



ETIOLOGY OF DERMATOPHYTOSIS : A STUDY FROM SOUTH INDIA

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ABSTRACT

BACKGROUND: Dermatophytes are one of the most common fungal agents causing superficial skin infections. The prevalence of these infections varies from place to place and is more commonly associated with low socioeconomic status.

AIMS AND OBJECTIVES: To isolate and identify the common dermatophytic species causing the infection and to know the efficacy of the antifungals commonly used against them.

METHODS: One hundred and ten new cases, who consented for study were included. Skin scrapings were collected for direct microscopy by KOH and for fungal culture in Sabouraud 4% dextrose agar (SDA) with cycloheximide and dermatophyte test medium. Fungi were identified on the basis of their macroscopic and microscopic features with the help of lactophenol cotton blue staining and urease test.

RESULTS: Of the 110 cases, 58 cases were KOH positive for fungal filaments and culture positive for dermatophytes. Trichophyton was the predominant isolate (51 cases) with *T. verrucosum* being the commonest species (28 cases), followed by *T. rubrum* (16 patients), and *T. mentagrophytes* (7 cases). All species of Trichophyton were found to be most sensitive to systemic itraconazole and topical luliconazole amongst antifungals.

CONCLUSIONS: Trichophyton species is the commonest organism causing fungal infections. Itraconazole and luliconazole are the most effective systemic and topical agents against them.

KEYWORDS : Dermatophyte, Trichophyton verrucosum, Itraconazole, Luliconazole

INTRODUCTION

Dermatophytosis refers to superficial fungal infection of keratinized tissues such as skin, hair, and nails. This is caused by a group of fungi called dermatophytes. Trichophyton, Microsporum and Epidermophyton are the genera implicated to cause dermatophytoses. Over few years, it has been evidenced that dermatophyte infections have increased by many folds in India.[1] In addition, there is a change in the disease presentation, severity, treatment response, and relapse rate.[2]

Studies suggest that the emergence of Trichophyton mentagrophytes as the principal causative organism and high terbinafine resistance could be the cause of these changing patterns of the disease and response.[3,4] However, the causes may even be more diverse; from the irrational use of antifungal drugs to topical steroid usage and also low socioeconomic status of the population.[2] Though there are a few published articles from Himachal Pradesh,[5] Delhi,[4] and Sikkim[6] there is not much data available from southern part of India where the disease is widespread. Furthermore, there are a very few studies determining the sensitivity pattern of the dermatophyte species against various systemic and topical antifungal drugs. Taking into account of all these factors, we undertook this study to isolate the species causing dermatophyte infections and to know the efficacy of the antifungals commonly used against them.

METHODS

We conducted a descriptive study among the patients with dermatophytosis attending the dermatology outpatient of a tertiary healthcare center in south India. We recruited patients

over eight months, from January 2021 to August 2021. Institutional ethical clearance was taken and all patients participated after signing informed consent form. Patients of both genders presenting to the dermatology outpatient with the clinical diagnosis of dermatophytosis (tinea corporis, faciei, and cruris) were included. Those with secondary pyoderma, or other infections were excluded.

After cleansing the affected area with 70% alcohol, skin scrapings were collected in the sterile container from the edge of the lesion from the most accessible sites as decided by the treating physician.

However, we have included only those cases who were not treated with any topical or systemic drug in the past 3 months. Some (32, 29%) had a family history of similar disease in the recent past.

All the samples were subjected to potassium hydroxide preparation for direct microscopic examination. Slides were examined in light microscope, and hyaline branching septate hyphae were identified. In addition, all samples were sent for fungal culture, species identification, and sensitivity determination. They were cultured on Sabouraud 4% dextrose agar (SDA) with cycloheximide, and dermatophyte test media. These inoculated cultures were incubated at 37°C (for isolation of *T. verrucosum*) and at 28°C for other dermatophytes for 4 weeks.

The culture isolates were identified based on the growth characteristics and microscopic morphology of the conidia (Micro and Macroconidia) in Lactophenol Cotton Blue (LPCB) Mount and

Urease test. The diagnosis of the dermatophytic infection was confirmed by the positivity of the smear and culture.

Drug sensitivity

The cultured dermatophytes were subjected to drug sensitivity to the common oral and topical antifungal agents. Sensitivity of all three species of *trichophyton* to itraconazole, fluconazole, terbinafine, and voriconazole was tested. Similarly, among topical antifungal agents, sensitivity to clotrimazole, miconazole, ketoconazole, and luliconazole was determined. All the samples were inoculated in SDA slant containing cycloheximide and incubated both at 26°C and at 37°C.

Statistical analysis was performed by Mann-Whitney U test and Kruskal-Wallis tests using SPSS-16 software in order to find the significant differences between variables. P value of <0.05 was considered significant.

RESULTS

A total of 110 cases of clinical dermatophyte infection were included in this study. There were 72 (65%) female and 38 (34%) male patients. Of these 110 patients, 91 had tinea corporis, 78 had tinea cruris, and 15 had tinea faciei. More than one site was involved in few patients.

58 cases were KOH positive for fungal filaments and culture positive for dermatophytes. *Trichophyton* was the predominant isolate causing dermatophytosis in 51 cases. *T. verrucosum* was seen in 28 cases, followed by *T. rubrum* (16 patients) and *T. mentagrophytes* (7 cases) [Table 1].

Causative organism	Number of patients
<i>Trichophyton</i>	51 (87.9%)
<i>T. Verrucosum</i>	28 (54.9%)
<i>T. Rubrum</i>	16 (31.3%)
<i>T. Mentagrophytes</i>	7 (13.7%)
<i>Epidermophyton</i>	6 (10.3%)
<i>Microsporum</i>	1 (1.7%)

RESULTS OF DRUG SENSITIVITY

Dermatophyte sensitivity was tested to common antifungals [Table 2]. All three species of *Trichophyton* showed the highest sensitivity to itraconazole amongst oral antifungal drugs and to luliconazole amongst the topical antifungals. Amongst the oral antifungal agents, high sensitivity was noted with itraconazole, followed by voriconazole and fluconazole. Similarly, amongst the topical antifungals, luliconazole showed a higher sensitivity over others.

Table 2: Results of drug sensitivity

	<i>T. Verrucosum</i>	<i>T. Rubrum</i>	<i>T. Mentagrophytes</i>
Itraconazole	86%	85%	81%
Voriconazole	72%	60%	64%
Ketoconazole	50%	29%	50%
Terbinafine	30%	22%	27%
Luliconazole	87%	83%	64%
Miconazole	36%	47%	33%
Clotrimazole	28%	34%	41%
Fluconazole	52%	59%	52%

DISCUSSION

Earlier studies from India have described *T. rubrum* as the commonest agent causing dermatophytosis.[7,8] Our study was not in concordance with the study conducted by Jain et al.,[9] Agarwalla et al.,[10] Bindu et al.,[11] and Asticcioli et al.[12] in which *T. rubrum* was the most common species.

However, in the recent years, there seems to be an epidemiological transformation of dermatophytes in India. Although many studies done across India have found

Trichophyton rubrum, to be the most common organism, the prevalence is much less compared to the past.

In all these studies, *Trichophyton mentagrophytes* has emerged as the co-dominant pathogen with an increased prevalence in comparison to what was seen in the past.

Recent mycological studies undertaken across the country have demonstrated *Trichophyton mentagrophytes* to be the predominant causative organism. This was in concordance with the study conducted by Bhatia et al. in 2014 [5] and by Pavani et al. in 2016[13]

However, two studies found *T. mentagrophytes* and *T. rubrum* had near equal prevalence.[14,15]. *T. mentagrophytes* was isolated as the most common species from Sikkim.[6] *T. interdigitale* was the most common isolate from Delhi accounting for 94% of cases.[5]

In our study, *T. verrucosum* was found to be the most common dermatophyte with 48.2% of cases positive for it. This was followed by *T. rubrum* (27.5%) and *T. mentagrophytes* (12%). *Epidermophyton* and *Microsporum* were relatively less common with 10% and 2% positivity, respectively.

The causes for the shift of causative organisms are not known but can be postulated to multiple factors, including steroid abuse, indiscriminate use of oral and topical antifungals, changing agent and host factors, and environmental changes.

Worldwide too, only few studies from the Middle East report *T. verrucosum* to be common, otherwise considered to be a rare organism.[16] [Table 3]

Table 3: The predominant species of Trichophyton in different studies.

Study	Dermatophytes	Percentage
Agarwalla et al., 2001	<i>T. rubrum</i>	45.74
Bindu et al., 2002	<i>T. rubrum</i>	66.2
Anupama et al., 2017	<i>T. rubrum</i>	33
Bhatia et al., 2014	<i>T. mentagrophytes</i>	63.5
Pavani et al., 2016	<i>T. mentagrophytes</i>	69.5
Present study	<i>T. Verrucosum</i>	48.2

However, furthermore studies with larger sample size, with detail epidemiological factors including occupation, contact with animals and so on are required to reveal the factors for this variation.

The second part of our study dealt with the drug sensitivity of the common dermatophytes, to both oral and topical antifungals. In the recent years, very few studies were conducted to find out the effectiveness of the available drugs in this changing scenario. It is a common finding amongst dermatologists in india that the disease is becoming increasingly treatment unresponsive with frequent failures and relapses.[17]

In our study itraconazole was found to be the most efficacious drug for *T. verrucosum*, *T.*

rubrum, and *T. mentagrophytes*, respectively, followed by griseofulvin, ketoconazole.

However, terbinafine showed a very low sensitivity.

Among the topical antifungals, luliconazole, clotrimazole, and miconazole were tested. Luliconazole was found to be the most effective and Clotrimazole least effective.

The sensitivity of common dermatophytes to itraconazole is still quite high and therefore, the common perception that dermatophytes are not responding to itraconazole might

either be due to improper dosing, poor compliance, socioeconomic and hygiene issues, or unsatisfactory quality of the brand used. An interesting finding in the current study is the very low sensitivity of terbinafine which was pointed out in some earlier studies as well. [4,18]

CONCLUSION:

To conclude, dermatophytoses are distributed worldwide with increased incidence especially in tropical countries like India. In the present study we have attempted to understand the epidemiological status of dermatophytes in southern part of India. Till date, majority of studies conducted in South India, reported *T. rubrum* and *T. mentagrophytes* as the predominant species.

On the contrary, in our study, the most common causative organism was *T. verrucosum* followed by *T. rubrum* and *T. mentagrophytes*. This variation in the epidemiological pattern may be associated with environmental factors, local cultural and habitual variants with respect to a particular geographical area, which may change from time to time.

This study also depicted higher sensitivity of itraconazole and luliconazole compared to other antifungals commonly in use in superficial dermatophytosis.

Every patient with a tinea infection should be properly studied for mycological examination and should be treated accordingly.

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DECLARATIONS

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