

## CLINICO-MYCOLOGICAL STUDY OF SUPERFICIAL FUNGAL INFECTIONS IN COASTAL KARNATAKA, INDIA

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**ABSTRACT:** Cutaneous fungal infections are common in coastal Karnataka owing to its tropical and humid climate. The organisms causing these infections commonly are dermatophytes, non dermatophytes and yeasts. This study aims to determine the prevalence of cutaneous mycosis, with their different clinical types and etiological agents, and correlate the findings. A total of 96 patients were included in our study, all of them attending dermatology OPD at a tertiary hospital in Mangalore with clinically suspected tinea corporis, tinea cruris, tinea pedis, tinea capitis, tinea mannum, onychomycosis, candidiasis and pityriasis versicolor. The study revealed male to female ratio being 0.74:1. The leading diagnosis was pityriasis versicolor, the commonest organism isolated was *C. albicans*; and the commonest site involved is groin and skin flexures. This study emphasizes utility of timely detection of cutaneous fungal infection in preventing transmission and spread of such infections.

**KEYWORDS:** Fungal infections; Dermatophytes; Pityriasis versicolor

**INTRODUCTION:** Cutaneous fungal infections have been reported worldwide as being one of the most common human infectious diseases in clinical practice. In spite of therapeutic advances in the last decades, the prevalence of cutaneous mycoses is still increasing.<sup>1,2</sup> Surveillance for 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.

Cutaneous fungal infections can be caused by dermatophytes, yeasts and non-dermatophyte moulds, although dermatophytes cause most of the cutaneous fungal infections. The dermatophytes are a group of closely related fungi that have the capacity to invade the keratinized tissue (skin, hair and nails) of humans and other animals to produce an infection, dermatophytosis, commonly referred to as ringworm can be divided into three groups of anthropophilic, zoophilic and geophilic depending on their natural habits and host preferences.<sup>3,4</sup> Fungi in all three categories may cause human infections.<sup>5</sup> These organisms, which attack the keratinized tissue of living host, are classified into three genera of Epidermophyton, Trichophyton and Microsporum.<sup>6</sup> The prevalence of dermatophytoses varies in different geographical locations. Dermatophytosis is a common disease in tropical countries due to factors like heat and humidity. The high humidity and temperature provides a fertile ground for the abundant growth of dermatophytes. Over the last 3 decades, an increasing number of non- dermatophyte filamentous fungi have been identified as agents that cause skin and nail infections, producing skin lesions similar to those caused by dermatophytes.<sup>7,8</sup> Other fungi commonly causing superficial mycosis is *Malassezia furfur*, a lipophilic fungus that affects the skin and hair causing diseases like dandruff, pityriasis versicolor, tinea circinata and seborrhoeic

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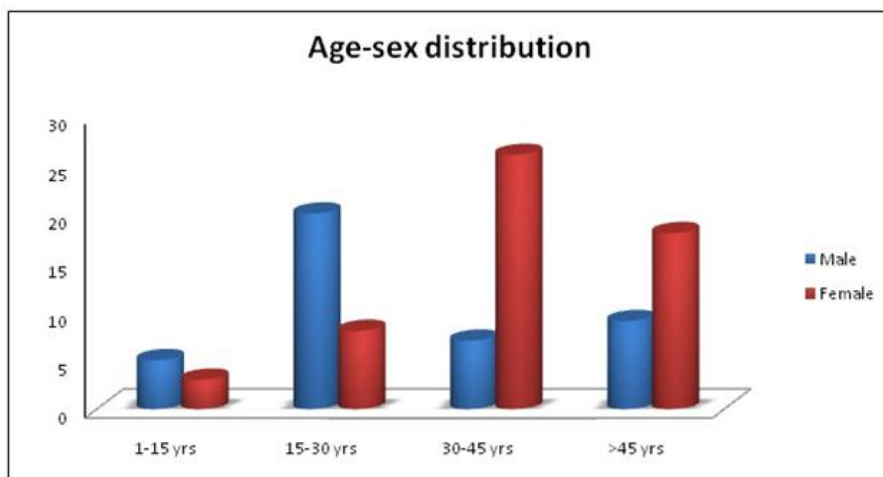
dermatitis.<sup>9</sup> This study aims to determine the prevalence of cutaneous mycosis, with their different clinical types and etiological agents, and correlate the findings.

**MATERIALS AND METHODS:** 96 patients with clinical features of superficial fungal infections attending Dermatology OPD in a tertiary hospital in Coastal Karnataka were enrolled in our study. Samples from clinically diagnosed cases of superficial fungal infections were subjected to direct microscopy and culture. Direct microscopic examination was done using 10% potassium hydroxide (KOH) for skin scrapings and 40% KOH for hair and nail specimen. For culture, specimen was inoculated on two sets each of antibiotic incorporated Sabouraud's Dextrose Agar at 25° C, one with 0.05 mg/ml chloramphenicol and another with 0.5mg/ml of cycloheximide along with 0.05 mg/ml chloramphenicol. For isolation of *Malassezia furfur* Sabouraud's dextrose agar with chloramphenicol, layered with olive oil was used.

**RESULTS:** Among the 96 patients enrolled in our study, 41 (42.7%) were males and 55(57.3%) were females. The male to female ratio being 0.74:1. Majority of the patients were in the age group 30-45 yrs with 33 patients (34.37%); 28 were in the age group of 15-30 yrs(29.16%); 27 were in the age group of >45 yrs (28.12%); east amount of patients were in the age group 1-15 yrs with 8 patients (8.33%). Mean age was 36 yrs. The standard deviation is 14.0608.

Age (in years)	Male	Female	Total
1-15	5	3	8
15-30	20	8	28
30-45	7	26	33
>45	9	18	27
Total	41	55	96

Table 1: Age and sex distribution

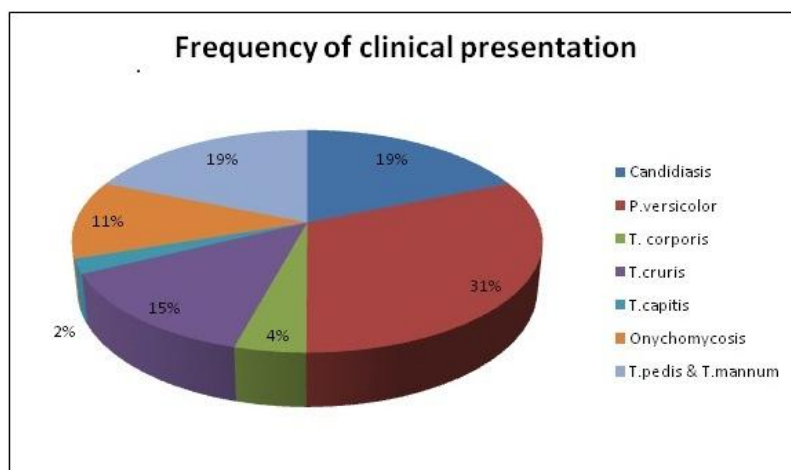


Graph 1: Age and sex distribution

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Fungal infection	No. of patients	Percentage
Candidiasis	18	18.75
Pityriasis versicolor	30	31.3
Tinea corporis	04	4.2
Tinea cruris	13	13.5
Tinea capitis	02	2.1
Onychomycosis	11	11.4
Tinea pedis and T.mannum	18	18.75
<b>Total</b>	<b>96</b>	<b>100</b>

**Table 2: Frequency of various clinical presentations among cutaneous fungal infections**

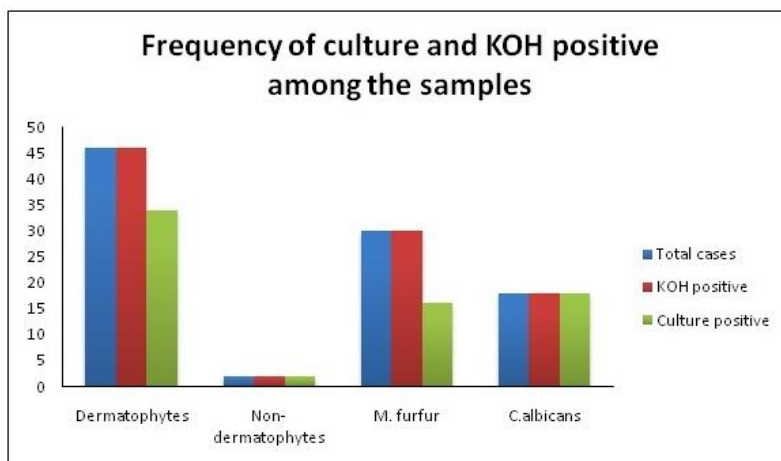


**Graph 2: Frequency of various clinical presentations among cutaneous fungal infections**

Among the 96 patients, 30 patients (31.3%) were leading with the diagnosis of P. versicolor, followed by 18 patients (18.75%) with candidiasis and 18 patients (18.75%) with T.mannum and T.pedis. Among the others were T. cruris with 13 patients (13.5%), 11 patients (11.4%) with onychomycosis, 4 patients (4.2%) with tinea corporis and 2 patients (2.1%) with tinea capitis.

Organism	Total	KOH positive	Culture positive
Dermatophytes	46	46	34
Non-dermatophytes	2	2	2
M.furfur	30	30	16
Calbicans	18	18	18
<b>Total</b>	<b>96</b>	<b>96</b>	<b>70</b>

**Table 3: Frequency of KOH and culture positive among samples**

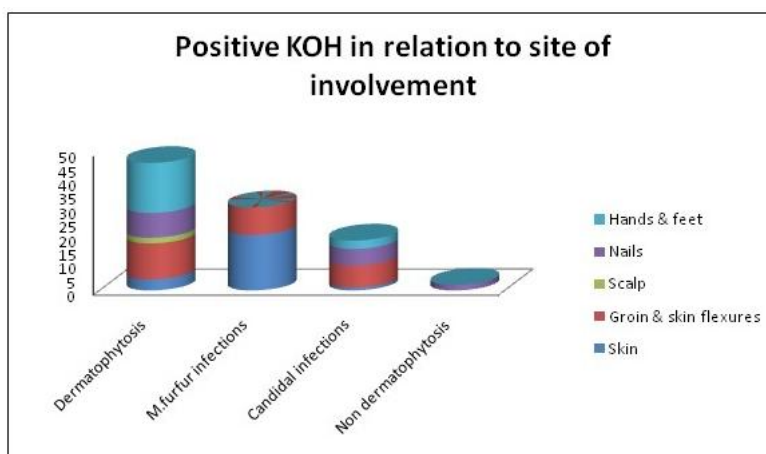


**Graph 3: Frequency of KOH and culture positive among samples**

Among the organisms isolated, all were positive for KOH (100%) among which 46 (47.9%) were dermatophytes, 2(2.08%) were non dermatophytes, 30(31.25%) were M.furfur and 18(18.75%) were C.albicans. Among the isolated organisms, 34 /46 (78.2%) dermatophytes were culture positive, 2/2 (100%) non-dermatophytes were culture positive, 16/30(53.3%) M.furfur were culture positive and 18/18 (100%) C.albicans was culture positive.

Fungal infection	Skin	Groin and skin flexures	Scalp	Nails	Hands and feet	Total
Dermatophytosis	04	13	02	09	18	46
M.furfur infections	20	10	00	00	00	30
Candidial infections	01	08	00	06	03	18
Non dermatophytosis	00	00	00	02	00	02
<b>Total</b>	<b>25</b>	<b>31</b>	<b>02</b>	<b>17</b>	<b>21</b>	<b>96</b>

**Table 4: Positive KOH in relation to site of involvement**



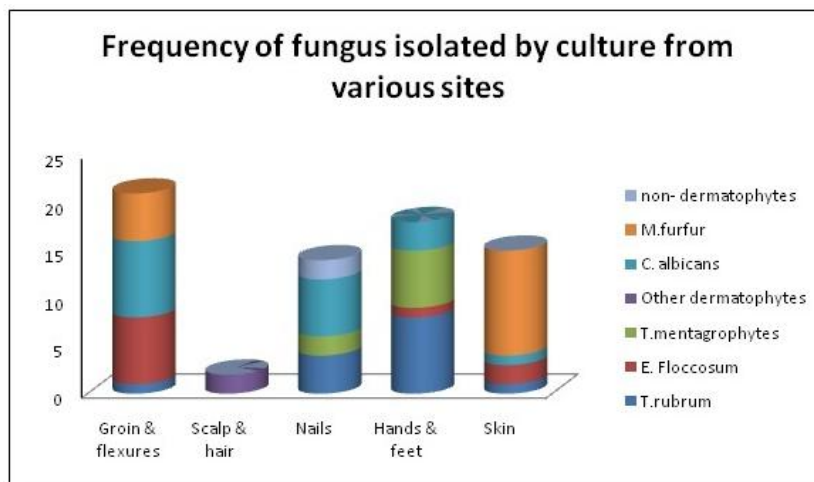
**Graph 4: Positive KOH in relation to site of involvement**

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The commonest site of involvement was the groin and skin flexures 31/96 (32.3%), followed by other skin areas 25/96 (26.04%), hands and feet 21/96 (21.88%), nails 17/96(17.70%) and least was the scalp with 2/96 (2.08%) cases .On KOH mount, it was noticed that dermatophytes were more commonly isolated from the hands and feet 18/46(39.1%), the Malassezia furfur were commonly found in other skin areas 20/30 (66.7%), Candidal infections were commoner in groin and skin flexures 8/18(44.4%) and non dermatophytes in nails 2/2 (100%).

Organism	Skin	Groin and skin flexures	Scalp	Nails	Hands and feet	Total
T. rubrum	1	1	0	4	8	14
E. floccosum	2	7	0	0	1	10
T.mentagrophytes	0	0	0	2	6	8
Other dermatophytes	0	0	2	0	0	2
C.albicans	1	8	0	6	3	18
M.furfur	11	5	0	0	0	16
Non-dermatophytes	0	0	0	2	0	2
Total	15	21	2	14	18	70

Table 5: Frequency of fungus isolated from various sites by culture



Graph 5: Frequency of fungus isolated from various sites by culture

Among the 96 KOH positive isolates, only 70(72.9%) were culture positive. Candida albicans was the commonest organism isolated i.e., 18/70 (25.7%), followed by Malassezia furfur 16/70(22.9%), Trichophyton rubrum 14/70 (20%), Epidermophyton floccosum 10/70 (14.3%), Trichophyton mentagrophytes 8/70 (11.4%), other dermatophytes 2/70 (2.9%) and non-dermatophytes 2/70(2.9%).

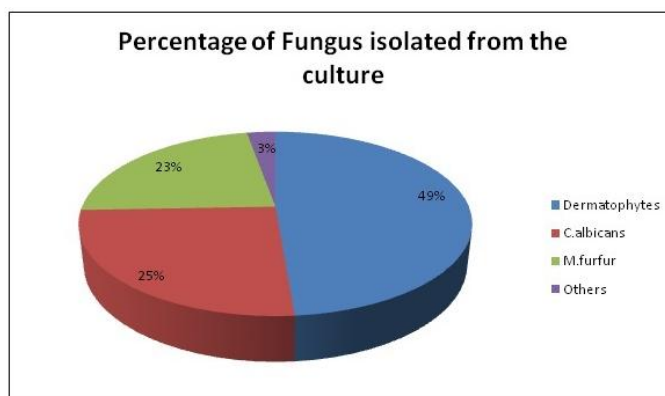
In the other skin areas M.furfur 11/15(73.3%) was the commonest organism isolated, followed by epidermophyton floccosum 2/15(13.3%); in the groin and skin flexures the commonest organism isolated on culture was Candida albicans 8/21(38.1%), followed by Epidermophyton floccosum 7/21(33.3%); among the scalp organisms other dermatophytes were commonly isolated 2/2(100%); in the nails commonest organism positive for culture was Candida albicans 6/14

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(42.9%) followed by *Trichophyton rubrum* 4/14 (28.6%) ; among the hands and feet commonest culture positive organism was *Trichophyton rubrum* 8/18 (44.4%), followed by *Trichophyton mentagrophytes* 6/18 (33.3%).

Organism	Number of patients	Percentage
<i>T. rubrum</i>	14	20
<i>E. floccosum</i>	10	14.4
<i>T. mentagrophytes</i>	08	11.5
Other dermatophytes	02	2.8
<i>C. albicans</i>	18	25.7
<i>M. furfur</i>	16	22.8
Non dermatophytes	02	2.8

**Table 6: percentage of fungus isolated from the culture**



**Graph 6: Percentage of fungus isolated from the culture**

Among the culture positive organisms, *Candida albicans* was the commonest isolate 18/70 (25.7%), followed by *Malassezia furfur* 16/70(22.8%), *Trichophyton rubrum* 14/70 (20%), *Epidermophyton floccosum* 10/70(14.4), *Trichophyton mentagrophytes* 8/70 (11.55), other dermatophytes and non dermatophytes 2/70 (2.8%) each. The non-dermatophytic fungi *Fusarium* species was isolated in one case of onychomycosis.

**DISCUSSION:** Age, sex and race are important epidemiologic factors as dermatophyte infections are 5 times more prevalent in males than females.<sup>10</sup> The higher incidence in young males could be due to greater physical activity and increased sweating.<sup>11</sup>

In our study maximum number of patients were in the age group of 30-45 years (34.37%), followed by 15-30 yrs( 29.16%), >45 years (28.12%) and 1-15 years(8.33%) which is in par with the values shown in the study by Aruna Aggarwal et al which showed maximum prevalence of superficial fungal infections in the third decade.<sup>7</sup> It was observed in our study that male to female ratio was 0.74:1 which is similar to the study conducted by Bassiri- Jehroomi et al in Tehran whereas the study conducted by sanjeev sahai et al reported male preponderance where M: F ratio was 2:1<sup>12</sup>.The degree of inflammation is influenced both by the patient's immune status and by the organism involved.<sup>10</sup> In our study the most common clinical presentation was dermatophytosis

(38.55%), followed by pityriasis versicolor (31.3%), followed by candidiasis (18.75%) and the least common was onychomycosis (11.4%), which was in par with the study conducted by P Kannan et al where the commonest clinical presentation was dermatophytosis (48.5%), followed by *P. versicolor* (23.6%), followed by candidiasis (17.1%) and least was cases of mycetoma (7.1%).<sup>13</sup> Much like *Tinea corporis*, *tinea cruris* spreads via direct contact or fomites, and is exacerbated by occlusion and warm, moist climates.<sup>10</sup>

In our study, among dermatophytosis, *Tinea cruris* (13.5%) was the commonest presentation, followed by *Tinea corporis* (4.2%) and the least common was *Tinea capitis* (2.1%) which is similar to the study conducted by Peerapur et al who observed that *Tinea corporis* with *Tinea cruris* was the most common clinical pattern followed by *tinea cruris*. *Tinea capitis* was the predominant dermatophyte infection in children.<sup>11</sup> *P. versicolor* is common in the post-pubertal age where the sebaceous glands are active and in individuals who sweat more.<sup>14</sup> *P. versicolor* is more common in the tropical climates than in temperate zones and in the temperate zones the condition is more common in warmer months of the year.<sup>15</sup> In our study *M. furfur* was commonly isolated from the back, trunk and face in migrant laborers population, with incidence or aggravation in summer probably owing to the hot and humid climate in the summers and hot, congested working environment. Diabetes may however affect the course of established superficial fungal infection. In our study, 18/96 (18.7%) were diabetics.

Although microscopic evaluation can provide evidence of fungal infections within minutes, it may also yield false negative results. Hence fungal culture should be performed when a dermatophyte infection is suspected clinically.<sup>10</sup> Among our patients, all were positive for KOH (100%). but culture positivity was shown only in 72.9% of cases whereas the study done by Aruna Aggarwal et al reported that 59.2% isolates were positive on direct microscopy and 50.4% were culture positive in their study.<sup>7</sup>

In KOH mount, all dermatophyte species appear identical in skin and nail samples. Septate hyphae are observed, which may branch without constriction at the branching point and which display an even diameter along their length.<sup>15</sup> Under the microscope, the KOH preparation demonstrating spores and pseudohyphae suggests *C. albicans* whereas short thick fungal hyphae with large number of spores resembling spaghetti and meat ball appearance suggest *Malassezia furfur*.<sup>16</sup> The ubiquitous anthropophilic species, *T. rubrum* may invade the buttocks and lower back, as well as more distant sites of the trunk as an extension from *tinea cruris*.<sup>15</sup> *T. rubrum* is the commonest agent isolated from glabrous skin of the body, groin folds and the feet.<sup>17</sup> Three anthropophilic species, *T. rubrum*, *T. mentagrophytes* and *E. floccosum* are together responsible for the vast majority of cases of foot ringworm throughout the world. In the great majority of cases, onychomycosis caused by dermatophytes are associated with *tinea pedis* or *tinea manuum*.<sup>15</sup> Our study also observed *T. rubrum* being the commonest organism isolated from the ringworm of hands and feet, followed by *T. mentagrophytes*.

*E. floccosum* was the commonest isolate in the groin area in our study, which is similar to the observations in the study conducted by Bassiri jahromi and Khaksari where it was the commonest pathogen isolated from the groin with an incidence of 71.2%.<sup>3</sup> Most cases of cutaneous candidiasis occur from in the skin folds or where occlusion from clothing or medical dressings produces abnormally moist conditions.<sup>15</sup>

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In our study *Candida* was more commonly isolated from the groin folds and nails, followed by the hands and feet probably owing to the warm and humid climate of this area and also due to the heavy rains in rainy season where the patients tend to wear undried moist clothes. *Candida* species were isolated from the nail infections and tinea pedis in patients with history of repeated/prolonged immersing of hands/feet in water.<sup>7</sup> Onychomycosis refers to fungal infection of the nails with various etiological agents, viz. dermatophytes, yeasts and non dermatophyte moulds (NDM).<sup>18</sup> It accounts for upto 50% of nail disorders and 30% of all superficial fungal infections of the skin.<sup>19</sup> This is similar to our observation where onychomycosis constituted 14/70 (20%) of all the superficial fungal infections.

Dermatophytes mainly *T. rubrum* and *T. mentagrophytes* var *interdigitale* are responsible for nearly 80% of toenail onychomycosis and atleast 50% of fingernail infections. *Candida* species particularly *C. albicans*, prevail in fingernail infections.<sup>20</sup> A higher prevalence of NDM in onychomycosis is reported in hot and humid tropical and sub tropical climates.<sup>18</sup> In our study the commonest isolate obtained from the nails was *C. albicans* 6/14(42.9%), followed by *T. rubrum* 4/14(28.6%) and the least was Non dermatophyte moulds and *T. mentagrophytes* with 2/14 (14.3%) each.

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