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Recurrent Fungal Infections: Mechanisms, Risk Factors, and Treatment Approaches

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Abstract **Original Research Article**

Background: Fungal infections are a significant health concern globally, and recurrent infections present an increasing challenge, particularly in low- and middle-income countries such as Bangladesh. The tropical climate, socio-economic disparities, poor sanitation, and increasing prevalence of chronic conditions like diabetes contribute to the rising burden of these infections. ***Objective***: This study aims to investigate the mechanisms, risk factors, and treatment approaches for recurrent fungal infections in Bangladesh. ***Methodology***: A cross-sectional observational study was conducted between January and December 2023, with participants from diverse regions of Bangladesh. Data were collected through structured interviews and clinical assessments of patients diagnosed with recurrent fungal infections. Statistical analysis was performed to determine the prevalence of infections, associated factors, and treatment approaches. ***Results***: The study found a predominance of fungal infections among younger individuals (ages 25-70), with males being disproportionately affected. Ringworm was the most common infection (77.33%), followed by pityriasis versicolor (10.67%) and seborrheic dermatitis (8.00%). The study also identified several socio-economic and lifestyle factors associated with higher infection rates, including urban residency, sharing personal items, and overcrowding. Oral antifungals were the most commonly used treatment (50%), followed by topical creams (30%). ***Conclusion***: Recurrent fungal infections in Bangladesh are highly prevalent, particularly among younger males, with ringworm being the most common infection. Socio-economic and lifestyle factors, such as overcrowded living conditions and sharing personal items, significantly contribute to the spread of infections. There is an over-reliance on oral antifungal medications, which may lead to resistance, highlighting the need for improved treatment protocols and public health initiatives focused on prevention, education, and optimal management strategies.

Keywords: Recurrent fungal infections, ringworm, antifungal treatment.

INTRODUCTION

Fungal infections are a significant global health concern, with recurrent fungal infections emerging as a critical challenge, particularly in low- and middle-income countries like Bangladesh. These infections, caused by a variety of fungi including *Candida*, *Aspergillus*, and *Dermatophytes*, can affect the skin, nails, mucosa, and even systemic organs. Recurrent fungal infections occur when an individual experiences repeated episodes of the same infection, often indicating underlying health issues or environmental conditions that favor fungal growth. In Bangladesh, the rising prevalence of these infections is attributed to a combination of climatic factors, healthcare limitations, and socio-economic disparities [1-3].

Bangladesh's tropical and humid climate provides an ideal environment for fungal proliferation. High temperatures, heavy rainfall, and persistent moisture contribute to the widespread occurrence of fungal infections, particularly in rural and low-income urban areas. Additionally, poor sanitation practices, limited access to clean water, and inadequate hygiene exacerbate the spread of fungal pathogens. These conditions disproportionately affect vulnerable populations, including those with compromised immune

systems, diabetes, and other chronic illnesses, who are at a higher risk of developing recurrent infections [4, 5].

Recurrent fungal infections often signal deeper health problems, such as immunosuppression caused by conditions like HIV/AIDS or the use of immunosuppressive drugs. In Bangladesh, the increasing prevalence of diabetes—a known risk factor for recurrent fungal infections—further complicates the issue [6-8]. Diabetic patients are particularly prone to infections like recurrent vulvovaginal candidiasis, onychomycosis, and mucormycosis due to impaired immune responses and elevated blood glucose levels, which promote fungal growth. Additionally, malnutrition and anemia, common in rural and underserved populations, contribute to weakened immunity and a higher susceptibility to these infections [9, 10].

Another contributing factor to the persistence of fungal infections in Bangladesh is the overuse and misuse of antifungal medications. Over-the-counter availability of antifungal drugs and the absence of stringent prescription regulations often lead to incomplete or inappropriate treatments. This fosters the development of antifungal resistance, making recurrent infections more difficult to treat. For instance, the emergence of *Candida auris*, a multidrug-resistant fungus, poses a growing threat to public health, with limited therapeutic options available for its management [11].

The socio-economic and psychological impacts of recurrent fungal infections cannot be overlooked. Chronic skin conditions, disfigured nails, and persistent symptoms of fungal infections can lead to social stigma, loss of productivity, and decreased quality of life. In rural areas, traditional healing practices often delay proper diagnosis and treatment, further exacerbating the problem [12]. Moreover, the economic burden of managing recurrent infections—through repeated consultations, laboratory tests, and antifungal therapies—places a strain on both affected individuals and the healthcare system.

To address the burden of recurrent fungal infections in Bangladesh, a multi-pronged approach is essential. This includes improving public awareness about hygiene and prevention, strengthening healthcare infrastructure to facilitate timely diagnosis and effective treatment, and promoting research on fungal pathogens and antifungal resistance. Furthermore, integrating fungal infection management into existing public health initiatives, particularly for at-risk populations, can significantly reduce the prevalence and impact of these infections. As the climate continues to change and the prevalence of chronic illnesses rises, tackling recurrent fungal infections must become a public health priority in Bangladesh.

Objective

The objective of this study is to investigate the mechanisms, risk factors, and treatment approaches for recurrent fungal infections in Bangladesh.

METHODOLOGY

This study is a cross-sectional, observational study conducted to examine the risk factors, prevalence, and treatment approaches for recurrent fungal infections in Bangladesh. The study was carried out in a healthcare setting, with participants drawn from various regions of the country to ensure diversity in socio-economic backgrounds and living conditions. Data collection took place between January 2023 and December 2023, covering a one-year period.

Data was collected through structured interviews and clinical assessments of patients diagnosed with recurrent fungal infections. The participants were selected based on the presence of a fungal infection as per clinical and laboratory diagnosis, and informed consent was obtained from all participants before their inclusion in the study. The study aimed to gather demographic details, socio-economic information, lifestyle factors, and treatment patterns through questionnaires administered to the patients.

Quantitative data were analyzed using descriptive statistical methods, including frequencies, percentages, and means, to determine the prevalence of various types of fungal infections and their association with demographic and socio-economic factors. Statistical software was used to ensure the accuracy and reliability of the data analysis. The results were presented in tables, which depicted the distribution of the infections, treatment approaches, and associated factors.

RESULTS

The age distribution of the study population reveals that the majority of participants were between 21 and 30 years, accounting for 39.1% (25 individuals) of the total sample. The second largest group was aged 18-20 years, comprising 29.7% (19 individuals). A smaller proportion of participants were in the 31-40 years age group (23.4%, 15 individuals), while the least represented group was aged 41-50 years, making up just 7.8% (5 individuals). This suggests that the population in this study was predominantly younger, with the largest number falling within the 21-30 years range.

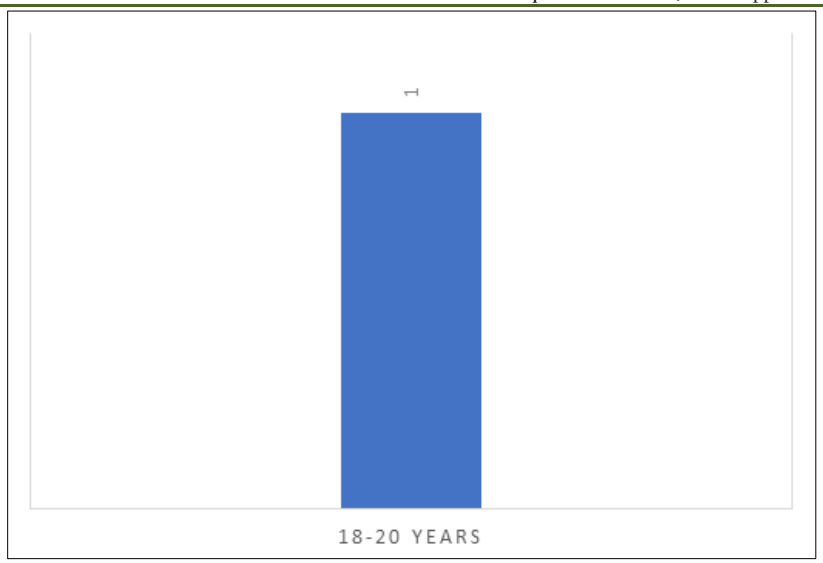

Figure 1: The age distribution of the study population reveals

The distribution of fungal infections based on sex shows a significant male predominance, with 73.4% of the cases being male, compared to 26.6% female. This indicates a higher prevalence of fungal infections among males in the study population.

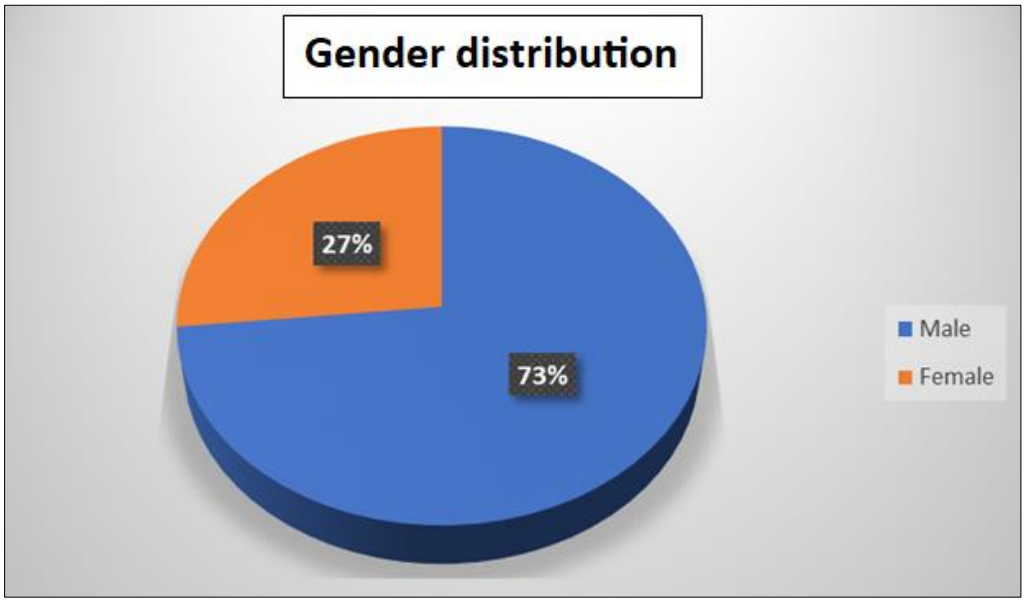

Figure 2: Gender Distribution of the Study group

The study revealed that ringworm was the most prevalent fungal infection among the patients, accounting for 77.33% of cases. Pityriasis versicolor followed with a prevalence of 10.67%, while seborrheic dermatitis and oral thrush/candidiasis were less common, with prevalence rates of 8.00% and 4.00%, respectively. These findings highlight the dominance of ringworm in the population studied, with other fungal infections being significantly less frequent.

Table 1: Prevalence of fungal skin disease among the patients

Fungal Infections	Prevalence (%)
Ringworm	77.33%
Pityriasis versicolor	10.67%
Seborrheic dermatitis	8.00%
Oral thrush / Candidiasis	4.00%

The results of the study show a diverse distribution of demographic, socio-economic, and lifestyle factors among the participants. A significant majority of patients were married (70.67%), with the rest being unmarried (16.00%), widowed/widowers (5.33%), and separated/divorced (8.00%). Socio-economic status indicated a higher prevalence in the upper-middle class (27.33%) and middle class (24.00%). The majority of participants had secondary education (36.00%), followed by higher secondary (24.00%). In terms of income, 37.33% of patients earned between Tk 15000-20000, while 26.67% earned more than Tk 20000. Occupation distribution showed that 32.00% were traders, while smaller proportions were employed in other fields, such as non-government services (10.67%) and industrial work (8.00%).

The seasonal prevalence of fungal infections was highest during summer (60.00%), with lower rates observed in the rainy (26.66%) and winter (13.34%) months. A significant portion of the participants identified as Muslim (86.67%), with Hindu participants making up 10.66%. Tap water was the most common source of water for 69.99% of the participants, while 26.66% used tube wells. Regarding living conditions, 70.66% lived in urban areas, and 60.00% practiced regular bathing. Types of clothing worn were predominantly cotton (26.67%) or mixed fabrics (34.68%). Sharing personal items was common, with 66.67% reporting sharing personal belongings. Overcrowding in families was also noted in 66.66% of cases, and 62.66% had a history of recurrent infections. These findings highlight the influence of various socio-economic, lifestyle, and environmental factors on the prevalence of fungal infections.

Table 2: Prevalence of fungal infections according to associated factors

Factors	**Prevalence (%)**
Marital Status	
Married	70.67%
Unmarried	16.00%
Widow/Widower	5.33%
Separated/Divorced	8.00%
Socio-economic Status	
Lower	17.33%
Middle	24.00%
Upper-middle	27.33%
Higher	21.34%
Educational Status	
Illiterate	9.33%
Primary	16.00%
Secondary	36.00%
Higher secondary	24.00%
Degree or above	14.67%
Monthly Income	
Below Tk 6000	16.00%
Tk 6000-12000	20.00%
Tk 15000-20000	37.33%
Tk 20000+	26.67%
Occupation	
Govt. Service	5.34%
Non-Govt. Service	10.67%
Traders	32.00%
Industrial Worker	8.00%
Housewife	9.33%
Driver (Rickshaw, van, bus, truck)	8.00%
Student	6.66%
Day Labor	9.33%
Others	10.67%
Seasons	
Summer (March-June)	60.00%
Rainy (July-October)	26.66%

Winter (November-February)	13.34%
Total	100%
Religion	
Muslim	86.67%
Hindu	10.66%
Others	2.67%
Sources of Water	
Tap	69.99%
Tube Well	26.66%
Pond	2.66%
Others	1.35%
Residence Location	
Urban	70.66%
Semi-urban	24.00%
Rural	5.34%
Regular Bath	
Yes	60.00%
No	40.00%
Types of Clothes	
Cotton	26.67%
Synthetic	20.00%
Nylon	10.67%
Mixed	34.68%
Others	7.98%
Personal Items Sharing	
Yes	66.67%
No	37.33%
History of Recurrent Infections	
Yes	62.66%
No	37.34%
Overcrowding Family	
Yes	66.66%
No	33.34%

The treatment approaches for recurrent fungal infections in the study group revealed that oral antifungal medications were the most commonly used, with 50.00% of participants opting for this treatment. Topical antifungal creams followed as the second most prevalent approach, used by 30.00% of patients. Antifungal shampoos were utilized by 10.00% of participants, while 7.00% underwent combination therapy, involving both oral and topical antifungals. A small percentage (3.00%) of patients reported using alternative treatments, such as natural remedies, to manage their fungal infections.

Table 3: Treatment Approach of the study group

Treatment Approach	**Prevalence (%)**
Oral Antifungal Medications	50.00%
Topical Antifungal Creams	30.00%
Antifungal Shampoos	10.00%
Combination Therapy (Oral + Topical)	7.00%
Other (e.g., natural remedies)	3.00%

DISCUSSION

The findings of this study revealed a predominant young adult population, with the majority of participants aged between 21 and 30 years, which is consistent with the results of several previous studies. For instance, a study also found a higher prevalence of fungal infections among younger individuals, particularly in the 20-30 years age group [11]. This could be attributed to lifestyle factors such as increased outdoor activities and prolonged exposure to moisture, which are common in tropical climates like Bangladesh. Additionally, the significant male predominance in the study population (73.4%) mirrors the findings of other studies where males were similarly more susceptible to

fungal infections, likely due to greater occupational exposure to environmental factors and less attention to personal hygiene compared to females [12].

Ringworm was the most prevalent fungal infection (77.33%) in this study, a finding that aligns with other regional studies. For example, a study reported ringworm as the most common dermatophyte infection, suggesting that dermatophytes, particularly *Trichophyton* species, are the primary pathogens in this geographical area [13]. This is consistent with the environmental conditions in Bangladesh, where high humidity and warmth create an ideal setting for the growth of dermatophytes. The lower prevalence of conditions like pityriasis versicolor (10.67%) and seborrheic dermatitis (8.00%) also corroborates findings from similar studies conducted in tropical regions, where fungal infections are generally dominated by dermatophytes.

The socio-economic and demographic factors observed in this study reveal significant associations with the prevalence of fungal infections. For example, the higher prevalence among individuals from the upper-middle and middle socio-economic classes (27.33% and 24.00%, respectively) may reflect increased exposure to fungal spores in crowded urban settings, as well as access to medical treatments that facilitate the diagnosis of fungal infections. This is similar to findings where urban dwellers were more likely to seek medical care and thus have higher rates of diagnosed fungal infections [14]. Additionally, the seasonal variation observed, with infections being most common in the summer (60.00%), corresponds with other studies that note the increase in fungal infections during warmer months due to the proliferation of fungi in hot and humid environments.

Regarding treatment approaches, this study highlighted the widespread use of oral antifungal medications (50.00%), followed by topical treatments (30.00%). This finding is consistent with the general treatment patterns observed in Bangladesh, where oral antifungals like fluconazole and itraconazole are commonly prescribed for dermatophyte infections. However, it also reflects a potential overreliance on oral medications, which might contribute to antifungal resistance [15]. The relatively low use of combination therapies (7.00%) suggests that many patients may not be receiving optimal treatment regimens, highlighting the need for increased awareness and guidelines for managing recurrent fungal infections. The use of natural remedies (3.00%) indicates an ongoing cultural preference for traditional treatments, which can sometimes delay the adoption of more effective medical therapies.

In comparison to global studies, this research aligns with trends observed in tropical and sub-tropical regions, where fungal infections are prevalent and strongly influenced by climatic, socio-economic, and behavioral factors. However, the study also underscores the need for public health interventions targeting prevention, education on proper use of antifungals, and improved healthcare access in rural and underserved urban areas.

CONCLUSION

In conclusion, this study highlights the high prevalence of recurrent fungal infections in Bangladesh, particularly among younger, male individuals, with ringworm being the most common infection. Socio-economic factors, seasonal variations, and lifestyle habits such as sharing personal items and living in overcrowded conditions were found to significantly influence the occurrence of fungal infections. The widespread use of oral antifungal medications, along with a lesser reliance on combination therapies, emphasizes the need for better treatment protocols and awareness regarding antifungal resistance. These findings call for targeted public health interventions to improve prevention, diagnosis, and treatment, particularly in urban and rural areas where the burden of fungal infections remains high.

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