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Clinico-mycological profiles of dermatophytosis in Jaipur, India

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Dermatophytosis poses a serious crisis to the socio-economically backward population. The infections are caused by three anamorphic genera; *Epidermophyton, Trichophyton* and *Microsporum* which are distributed around the world. The objective of this study was to find out the occurrence, distribution and prevalence of dermatophytes causing human dermatomycosis in various categories of patients in Jaipur (Rajasthan), India. One hundred samples were collected, including infected skin and nails from Dermatology Department, Sawai Maan Singh Hospital, Jaipur for a period of June 2014 to January 2015. Before sample collection, the infected area was cleaned with 70% ethyl alcohol. Skin samples were collected with the help of sterilized scalpel and nail samples by clipping. Identification of causative pathogens was done by performing lacto-phenol cotton blue mount. Out of 100 samples, 79 were found positive by KOH examination and out of them 53 confirmed by culture. In the present study, *Trichophyton rubrum* (20.7%) was the predominant pathogen followed by *Trichophyton mentagrophytes* (16.9%) and *Trichophyton interdigitale* (13.2%). Tinea corporis was the most common clinical type reported in all age groups. The second most common clinical type was Tinea cruris. These infections were observed more frequently in the age group of 21 to 30 (55%) followed by 31 to 40 (24%).

Key words: Dermatophytosis, Tinea corporis, *Trichophyton, Microsporum, Epidermophyton*.

INTRODUCTION

Dermatophytosis constitutes an important public health problem, not only in developing countries, but also in immuno-compromised patients worldwide (Walsh and Groll, 1999; Ghannoum et al., 2003; Carrillo-Munoz et al., 2008). Dermatophytosis is superficial infection of keratinised tissue caused by an organism of three genera of fungi known as Dermato-Phyton (Bhadauria et al., 2001). The etiological agents of the dermatophytosis can be categorized into one of the three genera: *Microsporum, Epidermophyton* and *Trichophyton* (Ghannoum and Isham, 2009). They possess keratinophilic and keratinolytic properties (Simpanya, 2000).

The typical infections of dermatophytes are generally referred to as ringworm infections due to their ringlike outer shell. These infections are also recognized as 'Tinea infections' and are named according to the location of the lesions on the body e.g. Tinea cruris refers to ringworm infection of the groin area. Since these

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infections are frequently confused with additional skin disorders, it is, therefore, necessary to make an early laboratory diagnosis for better management of these conditions (Bhatia and Sharma, 2014; Huda et al., 1995). The warm and humid climate of India makes dermatophytosis a very common superficial fungal infection of skin (Niranjan et al., 2012).

Dermatophytes typically do not affect the mucous membranes, but slightly affect the keratinized tissues and extend by direct contact from infected human beings (anthropophilic organisms), soil (geophilic organisms) and animals (zoophilic organisms) by the indirect way from fomites. Although, the clinical symptoms of dermatophytosis may differ depending on the affected part of the body, itching is the most frequent symptom in humans (Nweze, 2010).

The lifestyle in societies, contact with animals and prolonged use of antibiotics, antineoplastic and corticosteroids drugs are some of the factors that contribute to the increase in the risk of infection by fungi, especially by dermatophytes (Rippon, 1985). Dermatophytosis, considered as zoonosis, have created more public health concerns due to close contact between humans and animals such as dogs, birds, cats, and small rodents or pocket pets. The clinical symptoms may not create a serious threat, but effective treatment is usually time-consuming and costly (Javed, 2015). The dermatomycosis takes place by contact of soil-to-human, animal-to-human and human-to-human spread. Recently, we frequently examine patients with widespread dermatomycosis on groin area and glabrous skin, on hands, on face, on the scalp and on foot.

The major objective of the study was to discover the prevalence, distribution and prevalence of dermatophytes causing human dermatomycosis in various categories of patients in Jaipur (Rajasthan), India.

MATERIALS AND METHODS

In the present study, sample collection was conducted for a period of 8 months from June 2014 to January 2015. The skin scrapings, nail clippings were collected from Dermatology Department, Sawai Man Singh Hospital in Jaipur district. A detailed clinical history was elicited from all the patients as per the performa. The following additional points were also recorded: name, gender, age of patient, body part involved, the presence of inflammatory margin, symptoms, duration of illness.

Sample collection

A total 100 skin scrapings and nails were collected. However, a proper explanation of the study was addressed to the patients and the consent was taken from them before collection of the sample. The first step of the sample collection was cleaned of the infected area with 70% ethyl alcohol and ensured that it was totally dry. The skin sample was scraped with the help of a sterilized scalpel from a peripheral area of the lesion and nail sample by clipping. Sample materials were transported in dry, strong black paper folded in the manner of an herbarium packet, and transferred to the laboratory as soon as possible for direct microscopic examination and culturing (Weitzman and Summerbell, 1995; Kane and Summerbell, 1997).

KOH mount

The skin scrapings were treated with an aqueous solution of 10% potassium hydroxide (KOH) and 20% for nail clipping and gently heat, examined after 5 min under the microscope for the presence of fungal hyphae (Rebell and Taplin, 1970). Heat may help to increase the lytic activity of KOH (Behzadi and Behzadi, 2003; Hainer, 2003; Webster and Weber, 2007; Deacon, 2009; Garg et al., 2009; Behzadi and Behzadi, 2012; Moriarty et al., 2012).

Culture and maintenance

Skin scrapings were inoculated on Sabouraud's dextrose agar with Chloramphenicol and Cycloheximide (Himedia) by slant method. The inoculated slants were placed in a mycological incubator at 26 ± 2°C for 14 to 21 days. After the isolation, dermatophytic fungi were again subcultures on SDA slants for purifications. The purified dermatophytic fungi were maintained and preserved at 4°C for further future analysis. Isolates of dermatophytes were identified by examining macroscopic and microscopic characteristics of their colony. Rate of growth, texture, topography, and pigmentation of the front and the reverse side of the culture were employed for the macroscopic identification.

Microscopic identification of dermatophytes

Isolates were examined microscopically by removing a portion of aerial mycelium with an inoculating needle. The material was placed on a glass slide in a drop of Lacto phenol cotton blue and the matted mycelium was gently removed by coverslip. A cover-slip was then placed on the side and excess of stain removed with blotting paper. The morphology was then observed under microscope. The identification was based on features such as the organization of hyphae (spiral, pencil shaped, pyriform, septations, etc.), microconidia and macroconidia (drop like, tear shaped, in bunches, spherical, abundance or rare, etc.) (Bhatia and Sharma, 2014).

RESULTS

In the present study, out of 100 samples, 79 (79%) were KOH positive and out of them 53 (67%) cultures positive.

The data presented in Table 1 shows the occurrence of various clinical types and etiological agents of ringworm infections. *Trichophyton rubrum* was the major etiological agent reported from 11 cases (20.7%). It was isolated from Tinea corporis and T. cruris clinical types. The second etiological agent *Trichophyton mentagrophytes* (16.9%) followed by *Trichophyton interdigitale* (13.2%),

Table 1. Distribution of fungal isolates from different cases.

S/N	Clinical types	Tinea corporis	Tinea cruris	Tinea corporis + cruris	Tinea pedis	Tinea manuum	Tinea faciei	*Onychomycosis*	Tinea capitis	Tinea barbae	Total Cases	%
1	No. of cases examined	42	38	8	4	3	1	1	2	1	100	-
2	No. of cases positive by microscopy	30	32	8	2	3	1	1	1	1	79	79
3	No. of cases positive by cultures	20	20	6	2	1	1	1	1	1	53	53
4	No. of cases negative by microscopy	12	6	0	2	0	0	0	1	0	21	21
	Species isolated											
a	*T. rubrum* (11)	5	6	-	-	-	-	-	-	-	11	20.7
b	*T.mentagrophytes* (9)	1	7	1	-	-	-	-	-	-	9	16.9
c	*T. interdigitale* (7)	3	3	-	1	-	-	-	-	-	7	13.2
d	*T.verrucosum* (5)	1	2	2	-	-	-	-	-	-	5	9.4
e	*M.gypseum* (3)	-	2	1	-	-	-	-	-	-	3	5.6
f	*T. equinum* (2)	-	-	-	-	-	-	1	1	-	2	3.7
g	*T. erinacei* (2)	-	-	-	-	1	1	-	-	-	2	3.7
h	*M.nannum* (2)	2	-	-	-	-	-	-	-	-	2	3.7
i	*T. terrestre* (1)	1	-	-	-	-	-	-	-	-	1	1.8
	Other associated fungi											
j	*Emericiella* (4)	2	-	1	1	-	-	-	-	-	4	7.5
k	*Histoplasma capsulatum* (1)	-	-	-	-	-	-	-	-	1	1	1.8
l	*Chrysosporium indicum* (1)	1	-	-	-	-	-	-	-	-	1	1.8
m	*Chrysosporium queenslandicum* (1)	1	-	-	-	-	-	-	-	-	1	1.8
n	*Fusarium oxysporum*(1)	1	-	-	-	-	-	-	-	-	1	1.8
o	*Fusarium equiseti* (1)	1	-	-	-	-	-	-	-	-	1	1.8
p	*Fusarium solani* (1)	1	-	-	-	-	-	-	-	-	1	1.8
q	*Aspergillus niger* (1)	-	-	1	-	-	-	-	-	-	1	1.8
	Total No.	20	20	6	2	1	1	1	1	1	53	100
	Percentage (%)	37.7	37.7	11.3	3.7	1.8	1.8	1.8	1.8	1.8	100	

Trichophyton verrucosum (9.4%), *Microsporum gypseum* (5.6%), *Trichophyton equinum* (3.7%), *Trichophyton erinacei* (3.7%), *Microsporum nanum* (3.7%), and *Trichophyton terrestre* (1.8%).

Some associated fungi were also isolated and Identified from *Tinea* patients such as *Emericiella, Histoplasma capsulatum, Chrysosporium indicum, Chrysosporium queenslandicum, Fusarium oxysporum, Fusarium equiseti, Fusarium solani* and *Aspergillus niger*.

In the present study, T. corporis was found to be the most common disease 42:100%. T. cruris was

Table 2. Clinical analysis of superficial mycoses in various age groups.

Clinical type	11-20 years	21-30 years	31-40 years	41-50 years	Total
Tinea cruris	4	22	8	4	38
Tinea corporis	4	22	12	4	42
Tinea cruris+corporis	0	5	3	0	8
Tinea pedis	0	2	1	1	4
Tinea faciei	0	0	0	1	1
Tinea manuum	0	2	0	1	3
Onychomycosis	0	0	0	1	01
Tinea capitis	1	1	0	0	02
Tinea barbae	0	1	0	0	1
Total	9	55	24	12	100

Table 3. Skin scrapings collected from various types of *Tinea* infection from SMS Hospital.

Types of employment	Tinea corporis	Tinea cruris	Tinea corporis +cruris	Tinea pedis	Tinea faciei	Tinea manuum	Tinea capitis	*Onychomycosis*	Tinea barbae	Total
Labour class	9	12	2	2	-	1	-	-	-	26
Private employee	12	10	1	-	-	1	-	-	1	25
Student	11	10	1	1	-	-	1	-	-	24
Self employed	6	5	1	-	-	-	-	-	-	12
Farmer	4	1	2	1	1	1	-	1	-	11
Business class	-	-	1	-	-	-	1	-	-	02
Total	42	38	08	04	01	03	02	01	01	100

the second clinical type reported in 38:100%, followed by Tinea corporis + T. cruris 8:100%, Tinea pedis 4:100%, Tinea manuum 3:100%, Tinea capitis 2:100%, Tinea faciei 1:100%, Tinea *barbae* 1:100% and *onychomycosis* 1:100% (Table1).

Table 2 represents that Tinea infection was the most common in the age group of 21 to 30 years followed by 31 to 40, 41 to 50 and 11 to 20 years. T. corporis was the most common clinical type of infection in age group of 21 to 30 and 31 to 40 years.

Table 3 represents the prevalence of various clinical types of ringworm infection in different categories. In all clinical types of Tinea infection, patients were commonly reported from the labour class as they work in unhygienic environment and poor socioeconomic background compared to other patients. On the other hand, T. corporis was common in private employee (12%) followed by student patients (11%).

DISCUSSION

The occurrence of dermatophytosis has increased globally in recent years, especially in immunocom-

promised patients (Borman et al., 2007). Few studies have investigated the etiology of superficial fungal infections in the developing world, and accordingly, there is less knowledge of any changes to their epidemiology (Saunte et al., 2008; Hasan et al., 2011).

The present study highlights the prevalence of different dermatophytic species concerned in different Tinea infections in Jaipur. The common occurrence of this species in Jaipur may be due to hot and dry climate in summer. The temperature exceeds 46°C with high humidity during the monsoon season (rainy season) which is the favorable condition for the occurrence of superficial mycoses. Various studies have been conducted to discover the occurence of dermatophytosis in different parts of the country including 65% in Chandigarh (Chakrabarti et al., 1992), 70.5% in West Bengal (Grover and Roy, 2003), 52.78% in Gujarat (Bhavsar et al., 2012), 78.9% in Chennai (Venkatesan et al., 2007), 61.56% in Andhra Pradesh (Maruthi et al., 2012), 85.5% in Madhya Pradesh (Pandey and Pandey, 2013), 36.6% in Himachal Pradesh (Bhatia and Sharma, 2014), 86% in Uttar Pradesh (Kumar et al., 2014), 78.53% in Karnataka (Reddy et al., 2012), 81.36% in Rajasthan (Jain et al., 2014), 57.89% in Manipur (Singh et al., 2015) and few other states.

In the present study, *Trichophyton rubrum* (20.7%) was the most prevalent dermatophytic species in jaipur. Bhadauria et al. (2001) reported 34% occurrence of *T. rubrum* in Jaipur area during 1999 to 2001. Jain et al. (2014) reported *T. rubrum* (32.1%) was the most major dermatophytic species in Jaipur. The second most common etiological agent of dermatophytosis was *Trichophyton mentagrophytes* (16.9%). This result correlated with the results of Jain et al. (2014). They reported 14.3% occurrence of *T. mentagrophytes* in their study. Kumar et al. (2014) also reported *T. mentagrophytes* (17.9%) was the second etiological cause of dermatophytosis in his research work.

In the present study, the maximum occurrence of Tinea infection was observed in 21 to 30 years age group followed by 31 to 40 year age group. The earlier researchers reported the maximum occurrence of dermatophytosis in 21 to 30 age group (Patwardhan et al., 1999; Jain et al., 2014; Goyal et al., 2015).

In the present study, T. corporis (42%) was the most common clinical type followed by T. cruris. Bhadauria et al. (2001) reported 60% prevalence of T. corporis. Jain et al. (2014) also reported most common prevalence of T. corporis followed by T. cruris in his study. The second clinical type of dermatophytosis in the present study was T. cruris (38%). In the earlier report by Patwardhan et al. (1999), T. cruris was the second most common clinical type in his study. Venkatesan et al. (2007) and Jain et al. (2014) reported that T. cruris was the second common clinical type of dermatophytosis. *T. rubrum* was the most common etiological agent in T. corporis and T. cruris followed by *T. mentagrophytes*.

Conclusion

The present research concluded that the climatic conditions of Jaipur are favourable for dermatophytosis in the population. The present research work also highlights that T. corporis was the major clinical type infection followed by T. cruris. *T. rubrum* was the predominant species followed by *T. mentagrophytes* and *Trichophyton interdigitale.* Unhygienic conditions with poor socio-economic class, frequent migration of laborers, workers, regular visits of tourists in Jaipur district of Rajasthan may be some of the contributing epidermiological factors.

Conflict of interest

The authors have not declared any conflict of interest.

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