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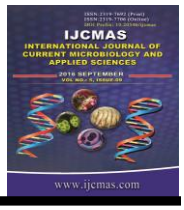

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A Study of Prevalence of Dermatophytosis in and around Guntur District, Andhra Pradesh, South India

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A B S T R A C T

Fungal diseases formed an important entity in the recent times in tropical countries like India. The prevalence of dermatophytosis varies from place to place, but in tropical and subtropical countries it occurs in increase frequencies. The purpose of the study is to know the prevalence, causative agents of dermatophytosis and their mycological aspects in different clinical types of dermatophytosis in and around Guntur. A total of 125 clinically diagnosed cases of dermatophytosis attending the outpatient department of Dermatology and venereology, Tertiary care teaching Hospital, Guntur were studied. Skin scrappings, nail clippings and hair stubs were collected from infected patients and processed by potassium hydroxide preparation (KOH) for direct microscopy and culture using SDA with actidione. In our study highest incidence of dermatophytosis is seen in the age group of 21-30yrs, 46 (36.8%). Males were affected more frequently than females in ratio of 1.1:1. Ringworm infection was more common in people of low socioeconomic status. *Tinea capitis* was more common in male children (80%).*Tinea corporis* and *T.unguium* were more common in females. T.cruris were common in males in the age group of 21 -30 yrs. Mixed infection with Tinea corporis and Tinea cruris were also prominent in this study. Out of 125 cases direct microscopy was positive in 111 (88.8%) and culture were positive in 94 (75.2%). So it was shown that this method was considered important in the processing of specimen for dermatophytosis compared with 94 culture positives isolated in SDA media. T. rubrum is the commonest species followed by *T. mentagrophytes*. *T. rubrum* was the commonest etiological agent of *T. corporis* followed by *T. mentagrophyte. M. audouinii* were isolated in 3 cases of *Tinea corporis. T. mentagrophyte* was the only species isolated in T. pedis. In the mixed infection also the commonest species was *T. rubrum.* The different dermatophyte species isolated in the present study were *T. rubrum, T. mentagrophytes, T. violaceum, T. tonsurans, T. schoenleinii* in genus *Trichophyton. E. floccosum and M. audouinii. T. rubrum* incidence was highest among Trichophyton species in causing dermatophytosis. Dermatophyte infections are the most common fungal infections in our country. The hot humid season produces a lot of sweat which is congenial for the growth of dermatophytes. There is a varying difference in the isolation of different species of dermatophytes from South and North India. By and large Trichophyton species form the commonest etiological agent of dermatophytosis.

Introduction

Cutaneous infections are common diseases encountered in tropical countries, of which dermatophytosis are of particular concern in developing countries. This infection is prevalent in all age groups of both the sexes in our country and they seek physician advice mainly for the cosmetic reason. Dermatophytosis constitutes 16 to 75% of all mycological infections. It is commonly acquired due to hot humid climatic condition of our country. Overcrowding, low socioeconomic status, unhygienic living conditions, outdoor work, increased physical activity and excessive sweating predisposes to ring worm infection.

The Dermatophytes are a group of closely related fungi that have the capacity to invade the keratinized tissue (skin, hair, and nail) of humans and other animals to produce an infection, dermatophytosis, commonly referred to as ringworm. Infection is generally cutaneous and restricted to the nonliving cornified layers because of the inability of the fungi to penetrate the deeper tissues or organs of immunocompetent hosts. Reaction to a dermatophyte infection may range from mild to severe as a consequence of the hosts reactions to the metabolic products of the fungus, the virulence of the infecting strains or species, the anatomical location of the infection, and local environmental factors (Weitzman *et al.,* 1995).

Emmons (1934) has classified dermatophytes broadly into three genera. *Trichophyton*, *Microsporum* and *Epidermophyton.* There were numerous reports of the prevalence of dermatophytosis in different parts of India. It is with this background the present study was undertaken to know the prevalence, causative agents, predisposing factors in dermatophytosis and their mycological aspects in different clinical types of dermatophytosis in around Guntur.

Material and Methods

The study was undertaken with a view to isolate and identify various species of the dermatophytes from the clinical specimens such as skin scrapping, nail clipping and hair stubs from 125 clinically suspected cases of dermatophytosis attending the outpatient department of Dermatology, Tertiary care teaching Hospital, Guntur, over a period of one year.

A detailed clinical history was taken from all patients after obtaining informed consent. It included age, sex, socioeconomic status, occupation, site of infection, duration of disease, history of similar illness in family, history of recurrence, lifestyle and history of associated diseases were elicited and recorded in proforma. Patients on antifungal treatment and non – dermatophyte fungal infections were excluded from the study. Depending on the clinical types of dermatophytosis and site of lesions, skin scrapings, nail clippings along with subungual debris and infected hair stubs were collected. The site of lesion were cleaned with 70% alcohol, allowed to dry then samples were collected using sterile scalpel blade in a sterile black paper folds and labelled with details of the patient. The collected samples were transported to the laboratory immediately without any delay for microscopic examination & culture.

Direct microscopic examination of the scraping placed on a microscopic slide with one or two drops of 20% potassium hydroxide & a cover slip was applied. The sample was warmed by passing the slide several times over a flame of Bunsen burner & examined under microscope. A sample like nail clipping along with subungual debris was placed on a microscopic slide with few drops of 40% KOH and a cover

slip was applied. The preparation was examined after 6 hours, so that the nails get dissolved in KOH & hyphae and / arthroconidia become clearly visible when examined under low (x10) and high (x40) power objective (Koneman *et al.,* 1997).

The culture was performed in two different sets of antibiotic incorporated Sabouraud dextrose agar (SDA) media, one with chloramphenicol 50mg/l and the other with cycloheximide 500mg/L and in addition to chloramphenicol and gentamicin (Emmons *et al*., 1977)

The cultures were incubated at 25°c for one to four weeks and checked twice in a week for any growth. In case of positive cultures identification of the causative agents was performed based on macroscopic & microscopic examination of culture isolates which include gross morphology of the fungal colony (texture, color, surface and reverse pigment, topography), rate of colony growth. Microscopic examination was done using Lactophenol cotton blue preparation. Fungal conidia (type of macroconidia, shape and size of microconidia) and accessory structures were studied using slide culture method. Special test like hair perforation test, urease production and slide culture were performed whenever necessary by standard technique (Forbes *et al*., 2002). In absence of growth even after four weeks, the culture was declared negative.

Results and Discussion

Out of 125 samples collected, skin scrapings formed 104 (83.2%) samples, nail clippings were 16 (12.8%) and hair stubs 5(4%) (Table-1). Sex wise incidence of cases showed male predominance. The incidence in males was 66 (52.8%) and females 59 (47.2%). The male to female ratio was 1.1:1 (Table-2). Highest incidence was seen in the age group of 21-30yrs 46(36.8%) followed by 11-20yrs age group and 31-40yrs age which had an incidence of 23 (18.4%) each. Age group of 41-50yrs had an incidence of 15 (12%), 51-60yrs age group 12 (19.6%) and 0-10 yrs age group has least incidence 6(4.8%) (Table-3). Categorisation of cases by socioeconomic status revealed that the incidence of ringworm infection was more in people of low socioeconomic status 85(68%) followed by 36 (28.8%) in middle socioeconomic status, and in high socioeconomic status it was least common 4 (3.2%) (Table-4). In this study 42% of patients which include both male and female cases were farmers in the age group of 21-40 yrs, who were in contact with soil as a part of their occupation. In our study, *Tinea capitis* was more common in male children (80%) and in age group of 0 -10 yrs (80%). *Tinea corporis* was found to be more common in females (60%) and in age group of 21 -30yrs (41.8%). *Tinea cruris* is more common in males (76%) and in age group of 21-30yrs (38.46%). *Tinea unguium* is common in females (56.25%) and in age group of 21-30yrs (37.21%). There was one female case of *T.pedis* in age group of 21 -30yrs and 2 cases of *T. manuum*, one was a male, one was a female patient in age group of 21 -30 yrs. *Tinea barbae* was seen in 3 males in age group of 21-30yrs. Mixed infection with *T.corporis* and *T. cruris* was also prominent in this study. Of the 30 cases of mixed infection 19 were males (63.34%) and 11 were females (36.67%). The predominant age group of mixed infection was 21-30 yrs and 41-50 yrs each of (22.5%) incidence, (Table-5).

Out of 125 cases, direct microscopy was positive in 111 (88.8%) cases and culture positive in 93 (75.2%) cases. 85 cases (68%) were both KOH positive and culture positive. 20 cases (16%) were KOH positive but culture negative. Whereas 8 cases

(6.4%) were KOH negative but culture positive. 12 (9.6%) were both KOH and culture negative, (Table- 6). In our study, *T. rubrum* was the commonest pathogenic species isolated 32 (37.64%) followed by *T.mentagrophytes* 26(30.58%). *T. violaceum, T. tonsurans and T. verrucosum* with an incidence of 7.05% (each 6 isolates). There were two isolates of *T.schoenleinii* (2.35%), *Epidermophyton floccosum* in 4 (4.75%) and *M. audouinii* in 3 (3.53%) were isolated (Table- 7). Dermatophytes isolated from different clinical types (Table-8) showed that *T. rubrum* (16) was the most common pathogenic fungi in clinical type *T. corporis* followed by *T.mentagrophytes* (13), *T.tonsurans, T.verrucosum* were isolated in 3 cases each. *T. violaceum* and *T. schoenleinii* 2 cases each, of *T.corporis, M. audouinii* in 3 cases, *E. floccosum* in one case of *T. corporis* 55 (44%). In 16 cases (12.8%) of *T. unguium*, there were only 2 isolates of *T. rubrum*. In *T. cruris* 13 (10.4%) different dermatophyte species isolated were *T. rubrum* (3). *T.mentagrophytes* (2), *T. violaceum* (1),*T. tonsurans* (1), *Epidermophyton* (1). In 5(4%) cases of *T. capitis* 3 isolates were *T. violaceum, T. tonsurans* one, *T. verrucosum* (1). *T.mentagrophytes* was the only isolates of *T. pedis*. Among the two cases (1.6%) of *T. manuum, T. rubrum* was isolated from one case. Out of 3 cases (2.4%) of *T. barbae, T. rubrum* was isolated in 2 cases and *T.mentagrophytes* in one case. Mixed infection (*T. corporis* and *T. cruris*) was noticed in 30 cases (24.8%). The common species isolated were *T. rubrum* (9) followed by *T.mentagrophytes* (8), *T. tonsurans* (1), *T. verrucosum* (2) and *E. floccosum* was isolated in 2 cases.

Dermatophytosis is the most common fungal infection of human and is usually referred to as tinea (Latin for worm) or ring worm. The infection is characterised by another latin name to designate the area of the body involved *T. corporis, T cruris, T.capitis, T. barbae, T.unguium and T. manuum*. These fungi breakdown and utilize keratin as a source of nitrogen. The genus *Trichophyton* is capable of invading hair, skin & nail. The Genus *Microsporum* involve skin & hair and Genus *Epidermophyton* involve skin and nails.

In the present study, 125 clinically diagnosed cases of dermatophytosis attending Dermatology department were taken. Highest incidence was seen in the age group of 21 -30 yrs (36.8%) followed by 11-20yrs and 31-40yrs age group (18.4%). Males (52.8%) are affected more than females (47.2%). Male to female ratio is 1.1:1 (Table 2,3). Similar findings were reported by Bose *et al.*,2013, Gupta *et al.*, 2014, Ramaraj V *et al*.,2016. The increase incidence in males may be due to outdoor work, increase physical activity in hot humid climate, excessive sweating, poor hygienic conditions and wearing of occlusive clothing, predisposes to ring worm infection. In our study, dermatophyte infection was more common in people of low socioeconomic status 85 (68%). Most of the male and female cases under this category were daily wage labourers and farmers who work outdoor and are more exposed to soil as a part of their occupation, which in turn predisposes to dermatophyte infection. Similar finding were reported by Ranganathan *et al.*, 1995; Poluri *et al.*, 2015; a high incidence of dermatophyte infection was observed in low socioeconomic group of people 35% and 67.74% in their study.

In the present study, *Tinea capitis* was more common in male children 0-10yrs (80%). *Tinea corporis* 33 (60%) in females and in the age group of 21-30yrs 23 (41.8%) and 31 - 40yrs 13 (23.6%) was commonly seen around waistline of females who wear sarees and work outdoor in our study. T. unguium

was found to be more common in females 9(56.25%). *Tinea cruris* was more common in males 10 (76%). However some workers found *Tinea cruris* as the commonest clinical type, Damle *et al.,* 1981 and Singh *et al.,* 1981. The commonest age group for *T.corporis* and *T. cruris* was 21 -30 yrs in both males and females. Our findings is in accordance with Poluri *et al.,* 2015; Sudha *et al.,* 2016 and Kanwar *et al.,* 2001 study. All *Tinea capitis* cases were in the age group of 0-10 yrs in our study. This corresponds to the study by Sudha *et al.,* 2003 and Philpo, 1997 in which he reported that *Tinea capitis* was a disease of children. It is said that pubertal changes in harmones results in acidic sebaceous gland secretions which is responsible for decrease in incidence of *Tinea capitis* in adults. T. unguium was found to be more common in females in our study may be due to more exposure to water as part of their daily work. In a study conducted by Gupta *et al.,* 2014 and Reena Ray Ghosh *et al.,* 2014, *Tinea unguium* was the commonest clinical type observed (52%) and (74.58%) followed by *Tinea corporis* (25%) & (8.65%). *T. cruris* was more common in males than females in our study (76%) which corresponds to Sudha *et al.,* 2016 and Kanwar *et al.,* 2001, study. Who also showed the incidence of *T. cruris* common in males 20.8%, 15.6% respectively.

Table.1 Categorical distribution of clinical samples

Type of Specimens	Number of cases	Percentages
Skin scrapings	104	83.2
Nail clippings	16	12.8
Hair stubs	5	4
Total	125	100

Table.2 Age wise distribution of cases

Age in years	Number of cases	Percentages
0-10	6	4.87
11-20	23	18.4
21- 30	46	36.8
31-40	23	18.4
41-50	15	12
51-60	12	9.6
Total	125	100

Table.3 Distribution of cases by socioeconomic status wise

Low socioeconomic status	Middle socioeconomic status	High socioeconomic status	Total
Number of cases	Number of cases	Number of cases	
85 (68%)	36 (28.8%)	4 (3.2%)	125

Fig.1 Categorical distribution of clinical samples

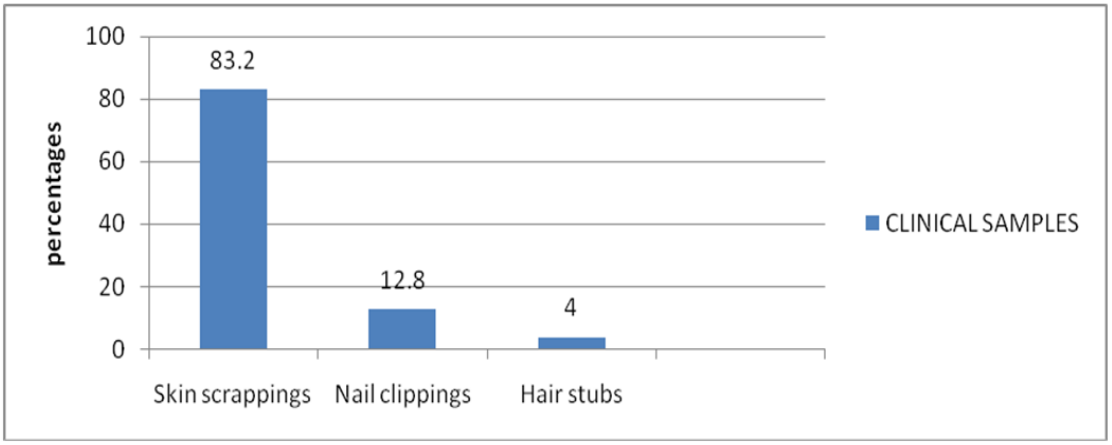


Fig.2 Sex wise distribution of cases

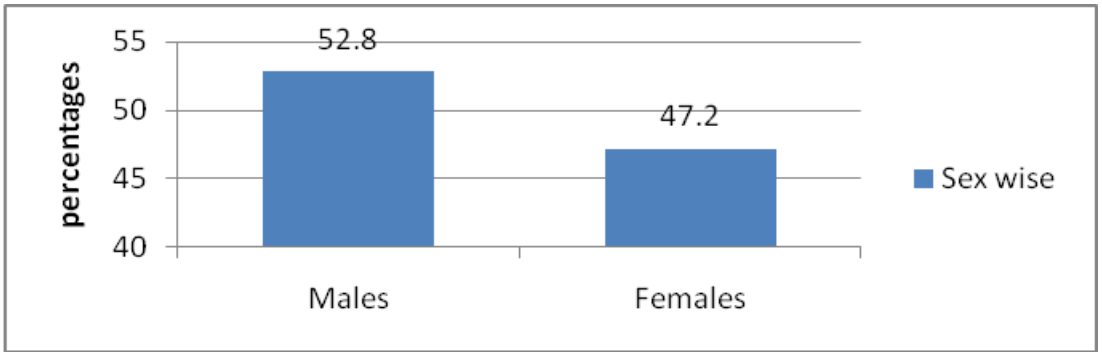


Fig.3 Age wise distribution of cases

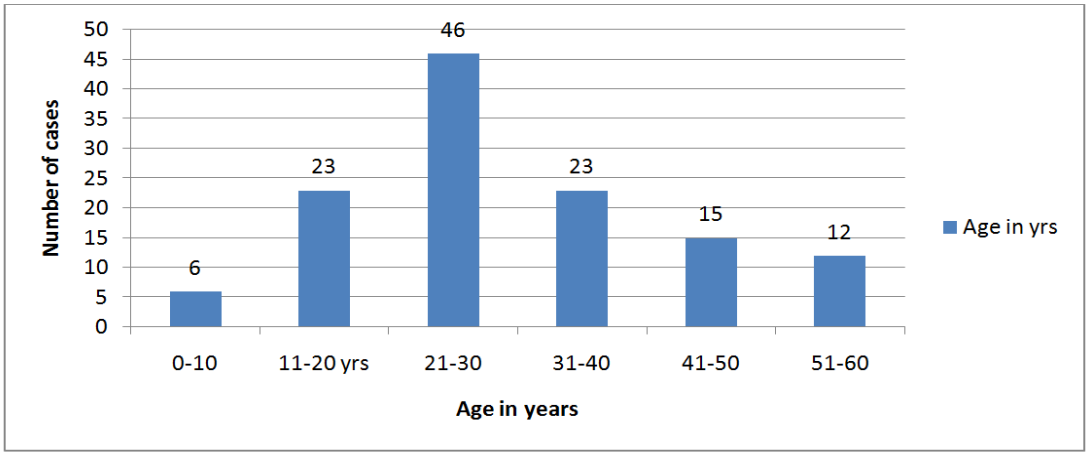


Table.4 Correlation of clinical types age and sex wise

S.No	Clinical types	Age group in years						Sex wise		Total
		0-10	11-20	21-30	31-40	41-50	51 & above	Male	Female	
1.	*T. corporis*	2 (3.6%)	8 (14.5%)	23 (41.8%)	13 (23.6%)	6 (10.9%)	3 (5.4%)	22 (40%)	33 (60%)	55(44%)
2.	*T. cruris*	-	3(23%)	5 (38.46%)	3(23.7%)	1(7.6%)	1 (7.6%)	10(76%)	3(23%)	13(10.4%)
3.	*T. unguium*	-	5 (31.25%)	6(37.2%)	2(12.5%)	1(6.25%)	2 (7.25%)	7(13.75%)	9 (56.25%)	16(12.8%)
4.	*T. capitis*	4 (80%)	1(20%)	-	-	-	-	4(80%)	1(20%)	5(4%)
5.	*T. pedis*	-	-	1(100%)	-	-	-	-	1(100%)	1(0.8%)
6.	*T. manuum*	-	-	2(100%)	-	-	-	1(50%)	1(50%)	2(1.6%)
7.	*T. barbae*	-	-	3(100%)	-	-	-	3 (100%)		3(2.4%)
8.	*Mixed type. T.corporis +T. cruris*	-	6 (19.35%)	7(22.5%)	5 (16.12%)	7(22.5%	7(22.5	20 (60.5%	11 (35.48%	30(24.8%
	Total	6 (4.8%)	23 (18.4%)	46 (36.8%)	23 (18.4%)	15(12%)	15(12%)	66 (52.8%)	59 (47.2%)	125 (100%

Table.5 Identification of Dermatophytes by Microscopy and culture wise among clinical types

S. No	Clinical types	Number of cases	Total KOH positive	Total culture positive	KOH positive culture positive	KOH positive culture negative	KOH negative Culture positive	KOH Negative Culture Negative
1.	*T. corporis*	55	51	43	40 (72.7%)	10(18.19 %)	3(5.45%)	2(3.63%)
2.	*T.cruris*	13	13	11	11 (84.62%)	2(15.38 %)	-	-
3.	*T. unguium*	16	6	2	1 (6.25%	5(31.25 %)	1(6.25%)	9(56.25 %)
4.	*T.capitis*	5	5	5	4 (80%)	-	1(20%)	-
5.	*T. pedis*	1	1	1	-	-	1	-
6.	*T. manuum*	2	2	2	-	-	-	-
7.	*T. barbae*	3	3	3	3	-	-	-
8.	Mixed type	30	30	27	24 (80%)	3(9.68%)	2(6.45%)	1(3.23%
	Total	125	111(88.8 %)	94(75.2 %)	85(68%)	20(16%)	8(6.4%)	12(9.6%)

Table.6 Incidence of dermatophytes species wise

S. No.	Dermatophyte species	Number of isolates / percentages
1.	*T. rubrum*	32 (37.64%)
2.	*T.mentagrophytes*	26 (30.58%)
3.	*T. violaceum*	6 (7.06%)
4.	*T. tonsurans*	6 (7.06%)
5.	*T. schoenleinii*	2 (2.35%)
6.	*T. verrucosum*	6 (7.06%)
7.	*M. audouinii*	3 (3.53%)
8.	*E.floccosum*	4 (4.37%)
	Total 125 cases	85 (100%)

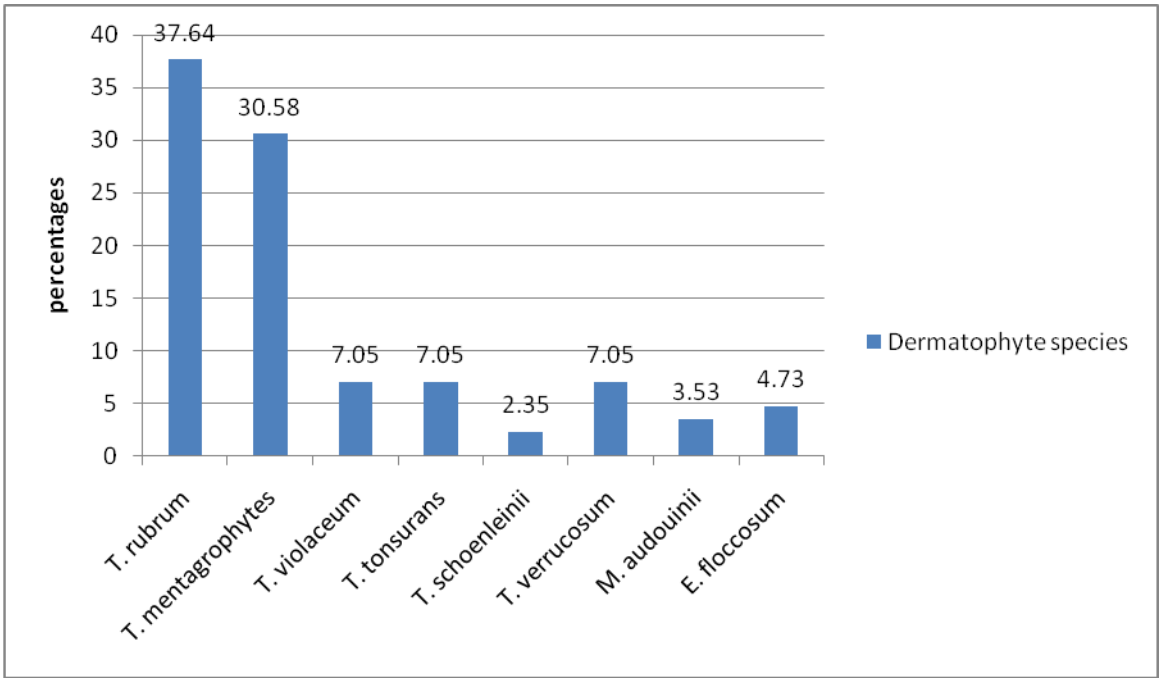
Table.7 Dermatophytes isolated from different clinical types

S.No.	Clinical types	Number	*T. rubrum*	*T.mentagrophytes*	*T. violaceum*	*T. tonsurans*	T. schoenleinii	*T. verrucosum*	*M.audouinii*	*E.floccosum*
1.	*T. corporis*	55(44%)	16	13	2	3	2	3	3	1
2.	*T. cruris*	13 (10.4%)	3	2	1	1	-	-	-	1
3.	*T. unguium*	16 (12.8%)	2	-	-	-	-	-	-	-
4.	*T. capitis*	5(4%)	-	-	3	1	-	1	-	-
5.	*T.pedis*	1(0.8%)	-	1	-	-	-	-	-	-
6.	*T.manuum*	2(1.6%)	1	-	-	-	-	-	-	-
7.	*T.barbae*	3(2.4%)	2	1	-	-	-	-	-	-
8	*Mixed type. T.corporis+T.cruris*	30 (24.8%)	9	8	-	1	-	2	-	2
	Total cases	125 (100%)	32 (37.64%)	26 (30.58%)	6 (7.05%)	6 (7.05%)	2 (2.35%)	6 (7.05%)	3 (3.53%)	4 (4.75%)

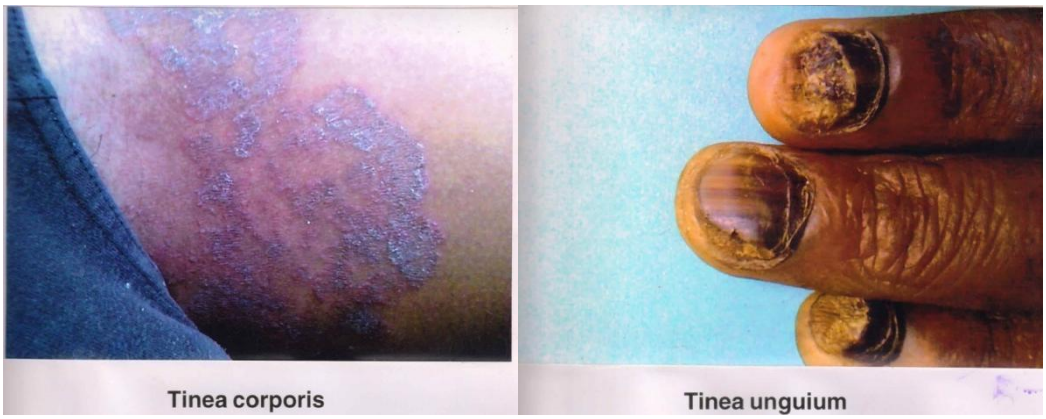
Table.8 Reports of dermatophytosis in India

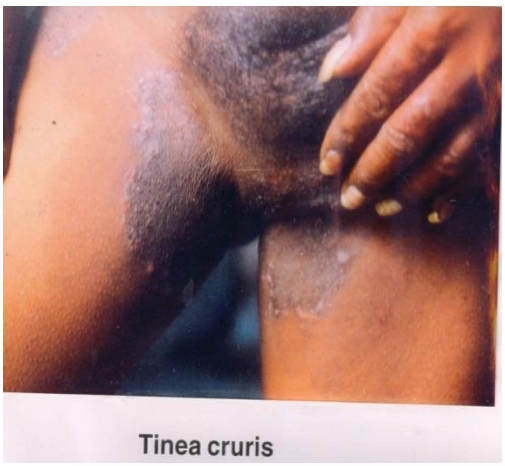
Author	**Region, Year of study,**	**Commonest clinical type**	**Isolates with percentages if given**						
			T. rubrum	*T.mentagrophytes*	*T. violaceum*	*T. tonsurans*	T. schoenleinii	*Epidermophyton*	*Microsporum*
Mathur *et al*	Central Nepal, 2012	*T.corporis* (47%)	25%	8.8%	-	25%	*T.verrucosum* (30.6%)	-	-
Bose *et al*	Maharashtra,2013	*T. corporis* (42%)	33.33%	21.33%	-	-	-	3.29%	2.19%
Gupta *et al*	Central India, 2014	T.unguium, (52%)	26.9%	11.5%	-	3.8%	*T.verrucosum* (5.7%)	1.9%	-
Reena Roy Ghosh *et al*	West Bengal, 2014	T. unguium 74.58%	22.2%	21.16%	2.11%	T.saudanense 4.76%	*T.schoenleinii* (6.34%)	4.23%	13.7%
Poluri *et al*	Nalgonda,Telangana, 2015	*T. corporis* 38.71%	58.06%	22.58%	6.45%	3.22%	3.22%	6.45%	-
Ramraj V *et al*	Tamilnadu, 2016	*T. corporis* 63.27%	48.95%	44.75%	-	3.05%	-	0.70%	2.1%
Present study	Guntur, Andhra Pradesh	*T.corporis* (44%)	37.64%	30.58%	7.05%	7.05%	2.35%	4.75	3.53%

Fig.4 Incidence of dermatophytes species wise

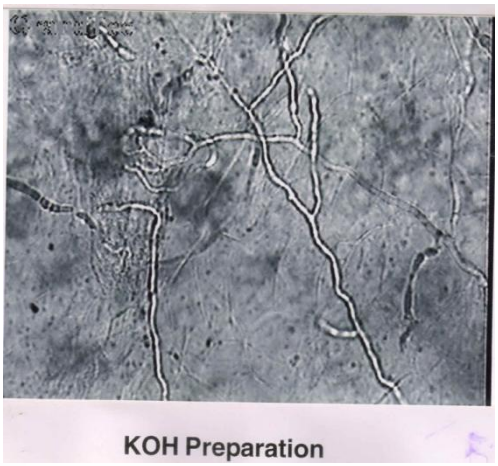


Images of dermatophytosis - Clinical cases, KOH mount and clinical isolates with LPCB mounts

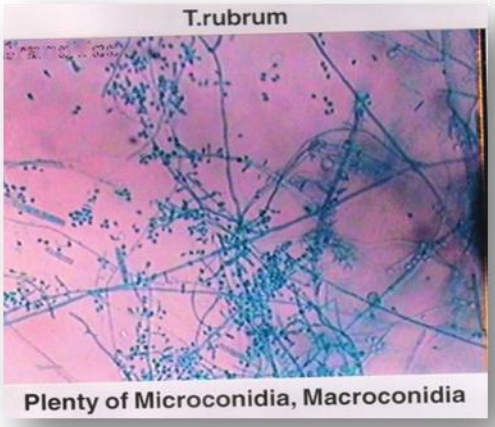




Tinea cruris

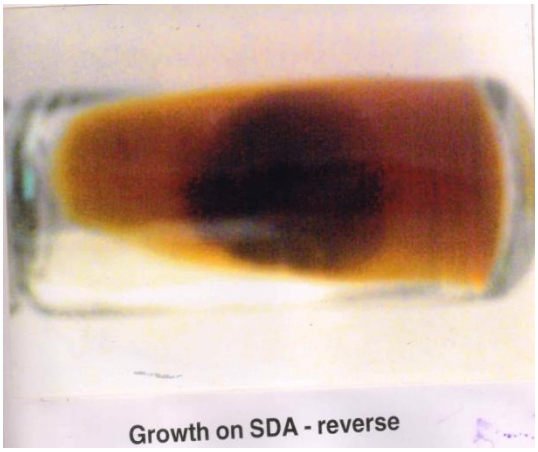


KOH Preparation



T.rubrum

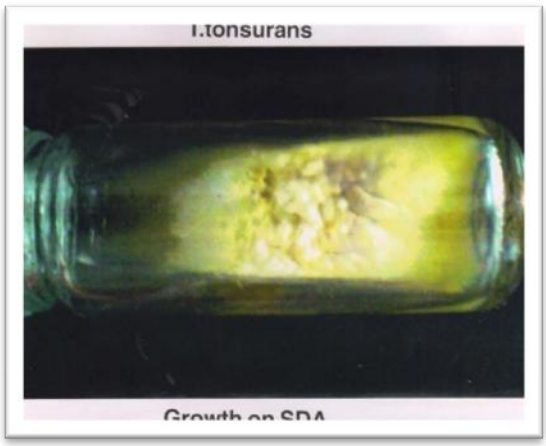
Plenty of Microconidia, Macroconidia

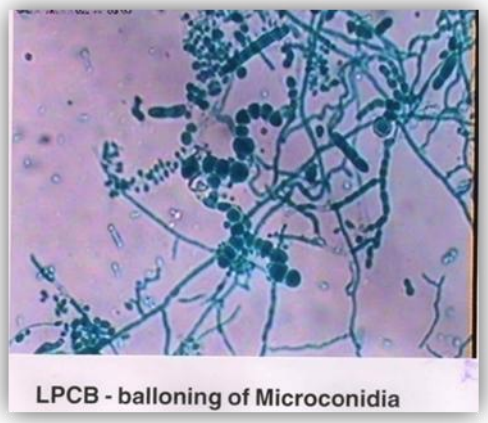


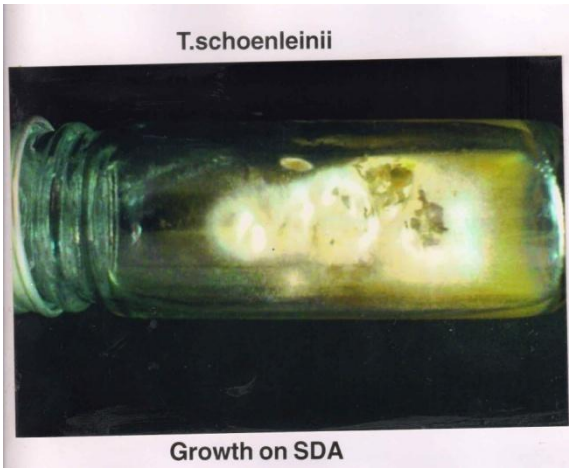
Growth on SDA - reverse

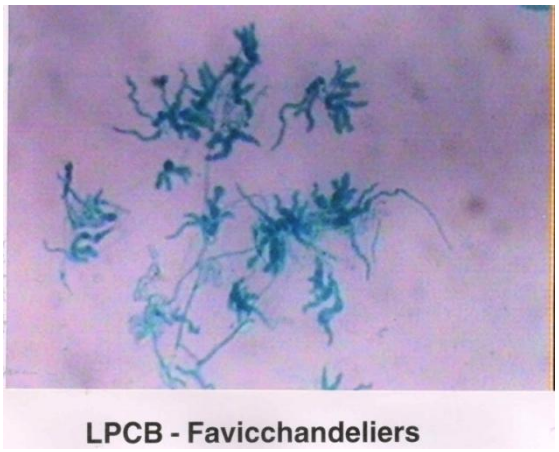
Urease test

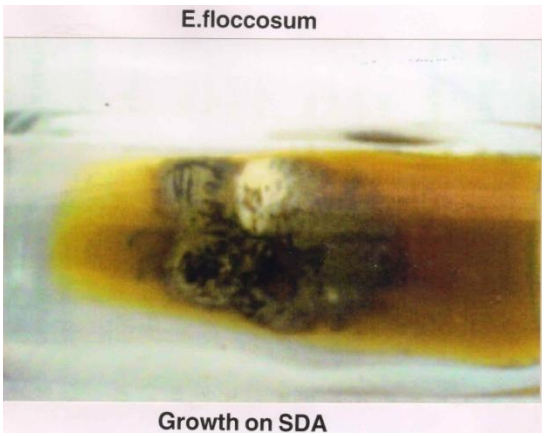
LPCB - Spiral hyphae

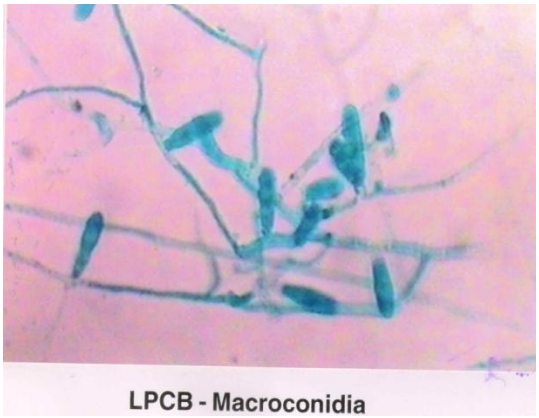












Among all the clinical types *Tinea corporis* was the predominanat one 55(44%) followed by *T. corporis* with *T. cruris* 30(24.8%). This finding is similar to the study conducted by Poluri *et al.,* 2015. The least incidence was found to be of *T. pedis* (0.8%), T. mannum (1.6%) and *T. barbae* (2.4%) in our study. The highest incidence of *T. corporis* among cases of dermatophytosis was also noted by several workers, Mathur *et al.*, 2012; Bose *et al.*, 2013 and Ramaraj *et al.*, 2016 (Table 5).

In our study, fungal infection in clinical samples was detected by direct microscopy

using 20% KOH mount which later on confirmed by culture using SDA with actidione as shown in Table 6.The correlation of direct microscopy and culture positive was seen in 85 (68%) of the 125 cases. Direct microscopy was positive in 111(88.8%) cases and culture was positive in 94 (75.2%). This shows that direct microscopy by KOH mount is useful screening technique in the laboratory diagnosis of dermatophytosis. KOH positive and culture negative were 20 (16%). KOH negative and culture negative were 8 (6.4%). This study is in accordance with the study of Gupta *et al.,* 2014; Doddamani *et al.,* 2013, who reported 55% and 65% KOH positivity and 46% and 39% culture positivity.

In the present study, *T. rubrum* 32 (37.64%) was the most common species isolated, followed by *T.mentagrophytes* 26(30.58%), Table 7. This was in correlation with other studies conducted by Mohanty *et al.,* 1998; Singh *et al.,* 2003; Peerapur *et al.,* 2004 and Poluri *et al.,* 2015. Other species isolated in our study was *T. violaceum*, *T. tonsurans*, T. verrucossum (7.05%) each. *E. floccosum* 4(4.73%), *M. audouinii* 3(3.53%) and T. schoenleinii 2 (2.35%).

The correlation between species isolated and the clinical types was shown in the Table 8. In our study all the three genera of dermatophytes, that is *Trichophyton*, *Epidermophyton* and *Microsporum* have been isolated as the causative agents. *T. rubrum* (37.64%) was the commonest causative agent in majority of clinical types followed by *T.mentagrophytes* (30.58%) which is similar to other studies conducted by Peerpur *et al.,* 2004; Doddamani *et al.,* 2013. In *Tinea capitis* 5 (4%) cases, we have isolated *T. violaceum*(3), *T. tonsurans* (1) and *T. verrucosum* (1) which is similar to the findings of Peerpur *et al.*, 2004; Poluri *et al.,* 2015 study.

Our study was compared with reports of dermatophytosis in South and Northern parts of India, (Table 9). Studies showed that *T. corporis* is the most common clinical type and *T. rubrum* followed by T. mentagrophyte is the most common etiological agent in most of the studies, except in study conducted by Gupta *et al.,* and Reena Ray Ghosh *et al.,* 2014 in their study showed that T. unguium is the common clinical type but *T. rubrum* and *T. verrucosum* are the commonest causative agents, which is in contrast to our study.

In conclusion, dermatophytosis is a common public health problem affecting all age groups in our area and usually seek medical advice for cosmetic reasons. The present study reveals that *T. capitis* is the commonest clinical type in children and *T. corporis* in adults. Males were more frequently affected than females. The commonest isolates were *T. rubrum* followed by *T.mentagrophytes*. Dermatophytosis diagnosis based on clinical findings confirmed by the wet mount using KOH is useful screening technique followed by gold standard culture using SDA with actidione is best method for diagnosis and appropriate treatment of the patient. Use of nonocclusive absorbent cotton garments and good hygiene prevent ring worm infection.

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