

## Original Research Article

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## Clinico-Mycolological Study of Dermatophytoses at a Tertiary Care Hospital in Belagavi, Karnataka, India

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### ABSTRACT

Dermatophytes are among the common fungal agents implicated in superficial skin infections worldwide. Infections commonly occur in hot and humid climates. They include species of *Trichophyton*, *Microsporum* and *Epidermophyton*. The present study was done to assess the clinical profile of dermatophytic infections and to identify the species of fungi that are prevalent in this region. A total of 80 samples consisting of skin scrapings, nail scrapings and hair follicles were collected from patients presenting with different ringworm/ tinea infections. Direct microscopy in 10% potassium hydroxide (KOH) and culture on DTM and SDA was done for every sample. Tinea corporis 18/44 (40.9%) was the most common presentation. *Trichophyton spp* were implicated in 97.7% (43/44) cases while *Microsporum spp* was detected only in 2.27% cases. *Trichophyton mentagrophytes* was the predominant organism (81.8% cases) followed by *Trichophyton rubrum* (11.36% cases). Tinea corporis was the most frequently encountered clinical condition followed by tinea cruris. *T. mentagrophytes* was implicated as the predominating species followed by *T. rubrum* and *M. gypseum*. Unhygienic conditions among low socio-economic group, occupation of construction work may be some of the contributing epidemiological factors.

#### Keywords

Dermatophyte,  
Tinea,  
*Trichophyton*,  
*Microsporum*

#### Article Info

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### Introduction

Dermatophytes are fungi producing proteases that digest keratin and allow colonization, invasion and infection of the stratum corneum of the skin, hair shaft, and the nail (Gorbach *et al.*, 2004). They are molds belonging to the three genera of fungi imperfecti: *Microsporum*, *Trichophyton* and *Epidermophyton* (Kanwar *et al.*, 2001) Infection is generally cutaneous and restricted

to the nonliving cornified layers because these fungi cannot penetrate the deeper tissues or organs of healthy immunocompetent host. (Bhatia and Sharma, 2014) The infection is commonly designated as ring worm or “tinea”. The nomenclature of tinea infections is based on the location of the lesions on the body e.g. tinea capitis refers to ring worm infection of the head region. (Huda *et al.*, 1995) Tinea infections are more prevalent in tropical and subtropical countries including India, where

heat and moisture play an important role (Vernekar *et al.*, 1991). In Asia, *Trichophyton rubrum* and *Trichophyton mentagrophytes* are most commonly isolated (Singh *et al.*, 2016). Further, in India the cause of dermatophytoses is adversely influenced by economic factors like poverty, poor hygiene and social conditions like overcrowding. Nature of dermatophytoses may change with passage of time, living population, and evolution of preventive measures and hygienic conditions in society (Das *et al.*, 2009; Venkatesan *et al.*, 2007, Patwardhan and Dave, 1999).

Clinical lesions caused by these fungi are highly variable and closely resemble other skin diseases making laboratory diagnosis and confirmation necessary (Janardhan and Vani, 2017) Non-compliance to treatment, inadvertent use of steroids, irrational use of antifungals, sharing of clothes, geographic location predisposing to heat, humidity and increased sweating, obesity, associated conditions like diabetes, immunosuppression, atopy are all predisposing factors of chronic dermatophytosis. (Hay and Ashbee, 2016) *Trichophyton rubrum* is the commonest organism said to cause chronic dermatophytosis (Meriya Zacharia *et al.*, 2017).

Frequent occurrence of fungal infections due to dermatophytes has been noticed in this region of Belagavi. Till now very few studies are done on dermatophytes in the state of Karnataka. The present study was done to assess the clinical and epidemiological profile of dermatophytic infections; to identify the species of fungi and to compare the clinical diagnosis with potassium hydroxide (KOH) smear positivity and culture positivity.

It is necessary to make early laboratory diagnosis for better management of these conditions. The study was done utilizing conventional methods of isolation and

identification of dermatophyte species from superficial mycoses in human patients.

## **Materials and Methods**

The study population included 80 patients who were clinically suspected of dermatophytosis. The patients presented to the Dermatology outpatient department of KLE centenary charitable hospital, Yallur road, Belagavi. The study included samples collected from July 2017 to December 2017. A detailed clinical history including age, sex, socioeconomic status, occupation, duration of disease, history of recurrence and type of lesion, similar complaints in the family and contacts with animals or soil were elicited and recorded in all cases. General physical examination and systemic examination was conducted and investigations like hemoglobin, total count, differential count, blood sugar, and liver function test were done whenever necessary. Age limit and sex bias were not used and patients of all age groups and both the sexes were included. The exclusion criteria were: use of antifungal therapy (oral as well as topical) in the previous 3 months, immunocompromised state, secondarily infected, those who had taken other modality of treatment like steroids and presence of serious underlying systemic conditions as adjudged inappropriate by the clinician for inclusion in the study.

The patients were classified according to the site of involvement. These conditions included: *Tinea corporis*, *T. capitis*, *T. cruris*, *T. pedis*, *T. unguium* and *T. manuum*. For obtaining the samples aseptically, the infected areas or lesions were wiped with 70% ethanol in order to remove the dirt and environmental contaminants. Skin scraping, nail scrapings and clippings, hair stubs were collected from advancing margins of the lesions in sterile plastic containers with the help of sterile scalpel/ tweezers. 10% KOH solution was

used for skin and hair samples. 20% KOH was used for nail samples. All preparations were examined under low power and confirmed under high power. The positive samples were processed for the isolation of the dermatophyte species on Sabouraud's Dextrose Agar (SDA, Himedia) and Dermatophyte test media (DTM, used as a selective media) containing cycloheximide (0.05%) and chloramphenicol (0.004%) under sterile conditions. The SDA and DTM slants were incubated at 30°C for four weeks and monitored for the growth. The colonies on the slants were examined for their morphology, texture and pigmentation (obverse and reverse). Slide culture was done to study the morphology in detail. Examination using Lactophenol Cotton Blue (LPCB) staining was done for every specimen which showed growth and observed under low (10× lens) as well as high power (40× lens) of light microscope. The identification was based on features such as organization of hyphae (pencil shaped, spiral, pyriform, septations etc.), microconidia and macroconidia (tear shaped, drop like, spherical, in bunches, abundance or rare etc.).

## Results and Discussion

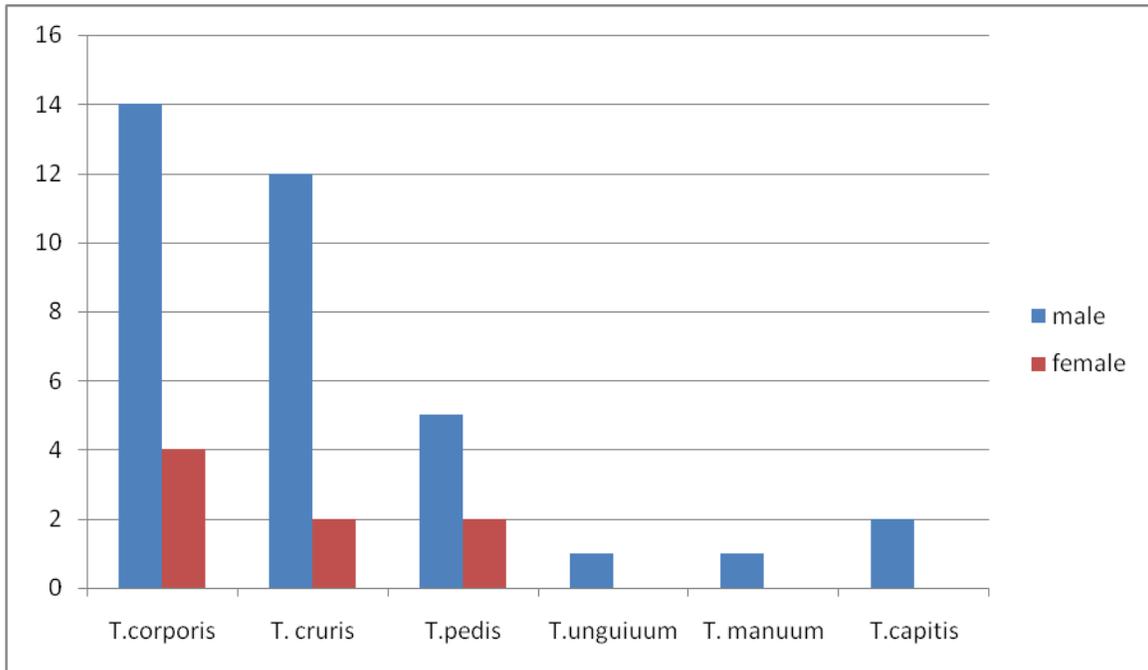
Out of 80 samples isolated 72(90%) were skin scraping, 07(8.75%) were hairs stubs and 01 (1.25%) was nail scraping. On cultural examination, 44(55%) were found positive for dermatophyte species (Table 1 and Chart 1). Among different tinea conditions, tinea corporis 18/44 (40.9%) figured at the top followed by tinea cruris 14/44 (31.81%) and tinea pedis 7/44 (15.90%) for culture positivity (Figure 1 and 2).

*Trichophyton* species were implicated in 97.7% (43/44) cases while *Microsporum* species was detected only in 2.27% cases. However, none of the *Epidermophyton* species was recovered in the present study. Among the

*Trichophyton* species, *T. mentagrophytes* was the predominant organism (81.8% cases) followed by *T. rubrum* (11.36% cases) (Table 2 and Figure 3). The identification of these dermatophyte species was based on cultural characteristics, growth rate, texture, colony size and pigmentation produced on obverse and reverse sides of SDA slants. *T. mentagrophytes* grew rapidly (3–5 days) on SDA, the growth was powdery to fluffy, cream to white on obverse and yellow to brown on reverse. On microscopic examination, well septate hyphae with numerous spherical microconidia were visible. Spiral hyphae were seen (Figure 3a and 3b). *T. rubrum* grew relatively slower (10–15 days), the growth was powdery to velvety with reddish tinge on obverse and rusty brown to deep red on the reverse. Well septate, pencil shaped hyphae with numerous spherical microconidia along with macroconidia were visible on microscopic examination (Figure 3c). *M. gypseum* grew rapidly (3–5 days), the growth was powdery to granular with rosy pink on obverse and yellow to brownish on reverse. Septate hyphae, rough thick walled macroconidia with rounded ends and 4-6 compartments were seen (Fig. 3d). *T. mentagrophytes*, the predominant species isolated was found associated mainly with Tinea corporis (15/36) 41.6% and Tinea cruris (12/36) 33.33%. However, it was seen in all other tinea conditions also except *T. manuum* (Table 2). Among the culture positive cases, 79.54% were of males and 20.45% were of female patients. It was also observed that 70.45% patients fell in the age group of 20–50 years while 36.36% and 11.36% patients were in the age group of 1–20 years and > 50 years respectively (Table 3).

The present study highlights the clinical pattern and prevalence of different dermatophyte species implicated in different tinea infections in and around Belagavi city of Karnataka.

**Chart.1** Details of culture positive samples recovered from patients with different ring worm infections



<b>Male</b>	<b>14</b>	<b>12</b>	<b>5</b>	<b>1</b>	<b>1</b>	<b>2</b>
<b>Female</b>	4	2	2	0	0	1

**Table.1** Details of culture positive samples recovered from patients with different ring worm infections

Tinea infection (types)	Samples examined (nos.)			KOH positive samples	No of culture positive samples		
	Total	Male	Female		Total	Male	Female
<i>T. corporis</i>	32	24	8	32	18	14	4
<i>T. cruris</i>	24	20	4	24	14	12	2
<i>T. pedis</i>	15	13	2	15	7	5	2
<i>T. unguium</i>	1	1	0	1	1	1	0
<i>T. manuum</i>	1	1	0	1	1	1	0
<i>T. capitis</i>	7	4	3	7	3	2	1
	80	63	17	80	44	35 (79.54%)	9 (20.45%)

**Table.2** Association of dermatophyte spp. with different Tenia conditions

Dermatophyte spp.	T.corporis	T.cruis	T.pedis	T.unguiuum	T.manuum	T.capitis	Total 44	%
<i>T.mentagro-phytes</i>	15	12	6	1	nil	2	36	81.8
<i>T.rubrum</i>	2	2	1	nil	nil	nil	5	11.36
<i>T.tonsurans</i>	nil	nil	nil	nil	nil	1	1	2.27
<i>T.verrucosum</i>	nil	nil	nil	nil	1	nil	1	2.27
<i>M.gypseum</i>	1	nil	nil	nil	nil	nil	1	2.27

**Table.3** Details of sex and age group of patients of dermatophytosis examined

Male patients			Female patients			Distribution of culture positive patients into age groups					
Total	Culture positive	%	Total	Culture positive	%	1-20 years		21-50 years		51 years and above	
						M	F	M	F	M	F
63	35	55.55	17	9	52.94	11	5	20	11	4	1

**Fig.1** Clinical pictures of *Tenia corporis*



Figure 1a



Figure 1b



Figure 1c



Figure 1d

**Fig.2** Clinical pictures of other teniaconditions



Figure 2a: Teniacruris



Figure 1b: Teniapedis

**Fig.3** Microscopic pictures of the fungal isolates

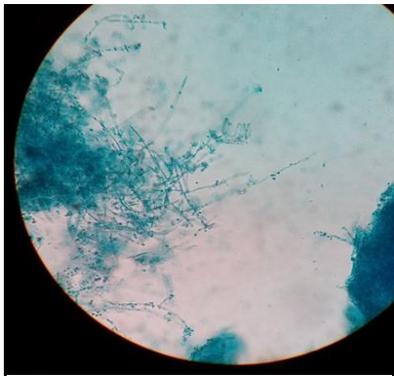


Figure 3a: *T. mentagrophytes*

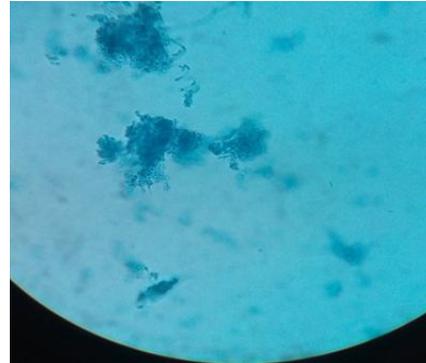


Figure 3b: Spiral hyphae of *T. mentagrophytes*



Figure 3c: *T. rubrum*: tear drop microconidia along hyphae, pencil shaped smooth walled macroconidia

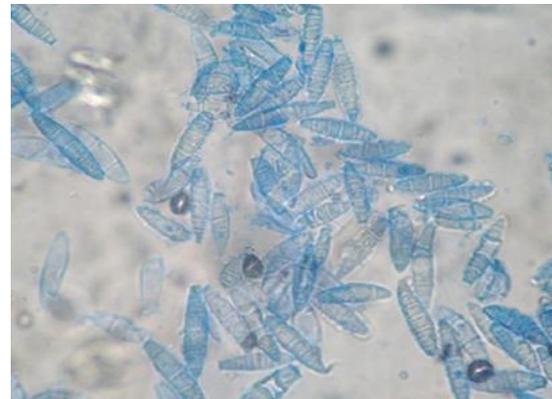


Figure 3d: *M. gypseum* – macroconidia with 4-6 compartments

In general, hot and humid environment of the tropical and sub-tropical regions are best suited for the dermatophytic infections which have been reported from different parts of India. The climate in Belagavi (with latitude of 15.84° N and longitude of 74.49° E) also remains hot and humid for major part of year which is favourable for growth of dermatophytic fungus. Hence the study was planned.

The study population consisted primarily of farmers and construction workers/laborers. Besides the climatic conditions favorable for the growth of dermatophytes, other factors such as overcrowding, unhygienic life style of the community with low socio-economic background were the contributing factors for the development of dermatophyte infections in this area.

Of the total 80 cases of superficial skin infections examined, only 44 (55%) were culture positive. Although patients of all ages were susceptible to dermatophytosis, most (64.9%) belonged to the age group of 21– 50 years as reported by other researchers (Bhatia and Sharma, 2014; Sarma and Borthakur, 2007; Patel *et al.*, 2010, Agarwal *et al.*, (2014); Hanumanthappa *et al.*, 2012; Gupta *et al.*, 2007). The probable reason for higher prevalence in this group could be that the individuals in this group are often most active because of their involvement in the outdoor activities.

The higher incidence may be due to increased physical activity and increased perspiration (Janardhan and Vani, 2017). Of the positive cases, 79.54% were males (Table 1). Such higher prevalence in males has been reported in other parts of India as well as other countries of the world by several researchers (Bhatia and Sharma, 2014; Vernekar *et al.*, 1991; Gupta *et al.*, 2007; Poria and Samuel, 1981; Hanumanthappa *et al.*, 2012; Sumathi *et al.*, 2013; Agarwal *et al.*, 2014; Bhavsar *et al.*, 2012; Mathur *et al.*, 2012; Jain *et al.*, 2008). This may be due to increased outdoor physical

activity and increased opportunity for exposure in men than women. Tinea corporis was the most common clinical condition observed in which various exposed parts of the body are affected followed by tinea cruris in which groin and surrounding areas are affected. The clinical picture of these conditions is presented through Figure 1. Similar observations have been made by other researchers (Venkatesan *et al.*, 2007; Janardhan and Vani, 2017). Tinea conditions are consequence of exhaustive physical work and prolonged exposure to sun leading to excessive sweating. Among the females who had tinea corporis, common site involved was the waist area due to the patterns of clothing worn by the women like the saree and salwar suits which act as precipitating factors due to friction, increased sweating, collection of dust particles and fungal spores at belt line.

In addition, the tight fittings and synthetic clothing particularly in males provide damp, sweaty and warm skin conditions. All these factors favour the growth of dermatophytes (Ranganathan *et al.*, 1995; Singh and Beena 2003). Tinea pedis and tinea unguium might result from wearing of socks and shoes for a long period providing damp conditions especially in inter-digital spaces.

In the present study, *T. mentagrophytes* was the predominant dermatophyte (81.8%) involved followed by *T. rubrum* (11.3%). This finding is contrary to the observations of others in which a reverse trend has been reported (Balakumar *et al.*, 2012; Patel *et al.*, 2010; Pandey and Pandey 2013). This could be due to the fact that *T. rubrum* is generally linked to chronic dermatophytosis (Aya *et al.*, 2004). However, we do not have exact data about the chronic cases of dermatophytosis as they were excluded on the basis of history extracted from the patients. Therefore, the low proportion of *T. rubrum* might be involved in acute superficial mycosis. Also, as this organism is a slow growing organism, there is a possibility that other dermatophyte species might overgrow or mask the growth of *T. rubrum* while attempting

isolation. PCR amplification directly from the samples could be a better tool to prove this. Molecular methods were not used for the diagnosis in our study due to the limitation of resources. *Microsporium gypseum* was involved only in 2.27% cases. We, however, did not observe any involvement of *Epidermophyton* spp in the present study. It may be concluded from the present study that the climatic conditions of Belagavi city favour infections caused by dermatophyte fungi. Dermatophytosis is mainly a disease of young and middle age adults, particularly males due to chances of exposure to the risk factors are more due to physical exertion and contact with infected persons. Patients from lower socioeconomic group predominated the study group due to poor personal hygiene, overcrowding and poor nutritional status. Tinea corporis and Tinea cruris were the most common clinical types. Although, the present study is a random study that focuses primarily on the prevalence of different dermatophyte species in a small area in the Belagavi city, more systematic study covering larger population and over a longer period of time would give a better insight into the epidemiology of dermatophytosis in the area.

### Consent

Written informed consent was obtained from the patients for the publication of this report and any accompanying images.

### Competing Interests

The authors declare that they do not have any competing/conflicting interests.

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