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Original Research Article

Clinico-microbiological aspects of tinea corporis in North India: emergence of *Trichophyton tonsurans*

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ABSTRACT

Background: Tinea corporis is a superficial fungal infection of the glabrous skin of the trunk and extremities caused by closely related organisms of the three genera of dermatophytes– *Trichophyton*, *Microsporum* and *Epidermophyton*. The prevalence of the different species varies according to geographic and climatic regions. This study was an attempt to find out the causative fungal agents in clinically suspected cases of tinea corporis.
Methods: During a period of six months from June 2017 to November 2017, various skin samples from clinically suspected cases of dermatophytosis were examined for presence of fungal elements using KOH preparation and culture on Sabouraud's dextrose agar. The causative organisms were identified using conventional methods.
Results: A total of 157 skin samples were obtained and processed. The most common age group involved was 21 to 30 years of age with male to female ratio of 1.5:1. The patients of rural area (67%) predominated over urban (33%) with most of the patients presenting in the monsoon season (43%). The KOH positivity was seen in 51% and culture positivity in 50% of samples. The dermatophytes (62.9%) predominate over non-dermatophytes (37.1%) with *Trichophyton tonsurans* isolated as the commonest causative fungal agent.
Conclusions: Due to the great variation in the presence of fungal species in different places and at different times, mycological examination is necessary to diagnose, differentiate and treat dermatophytosis.

Keywords: Dermatophytosis, Non dermatophytes, Dermatophytes, *Trichophyton*

INTRODUCTION

Superficial fungal skin infections are quite common and affect millions of people the world over. Dermatophytes are the most common causative agents of these superficial fungal infections with an estimated 10-20% lifetime risk of acquiring one.[1] It is indeed possible that almost every human being, belonging to any race or geographical location, during the course of his or her lifetime will be infected by dermatophytes at some point of time.[2,3] Non dermatophytes are recently gaining importance as causative agents of superficial fungal infections.[4]

Dermatophytes are a group of closely related fungi belonging to three different genera (*Trichophyton*, *Microsporum*, and *Epidermophyton*) that produce a skin infection, in humans and other animals, termed Dermatophytosis, commonly referred to as "Ringworm" or "Tinea."[4,5] These species are further classified as geophilic, zoophilic, or anthropophilic based on whether they predominantly reside in the soil, on animals, or on humans, respectively.[6] There is significant variability in the incidence and distribution of these fungal infections worldwide as the prevalence of the different species varies with geographic regions, climatic conditions, local cultural practices, and socioeconomic conditions.[7,8] Areas

with high humidity, overcrowding, and poor hygienic conditions are the predisposing factors for dermatophytosis making it one of the major public health problems in many countries.[9]

The dermatophyte infection of the glabrous skin of the trunk and extremities is termed tinea corporis and can be caused by any of the dermatophytes though most frequently attributed to the prevailing fungi of that particular region.[10] It is the most common dermatophyte infection in India and abroad.[6,8] Clinically presents with single or multiple, confluent, annular and polycyclic plaques with varied inflammatory responses. Milder lesions show peripheral scaling and minimal erythema while highly inflammatory lesions show pustular margins and marked erythema.[11] *Trichophyton rubrum* is responsible for up to 80% of cases of Tinea corporis worldwide while in India it is accountable for up to 88% of cases followed by *Trichophyton mentagrophytes* (up to 35% of cases). *Microsporum canis* is associated with 14% of tinea corporis infections worldwide and in India, making it the third most common causative organism, followed by *Epidermophyton floccosum* (upto 8%).[6,8]

Recent studies have shown that there has been a significant change in the worldwide distribution of these dermatophytes over the century, due to constant competition for their specific environment, leading to emergence of the predominant species and displacement of the others.[8] Further, the epidemiology of dermatophytic infection is likely to alter with changing patterns of migration, change in socio economic conditions and growth in tourism. The nature of dermatophytoses is also changing with the passage of time due to evolution of preventive measures and hygienic conditions in society.[6] In this region of state of Himachal Pradesh, the geoclimatic conditions like rainfall, humidity, agricultural activities and exposure to animals are highly conducive for growth of various fungi.

Since the infections caused by fungi are often confused with other skin disorders, it is therefore necessary to make early laboratory diagnosis for better patient management. The diagnosis of *Tinea corporis* is mostly clinical though it is prudent and essential to perform laboratory testing of infected cutaneous tissues which includes direct microscopy of the specimen in 10% potassium hydroxide (KOH) solution and fungal culture in Sabouraud's dextrose agar (SDA) medium.[12] The data obtained is used to compare the past and present trends, to predict increasing antifungal resistance and emphasize the need for newer drugs.

Due to great variability of various species of fungi worldwide and region-wise and the recent rise in antifungal resistance observed clinically, this study was undertaken to identify the clinico-etiological profile of tinea corporis.

METHODS

One hundred fifty seven clinically diagnosed cases of tinea corporis attending the outdoor patient department (OPD) of Dermatology, Venereology and Leprosy (Skin) of DRPGMC & H, Tanda from June 2017 to December 2017 were included in the present study after taking informed consent. The relevant clinical history and appropriate samples i.e. skin scrapings were collected according to the site involved in Skin OPD and transported immediately to Department of Microbiology for processing as per standard protocol.[7]

A total of 157 skin samples were collected. The skin specimens were subjected to KOH wet preparation using 10% KOH for the presence of fungal elements. Following this, the specimens were inoculated into three sets of culture media i.e., Sabouraud's dextrose agar (SDA) without antibiotic, SDA with antibiotics (chloramphenicol and cyclohexamide) and dermatophyte test medium (DTM). The cultures were incubated at 25^0C and 37ºC and were examined daily for the first week and every alternate day thereafter up to 4 weeks for evidence of fungal growth. If no growth was obtained after 4 weeks, it was taken as negative for growth of fungus. The fungal isolates obtained were identified, based on colony morphology, pigmentation, growth rate, microscopically by lactophenol cotton blue (LCB) mount, slide culture, urease test, hair perforation test and corn meal agar test. All the data was entered and analyzed using SPSS 17.0 software (significance level of $p<0.05$).

RESULTS

A total of 157 skin samples were collected from 157 patients of tinea corporis. The dermatophytosis was commonest (32.5%) among age group of 21 -30 years with male to female ratio of 1.5:1. There was history of similar complaint in the past in 21% (33/157) of patients. The previous history of pets' exposure was found in 48% (75/157) cases. Patients belonging to rural background were 86 (54.8%) as compared to 71 (45.2%) patients from urban areas (Table 1).

The similar complaints in the family members were seen in 15% (24/157). The patients had taken treatment for the same problem in 37% (58/157) cases. Majority of the patients were students (66%).The duration of disease ranged from 2 days to 13 years with mean of 21 months (Table 2).

Among 119 culture positive cases, dermatophytes and non-dermatophytes were obtained in 97 (61.8%) and 22 (14%) samples respectively (Figure 1). The KOH positivity was found in 81 (51.6%) and 18 (11.5%) dermatophtyic and non-dermatophytic isolates respectively (Table 3). The dermatophytes isolated were *Trichophyton* species in 97 (61.7%) with *Trichophyton tonsurans* accounting for 58 (59.8%) isolates. *T.*

mentagrophytes was isolated in 22 (22.7%), *T. rubrum* 13 (13.4%), *T. violaceum* 2 (2.1%) and *T. verrucosum* in 2 (2.1%) samples. Non- dermatophytes were considered significant on repeated isolation (>2 times) and in pure culture. Among non-dermatophytes, the most common isolate was *Aspergillus* species 7 (31.8%) followed by *Candida* species 4 (18.2%) (Figure 2).

Table 1: Demographic profile of patients.

Particular	Variable	Values
Age distribution N (%)	Range in years	4 to 78
	Mean±2SD (in years)	33.38±18
	0-10 years	1 (0.6)
	11-20 years	28 (17.8)
	21-30 years	51 (32.5)
	31-40 years	32 (20.4)
	41-50 years	23 (14.7)
	51-60 years	16 (10.2)
	>60 years	6 (3.8)
Sex N (%)	Male	95 (60.5)
	Female	62 (39.5)
Background N (%)	Rural	86 (54.8)
	Urban	71 (45.2)
Occupation N (%)	Students	66 (42)
	Farmers	34 (21.7)
	Housewives	19 (12.1)
	Businessmen	19 (12.1)
	Employees	15 (9.6)
	Labourers	2 (1.3)
	Drivers	2 (1.3)
Seasonal distribution N (%)	Winters	22 (14)
	Summer	40 (25.5)
	Monsoon	68 (43.3)
	Post monsoon	27 (17.2)

Table 2: Duration of illness and site of lesion correlation.

Duration of illness	No. of patients involved
Up to 6 months	126 (80.3)
7-12 months	9 (5.7)
>1 year	22 (14)
Group total	157

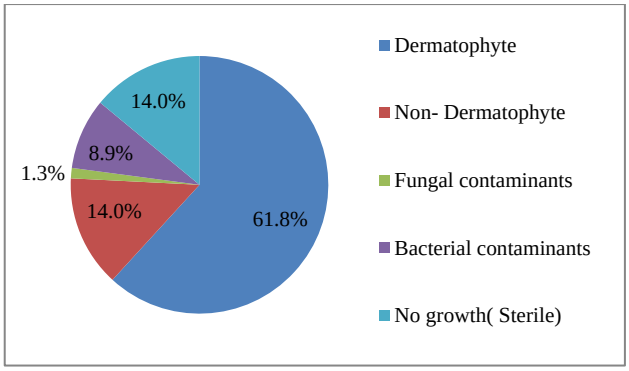
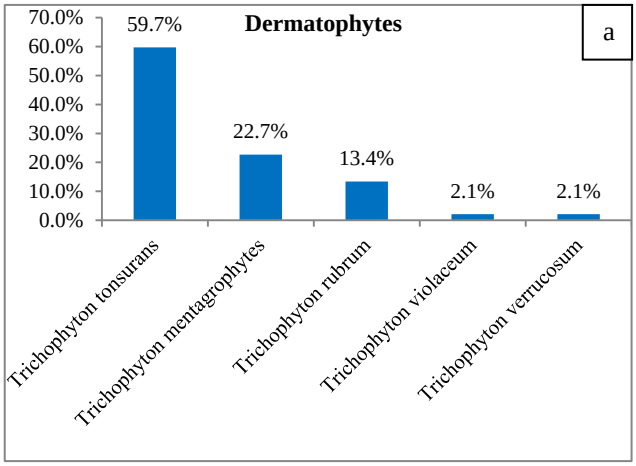


Figure 1: Isolates obtained on culture.



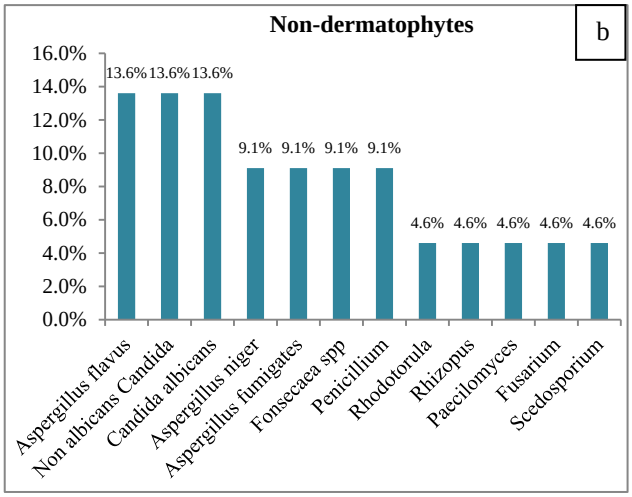


Figure 2: Distribution of various a) dermatophytic and b) non-dermatophytic isolates obtained.

Table 3: Correlation of KOH and culture positivity in various samples.

Type of specimen			Culture		P value
			Negative	Positive	
			N (%)	N (%)	
Skin (n=157)	KOH	Negative	38 (24.2)	20 (12.7)	<0.001
		Positive	18 (11.5)	81 (51.6)	

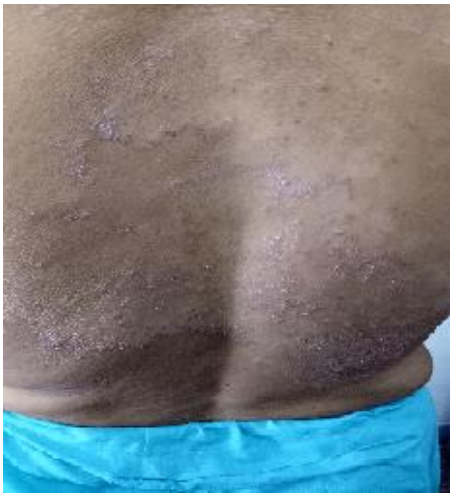


Figure 3: Annular erythematous scaly plaques with advancing margins of *Tinea corporis* of glabrous skin of back.

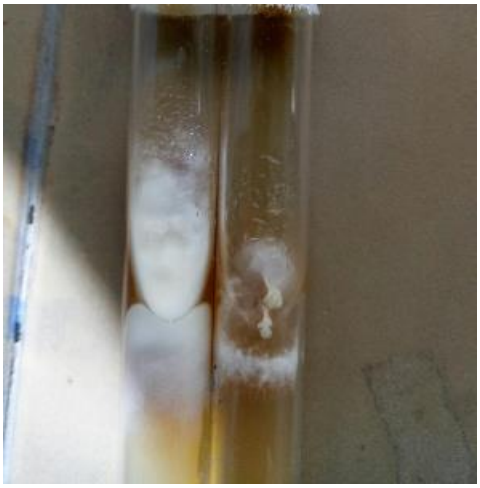


Figure 4: White mycelial colonies of *Trichophyton tonsurans* on SDA media.

Figure 5: Ballooned out forms and club shaped microconidia of *Trichophyton tonsurans* (LCB mount).

DISCUSSION

Superficial mycoses of the glabrous skin are among the most prevalent of human infectious diseases seen in clinical practise.[13] The characteristics and prevalence of superficial fungal infections vary with climatic conditions, lifestyle and population migration patterns. They can be caused by dermatophytes and non Dermatophytes like *Candida* species, *Scytalidium dimidiatum, Fusarium moniliforme* and *Scopulariopsis brevicaulis, Malassezia spp., Hortaea werneckii, Piedraie hortae* and *Trichosporon spp*.[4] Dermatophytosis is widely prevalent infection in Northern India due to favourable environmental and climatic conditions.[8] Delay in diagnosis and improper treatment can lead to disseminated and refractory lesions.[4]

In the present study, people of rural background are involved in 67% of cases. It could be because of their more involvement in agricultural activities, less hygiene awareness and improper treatment in initial phases of disease.[9] The predominance of dermatophytic infections among young and adults (32.5%) could be attributed to their active nature and more involvement in outdoor activities. The males were affected more than the females (1.5:1) which may be because of prolonged outdoor exposure and increased perspiration which creates an environment conducive for proliferation of fungi.[8,10,11] The hot and humid conditions favour fungus proliferation as observed in present study with maximum cases in monsoon season as has been seen earlier.[12,13]

The KOH examination did not show any fungal element in 37% of samples which could be due to bacterial contamination, severe inflammatory reaction which obscures fungal elements or due to minimal scaling in the lesions. The clinical importance of identifying the species of dermatophytes is to find the probable source and the prognosis of infection to prevent transmission with adequate treatment measures.[4] The culture positivity rate (75.8%) in our study correlated with earlier studies.[10,11,14] It was found to be statistically significant (<0.001). The culture negativity could be due to bacterial contamination, nonviable fungus due to prior use of topical anti-fungal agents or due to inappropriate collection of specimen. Bhagra et al reported culture positivity in 68% of samples.[15] Sen and Rasul reported KOH positivity in only 5% of samples which is discordant to our study.[16]

In present study, predominantly dermatophytes (81.5%) were isolated over the non-dermatophytes (18.5%) as seen earlier.[17]

However, some studies showed discordant findings in this regard.[18,19] In conformity to the previous reports *Trichophyton* spp was the most common genus responsible for dermatophytic infection.[14] *T. tonsurans* was the predominant species which is in accordance to earlier studies from adjoining regions.[14] Similar studies

from Kashmir by Bharadwaj et al and from Iran by Bassiri-Jahromi et al had shown a high incidence of *T. tonsurans*, 66.2% and 50.9%, respectively, causing tinea corporis while no other reports have shown such a high incidence.[20,21] However, from reports worldwide and other studies in India, *T. rubrum* has been reported as the most common dermatophyte causing tinea corporis while it only accounted for 13% in our study.[22-25]

Twenty two (18.5%) non-dermatophytic fungi were isolated from superficial cutaneous lesions in the present study. Non-dermatophytes were considered significant on repeated isolation (>2 times), in pure culture and with a positive KOH finding. Among non-dermatophytes, the most common isolate was *Aspergillus* species 7(31.8%) followed by *Candida* species 6 (18.2%). The association of non-dermatophytes and other fungi with dermatophytosis has been reported world over.[26,27] The findings of our study are similar to findings of Vyas et al who reported *Aspergillus* species in 40% (8/20) and *Candida* species in 15% (3/20) cases in their study.[17] Sarma and Borthakur isolated *Curvularia lunata* (3.27%), *Fusarium* spp (3.27%) and *Aspergillus niger*, *Aspergillus flavus* and *Penicillium* spp in 1.63% cases each respectively.[11]

CONCLUSION

This study highlights the causative agents of tinea corporis in this part of Himachal Pradesh. Dermatophytosis requires a multifaceted approach and antifungals play the most key role in combating these infections. The mycological profile of dermatophytosis in one particular region helps to identify the suitable antifungal agent for clearance of this infection. Although, worldwide and from most studies in India *T. rubrum* has been reported as the most common dermatophyte causing tinea corporis it only accounted for 13% of cases in this study. *T. tonsurans* was the most common pathogen isolated which has not been previously reported from our geographical location and only very few reports from other parts of the world. The emergence of this organism warrants a renewed look into the antifungal susceptibility patterns for combating this common superficial fungal infection efficiently.

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Ethical approval: The study was approved by the institutional ethics committee

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