Dermatophytoses; epidemiology and distribution among urban and sub urban population

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Abstract

Background: Superficial mycoses or superficial cutaneous fungal infections are the most common mycotic infections worldwide, which involve outermost covering of skin and its appendages like hair and nail. The patients invariably try to neglect such type of infections and seek medical attention usually for cosmetic reasons and not because of discomfort. At least 10% of world's population has dermatophyte infection. Dermatophytes are by far the most significant cutaneous fungi because of their widespread involvement of population and their worldwide prevalence.

The dermatophytes are a group of closely related keratinophillic fungi that invade keratinised tissues-skin, hair and nails of humans and animals to produce an infection called as dermatophytoses or ring worm. Dermatophytes colonise superficial dead or desquamating layers of skin and its appendages. Superficial mycoses have become a significant health problem affecting children, adolescents and adults in developing countries. The present study was planned to characterise the different dermatophytes, non dermatophytes, budding yeast like fungi and other fungi in various types of superficial mycoses cases and there distribution in urban and sub urban population. Specimens like skin, hairs and nail were collected and subjected to KOH wet mount preparation and culture on SDA further identification was done by LCB mount and slide culture technique. Out of 400 patients attending dermatology OPD various superficial fungal infection Specimens were collected and dermatophyte sps. were identified. ***T. tonsurans*** was the most common isolated spp from T.capitis. ***T. mentagrophytes*** was the most commonly isolated spp. from T.corporis. ***Candida sps.*** was isolated from T. cruris. **NDM** were isolated from T. pedis. From cases of T. unguium.

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Introduction

The dermatophytes are a group of closely related keratinophillic fungi that invade keratinised tissues-skin, hair and nails of humans and animals to produce an infection called as dermatophytoses or ring worm.

[1]At least 10% of world's population has dermatophyte infection. [2]Superficial mycoses or superficial cutaneous fungal infections are the most common mycotic infections worldwide, which involve outermost covering of skin and its appendages like hair and nail. The patients invariably try to neglect such type of infections and seek medical attention usually for cosmetic reasons and not because of discomfort. Dermatophytes are a group of morphologically and physiologically allied molds which have the hazard at the global plane as these are generally causative agent of fungal infections.

Microsporum and *Trichophyton* are human and animal pathogens. *Epidermophyton* is a human pathogen. Anthropophilic species are responsible for the majority of human infections. The dermatophytes are a group of closely related fungi that have the capacity to invade keratinized tissue (skin, hair and nails) of humans.[3] The dermatophytes are "among the commonest infectious agents of man". A dermatophytosis is a mycotic infection of the hair, skin or nails On the basis of clinical, morphologic & microscopic characteristics three anamorphic genera are recognized as Dermatophytes. *Epidermophyton Microsporum & Trichophyton.*

Dermatophytes are by far the most significant cutaneous fungi because of their widespread involvement of population and their worldwide prevalence. Non dermatophytic dermatomycoses and onychomycoses are likewise important groups of infection caused by fungi which were previously thought to be quite insignificant.

Dermatophytes colonise superficial dead or desquamating layers of skin and its appendages. The cutaneous tissue is exposed to the action of fungal metabolic products that are irritating and local inflammatory reactions are set up. Dermatophytic fungi are common and important causes of human morbidity but generally do not produce life threatening infections.

Superficial mycoses are defined as development of fungal growth on epithelial tissues e.g. skin, hair or nails without noticeable invasion of the living tissue. Superficial mycoses are of two types-**surface infections** where fungi live exclusively on dead layers of skin and its appendages and **cutaneous** & **sub cutaneous** infections.

Routes of infection are believed to include direct contact with other human beings, an animal or soil that is already infected as well as spread by means of mats

in gymnasiums, floor coverings, dirty clothing, shelves, public baths and jointly used footwear carrying scales or hair contaminated with dermatophytes.

Transmission and development of dermatophytic infections is influenced by a variety of factors including host preference, host susceptibility, natural habitat of fungus, virulence of pathogens, host nutritional status and anatomic location of the fungus.[4] A part from the clinical symptoms superficial fungal infections can cause debilitating effects on a person's quality of life. Although rarely life threatening they may in some circumstances spread to other individuals or become invasive.

Surveillance of fungal infections is important to define their burden and trends to provide the infrastructure needed to perform various epidemiological and laboratory studies and to evaluate interventions. Surveillance systems require following basic elements-a clear case definition, a defined population, mechanisms for reporting, analysis and disseminating the data and incentives to conduct surveillance. For fungal diseases, each one of these elements presents distinct challenges.

Superficial mycoses have become a significant health problem affecting children, adolescents and adults in developing countries.

The prevelance of various types of fungal infections varies according to geographical distribution of various fungi and their natural habitat on one hand and a number of host factors on other. Hot and humid weather conditions in tropical countries like India makes humans more susceptible to fungal infections.

The spectrum of infection varies from one geographical area to other. There are studies from various regions of India particularly **South India, Assam** and **Gujarat** that have shown occurrence of specific type of dermatophytes in immunocompetent host. However there are very few studies about superficial mycoses from **Uttar Pradesh**. A precise knowledge of the prevelance of the various types of superficial mycoses and dermatophytoses will be essentially helpful in prescribing empirical antifungal therapy and will also help understand the epidemiological aspect of disease.

Hence the present study was planned to characterise the different dermatophytes, non dermatophytes, budding yeast like fungi another fungi in various types of superficial mycoses cases.

Material and Method

The study was conducted in the Department of Microbiology, Era's Lucknow Medical College and Hospital, Lucknow, after obtaining approval from the Ethical Committee of this institution. Clinically suspected cases of superficial mycoses amongst individuals belonging to various age groups attending outpatient Department of Dermatology & Venereal Diseases of Era's Lucknow Medical College (including patients from Urban and Rural health centers of this College) during December 2014-November 2015 were subjected to clinico mycological workup. Patients attending the skin OPD were explained about the study and asked to participate. 400 suspected patients were included in the study, after taking written informed consent from them. All patients suspected of fungal infection on the basis of clinical presentation were enrolled Patients taking antifungal therapy were excluded.

Demographic data of patients like age, sex, occupation, socioeconomic status, monthly income, personal habits were recorded on a proforma. Information collected also included clinical presentation, specific risk factors, if any, present for superficial mycoses, microscopic examination report, fungal culture examination report, identification of organism genus and species for positive culture. Data was collected and analyzed statistically with chi-square test and p values were determined at the end of study.

Skin, hair or nail specimens were collected. Scrapings were collected from the border of skin lesions with a sterile scalpel blade. Basal root portion of hair was taken by plucking, scraping scales and excavating hair for direct examination and culture.

The nails were clipped short with the nail clippers and debris was discarded. Scrapping was collected (a) from nail bed (b) from the underside of nail plate (if nail plate is affected). Skin scraping, hairs stubs and nails were examined by direct microscopy and culture, by preparing KOH wet mount and culture on Sabourauds Dextrose Agar with actidione. Species identification was done by slide culture technique.

Results

Table 1

Month/year	No. of Specimen n (%)
Dec-08	15 (3.75)
Jan-09	25 (6.25)
Feb-09	25 (6.25)
Mar-09	30 (7.5)
Apr-09	35 (8.75)
May-09	45 (11.25)
Jun-09	49 (12.25)
Jul-09	61 (15.25)
Aug-09	65 (16.25)
Sep-09	30 (7.5)
Oct-09	23 (5.75)
Nov-09	17 (4.25)
Total	400 (100)

The maximum number of cases 65 (16.25%) were enrolled in the month of Aug, followed by 61 (15.25%) in July, 49 (12.25%) in June. The least no. of cases were enrolled in the month of Dec. (3.75%). Only 77 (19.25%) cases were enrolled from Nov. to Feb. From March to September maximum number of samples 315 (78.5%) were enrolled.

Table 2: Distribution of cases according to age group

Age (years)	Cases	T. capitis		T. corporis		T. pedis		T. manuum		T. unguium		T. faciei		T.cruis		T.ped. + T.ung.		T.ung.+ T.man.		T.cap.+ T.cor.		PV		Male	Female	M: F
	n=	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	n (%)	n (%)	Ratio
0-10	60 (15%)	24	20	6	4	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	2	0	0	32 (8%)	28 (7%)	1.1:1
11-20	71 (17.75%)	6	10	10	8	0	0	0	2	6	4	2	2	2	0	2	0	4	0	2	0	7	4	55 (13.7%)	16 (4%)	3.4:1
21-30	97 (24.25%)	10	10	16	4	2	2	4	2	8	4	6	0	6	0	4	0	2	0	4	0	8	5	75 (18.75%)	22 (5.5%)	3.4:1
31-40	57 (14.25%)	4	4	8	0	8	0	2	0	8	4	0	2	2	2	2	0	2	0	2	0	5	2	45 (11.25%)	12 (3%)	3.75:1
41-50	46 (11.5%)	6	4	6	4	4	0	2	0	6	2	0	2	0	0	0	0	4	0	0	0	4	2	32 (8%)	14 (3.5%)	2.3:1
51-60	37 (9.25%)	0	2	4	2	2	2	4	2	4	4	4	0	0	0	0	0	3	0	0	0	3	1	24 (6%)	13 (3.25%)	1.8:1
61-70	22 (5.5%)	0	0	2	4	0	2	0	2	4	2	0	0	0	0	2	0	1	0	2	0	1	0	12 (3%)	10 (2.5%)	1.2:1
71-80	10 (2.5%)	0	0	2	0	2	0	0	0	4	0	0	0	0	0	2	0	0	0	0	0	0	0	10 (2.5%)	0 (0%)	10:0
Total	n=400	50	50	54	26	18	6	12	8	40	20	12	8	10	2	12	0	16	0	12	2	28	14	400		
	100%	100		80		24		20		60		20		12		12		16		14		42		100%		

Relationship of age groups and different clinical types of Tinea. T.capitis was most common in 0-10 yrs (11%), T.corporis was most common in 21-30 yrs age (5%), T.pedis was most common in 31-40yrs age (2%), T. manuum was most common in 21-30 and 51-60yrs age (1.5%), T. unguium was most common in 21-40yrs age (3%), T. faciei and T.cruris was most common in 21-30 yrs age (1.5%), T. pedis + T. unguium, T. capitis + T. corporis was most common in 21-30 yrs age (1%), T. manuum + T. unguium was most common in 11-20 yrs and 41-50 yrs age (1%). PV was most common in 21-30 yrs age.(3.25%).

Table 3: Disease Distribution according to sex

Clinical presentation	No. of cases (%)	Male	Female	Male/ Female Ratio
T.capitis	100(25)	50(12.5%)	50(12.5%)	1:1
T.corporis	80(20)	54(13.5%)	26(6.5%)	2:1
T unguium	60(15)	40(10%)	20(5%)	2:1
T.pedis	24(6)	18(4.5%)	6(1.5%)	3:1
T.manuum	20(5)	12(3%)	8(2%)	1.5:1
T.faciei	20(5)	12(3%)	8(2%)	1.5:1
T. cruris	12(3)	10(2.5%)	2(0.5%)	5:1
T.manuum+unguium	16(4)	16(4%)	0(0%)	16:0
T.capitis+corporis	14(3.5)	12(3%)	2(0.5%)	6:1
T.pedis+unguium	1 2(3)	12(3%)	0(0%)	12:0
P.versicolor	42(10.5)	28(7%)	14(3.5%)	2:1
Total	400(100)	264(66%)	136(34%)	1.94:1

Table 3 & Fig. 3 show relationship of age groups and different clinical types of Tinea. T.capitis was most common in 0-10 yrs (11%), T.corporis was most common in 21-30 yrs age (5%).

Table 4: KOH positivity and culture corelation

	Culture Done		Culture not done for PV Cases
	Culture positive	Culture negative	
KOH Positive – 326 (81.5%)	240 (60.0%)	44(11%)	42 (10.5%)
KOH Negative – 74 (18.5%)	52 (13%)	22 (5.5%)	-
Total – 400	292 (73%)	66 (16.5%)	42 (10.5%)

Of the total 400, cases 326 (81.5%) were KOH positive and 74 cases (18.5%) were negative for fungal elements. However, 292 (73%) cases were culture positive and 66 (16.5%) were culture negative for fungal elements. 22 (5.5%) cases were negative for fungal elements both by direct microscopy and culture.

Table 5: Prevalence of Fungal isolates from different clinical presentation

Fungal isolates	T. capitis	T. corporis	T. unguium	T. manuum	T. pedis	T. cruris	T. faciei	T. pedis+ T. Unguium	T. manuum + T. unguium	T. capitis+ T. corporis	Total	%
T. mentagrophytes	11	18	6	4	4	2	2	3	2	4	56	19.17
T. tonsurans	24	10	6	2	2	0	4	0	0	2	50	17.12
T. rubrum	4	2	2	0	0	0	0	0	0	1	9	3.08
T. soudanense	7	2	0	0	4	0	0	2	2	0	17	5.82
T. schoenleinii	4	9	2	0	2	0	0	2	5	0	24	8.21
T. verrucosum	10	5	10	2	4	2	0	0	0	0	33	11.3
M. ferrugineum	11	3	0	1	0	0	2	2	2	2	23	7.87
M. audouinii	8	8	0	0	0	0	0	0	0	0	16	5.47
E. floccosum	0	4	3	1	0	0	0	0	0	1	9	3.08
C. albicans	1	2	4	4	1	1	3	0	0	0	16	5.47
C. non albicans	1	3	0	4	0	3	4	0	0	0	15	5.13
Non dermatophytes	0	0	12	2	5	0	0	3	2	0	24	8.21

Total	81	66	45	20	22	8	15	12	14	10	292	100

Table 6: Comparison of Fungal Isolates among Suburban and Rural Cases

Fungal Isolates	Total cases n (%)	Residence		
		Sub urban n (%)	Rural n (%)	p value (<0.05)*
T.mentagrophytes*	56 (19.2)	37 (12.7)	19 (6.5)	0.012
T.tonsurans **	50 (17.1)	43 (14.7)	7 (2.4)	0..001
T.verrucosum **	33 (11.3)	24 (8.2)	9 (3.1)	0.009
Tschoenleinii	24 (8.2))	16 (5.5)	7 (2.4)	0.094
M.ferrugineum	23 (7.9)	13 (4.5)	11 (3.8)	0.298
T.soudanense*	17 (5.8)	12 (4.1)	5 (1.7)	0.035
M.audouinii	16 (5.5)	13 (4.5)	3 (1.0)	0.058
T.rubrum*	9 (3.1)	1 (0.3)	8 (2.7)	0.017
E.floccosum	9 (3.1)	6 (2.1)	3 (1.0)	0.328
NDM	24 (8.2)	10 (3.4)	14 (4.8)	0.131
Candida sps.	31 (10.6)	19 (6.5)	12 (4.1)	0.234
Total	292 (100)	194	98	

Discussion

This study was conducted to evaluate distribution of various dermatophytes among suburban population at Lucknow. The spectrum of various fungi causing superficial mycosis has not been recently documented from our region and treatment is empirical. Therefore, the present study was undertaken to describe the prevailing spectrum and frequency of various fungal isolates causing dermatophytosis along with their distribution among suburban population.

Out of these 400 patients, 316 (79%) were found to be dermatophytoses, 42 (10.5%) Pityriasis versicolor and 42 (10.5%) superficial candidiasis.

In our study most of the patients belonged to the age group of 21-30 yrs (24.25%), followed by 11-20 yrs (17.75%) and 0-10 yrs (15%). Least common age group involved was 71-80 yrs (2.5%). Other age groups involved were 31-40 yrs (14.25%), 41-50 yrs (11.5%), 51-60 yrs (9.25%), 61-70 yrs (5.5%).

Maximum number of females belonged to 0-10 yrs (7%) followed by 21-30 yrs age group (5.5%). In 11-20 yrs age group females were 4%, in 31-40 yrs age 3%, in 41-50 yrs age 3.5%, in 51-60 yrs 3.25%, in 61-70 yrs age 2.5%. No female of 71-80yrs age was involved. The minimum age involved in our study was a female of 3 months age and the maximum age was a male of 79 yrs.

Dermatophytic infections are most common in adults aged 16-45 yrs.[5] The post pubertal changes in hormones resulting in acidic secretions from sebaceous glands are responsible for the decrease in incidence with age.

In T. capitis male: female ratio was 1:1. In other clinical presentations, males predominated. In the present study T. capitis (25%) was the most common clinical presentation followed by T. corporis (20%), T. unguium (15%), T. pedis (6%), T. faciei (5%), T. manuum (5%), T. cruris (3%), T.pedis+T. unguium (3%), T.manuum +T. unguium (4%), T. capitis + T. corporis (3.5%). PityriasisVersicolor was seen in 10.5% of cases. Only few studies from India and abroad have shown T. capitis as the most common presentation.[6,7]

T. capitis was the most common clinical presentation (25%) in our patients. The male: female ratio was equal (1:1). This clinical presentation was most common in the age group of 0-10 years followed by 21-30 years. It was not seen in 61-80 years.

Prevalence of T.capitis as a clinical syndrome is uniformly high in Africa (10-30%) in primary schools.[8] Protein deficiency, malnutrition along with vitamin A deficiency have been seen to be associated as a predisposing factor to develop infection[9]. Mustard oil which is used in North and North East India for hair dressing was found to have an inhibitory effect on fungi in T. capitis but coconut oil has no such effect.[10]

The next most common clinical presentation was T. corporis. Males outnumbered females. T.corporis on or below the waist line is commonly seen in Indian women due to typical Indian costume i.e. sari and salwaar-kameez.[11] In this study T.corporis had a prevalence of 20%. 13.5% were males, 6.5% were females. Male: Female ratio was 2:1. It was more common in the 21-30 yrs age group, followed by 11-20 yrs age group.

Prevalence of T.capitis as a clinical syndrome is uniformly high in Africa (10-30%) in primary schools[8]. Protein deficiency, malnutrition along with vitamin A deficiency have been seen to be associated as a predisposing factor to develop infection[9]. Mustard oil which is used in North and North East India for hair dressing was found to have an inhibitory effect on fungi in T. capitis but coconut oil has no such effect[10].

[4]In a study of 375 cases of dermatomycoses in South East Rajasthan and found Tineaunguium as the fourth most common clinical type. In the present study T. capitis (25%) was the most common clinical presentation followed by T. corporis (20%), T. unguium (15%), T. pedis (6%), T. faciei (5%), T. manuum (5%), T. cruris (3%), T.pedis+T. unguium (3%), T.manuum +T. unguium (4%), T. capitis + T. corporis (3.5%). The study population comprised of 264 (66%) males and 136 (34%) females. The Male: Female ratio was 1.94:1. A higher incidence of dermatophytes in males in comparison to females has been reported both in India and abroad[12]. The higher incidence in young males is probably due to greater physical activity and increased sweating in them. The majority of samples *i.e.* 315 (78.25%) in the present study were collected in the months of March-September. The sample collection in November was 17 (4.25%) and in December it was 15 (3.75%), in February 25 (6.25%), March 30 (7.5%), April 35 (8.75%), May 45 (11.25%), June 49 (12.25%), July 61 (15.25%), August 65 (16.25%), September 30 (7.5%) and October 23 (5.75%). Only 82 (20.5%) cases were enrolled from Nov. to Feb. The lower occurrence of dermatophytosis in winter months is attributable to the fact that in winters sweating is decreased which is one of the significant risk. In our study out of the 81 cases from patients of T. capitis 12 were ***T. tonsurans*** followed by ***M. ferrugineum***(11), ***T. mentagrophytes*** (11), ***M. audouinii*** (8), ***T. soudanense*** (7), ***T. verrucossum***(10), ***Candida*** (2), ***T. rubrum***(4), ***T. schoenleinii***(4). Our findings are different from other studies of T. capitis from India in which ***T. violiceum*** is the prominent species. In the present study, the most common isolated species .was ***T. mentagrophytes***(19.17%), followed by ***T. tonsurans***(17.12%), ***T. verrucosum***(11.3%), ***T. schoenlenii***(8.21%). Other spp were ***M. ferrugineum*** (7.87%), ***E. floccosum*** (3.08%), ***M. audouinii*** (5.47%) ***T. soudanense*** (5.82%), ***T. rubrum*** (3.08%), ***Candida*** 10.6%, **NDM** (8.21%).

Our findings are similar to a study of dermatophytoses in South West of Iran where ***T. mentagrophytes*** was most prevalent spp. Followed by ***E. floccosum***[13].

In a study of the spectrum of fungal infections with a special reference to dermatophytoses in the capital area of Kuwait during 2000-2005 it was observed that ***T. mentagrophytes*** was most commonly isolated (39%), ***M. canis*** was 16%[14].

T. rubrum was isolated only from 9 cases in our study most commonly from T.capitis (4) followed by T. corporis and T. unguium (2 each) and T.capitis + T. corporis (1) case was reported. It was not isolated from T. manuum, T. pedis, T. cruris, T. faciei and T. manuum+unguium. ***T. rubrum*** was the only dermatophyte which was isolated more from rural cases (8) than from suburban cases (1). The decrease in incidence of ***T. rubrum*** is the most significant finding of our study as we are observing this trend in our lab for the last few years. Only two studies from India have shown decreased incidence of ***T. rubrum*** one from onychomycosis and another from T. captis cases. However, other studies from world[15] from Tehran,[16] from Nepal, from Hamadan[7] reported decreased incidence of ***T. rubrum***. These studies indicate that frequency of dermatophyte might change with time anywhere in the world and our findings are not surprising. In our study ***T. rubrum*** has been isolated mainly from rural cases. This finding clearly indicates that while it is still prevalent in rural areas, in suburban areas it has been replaced by other anthropophilic dermatophytes.

Our study has revealed a strikingly different local dermatophytic flora in our region compared to the rest of the country. This signifies the importance of epidemiological studies to be conducted at regular intervals.

Conclusion

Maximum number of samples were collected in the month of August (16.25%) followed by July (15.25%), June (12.25%). In our study most of the patients belonged to the age group of 21-30 yrs (24.25%) followed by 11-20yrs (17.75%) and 0-10 yrs (15%). In our study male population was 264(66%) and female population was 136 (34%). Male:Female ratio was 1.94:1. In the present study the distribution of clinical disease was as follows- T.capitis (25%), T.corporis (20%), T.unguium (15%), T.faciei (5%), T. pedis (6%), T. manuum (5%). and T.cruris (3 %). T.pedis +unguium (3%), T.manuum +unguium (4%), T.capitis +corporis (3.5%). In our study among 400 (89.5%) cases, 326 (81.5%) were KOH positive, and 74 (18.5%) were negative for fungal elements. However, 292 (73%) were culture positive and 66 (16.5%) were culture negative for fungal elements. 22 (5.5%) cases were negative for fungal elements both by direct microscopy and culture. In our study most common isolated spp. was ***T. mentagrophytes*** (19.17%), followed by ***T. tonsurans*** (17.12%), ***T. verrucosum*** (11.3%), ***T. schoenlenii***(8.21%). ***M.ferrugineum*** (7.87%), ***T.soudanense*** (5.82%), ***M. audouinii*** (5.47%), ***E. floccosum*** (3.08%), ***T. rubrum*** (3.08%), ***Candida*** (10.6%), **NDM** (8.21%). ***T.tonsurans*** was the most common isolated spp from T.capitis. ***T.mentagrophytes*** was the most commonly isolated spp. from T.corporis. ***Candida sps.*** was isolated from T.cruris. **NDM** were isolated from T. pedis. From cases of T.unguium, ***T.verrucosum***and **NDM** were isolated. ***Candida sps.*** was isolated from T.manuum. From T.faciei, ***Candida*** was commonly reported both ***T.mentagrophytes*** and **NDM** were isolated. Among sub urban population most commonly ***T. tonsurans*** was isolated followed by ***T.mentagrophytes.*** In rural cases, ***T.mentagrophytes*** was the most common isolate. Only ***T. rubrum*** and **NDM** predominated in rural cases.

Candidasps. were also predominant in suburban cases. Among sub urban population most commonly ***T. tonsurans*** was isolated followed by ***T.mentagrophytes.*** In rural cases, ***T.mentagrophytes*** was the most common isolate.

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