatophytosis, chloramphenicol, culture, dermatological.

INTRODUCTION

Dermatophytes, comprising a diverse and closely related group of fungi, exhibit a remarkable ability to induce distinctive skin alterations recognized as ringworm or dermatophytosis.[1] These fungi, collectively representing the most prevalent culprits in fungal infections globally, have been estimated by the World Health Organization to afflict nearly 20% of the world's population with dermatomycosis.Within the taxonomic landscape, dermatophytes are organized into three asexual genera—Microsporum, Trichophyton, and Epidermophyton. The classification is predicated on the morphological nuances of their large, multicellular macroconidia, serving as pivotal markers in the systematic arrangement of these fungi.Beyond the realms of mycological classification, the grouping of dermatophytes has been a longstanding tradition, motivated by both clinical and epidemiological considerations. This classification hinges on their ecological niche: geophilic species with origins in the soil, zoophilic species rooted in animal sources, and anthropophilic species predominantly colonizing human skin.[2] The consequences of infection exhibit variation, with zoophilic species provoking robust inflammatory reactions, often leading to spontaneous cures, while anthropophilic species typically give rise to milder yet chronic lesions.A striking feature of dermatophytes as parasitic entities lies in their strict restriction to dead keratinized tissue. Despite inflammatory responses impacting the dermis and the Malpighian stratum of the epidermis during ringworm

infection, the fungus thrives exclusively within the stratum corneum of the epidermis, encircling keratinized hair shafts, and residing within nails. In these keratinized tissues, the fungus exists predominantly in the form of mycelium and arthroconidia. In cases involving hair, the fungus infiltrates the follicle from the adjacent stratum corneum, adhering to precise patterns of growth.[3]While dermatophytosis typically manifests as a superficial infection, individuals with compromised immune systems may experience severe disseminated disease. The prevalence of dermatophytosis is particularly noteworthy in tropical and subtropical regions, such as India, where the hot and humid climate provides conducive conditions for the acquisition and perpetuation of this mycotic disease. The intricate interplay of these factors underscores the importance of a comprehensive understanding of dermatophytosis for effective management and prevention strategies.

The local climate, characterized by a high level of environmental moisture content, plays a pivotal role in shaping the dynamics of dermatophytosis in the region.[4] The elevated humidity retards the evaporation of sweat, creating a milieu that is highly conducive to the proliferation of fungi. Consequently, the prevalence of fungal diseases in this area is notably high, underlining the significance of understanding the environmental factors influencing dermatophyte infections.Focusing on the specific manifestation of dermatophytosis known as Kerion, it represents an inflammatory form of tinea capitis.[5,6] Traditionally associated with zoophilic ectothrix dermatophytes, particularly Microsporumcanis, there has been a noticeable shift in causative agents. Endothrix infections, notably T. tonsurans, are increasingly identified as the culprit, especially in urban settings. Kerion is characterized by a tender, erythematous, suppurative swelling that is often accompanied by alopecia, regional lymphadenopathy, and can be easily misdiagnosed as a bacterial infection. This misinterpretation may lead to unnecessary antibiotic or surgical interventions, and delayed treatment may result in permanent hair loss. The immunological aspect of Kerion involves a T cell–mediated hypersensitivity reaction to the causative dermatophyte.[7]Understanding the taxonomy of dermatophytes is crucial for comprehending their diverse impacts. Grouped into three genera—Trichophyton, Epidermophyton, and Microsporum—these fungi exhibit specificity in causing infections on different cutaneous and appendageal structures. Furthermore, their mode of transmission is categorized as anthropophilic, zoophilic, or geophilic. Clinically, dermatophyte infections are classified based on the affected site, giving rise to various presentations such as tinea capitis (head), tinea faciei (face), tinea barbae (beard), tinea corporis (body), tinea manus (hand), tinea cruris (groin), tinea pedis (foot), and tinea unguium (nail). Variants like tinea imbricate, tinea pseudoimbricata, and Majocchi granuloma add to the complexity of dermatophytosis.The research initiative undertaken aims to delve into the clinical profile of dermatophytosis, with a particular emphasis on identifying the causative fungal species associated with a spectrum of clinical presentations.[8] This endeavor not only contributes to the scientific understanding of dermatophytosis but also holds implications for refining diagnostic approaches and formulating targeted management strategies tailored to the diverse manifestations of this prevalent fungal infection.

MATERIALS AND METHODS

In the outpatient department (OPD) study, 200 cases were enrolled for thorough examination and analysis. A comprehensive set of 200 samples, consisting of 162 skin samples, 16 hair samples, and 22 nail samples, were collected specifically from individuals clinically diagnosed with dermatophytosis.The selection criteria for participants involved identifying patients with characteristic lesions, specifically papules with scales distributed across the body. These individuals were then chosen for the study, and samples were obtained by scraping lesions, plucking hair, or clipping nails for potassium hydroxide (KOH) mount and fungus culture analysis.Patients attending the Dermatology OPD displaying lesions indicative of dermatophytosis, as determined by the clinician's expertise, were considered eligible for participation. Notably, there were no age restrictions or gender biases, as individuals of all age groups and both sexes were included in the study.

To ensure the validity of the study, certain exclusions were applied. Participants who had undergone antifungal therapy (both oral and topical) within the preceding 2–3 months from the initiation of the study were excluded. Additionally, individuals with serious underlying systemic conditions were deemed inappropriate for inclusion by the clinician.Furthermore, to maintain the focus on dermatophytosis, other skin fold and nail infections, whether bacterial or fungal, such as paronychia and intertrigo, were deliberately excluded from the study. This careful selection and exclusion criteria aimed at enhancing the precision and relevance of the findings related to dermatophytosis in the specified population.

In the laboratory procedures, skin scrapings underwent treatment with 10% potassium hydroxide (KOH) for a duration of 20 minutes, while hair and nail samples were treated with 20% KOH for 2 hours and overnight, respectively. After this treatment, the samples were mounted on a glass slide and examined under a microscope, focusing on low magnification to identify the presence of fungi.

Positive samples were subjected to further processing to isolate the specific dermatophyte species, employing Sabouraud's Dextrose Agar (SDA) as the medium. For primary isolations, SDA slopes

supplemented with chloramphenicol and cycloheximide were utilized. Subsequent subculture involved transferring samples to SDA without antibiotics. Two sets of cultures were established, with one set incubated at 37°C and the other at room temperature, allowing for a comprehensive assessment over one month. Typically, observable growth appeared within two weeks.

Identification of the dermatophyte species was carried out based on both macroscopic and microscopic features. The gross morphology of the colony was examined, considering several key characteristics:

1. **Rate of Growth:** The speed at which the colony expanded on the culture medium.
2. **General Topography:** Whether the colony appeared flat, heaped, or displayed regular or irregular folds.
3. **Texture:** The overall feel of the colony, described as powdery, velvety, fluffy, and so on.
4. **Surface Color and Pigment Color on Reverse:** The coloration on the surface of the colony and the color of the pigment on the reverse side of the culture.

In cases where no growth was observed at the end of the four-week incubation period, the culture was labeled as negative. This systematic approach allowed for a thorough examination and identification of dermatophyte species based on their growth characteristics and macroscopic features, contributing to the overall understanding of dermatophytosis in the study.

RESULTS

In this comprehensive study encompassing 200 patients afflicted with cutaneous dermatophytic infections, the prevalence of tinea, a specific type of dermatophytosis, was found to constitute a noteworthy 22.68% of the total dermatology outpatient cases under investigation. The gender distribution among the subjects revealed a majority of male patients, accounting for 59%, while females comprised 41% of the study population. The mean age of the patients, calculated at 38 years, provided insights into the demographic characteristics of those affected, with a predominant concentration in the age groups of 21-30 years and 31-40 years.An in-depth analysis of sample distribution highlighted the prominence of skin scraping as the primary specimen type, representing a substantial 81% of the total samples collected. Nail clippings and hair pluck samples contributed 11% and 8%, respectively, offering a comprehensive representation of the various specimen types considered in the study.The diagnostic evaluation revealed intriguing findings, with 68 cases identified as potassium hydroxide (KOH) positive, signifying the presence of fungal elements. In contrast, 122 cases were confirmed as culture positive, denoting the successful growth of the causative dermatophyte in laboratory conditions. Notably, the study identified four cases that tested negative in the KOH mount but were culture positive, emphasizing the importance of using multiple diagnostic approaches. Conversely, 18 cases that were negative in the culture exhibited positive results in the KOH mount, further underscoring the nuanced nature of diagnostic outcomes.Delving deeper into the sample breakdown, among the 162 skin scraping samples, 108 were KOH positive, indicating the presence of fungal elements, while 94 were culture positive, affirming the growth of the dermatophyte. Similarly, among the 22 nail clipping samples, 16 showed positive results in both the KOH mount and culture, offering a congruent diagnosis. Out of the 16 hair pluck samples, 12 displayed positive results in both the KOH mount and culture, reinforcing the reliability of this dual diagnostic approach.This multifaceted analysis not only provides valuable insights into the prevalence and diagnostic aspects of cutaneous dermatophytic infections but also sheds light on the intricate interplay between different diagnostic methods. By comprehensively understanding the distribution of cases, gender representation, age demographics, and the efficacy of various diagnostic techniques, this study contributes to a more nuanced and informed approach to managing and diagnosing dermatophytosis in the studied population.

Table 1: **Distribution of cases according to KOH and culture findings**

Number of cases	KOH positive	KOH negative	Total cases
Culture on SDA +ve	118	4	122
Culture on SDA -ve	18	60	78
Total cases	136	64	200

Figure 1: **Distribution of cases according to KOH and culture findings**

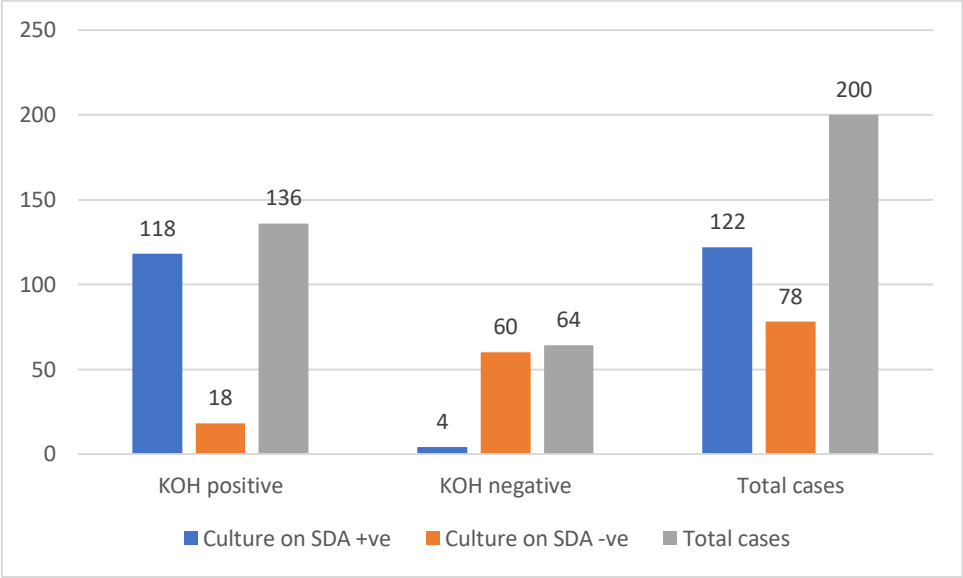


Table 2: Sample wise KOH and culture positive cases

Type of sample	No. of samples	KOH positive	Culture positive
Skin scrapping	162	108	94
Nail clipping	22	16	16
Hair pluck	16	12	12

Figure 2: Sample wise KOH and culture positive cases

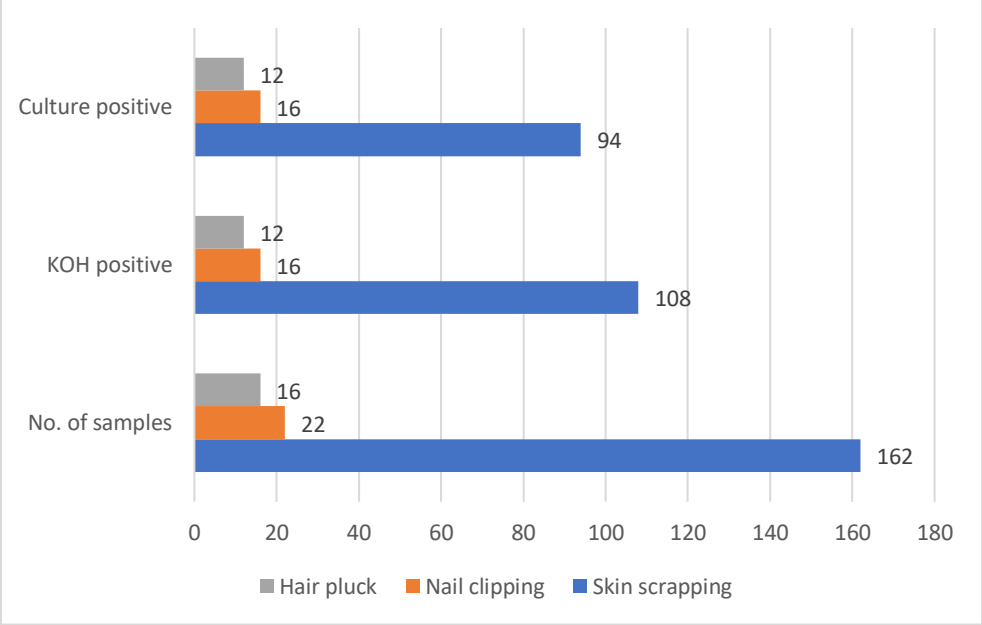
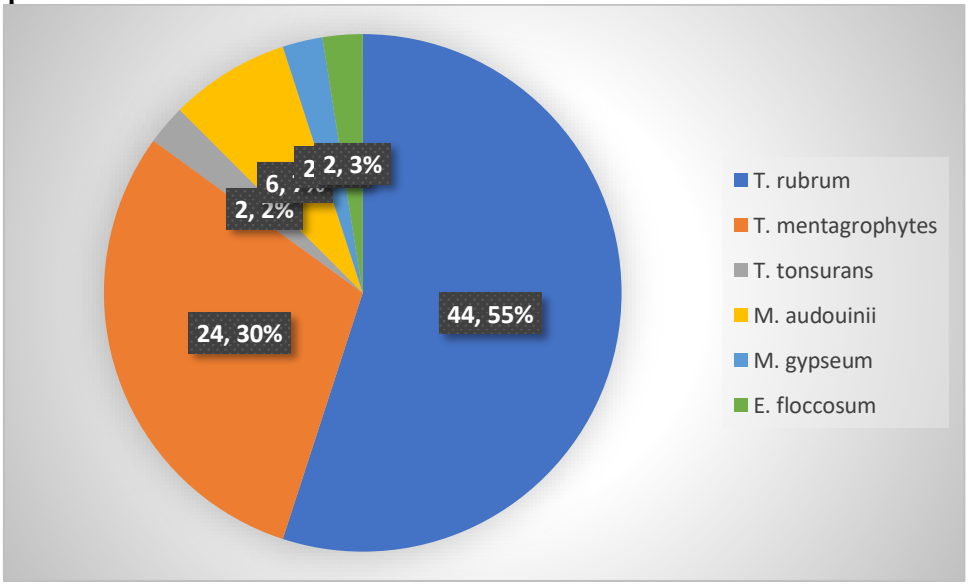


Table 3: Species identification on culture media

Name of the species	No. in skin scrapping	No. in nail clipping	No. in hair pluck	Total	Percentage of total culture positive
T. rubrum	44	4	6	54	44.26%
T. mentagrophytes	24	6	4	34	27.86%
T. tonsurans	2	0	0	8	1.63%
M. audouinii	6	0	2	8	6.55%
M. gypseum	2	0	0	2	1.63%
E. floccosum	2	6	0	8	6.55%

Figure 3: Species identification on culture media



DISCUSSION

Certainly, let's delve into a more detailed exploration of the study's findings on the incidence and gender distribution of dermatophytic infections, comparing and contextualizing the results with relevant studies.[9,10]The present study, involving a cohort of 200 patients with dermatophytic infections, reported an incidence rate of 22.68%. This incidence aligns closely with a study by de Hoog GS et al, indicating consistency in the prevalence of dermatophytic infections across different populations.A notable observation in the gender distribution revealed a substantial male predominance in the study, with 118 males and 82 females, resulting in a male-to-female ratio of 1.45. This finding resonates with numerous Indian studies, which consistently report a higher incidence of dermatophyte infections in males. The male-to-female ratio observed in this study, echoing the trend seen in Indian studies, reinforces the notion of a gender-specific susceptibility to dermatophytic infections.Comparative insights from other studies shed further light on this observed male predominance. In a study by Nita Patwardhan et al in 1999, the male-to-female ratio was reported as 2:1, suggesting a more pronounced male predominance compared to the current study. Similarly, Bindu V et al found a male-to-female ratio of 2.1:1, indicating a higher male prevalence. Singh S et al reported a ratio of 1.57:1, Sen SS et al indicated a higher ratio of 2.85:1, and Veer P et al documented a ratio of 1.8:1. Neetu Jain et al reported a notable male predominance, with males constituting 67.5% of the study population, while Madhavi S et al observed a male-to-female ratio of 1.3:1.[11] These consistent findings collectively affirm the trend of males being more susceptible to dermatophytic infections across diverse demographic settings.The convergence of results across different studies underscores the robustness of the observed male predominance, suggesting that gender-specific factors may influence susceptibility to dermatophytic infections. Various hypotheses, including hormonal differences, lifestyle factors, and occupational exposure, might contribute to the observed gender disparities. Understanding these patterns is crucial for tailoring preventive measures and therapeutic interventions.In conclusion, the present study not only contributes to the growing body of knowledge on dermatophytic infections but also aligns with and reinforces trends observed in other relevant studies. The nuanced exploration of gender-specific patterns in dermatophyte incidence enhances our understanding of this prevalent dermatological condition, facilitating the development of more targeted and effective strategies for its management and prevention.[12,13]

The mean age of the patients enrolled in the current dermatophytosis study was determined to be 38.4 years, providing a central tendency around which the age distribution of the affected individuals could be characterized. Notably, the analysis of age distribution revealed a distinctive peak in incidence within the age group of 21-30 years. This demographic trend aligns with the observations from several other pertinent studies, collectively pointing towards a higher susceptibility to dermatophytosis in individuals within this age range.In a study led by Nita Patwardhan et al, encompassing the examination of 170 clinical samples, the maximum number of cases of dermatophytosis was identified in the age group of 21-30 years, constituting 22.8% of the total cases. A parallel study by Aruna Aggarwal et al, which involved the scrutiny of 500 clinically diagnosed cases of dermatomycosis, revealed that 60.8% of the infections occurred in individuals above 20 years of age, with the highest prevalence recorded in the third decade of life.[14,15]The investigation conducted by Bindu V, focusing on 300 patients with dermatophytosis, noted that the highest concentration

of cases was observed in the age group of 11-20 years, accounting for 23.3% of the total cases. Additionally, Singh S et al, in their study encompassing 520 clinically suspected cases, reported a significant impact on young adults in the age group of 16-30 years, constituting a substantial 45.38% of the total cases.These converging findings across diverse studies emphasize a consistent pattern of heightened dermatophytic infection incidence in young to middle-aged adults, particularly within the second and third decades of life. The underlying factors contributing to this age-specific vulnerability could encompass various lifestyle elements, environmental exposures, and potentially age-related variations in immune response. Recognizing and comprehending these age-related trends is imperative for tailoring preventive strategies and optimizing clinical management approaches for dermatophytosis, taking into account the distinct characteristics and challenges associated with different age groups.

The study conducted by Sen SS et al, which focused on 200 clinically suspected cases of dermatophytosis, provided valuable insights into the age distribution of affected individuals. Notably, the prevalence of dermatophytosis was highest among adults aged 21-30 years, constituting a significant portion of the cases at 44%.[16,17] This age-specific trend aligns with the findings of other relevant studies, including the mycological investigation undertaken by Veer P et al, which specifically studied onychomycosis in 88 patients. In Veer P et al's study, the commonest age group affected was reported to be 31-40 years, emphasizing the vulnerability of individuals in this age bracket to dermatophytic infections. Similarly, Samita Sarma et al, in their study of 200 clinically diagnosed patients with fungal infections of the skin, identified the maximum number of cases in the age group of 21-30 years, comprising 39% of the total cases. This consistent pattern across studies underscores the demographic relevance of dermatophytosis, particularly among young to middle-aged adults.The age range observed in the present study, spanning from 6 years to 74 years, underscores the broad spectrum of individuals susceptible to dermatophytosis. The inclusion of a 6-year-old patient in the study highlights the importance of recognizing that dermatophytosis can affect individuals of various age groups, including children.In terms of diagnostic methods, the study employed potassium hydroxide (KOH) and culture analyses. The results revealed that 68% of cases were KOH positive, indicating the presence of fungal elements, while 61% were culture positive, confirming the growth of dermatophytes in laboratory conditions.[18] Trichophyton rubrum emerged as the most common pathogen isolated, constituting 44.26% of cases. This aligns with the findings of several other studies, including those conducted by Nita Patwardhan et al, Aruna Aggarwal et al, Bindu V et al, Singh S et al, Vijaya D et al, Sen SS et al, and Venkatesan G et al, where Trichophyton rubrum consistently stood out as the predominant species causing dermatophytic infections.

The specific presentation of dermatophytosis, with T. corporis being the most common manifestation, reflects the clinical patterns observed in the study. The isolation of T. rubrum as the most common pathogen from skin scrapings in cases of T. corporis emphasizes the correlation between clinical presentation and the etiological agent.In conclusion, the findings from this study, when considered alongside other related research, contribute to a comprehensive understanding of the epidemiology and etiology of dermatophytosis. The identification of age-specific trends and the prevalence of particular dermatophyte species provide valuable information for clinicians and researchers alike, guiding the development of targeted diagnostic and therapeutic strategies.

CONCLUSION

Dermatophytosis is a common concern, particularly affecting the younger population, with a noticeable majority of males seeking treatment. Skin is the primary site of involvement, and diagnostic tests like KOH and S.D.A. cultures are crucial. T. rubrum is the main pathogen causing tinea, with T. corporis and T. cruris being the most prevalent types. Despite valuable insights, the study has limitations like a small sample size, technical requirements for tests, and potential selection bias. Nonetheless, it sheds light on the prevalence, demographics, and causative agents of dermatophytosis in our setting.

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