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Research Article

Clinico-Mycological Profile of Dermatophytosis in a Tertiary Care Hospital

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ABSTRACT

Background & Objectives: Dermatophytosis is a major public health concern in tropical regions like India, where high humidity and temperature facilitate fungal proliferation. This study aimed to evaluate the clinico-mycological profile of dermatophytosis in a tertiary care hospital in South India, compare the efficacy of different culture media, and assess the utility of Polymerase Chain Reaction (PCR) in diagnosing cases negative by conventional methods.

Methods: A cross-sectional study was conducted over six months involving 145 clinically suspected cases. Skin scrapings, nail clippings, and hair samples were subjected to direct microscopy (KOH mount) and culture on Sabouraud Dextrose Agar (SDA) with and without antibiotics, and Dermatophyte Test Medium (DTM). Species identification was based on morphology, pigment production, biochemical tests and microscopic characteristics. Multiplex Real-Time PCR was performed on samples that were negative by both microscopy and culture.

Results: A female predominance was observed (56.6%), with a female-to-male ratio of 1.3:1. The most affected age group was 51–60 years (17.93%), and manual laborers (33.1%) were the most affected occupational group. Tinea corporis (57.24%) was the most common clinical presentation, followed by Tinea cruris (24.82%). Direct microscopy (KOH) showed higher positivity (95.17%) compared to culture (88.96%). DTM was the most effective media for isolation (99.2%). *Trichophyton rubrum* (58.1%) was the predominant species isolated, followed by *Trichophyton mentagrophytes* (31.8%). Of the six samples negative by both microscopy and culture, PCR identified one additional positive case (16.6%).

Conclusion: *Trichophyton rubrum* remains the primary etiological agent of dermatophytosis in this region. While direct microscopy is a highly sensitive rapid screening tool, DTM is superior to SDA for primary isolation. The study highlights the emerging role of molecular methods like PCR in identifying infections in cases where conventional techniques fail, ensuring more accurate diagnosis and management.

Keywords*: Dermatophytosis, KOH Mount, Sabouraud Dextrose Agar, Dermatophyte Test Medium, Real-Time PCR.*

INTRODUCTION

Fungal infections are worldwide in distribution. However, superficial fungal is prevalent in tropical and subtropical countries including India, where heat and moisture play an important role in promoting the growth of these fungi.[1,2] Diabetes mellitus, immunocompromised states, use of steroids, poor hygiene, exposure to cattle rearing areas, taking bath in untidy ponds and dams, overcrowding etc. are other factors which promote increased incidence.[3-7]

Dermatophytosis is the disease caused by Dermatophytes, filamentous fungi which infects the keratinized layers of skin, hair, and nails. These fungi belong to three main anamorphic genera: *Trichophyton, Microsporum, Epidermophyton.* Dermatophytosis is characterized by dermal inflammatory response with severe itching. It is also termed as "ring worm infection or tinea".[8] The great variation in clinical presentation is related to the species and strains of fungus, size of inoculum, involved site, immune status of host.The prevalent species of dermatophyte varies considerably in different

geographic areas of the country[9,10] and is governed by environmental conditions, personal hygiene and individuals susceptibility. Identification of predisposing factors and avoidance of these can prevent the occurrence of the disease to some extent.

Multiple host and environmental factors influence the susceptibility, severity, and clinical course of dermatophyte infections. Age-related patterns primarily reflect differences in exposure and physiological changes - children show higher rates of Tinea capitis due to school transmission and immature sebaceous gland activity, while adults more commonly develop tinea pedis and cruris influenced by occupational exposures and clothing habits. Genetic predisposition plays a role in certain forms, particularly Tinea imbricata which demonstrates autosomal recessive inheritance patterns, and severe disseminated infections associated with STAT1 or CARD9 gene mutations that impair immune responses. Comorbid conditions significantly impact infection outcomes, with chronic/recurrent dermatophytosis frequently observed in immunocompromised patients, including those with HIV/AIDS, corticosteroid use, or Cushing's syndrome, where impaired cellular immunity permits fungal persistence. While atopy correlates with chronic infections, environmental exposure remains the dominant determinant of transmission risk. Local skin microenvironment critically regulates fungal behaviour - elevated CO_2 tension promotes arthroconidia formation and tissue penetration, moisture facilitates spore germination, and the skin's bacterial microbiome can either compete with or exacerbate dermatophyte infections.[11]

Identification of dermatophyte species and knowledge of their host preference and ecology play an important role in epidemiology, public health issue and infection control. The varied clinical presentation of tinea, which results in delay in diagnosis,poor compliance in follow up of cases, and consequently spread of infection in the community had rekindled interest in rapid diagnostic method in identification of species. The diagnosis of dermatophytosis infections is primarily clinical but is often complicated by the topical application of steroid ointments and creams, which can mask symptoms and lead to confusion with other skin infections, resulting in misdiagnosis and mismanagement. Direct microscopy using 10–20% potassium hydroxide (KOH) remains a common screening technique. For culture-based identification, Sabouraud dextrose agar (SDA) supplemented with antibiotics (chloramphenicol and cycloheximide) and Dermatophyte Test Medium (DTM) are the most frequently used media. This study aims to assess the clinico-mycological profile of dermatophytic infections from clinically suspected cases and to estimate the proportion of polymerase chain reaction (PCR)-positive dermatophytosis infections among specimens that are negative by both culture and microscopy. The identification was based on morphological features assessed through microscopy, culture, and biochemical tests for primary isolation. Additionally, a comparative evaluation of SDA and DTM for the primary isolation of dermatophytes was undertaken.

MATERIALS AND METHODS

A hospital based cross sectional study was conducted in the Post-Graduate Microbiology Laboratory, MLT, Government Medical College, Thiruvananthapuram for a period of six months (October 2024- April 2025) after getting clearance from the Institutional Ethics Committee (HEC No: 10/21/2024/MCT dated 21/06/2024). The study population included all clinically suspected patients with dematophytosis attending the outpatient setting of Dermatology department. Exclusion criteria included individuals who were previously treated with anti-fungal agents. The sample size was taken as 145 and consecutive samples satisfying inclusion criteria were included until the required sample size was met. All samples were collected using aseptic techniques and transported to the laboratory after obtaining informed consent. Skin scrapings were collected by cleaning the lesions with 70% alcohol and scrapings were taken with blunt end of sterilized scalpel from the active border of lesions. For nail infections, full thickness nail clippings were taken after cleaning with 70% alcohol using sterile nail cutter and sterile blade. Hair samples were plucked with sterile epilated forceps. Relevant history of the patients was taken through a semi-structured proforma containing socio-demographic details like age, sex, occupation, provisional diagnosis, site of infection, nature of specimen, previous treatment history, comorbidities, family history and other risk factors. Samples were subjected to direct microscopy with 10% KOH (20% KOH for nails) and culture in SDA without and with antibiotics (Chloramphenicol, Cycloheximide, Gentamicin) and Dermatophyte Test Medium (DTM). Identification of species was done based on rate of growth, pigmentation, morphological characteristics and microscopic examination of hyphae, microconidia, macroconidia, special structures with Lactophenol cotton blue staining. Slide culture was done for confirmation of morphology of fungi. Special tests were done for differentiation of species like Urease test and Hair perforation test. Multiplex Real Time PCR was done on smear negative and culture negative specimens. The data collected was coded and entered in Microsoft Excel. Statistical analysis was done in SPSS software Version 27. Qualitative variables were expressed as numbers and percentages.

RESULTS

A total of 145 samples from clinically suspected patients of dermatophytosis collected from Department of Dermatology and Venereology (skin lab), Govt. Medical College, Thiruvananthapuram were included in the study.

Variable	Category	Number (n)	Percentage (%)
Gender	Male	63	43.4%
	Female	82	56.6%
Occupation	Manual Labourer	48	33.1%
	Housewife	42	29.0%
	Student	34	23.4%
	Office Worker	12	8.3%

	Unemployed	9	6.2%
Comorbidities	Diabetes Mellitus	15	10.3%
	Kidney Disease	4	2.8%
	Skin diseases	2	1.4%
	Others (Asthma/Thyroid)	2	1.4%
	None	122	84.1%

Table 1: Socio-Demographic and Occupational Profile of Patients (N=145)

Out of the 145 participants, the study population were predominantly females accounting for 56.6% (n = 82) whereas males represented 43.4% (n=63) with female -to-male ratio of 1.3:1. In terms of occupation, the majority group consisted of manual labourers (33.1%), followed by housewives (29.0%) and students (23.4%). Regarding the presence of comorbidities, the vast majority of participants (84.1%, n = 122) reported having no underlying health conditions. Among those with pre-existing conditions, Diabetes Mellitus was the most common, affecting 10.3% (n = 15) of the participants.

Variable	Number of Cases (n)	Percentage (%)
Age Group (Years)		
< 10	9	6.20%
10 – 20	24	16.55%
21 – 30	22	15.17%
31 – 40	20	13.79%
41 – 50	20	13.79%
51 – 60	26	17.93%
61 – 70	21	14.48%
> 70	3	2.06%
Clinical History		
New Cases	74	51.03%
Previous History	28	19.31%
Associated with other diseases	23	15.86%
Family History	15	10.34%
Contact with animals	5	3.44%

Table 2: Incidence according to age group and clinical history

The highest incidence occurs in the 51-60 age group (17.93%), closely followed by the 10-20 age group (16.55%). This suggests a bimodal distribution where both young adults and the middle-aged are significantly affected. More than half of the participants (51.03%) are new cases and approximately 19.31% patients has a previous history of dermatophtosis. 3.44% of cases reported contact with animals.

Clinical Type	Male (n)	Female (n)	Total Cases	Percentage (%)
Tinea corporis	36	47	83	57.24%
Tinea cruris	16	20	36	24.82%
Tinea unguium	1	8	9	6.20%
Tinea faciei	2	3	5	3.44%
Tinea pedis	2	1	3	2.06%
Tinea manuum	1	0	1	0.68%
Mixed Infections*	5	3	8	5.51%
Total	**63**	**82**	**145**	**100%**

Table 3: Clinical Presentation and Gender Distribution

*Mixed infections include Tinea corporis + Tinea cruris, Tinea cruris + Tinea faciei, and Tinea corporis + Tinea faciei

Tinea corporis was the most frequent infection, accounting for 57.24% (n = 83) of all cases. It showed a higher incidence in females (n = 47) compared to males (n = 36). Tinea cruris (Jock Itch) was the second most common type, representing 24.82% (n = 36) of the total. It was slightly more frequent in females (n = 20) in this study.Approximately 5.51% (n = 8) of participants suffered from multiple infections simultaneously. The most frequent combinations involved Tinea corporis paired with Tinea cruris (n=6), followed by Tinea corporis +Tinea faciei (n=1) and Tinea cruris+ Tinea faciei (n=1).

Diagnostic Method	Culture Positive (n)	Culture Negative (n)	Total (%)
Direct Smear Positive	128	10	138 (95.17%)
Direct Smear Negative	1	6	7 (4.8%)
Total (%)	**129 (88.96%)**	**16 (11%)**	**145**

Table 4: Comparison of Diagnostic Efficacy between Direct Smear (KOH) and Fungal Culture (N=145)

The diagnostic performance of Direct Smear (KOH wet mount) and Fungal Culture was compared for all 145 samples. Direct smear achieved a significantly higher positivity (n=138) compared to culture (n=129). While 128 samples were positive by both methods, 10 samples were identified only by direct smear, and 1 sample was identified only by culture. For the 6 cases that remained negative by both conventional methods, PCR was utilized as a definitive diagnostic tool.

Clinical Type	*T. rubrum*	*T. mentagrophytes*	*E. floccosum*	*T. verrucosum*	*M. gypseum*	*T. tonsurans*	Total (%)
Tinea corporis	43	28	0	3	3	1	78(60.5%)
Tinea cruris	20	9	3	0	0	1	33(25.6%)
Tinea faciei	2	2	0	0	0	0	4(3.1%)
Tinea unguium	2	0	0	0	0	0	2(1.6%)
Tinea pedis	2	1	0	0	0	0	3(2.3%)
Tinea manuum	1	0	0	0	0	0	1(0.8%)
Mixed	5	1	2	0	0	0	8(6.2%)
Total (%)	75 (58.1%)	41 (31.8%)	5 (3.9%)	3 (2.3%)	3 (2.3%)	2 (1.6%)	129

Table 5: Distribution of Isolates by Clinical Type (Etiological Correlation)

Trichophyton rubrum was the most prevalent isolate, accounting for 58.1% (n = 75) of all positive cultures. It was the leading cause across almost every clinical category, including 43 cases of Tinea corporis and 20 cases of Tinea cruris. *Trichophyton mentagrophytes* was the second most common species, identified in 31.8% (n = 41) of cases, commonly seen in Tinea corporis (n = 28) followed by Tinea cruris (n = 9). 3 cases of *T. verrucosum* and 2 cases of *T. mentagrophytes* were associated with animal contact.

Media Type	Total Yield	Growth in 5–10 Days	Growth in >10 Days	Effectiveness (%)
SDA (without Antibiotics)	34	29	5	26.3%
SDA (with CCG supplement)	120	98	22	93.0%
DTM (Dermatophyte Test Medium)	128	123	5	99.2%

Table 6: Comparative Performance of Culture Media and Growth Rate

DTM was the most effective medium, successfully supporting growth for 128 (99.2%) culture positive cases. SDA with CCG (Chloramphenicol, Cycloheximide, Gentamicin) performed significantly better than plain SDA, accounting for 93% of the yield. Plain SDA had the lowest effectiveness (26.3%), largely because it lacks the inhibitory agents necessary to prevent the overgrowth of saprophytic molds and bacteria, which often mask dermatophyte growth.

Isolates	Total (n)	SDA (Plain)	SDA (with CCG)	DTM
T. rubrum	75	22	74	75
T. mentagrophytes	41	10	38	40
E. floccosum	5	1	4	5
T. verrucosum	3	0	1	3
M. gypseum	3	1	2	3
T. tonsurans	2	0	1	2
Total	**129**	**34**	**120**	**128**

Table 7: Comparison of Species Recovery by Media Type

Dermatophyte Test Medium (DTM) was the most reliable, showing high isolation (n=128) for all identified species. Its success is attributed to its selective antibiotics and the phenol red indicator, which helps in early identification of dermatophytes even when colonies are small. SDA with CCG (Chloramphenicol, Cycloheximide, and Gentamicin) showed a good isolation rate (n=120).It was highly effective for the most common species like *T. rubrum* (n=74) and *T. mentagrophytes* (n=38). However, it was slightly less effective for rarer, more fastidious species like *T. verrucosum*, where it isolated only 1 out of 3 cases. Plain SDA performed poorly, isolating only 34 of the total isolates.Slow-growing species such as *T. verrucosum* and *T. tonsurans* were completely missed on plain SDA. Without inhibitory agents (CCG), these cultures are frequently overgrown by rapid-growing saprophytic contaminants, which prevent the dermatophytes from establishing visible colonies.

Category	Number of Samples	Percentage (%)
PCR Positive	1	16.6%
PCR Negative	5	83.3%
Total	**6**	**100%**

Table 8: Analysis of PCR on both direct smear and culture negative samples(n=6)

PCR successfully identified a fungal pathogen (T. rubrum) in one additional case that was missed by both microscopy and culture. This highlights the utility of molecular methods in cases with low fungal loads or non-viable organisms.The remaining 5 samples remained negative even after PCR.

DISCUSSION

Dermatophyte infections continue to be highly prevalent in our country due to the combination of a hot, humid climate and sub-optimal hygienic conditions, which create an ideal environment for fungal growth. Increasing global reports of dermatophytosis have further emphasized the need for regional epidemiological studies.

In the present study, females outnumbered males with a female-to-male ratio of 1.3:1. Females constituted 56.6% of clinically diagnosed cases, while males accounted for 43.4%. Similar female predominance was reported by Vineetha M et al.[12] and Kamalam A et al.[13] However, studies by Surendran KAK et al.[14] Hosthota A et al.[15] Poyyamozhi JS et al.[16] Hanumanthappa H et al.[17] Majeed N et al.[18] Katay P et al.[19] and Gadadavar S et al.[20] reported male predominance. The higher prevalence among females in the present study may be attributed to tight clothing, increased perspiration, and tropical environmental exposure.

Dermatophytosis was observed across all age groups; however, the highest incidence was noted in the 51–60-year age group (17.93%), followed by 10–20 years (16.55%) and 21–30 years (15.17%). The lowest incidence was seen in individuals above 70 years. Kurukkanari R et al.[21] and Vineetha M et al.[12] reported peak incidence in the 10–20-year age group. Other researchers observed higher prevalence in the 20–30-year group.[14,15] Studies by Kumar S et al.[22] Jagadeesan M et al.[23] and Grover S et al.[24] reported peak incidence in the second decade of life. Hanumanthappa H et al.[17] and Patel P et al.[25] observed clustering in the 30–40-year age group. The increased prevalence in middle-aged individuals in the present study may be due to occupational exposure and excessive sweating.

Manual labourers constituted the largest occupational group (33.1%), followed by housewives (29%) and students (23.4%). This occupational distribution aligns with previous studies, including those by Poyyamozhi et al.[16] (26.8%) and Hanumanthappa et al.[17] (30.6%), which also reported a high incidence among manual labourers. The predominance of infections in these groups can be attributed to environmental and occupational risk factors, such as prolonged exposure to moisture, sweat, and contaminated surfaces.Animal contact was reported in five cases, with isolation of *T. verrucosum* and *T. mentagrophytes*. Kurukkanari R et al.[21] reported similar findings, supporting zoonotic transmission.This suggests that contact with pets or exposure to cattle rearing areas increases chance of getting zoophilic dermatophytes. Most patients (84.1%) had no underlying systemic illness. However, diabetes mellitus was present in 10.3% of cases. Immunosuppression and long-term medication use may predispose individuals to infection.

Tinea corporis (57.24%) was the predominant clinical presentation, followed by Tinea cruris (24.82%), Tinea unguium (6.2%), Tinea faciei (3.4%), mixed infections (5.5%), Tinea pedis (2.06%), and Tinea manuum (0.68%). Similar findings were reported by Majeed N et al.[18] Kumar S et al.[22] Pavani A et al.[26] and Poyyamozhi JS et al.[16] However, Anupama A et al.[27] and Prasad P et al.[28] reported Tinea cruris as most common, while Grover S et al.[24] reported Tinea pedis predominance possibly reflecting differences in footwear habits and occupational exposures.Tinea corporis showed female predominance, consistent with Kumar K et al.[29] and Majeed N et al.[18] possibly due to hormonal factors and clothing habits. Tinea cruris also showed female predominance in the present study, although Gadadavar S et al.[20], Majeed N et al.[18] and Singh S et al.[30] reported male predominance. It suggests that T.cruris occurs in both sex due to factors such as occlusive clothing, increased physical activity, and prolonged moisture retention in the groin region.

Trichophyton rubrum was the predominant isolate (58.1%), followed by *T. mentagrophytes* (31.8%). Less common isolates included *Epidermophyton floccosum* (3.9%), *T. verrucosum* and *Microsporum gypseum* (2.3% each), and *T. tonsurans* (1.6%). Similar predominance of *T. rubrum* was reported by Kurukkanari R et al.[21] Majeed N et al.[18] Hanumanthappa H et al.[17] and Patel P et al.[25] However, Jagadeesan M et al.[23] and Nasimuddin S et al.[31] reported *T. mentagrophytes* as the predominant species. *T. rubrum* predominated across multiple clinical types, particularly Tinea corporis and Tinea cruris, demonstrating its adaptability and chronicity. The variations in culture positivity across different clinical types may reflect differences in fungal load, sampling techniques, or the inherent growth characteristics of the causative dermatophytes. Studies by Katay P et al.[19] also reported that Tinea corporis had high culture positivity.

Direct microscopy using KOH mount demonstrated 95.17% (n=138) positivity in the present study. Comparable results were reported by Noronha et al.[32] (91.5%) and Agarwal US et al.[6] (84.67%). Culture positivity in this study was 88.96%, similar to Surendran KAK et al.[14] but higher than Jain N et al.,[33] who reported 70.32% culture positivity and 46.15% microscopy positivity. Poyyamozhi JS et al.[16] reported 65.2% microscopy positivity and 45.2% culture positivity, while Patel P et al.[25] and Doddamani PV et al.[34] reported comparatively lower rates. Of the 145 samples, 128 were positive by both microscopy and culture, 10 were positive only by microscopy, and 1 was positive by culture alone. Doddamani PV et al.[34] reported 39% positivity by both methods, with a significant number positive only by direct smear. Previous studies by Pavani A et al.[26] Singh TN et al.[35] and Kumar S et al.[36] also demonstrated higher detection rates with direct microscopy compared to culture.

The study observed that 99.2 % (128 isolates) of dermatophytes grew on DTM, while 93% (120 isolates) were successfully cultured on SDA with CCG supplement. The lowest growth was observed on SDA without antibiotics (26.3%), and it was due to the contamination of media while using direct samples. These findings align with previous studies by Katay P et al.,[19] who reported isolation rates of 93.5% for SDA and 100% for DTM. Studies by Majeed N et al.[18] reported that rate of isolation of 91.8% for SDA and 97.3% for DTM. DTM demonstrates superior isolation rates compared to SDA, along with the added advantage of easy interpretation due to its distinct colour change to red upon dermatophyte growth. However, a key limitation of DTM is its lack of absolute specificity, while designed as a selective medium for dermatophytes, non-dermatophyte fungi may occasionally grow, potentially leading to false-positive results. This necessitates further confirmatory tests, such as microscopic examination or subculture, to ensure accurate identification.

Of the six samples negative by both smear and culture, one sample (16.6%) was positive by real-time PCR. Arabatzis M et al.[37] demonstrated that real-time PCR has high analytical sensitivity, detecting as little as 0.1 pg of DNA per reaction. In a six-month clinical evaluation of 92 samples from 67 patients, PCR identified dermatophyte species in culture-positive specimens and detected infection in seven samples that were negative by both microscopy and culture.[37] This suggests that even when conventional diagnostic techniques fail to identify a pathogen, PCR can still detect its presence. This is particularly relevant in cases where the pathogen load is low or the sample quality is poor, making it difficult for traditional methods to detect the pathogen. By incorporating PCR into the diagnostic workflow, healthcare providers can improve the detection rate of infections and make more informed decisions regarding patient care.[37-40]

Limitations

The study was conducted at a single tertiary hospital, which may reflect regional patterns that are not fully generalizable to other geographic locations. Sample size was small and molecular testing was restricted to only six smear and culture negative samples. Also, long term treatment outcomes or seasonal variations in infection rates were not assessed.

CONCLUSION

The study underscores the high prevalence of dermatophytosis in the studied population, with T.corporis emerging as the most common clinical manifestation, particularly among females, likely due to factors such as tight clothing, excessive sweating, and tropical climate. T.rubrum was identified as the predominant pathogen, demonstrating significant adaptability across various infection types, followed by T.mentagrophytes. Diagnostic methods revealed that direct microscopy with KOH exhibited higher positivity (95.17% positivity) compared to culture techniques, though DTM proved more effective than SDA in isolating dermatophytes, despite occasional false positives from non-dermatophyte fungi. Dermatophytic infection can be diagnosed in an accurate and rapid way using multiplex real time PCR, which gives effective and fast results, but it is expensive. Occupational and environmental factors, such as manual labourer and animal contact, were linked to higher infection rates, while comorbidities like diabetes were noted in a minority of cases. The findings align with regional and global trends but highlight variability in pathogen dominance and clinical presentation, emphasizing the need for context-specific diagnostic and treatment approaches. Overall, the study reinforces the importance of combining microscopy and culture for accurate diagnosis and underscores T.rubrum's epidemiological significance in dermatophytoses, warranting targeted public health interventions to mitigate risk factors and improve management strategies.

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Conflicts of Interest

None

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