

Full Length Research Paper

Spectrum of dermatophytoses in Jaipur, India

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In order to determine the extent and causative agent of ringworm infections in Jaipur area, a study was done in outdoor patient Department of Skin, SMS Hospital, Jaipur. Out of 196 diagnosed cases, 148 were found to be positive by KOH examination while culture positive cases were 160. *Trichophyton rubrum* was the most common etiological type reported from 53 cases followed by *Trichophyton mentagrophytes* (23 cases). *Trichophyton verrucosum*, *Trichophyton ferrugineum*, *Trichophyton concentricum*, *Trichophyton megninii*, *Microsporum canis*, *Microsporum audouinii*, *Microsporum fulvum* were reported for the first time in Jaipur. *Scopulariopsis* sp., *Paceilomyces* sp. and *Curvularia* sp. were also reported for the first time from human skin in Jaipur. Tinea corporis was the most common clinical type reported from all age groups. Tinea cruris was the second most common clinical type, followed by tinea capitis, tinea manuum, tinea unguium, etc. These infections were observed more frequently in the age group of 21-30 (26 %), followed by 31-40 (18.8%) and 11-20 (16.3%). Males (75.5%) were more infected than females (24.5%).

Key words: Dermatophytoses, ring worm, tinea infection, *Trichophyton*, *Microsporum*.

INTRODUCTION

Infections caused by fungi in humans and animals are common throughout the world. Dermatophytoses pose a serious concern to the sociologically backward and economically poor population of India. Dermatophytoses are superficial infections of keratinised tissue caused by organism of three genera of fungi known as dermatophyton (Bhadauria et al., 2001). The dermatophytes represent more than 40 closely related species classified in three genera: *Microsporum*, *Trichophyton* and *Epidermophyton*. Only a few of these species are responsible for most human fungal infection (Wagner and Sohnle, 1995). Skin infection due to dermatophytes has become a significant health problem affecting children, adolescent and adults. Recently, there has been an increase in the incidence of fungal infections in developing countries. This may be the result of frequent

usage of antibiotics, environmental condition, immunosuppressive drugs and various conditions, like organ transplantation, lymphomas, leukemia and human immunodeficiency virus (Petmy et al., 2004).

In the present day living conditions, human and animal (domesticated) live their lives in close proximity to one another and are housed under the same roof or sleep on a common floor. In such a situation, skin and other infections are contracted easily and are perpetually multiplied. Fungal etiological infections in human are frequently observed during those seasons of the year when the environmental temperature and relative humidity are high (Karmakar et al., 1995). Jaipur has got a dry climate and in summer, the temperature exceeds even 46°C with high humidity during monsoon season. These climatic conditions favour the incidence of the

fungi and consequently the disease.

The aim of this investigation was to find out unexplored species of dermatophytes and other related fungi and also to determine the pattern of dermatophytoses in Jaipur.

MATERIALS AND METHODS

Collection of infected skin scraping

In order to determine the extent and causative agent of ringworm infection in Jaipur area a study was done for six months period from April 2006 to September 2006. The collection of infected material was done in Dermatology department, SMS hospital at Jaipur. First of all, the infected area was cleaned with the help of 70% ethyl alcohol swabs and then, skin was scraped with the help of sterilized scalpel from peripheral area of the lesion. The scraping was collected in sterilized paper folders or in sterilized plastic bags. In the case of tinea capitis, the hairs or stump of broken hair were plucked from the affected area with sterilized forceps. In the case of onychomycosis or tinea unguium, the nail scraping or part of nails were removed with the help of sterilized scalpel or blade.

KOH mounting

The preliminary examination of the material was done immediately. For this, small portions of these scraping were taken and mounted in 10% potassium hydroxide (KOH) solution and examined after 5 min under microscope for the presence of fungal hyphae and/or arthrospores.

General characters

The following additional points were also recorded: Sex (male or female), age of patient, nature of infection, body part involved, profession and surrounding history of the patients, date of collection of scraping etc. for para-clinical data.

Culture and maintenance

Sabouraud's dextrose chloramphenicol agar (Himedia) medium was used for the isolation, purification and maintenance of dermatophytes.

Identification of fungi

The mycological identification was based on macroscopic and microscopic examination of the culture isolates. The macroscopic examination of dermatophytes was characterized by duration of growth, surface morphology and pigment production on the reverse. Strains were identified by their morphological and physiological characteristics according to the procedure described by Conant et al. (1959) and Forbes et al. (2002).

Identification characteristics

Trichophyton rubrum

Colonial types vary from white downy to pink granules; reverse

yellow when colony is young; however, wine red color commonly develops with age. Microconidia usually teardrop, most commonly borne along sides of the hyphae, macroconidia are smooth and pencil shaped.

Trichophyton mentagrophytes

White granular and fluffy colony growth, reverse buff to reddish brown. Spiral hyphae commonly seen, microconidia most commonly borne in grapelike clusters, macroconidia are thin walled, smooth, club-shaped and multiseptate.

Microsporum gypseum

Cinnamon-colored powdery colony, reverse light tan, macroconidia multiseptate thick walled, rough, elliptical. Microconidia few or absent.

Microsporum canis

Colony usually membranous with feather periphery center of colony white to buff over orange-yellow; lemon yellow or yellow-orange apron and reverse. Macroconidia thick walled, spindle shaped, multiseptate, rough walled, some with curved tip. Microconidia rarely seen.

Microsporum audouinii

Downy white to salmon-pink colony, reverse tan to salmon pink. Sterile hyphae, terminal chlamydospores favic chandeliers and pectinate bodies, macroconidia rarely seen-bizarre shaped if seen, microconidia rare or absent.

Microsporum fulvum

Colonies are fast growing, flat, suede-like, tawny-buffy to pinkish-buff in colour and frequently have a fluffy white advancing edge. A dark red undersurface is occasionally seen otherwise it is colourless to yellow brown. Macroconidia abundant, thin walled, elongated, ellipsoidal closely resemble those of *M. gypseum* except that they are longer and more bullet shaped with 3-6 septa.

Trichophyton verrucosum

Glabrous to velvety white colonies, rugal folds with tendency to skin into agar surface. Macroconidia extremely rare, but form characteristic "rat tail" types when seen; many chlamydospores are seen in chains particularly when colony is incubated at 37°C. Microconidia are rare, tear shaped.

Trichophyton violaceum

Port wine to deep violet colony, may be heaped or flat with waxy-glabrous surface; pigment may be lost on subculture. Mycelium branched tortuous hyphae that are sterile, Chlamydospores commonly aligned in chains.

Trichophyton tonsurans

White, tan to yellow or rust, suede like to powdery, wrinkled with

heaped or sunken center, reverse yellow to tan to rust red. Microconidia are teardrop or club shaped with flat bottoms, vary in size but usually large to dermatophytes. Macroconidia are rare and balloon forms are found when present.

Trichophyton schoenleinii

Irregularly headed, smooth white to cream colony with radiating grooves, reverse white, hyphae usually sterile, many antler type hyphae is seen.

Trichophyton megninii

The colony is cottony to velvety and white at first, but later become pale rose to violet. A non-diffusible red pigment is seen on the reverse side of the culture. Macroconidia and microconidia are produced more abundantly on trypticase dextrose agar.

Trichophyton concentricum

The colony is heaped, deeply folded, glabrous and white at first, but becomes deep brown in the center with cream colored somewhat powdery periphery, the pigment in the agar becomes deep amber in color. This fungus is macroscopically and microscopically identical with many strains of *T. schoenleinii*.

Epidermatophyton floccosum

Center of colony tends to be folded and is khaki green, periphery is yellow, reverse yellowish brown with observable folds. Macroconidia large, smooth wall, multiseptate, clavate and borne singly or in clusters of two or three, microconidia not formed by this species.

Candida albicans

White to cream colored, smooth, glabrous and yeast like in appearance. Microscopic morphology shows spherical to subspherical budding yeast like cells or blastoconidia.

RESULTS

The data presented in Table 1 shows prevalence of various clinical types and etiological agents of ringworm infections. It may be noted that *T. rubrum* is the most predominant etiological agent reported from 53 cases (32.1%). It was isolated from all clinical types except tinea versicolor (which was found to be negative in culture test). The other important species isolated are *T. mentagrophytes* 23 (14.3%), *T. schoenleinii* 6 (3.7%), *T. verrucosum* 4 (2.5%), *T. violaceum* 10 (6.2%), *T. ferrugineum* 1 (0.6%), *T. tonsurans* 9 (5.6%), *T. concentricum* 2 (1.2%), *T. megninii* 2 (1.2%), *M. gypseum* 5 (5.6%), *M. canis* 8 (5%), *M. audouinii* 1 (0.6%), *Microsporum* sp. 1 (0.6%), *Epidermatophyton floccosum* 4 (2.5%) and *M. fulvum* 1 (0.6%) (Table 1).

T. verrucosum, *T. ferrugineum*, *T. concentricum*, *T.*

megninii, *M. canis*, *M. audouinii*, *Curvularia* are reported for the first time in Jaipur district Rajasthan. Other related keratinophilic fungi like *Scopulariopsis* sp., *Paecilomyces* sp. are also reported for the first time in Rajasthan.

In the present investigation, tinea corporis is found to be the most prevalent disease. Out of 196 diagnosed cases tinea corporis is observed in 69 patients (35.2%). The second most common clinical type is tinea cruris reported in 44 patient (22.4%), followed by tinea capitis (11.2%), tinea manuum (7.1%), tinea unguium (6.6%), tinea pedis (6.6%), tinea corporis + cruris (5.1%), tinea versicolor (1.0%) and tinea manuum + corporis (0.5%) (Table 1).

It is evident from the results (Table 2) that tinea infections are more common in the age group of 21-30 (26.0%) followed by 31-40 (18.8%), 11-20 (16.3%). Tinea corporis is the most commonly observed infection in 21-30 and 31-40 age groups. Incidence of tinea infection in higher age groups was found to be less.

Tinea infections are more dominant in males (75.5%) rather than females (24.5%) for all age groups except infant-10 year age group where the percentage of female (7.65%) patients is higher than male patients (5.61%).

Among all clinical types, tinea capitis is more frequently reported in females (7.1%) than males (4.0%). Professional background sometimes plays an important role in the development as well as the spread of disease as observed in the present study. Data incorporated in Table 3 shows that Employers (60 cases) are more commonly infected with this disease followed by students (59 cases) and housewives/house girls (23 cases).

DISCUSSION

The dermatophytes are among the commonest infectious agents of man and no persons or geographic areas are free of them. In the present study, *T. rubrum* was found to be the predominant dermatophytic species in Jaipur (32.1%). Bhadauria et al. (2001) reported 34% incidence of *T. rubrum* in Jaipur area during 1999-2001. Tinea corporis was the most common clinical type of infection followed by tinea capitis, tinea pedis and tinea manuum. A review of available literature (Gupta and Shome, 1959; Gupta et al., 1993; Narayanan and Sareesh, 2011; Hanumanthappa et al., 2012) about dermatophytoses occurring in India confirmed beyond doubt that *T. rubrum* was the most prevalent species. The common occurrence of this species in various part of the country may be due to its greater adaptability to survive in varying climatic, populated and unhealthy conditions besides more susceptible individuals with poor nutrition. The second most common etiological agent was *T. mentagrophytes* isolated from 23 cases (14.3%). This is in general agreement with the earlier reports (Bhadauria et al., 2001; Maraki and Tselentis, 1998). Sharma et al.,

Table 1. Prevalence of various clinical types and etiological agents of ringworm infections at Jaipur.

Clinical diagnosis	Tinea corporis	Tinea capitis	Tinea cruris	Tinea pedis	Tinea manum	Tinea barbae	Tinea unguium	Tinea versicolor	Tinea corporis + cruris	Tinea manum + corporis	Total no. percentage (%)
1. No. of cases examined	69	22	44	13	14	8	13	2	10	1	196
2. No. of cases positive by microscopy	51	18	31	10	10	7	11	0	9	1	148
3. No. of cases positive by culture	57	17	36	10	10	7	12	-	10	1	160
4. No. of cases negative by culture	12	5	8	3	4	1	1	2	-	-	36
Species											
1. <i>T. rubrum</i>	18	3	13	4	3	3	3	-	5	1	53 (33.1%)
2. <i>T. mentagrophytes</i>	12	1	6	2	-	1	-	-	1	-	23 (14.3%)
3. <i>T. verrucosum</i>	1	1	2	-	-	-	-	-	-	-	4 (2.5%)
4. <i>T. schoenleinii</i>	3	2	1	-	-	-	-	-	-	-	6 (3.7%)
5. <i>T. violaceum</i>	3	4	-	1	-	-	2	-	-	-	10 (6.2%)
6. <i>T. ferrugineum</i>	-	-	-	-	-	-	1	-	-	-	1 (0.6%)
7. <i>T. megninii</i>	1	-	1	-	-	-	-	-	-	-	2 (1.2%)
8. <i>T. tonsurans</i>	6	1	2	-	-	-	-	-	-	-	9 (5.6%)
9. <i>T. concentricum</i>	1	-	-	-	-	-	-	-	1	-	2 (1.2%)
10. <i>M. gypseum</i>	1	1	1	-	-	1	1	-	-	-	5 (3.1%)
11. <i>M. canis</i>	2	-	-	-	4	1	-	-	1	-	8 (5%)
12. <i>M. audouinii</i>	-	1	-	-	-	-	-	-	-	-	1 (0.6)
13. <i>Microsporum</i> sp.	-	1	-	-	-	-	-	-	-	-	1 (0.6%)
14. <i>E. floccosum</i>	-	-	1	-	2	-	1	-	-	-	4 (2.5%)
15. <i>M. fulvum</i>	-	-	-	-	-	1	-	-	-	-	1 (0.6%)
16. <i>C. albicans</i>	1	-	2	-	1	-	2	-	1	-	7 (4.3%)
17. <i>Candida</i> sp.	-	-	2	-	-	-	1	-	-	-	3 (1.8%)
18. <i>G. reessii</i>	1	-	-	2	-	-	-	-	1	-	4 (2.5%)
19. <i>Curvularia</i> sp.	1	-	3	-	-	-	-	-	-	-	4 (2.5%)
20. <i>Scopulariopsis</i> sp.	-	-	-	-	-	-	1	--	-	-	1 (0.6%)
21. <i>Paecilomyces</i> sp.	-	-	1	-	-	-	-	-	-	-	1 (0.6%)
22. <i>B. dermatitidis</i>	1	-	-	-	-	-	-	-	-	-	1 (0.6%)
23. <i>T. simii</i>	2	-	-	1	-	-	-	-	-	-	3 (1.8%)
24. <i>Torulopsis</i> sp.	1	1	-	-	-	-	-	-	-	-	2 (1.2%)
25. <i>A. fumigatus</i>	-	1	-	-	-	-	-	-	-	-	1 (0.6%)
26. <i>C. tropicum</i>	2	-	1	-	-	-	-	-	-	-	3 (1.8%)
Total	57 (35.6%)	17 (10.6%)	36 (22.5%)	10 (6.2%)	10 (6.2%)	7 (4.3%)	12 (7.5%)	(0%) -	10 (6.2%)	1 (0.6%)	160 (100%)

Table 2. Clinical analysis of 196 cases of dermatophytoses in relation to age and sex.

Clinical types	Infant-10 Years		11-20 Years		21-30 Years		31-40 Years		41-50 Years		51-60 Years		61 & above		Total Males		Total Females	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	No.	%	No.	%
Tinea corporis	5	1	6	3	16	4	8	6	8	2	6	-	4	-	53	27.0	16	8.1
Tinea capitis	4	12	4	2	-	-	-	-	-	-	-	-	-	-	8	4.1	14	7.1
Tinea cruris	-	-	6	1	15	-	7	-	8	1	5	1	-	-	41	20.9	3	1.5
Tinea pedis	1	1	1	1	3	-	1	1	2	-	1	-	1	-	10	5.1	3	1.5
Tinea manuum	1	-	3	-	2	1	4	3	-	-	-	-	-	-	10	5.1	4	2.0
Tinea unguium	-	1	1	2	2	1	2	-	1	1	2	-	-	-	8	4.1	5	2.5
Tinea manuum + corporis	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	0.5	-	-
Tinea barbae	-	-	1	-	1	-	3	-	2	0	1	-	-	-	8	4.1	-	-
Tinea corporis + cruris	-	-	-	-	6	-	1	-	1	1	1	-	-	-	9	4.6	1	0.5
Tinea versicolor	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	2	1.0
Total percentage	11	15	22	10	45	6	26	11	23	5	16	1	5	-	148	75.5	48	24.5
	5.6	7.6	11.2	5.1	22.9	3.1	13.2	5.6	11.7	2.5	8.1	0.5	2.5	-				

M = Male, F = female, percentage = %.

Table 3. Types of clinical infection and professional background of the patients.

Occupation	Tinea corporis	Tinea capitis	Tinea cruris	Tinea pedis	Tinea manuum	Tinea unguium	Tinea manuum + corporis	Tinea barbae	Tinea corporis + cruris	Tinea versicolor	Total	
											No.	Percentage
Students	13	21	12	4	4	2	-	1	1	1	59	30.1
Employees (clerk, technicians and peons)	23	-	13	3	4	4	1	5	7	-	60	30.6
Housewives	10	1	1	2	4	3	-	-	1	1	23	11.7
Businessmen	10	-	8	1	-	1	-	1	-	-	21	10.7
Farmers	4	-	3	3	2	2	-	1	1	-	16	8.2
Miscellaneous	8	-	6	-	-	-	-	-	-	-	14	7.1
Teachers	1	-	1	-	-	1	-	-	-	-	3	1.5
Total	69	22	44	13	14	13	1	8	10	2	196	100
Percentage	35.2	11.2	22.4	6.6	7.1	6.6	0.5	4.1	5.1	1.0	100	100

(2012) carried out a survey of dermatophytosis in Sitapura and Sanganer area, Jaipur. *Tinea corporis* was found to be the most common infection type followed by *tinea cruris* and *tinea capitis*.

During the present investigation, *T. verrucosum*, *T. ferrugineum*, *T. concentricum*, *T. megninii*, *M. canis*, *M. audouinii*, *M. fulvum* were reported for the first time in Jaipur district, Rajasthan. *T. verrucosum* is a zoophilic strain, usually isolated from animal. Rajpal et al. (2005) reported *T. verrucosum* from a 25 year old female. This zoophilic fungal infection occurs through occupational exposure to animal.

Other related keratinophilic fungi like *Scopulariopsis* sp., *Paecilomyces* sp., *Curvularia* sp. are also reported for the first time from human beings in Rajasthan.

In the present work, *tinea corporis* is the most common clinical type and the next most common is *tinea cruris*. Sharma et al. (1983) reported 34.48% incidence of *tinea corporis*, followed by 31.37% *tinea cruris* and 17.58% *tinea capitis*. *T. rubrum* (49%) was most common etiological agent followed by *T. mentagrophytes* (31.3%). Patwardhan and Dave (1999) studied 175 cases of dermatophytoses in and around Aurangabad. *Tinea corporis* (24.57%) was found to be most common clinical type followed by *tinea cruris* (22.28%). *Trichophyton rubrum* was most common etiological agent. Similar reports were given by various workers (Rajpal et al., 2005; Patwardhan and Dave, 1996). The higher rate of the prevalence of *tinea corporis* could be attributed to the fact that certain body parts are exposed more frequently than others like the hands and once it gets in contact with other body parts, it helps in the spread of the infection.

Once the disease is established, it can be transmitted to any person who comes in contact with the patient through his/her belongings like clothes, towel, soap, etc. Family members who are more frequently in touch with the patient have a greater chance to contract the disease. In the present survey, it was recorded that some time, two or more members of the same family acquire *tinea corporis*, *tinea cruris* and *tinea capitis* infections.

During the present investigation, *tinea* infections are more frequently observed in the age group of 21-30 (26.0%), followed by 31-40 (18.8%). Sharma et al. (1983) had observed a majority of *tinea* infections in the age group of 21-30 year in Jaipur during 1980-81. According to Gokhale et al. (1999), the most commonly affected age group was 21-40 year (60.3%) in Pune. Same report was also given by Sen and Rasul (2006) during the study of dermatophytosis in Assam. During clinicomycological study of dermatophytoses in Bijapur, Karnataka. Peerapur et al. (2004) reported higher incidence in 21-30 years age group. Males were more frequently infected as compared to females. The higher incidence in young males could be due to greater physical activity and increased sweating.

The incidence of ringworm infections is found to be

higher in males (75.5%) as compared to females (24.5%). This fact agrees with the reports and observations of Sharma et al. (1983). Karmakar et al. (1995) studied 250 cases of dermatophytes in a desert district of western Rajasthan. Incidence of dermatophytes was found to be 8.60% with *tinea cruris* 34.4% as the major clinical type followed by *tinea corporis* 24%. Male preponderance was observed (M : F = 2:1).

In the present study, the male prevalence is higher in all *tinea* infections except in the case of *tinea capitis* where the number of female patients (14) is higher than males (8). Kumar et al. (1996) studied 72 patients of *tinea capitis* between 1992 and 1994. The majority of the patients were children (94%), boys and girls being equal. This may be due to the lifestyle. Girls have longer and thicker hair than boys and usually wash it twice a week or on alternate days. In summer, due to sweat, the moisture in the hair also increases which provides a platform for the growth of dermatophytes. This is the reason of higher incidence of *tinea capitis* in females in this age group. Sentamilselvi et al. (2004) observed *tinea* infection three times more frequently in male than female patients. Bhavsar et al. (2012) reported that males are infected more than females with a ratio of 2.14:1 during studies of superficial mycoses with clinical mycological profile in tertiary care hospital in Ahmedabad, Gujarat.

The lesser incidence of *tinea* infection in females may be due to: (i) social restrictions and personal inhibitions on the part of females which prevents them from reporting to hospitals and (ii) confinement of the majority of females to their house thereby minimising the chance of their coming into contact with infected persons outside the confines of their homes.

The reason for a high infection among employees could be public interaction, travelling, frequent handling of business articles or files and papers, which move from place to place, and hand to hand.

The above study clearly reveals the fact that person who have more responsibilities and outdoor activities are more prone to such infections, further, persons leading more of an indoor life or with lesser mobility or living away from thickly populated areas have lesser chances of getting such infections. Personal hygiene together with individual susceptibility to infection are also important factors for the incidence of these infections.

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