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Fungal Culture: Evaluate the Tools and Pattern for Resistance to Superficial Fungal Infections in the Rural and Urban Areas of Bangladesh

Shaila Ahmed[1*], Taslima Akhter[2], Taslima Begum[2]

[1]Associate Professor, Department of Dermatology, Holy Family Red Crescent Medical College Hospital, Dhaka, Bangladesh
[2]Associate Professor, Department of Microbiology, Holy Family Red Crescent Medical College Hospital, Dhaka, Bangladesh

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***Corresponding author:** Shaila Ahmed
Associate Professor, Department of Dermatology, Holy Family Red Crescent Medical College Hospital, Dhaka, Bangladesh

Abstract **Original Research Article**

***Background*:** Superficial fungal infections (SFIs) affecting the skin are highly prevalent in both rural and urban areas of Bangladesh. The occurrence and features of these infections differ based on factors such as age, gender, climate, lifestyle, and population migration patterns. Surprisingly, no previous studies have been conducted in Bangladesh to assess the prevalence and patterns of superficial fungal infections. Therefore, this study was initiated to identify the characteristics of SFIs among rural patients seeking medical care at the Dermatology outpatient Department of Dermatology, Holy Family Red Crescent Medical College Hospital, Dhaka, Bangladesh. ***Objective*:** The main objective of the study is to assess the pervasiveness of superficial fungal infections in the rural and urban areas of Bangladesh. ***Methods*:** From January 2020 to December 2022, there were 3650 patients visited in Dermatology outpatient department. Out of them, 860 patients diagnosed as SFIs (442 males and 418 females), aged between birth to 90 years were included in this study. The diagnosis of SFIs was based on clinical presentation which was confirmed by laboratory direct microscopy and culture. ***Results*:** In a comprehensive study involving 860 patients diagnosed with superficial fungal infections (SIFs), the distribution and prevalence of these infections across different age groups and genders were analyzed. The overall gender distribution showed that 51.36% of cases were in males and 48.64% in females. Tinea cruris emerged as the most frequent infection at 22.63%, predominantly affecting males (25.81%). Pityriasis versicolor followed closely with a balanced gender distribution at 12.81%. Notable variations in Tinea pedis and Tinea capitis percentages emphasized the gender-specific nature of certain infections. Among children (0-14 years), comprising 29.95% of the total cases, Tinea capitis was the most prevalent (26.67%), followed by oral thrush (21.67%) and Tinea corporis (13.33%). Gender distribution was relatively equal among affected children. In the adult population (15-64 years), totaling 507 cases, Tinea cruris dominated with a frequency of 26.63%, showing higher prevalence in males (29.98%) than females (22.56%). Pityriasis versicolor exhibited a relatively balanced gender distribution at 19.05%. The elderly population (65 years and above) represented 11.05% of the total cases, with Tinea corporis and Tinea cruris being most prevalent (32.63% and 21.88%, respectively). ***Conclusion*:** This study clearly shows that SFIs are of concern in both genders and in all age groups. The prevalence of superficial fungal infections is increasing day by day throughout Bangladesh. The pattern and distribution of SFI in Bangladesh particularly in rural populations seems to be very high beyond our prediction.

Keywords: Candidiasis, dermatophytosis, superficial fungal infection, tenia infection.

INTRODUCTION

Fungal infections are common worldwide and can affect individuals regardless of their geographical location. In Bangladesh, superficial fungal infections, such as dermatophytosis (Tenia infection), candidiasis, and pityriasis versicolor, are prevalent in both rural and urban areas. The warm and humid climate of Bangladesh creates favorable conditions for the growth and spread of these fungal infections. Superficial fungal infections (SFIs) affect millions of people worldwide; with an estimated lifetime risk of 10–20% [1]. The pathogens responsible for SFIs include dermatophytes and candida. Dermatophytes are the most frequently encountered causative agents of SFIs, leading to tinea infections, which are generally classified according to the body site affected. The geographic location, cultural background, and population migration patterns significantly affect the

characteristics and prevalence of SFIs in particular regions.

A significant variation in the pattern of mycotic infection in different countries is evident from studies performed in different countries like Algeria, South Africa, Mexico, Italy, Japan, USA, Canada, Brazil, India and Australia [2-11]. This heterogeneity in the prevalence of SFIs in different parts of the world has been attributed to factors such as climate (humidity, temperature), lifestyle (unhygienic), involvement in outdoor activities and the prevalence of underlying diseases (diabetes, malnutrition, liver and renal disease, immunosuppression, etc). Another factor is the reluctance of the patients to seek treatment because of the minor nature of the disease or due to embarrassment unless the condition becomes sufficiently serious to affect the quality of life [12]. In rural areas, where access to proper sanitation and healthcare facilities may be limited, the prevalence of superficial fungal infections can be relatively higher. Factors such as poor personal hygiene, lack of awareness about preventive measures, and limited access to antifungal medications can contribute to the higher incidence of these infections.

In urban areas, while individuals generally have better access to healthcare facilities, the prevalence of superficial fungal infections can still be significant. Factors such as overcrowding, poor sanitation in certain areas, increased exposure to communal spaces (e.g., public pools, and gyms), and a higher number of individuals with compromised immune systems (due to underlying health conditions or stress) can contribute to the spread of fungal infections. It's important to note that the prevalence of superficial fungal infections can vary over time and may be influenced by various factors, including changes in environmental conditions, public health initiatives, and access to healthcare. To obtain the most up-to-date and accurate information on the prevalence of superficial fungal infections in rural and urban areas of Bangladesh, it is advisable to consult recent studies, reports, or healthcare professionals familiar with the local situation. Studies aimed at determining the intensity and nature of SFIs in different regions of the world are important for the prevention and management of SFIs [1-16]. Although SFIs are quite common in rural areas [17, 18], very little attention has been paid to their characteristics and prevalence in this country.

OBJECTIVES

This study aimed to determine the prevalence of the SFIs and their association with age, gender, and body site in patients attending the Dermatology Department of Holy Family Red Crescent Medical College Hospital, Dhaka, Bangladesh.

MATERIALS AND METHODS

Type of Study: Prospective, Interventional cross-sectional study.
Place of Study: Department of Dermatology, HFMCH, Dhaka.
Time of Study: January 2020 to December 2022.
Duration of Study: 24 months

Suspected cases of superficial fungal infection (SFI) were brought to our laboratory for definitive diagnosis. To confirm the presence of infection, the affected areas of the body were first cleansed with alcohol. Then, skin scrapings, hair pluckings, and nail shavings were carefully collected using a scalpel. These specimens were placed on a glass slide with a drop of 20% KOH solution and examined under a microscope to detect fungal hyphae. Additionally, a portion of the sample was cultured on Sabouraud's dextrose agar media, supplemented with chloramphenicol and cycloheximide. The cultures were incubated at temperatures ranging from 22°C to 26°C, and observed for growth after a period of 2 weeks.

Fungal species were identified by analyzing their morphology and microscopic characteristics. Furthermore, mycological examinations were conducted specifically to confirm the diagnosis of pityriasis versicolor, where specimens were obtained using scotch tape. Oral and genital swabs were collected with swab sticks to investigate suspected candidal infections. Patients undergoing immunosuppressant therapy, those with diabetes, or individuals who were immunocompromised were excluded from the study. All gathered data were organized and prepared for further analysis.

RESULTS

Table 1: Demographical data of the study population (n=860)

Age Considered	No. of patients	Percentage (%)
0-14	258	30.00
15-64	507	58.95
>65	95	11.05
Sex Distribution		
Male	442	51.40
Female	418	48.60
Distribution of cases by their residence		
Rural	717	83.37
Urban	143	16.63
Distribution of cases by monthly income		
<5,000	200	23.26
5-10,000	250	29.07
10-15,000	250	29.07

>15,000	160	18.60

A total of 860 patients diagnosed with superficial fungal infections were included in our study. The patients comprised 442 (51.40%) males and 418 (48.60%) females aged from newborn to 0 years, 258 (30%) patients aged 0-14 years, 507 (58.95%) patients aged 15-64 years and 95 (11.05%) patients aged more than 64 years.

Table 2: Pattern of superficial fungal infections in male, female and total patients (n=860)

Name of Fungal Infections	Male n (%)	Female n (%)	Total (%)
Tinea corporis	47 (10.65)	42 (9.97)	89 (10.32)
Tinea cruris	114 (25.81)	81 (19.24)	195 (22.63)
Tinea pedis	32 (7.10)	53 (12.71)	85 (9.88)
Tinea capitis	54 (12.26)	17 (4.12)	71 (8.25)
Tinea fasciae	13 (2.90)	13 (3.09)	26 (3)
Tinea barbae	9 (1.94)	00 (00)	9 (1)
Tinea mannum	10 (2.26)	6 (1.37)	16 (1.83)
Pityriasis. versicolor	62 (13.91)	49 (11.68)	111 (12.81)
Onychomycosis	15 (3.27)	23 (5.50)	38 (4.33)
Tinea incognitio	1 (0.10)	9 (2.15)	10 (1.16)
Oral thrush	49 (10.97)	59 (14.09)	108 (12.55)
Chronic paronychia	10 (2.26)	20 (4.81)	30 (3.49)
Candidal intertrigo	17 (3.87)	39 (9.28)	56 (6.49)
Genital candidiasis	9 (1.94)	7 (1.73)	16 (1.83)
Total:	442 (51.36)	418 (48.64)	860 (100)

In this table, the distribution of superficial fungal infections is presented, with a focus on gender-specific prevalence. Overall, 51.36% of the cases are in males, while 48.64% are in females, summing up to a total of 860 patients. Tinea cruris has the highest frequency at 22.63%, predominantly affecting males (25.81%) compared to females (19.24%). Pityriasis versicolor follows closely at 12.81%, with a relatively balanced gender distribution. Notably, Tinea pedis and Tinea capitis show varying percentages between genders, emphasizing the gender-specific nature of certain infections.

Table 3: Pattern of superficial fungal infections in children (0-14yr)

Name of Fungal Infections	Male n (%)	Female n (%)	Total (%)
Tinea corporis	26 (20)	9 (6.67)	35 (13.33)
Tinea cruris	1 (1.11)	00 (00)	1 (0.56)
Tinea pedis	6 (4.44)	14 (11.11)	20 (7.78)
Tinea capitis	33 (25.56)	36 (27.78)	69 (26.67)
Tinea fasciae	10 (7.78)	12 (8.89)	22 (8.33)
Tinea barbae	1 (1.11)	00 (00)	1 (0.56)
Tinea mannum	00 (00)	00 (00)	00 (00)
Pityriasis. versicolor	2 (1.12)	6 (4.44)	8 (2.78)
Onychomycosis	00 (00)	6 (4.44)	6 (2.22)
Tinea incognitio	1 (1.11)	1 (1.11)	2 (1.11)
Oral thrush	32 (24.44)	24 (18.89)	56 (21.67)
Chronic paronychia	1 (1.11)	1 (1.11)	2 (1.11)
Candidal intertrigo	15 (11.12)	17 (13.33)	32 (12.22)
Genital candidiasis	1 (1.11)	3 (2.22)	4 (1.67)
Total	129 (50%)	129 (50%)	258 (30%)

Table 3 shows that of 860 patients, 258 (29.95%) children were affected by SIFs. Among children, maximum frequency was for tinea capitis (n=69, 26.67%) followed by oral thrush (n=56, 21.67%) and tinea corporis (n=35, 13.33%). Here, male and female children were equally affected as 36 (27.78%) female and 33 (25.56%) male children were affected by tinea capitis and 32 male (24.44%) and 24 female (18.89%) children were affected by oral thrush.

Table 4: Distribution of superficial fungal infections in adult population (15-64yr)

Name of Fungal Infections	Male n (%)	Female n (%)	Total (%)
Tinea corporis	48 (17.62)	14 (6.10)	62 (12.32)
Tinea cruris	82 (29.98)	53 (22.56)	135 (26.63)
Tinea pedis	16 (5.70)	28 (12.20)	44 (8.68)
Tinea capitis	13 (4.66)	6 (2.44)	19 (3.64)
Tinea fasciae	3 (1.04)	1 (0.61)	4 (0.84)
Tinea barbae	7 (2.59)	00 (00)	7 (1.40)
Tinea mannum	10 (3.63)	3 (1.22)	13 (2.52)
Pityriasis versicolor	55 (20.21)	41 (17.68)	96 (19.05)
Onychomycosis	10 (3.63)	10 (4.27)	20 (3.92)
Tinea incognitio	1 (0.52)	6 (2.44)	7 (1.40)
Oral thrush	16 (5.70)	30 (12.80)	46 (8.96)
Chronic paronychia	8 (3.11)	16 (6.71)	24 (4.75)
Candidal intertrigo	3 (1.04)	21 (9.15)	24 (4.75)
Genital candidiasis	2 (2.59)	4 (1.83)	6 (1.18)
Total	274 (54.06)	233 (45.94)	507 (58.95)

In this table, the distribution of superficial fungal infections in the adult population (15-64 years) is presented, highlighting gender-specific prevalence. The total number of cases is 507, with 54.06% in males and 45.94% in females. Tinea cruris exhibits the highest frequency at 26.63%, with a higher prevalence in males (29.98%) compared to females (22.56%). Pityriasis versicolor follows closely at 19.05%, showing a relatively balanced gender distribution. Notably, Tinea capitis and Tinea fasciae have lower percentages, emphasizing their lesser prevalence in this age group.

Table 5: Distribution of superficial fungal infections in elderly patients (65 yr +)

Name of Fungal Infections	Male n (%)	Female n (%)	Total (%)
Tinea corporis	12 (29.63)	19 (35.14)	31 (32.63)
Pityriasis versicolor	4 (11.11)	2 (2.70)	6 (6.25)
Tinea pedis	4 (11.11)	3 (5.41)	7 (7.81)
Tinea cruris	10 (25.93)	10 (18.92)	20 (21.88)
Tinea incognitio	2 (3.70)	3 (5.41)	5 (4.69)
Tinea capitis	2 (3.70)	00 (00)	2 (1.56)
Tinea mannum	00 (00)	3 (5.41)	3 (3.13)
Oral thrush	2 (3.70)	5 (8.11)	7 (6.25)
Onychomycosis	4 (11.11)	7 (13.51)	11 (12.50)
Chronic paronychia	00 (00)	3 (5.41)	3 (3.13)
Total	40 (42.19)	55 (57.81)	95 (11.05)

Table 5 illustrates the distribution of superficial fungal infections in elderly patients aged 65 years and above. Among the 95 total cases, 42.19% are in males, and 57.81% are in females. Tinea corporis and Tinea cruris are the most prevalent, with frequencies of 32.63% and 21.88%, respectively. Tinea corporis exhibits a higher prevalence in females (35.14%) compared to males (29.63%). Pityriasis versicolor and Tinea pedis also show notable percentages, with distinct gender variations.

DISCUSSION

In this study, Dermatology were the most common SFIs, followed by candidal infection. tinea corporis, tinea capitis and pityriasis versicolor were the most common and tinea barbae was the least common. Children under 14 years of age appeared to be more susceptible to tinea capitis, which is similar to the results of other regions, including Italy [19, 20]. Croatia [21], and Austria [22]. The high incidence of tinea capitis in the younger population (under 14 years) may be a result of the low level of fungistatic fatty acids in younger individuals [23]. Moreover, large families (four to eight children) are quite common in this region, which may possibly result in some neglect (in terms of hygiene standards) on the part of the mother, as she is busy with the youngest children. The sharing of towels, clothing and hair accessories with infected individuals may lead to the spread of SFIs. The spread of infections may also be attributed to the use of unsterilized barbering instruments [23, 24].

In our study, Tinea corporis was the most common superficial fungal infection (SFI) in this population, accounting for 22.63% of cases. It typically presents as oval, itchy, localized ring lesions with central clearing and sometimes inflammatory red papules. Pityriasis versicolor was the second most common SFI, accounting for 12.81% of cases. It presents with multiple hypopigmented patches with powdery scales involving the trunk and sometimes other sites. These lesions can become erythematous and itchy in hot weather. Tinea pedis is common in adults due to bare foot and excessive use of water. Humidity and temperature are well-known factors affecting fungal penetration through the stratum corneum of the skin [25].

Exposure to high temperature is common in rural areas because most of them are farmers who work in the hot weather. Frequent exposure to dirty water may affect the prevalence of tinea pedis infections. Earlier reports have shown that dogs and cats may play a significant role in spreading dermatophytes [26, 27]. Our data also suggest that males were affected by different kinds of SFIs more than females and the prevalence was highest in adult males aged between 15 and 64 years. These results are in agreement with those of earlier investigators who also reported a higher prevalence of SFIs in males than females [1-16]. By contrast, some studies have reported a higher frequency of SFIs in females as compared to males [15-29].

Although some investigators have suggested that gender may influence the susceptibility to particular forms of infection [30, 31], it should be emphasized that factors other than gender may play a major role in determining the prevalence of SFIs. The difference in the extent and severity of fungal infections in males and females in the rural areas may be attributable to the vast difference in daily work, lifestyle and propensity to micro-trauma [32]. In this region, the majority of women are confined to household activities, including child care, laundry, cooking, etc. Men are generally considered as the “breadwinners” and spend a significant time in their workplace. In patients with onychomycosis, the frequency of dermatophytes causing nail infections was quite low whereas non-dermatophyte molds were the most common causative agents. The greater susceptibility of adult females to onychomycosis infection in this study may be explained by their lifestyle and household responsibilities.

CONCLUSION

The incidence of superficial fungal infections in Bangladesh is on the rise, demonstrating a continuous upward trend. Surprisingly, the prevalence of these infections in the rural population far exceeded our initial predictions. The distribution and patterns of superficial fungal infections in Bangladesh exhibit significant variations depending on geographical location, as well as social, cultural, environmental, and occupational factors. Our findings have furnished valuable insights that can guide future endeavors aimed at preventing superficial fungal infections in rural regions of the country.

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