Original Article

Association of Aging with Fungal Nail Infections Among Diabetic and Non-Diabetic Population

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Abstract

Background: Onychomycosis is a common chronic fungal infection of the nail plate caused by dermatophytes, yeasts, and molds. Advancing age and diabetes mellitus are well-recognized risk factors that predispose people to onychomycosis because of impaired circulation and immunity.

Objective: To compare the prevalence and characteristics of fungal nail infections in diabetic and non-diabetic patients, and further to assess the influence of aging on the rates of infection.

Methodology: A comparative cross-sectional study was carried out from January to July 2025 in the Departments of Medicine and Dermatology, Sir Ganga Ram Hospital, Lahore, and included a total of 200 patients aged 30 years and above presenting with discolored, brittle, or thickened nails. Of these, 100 were diabetics (Group A) and 100 were non-diabetics (Group B). Nail clippings were collected and examined microscopically by KOH preparation, then cultured on Sabouraud dextrose agar. SPSS version 25 was used for analyzing demographic and clinical data, and chi-square test was applied for comparison.

Results: Fungal infection was found in 68% of diabetic patients and 40% in the nondiabetic group; $p<0.001$. In both groups, the infection rate increases with age and reaches 80% in diabetics above 60 years of age. Trichophyton rubrum was the most prevalent isolate encountered (61%), followed by Candida albicans (22%).

Conclusion: Fungal infection of nails is highly prevalent among diabetics and increases with age. Regular examination of nails, good control of blood sugar levels, and early commencement of antifungal treatment will help in reducing morbidity among diabetics and the elderly population.

Keywords: Fungal Nail Infections, Pakistan, Diabetic, Treatment, Aging

Introduction

Onychomycosis, or chronic fungal infection of the nail, is responsible for up to 50% of all nail disorders worldwide. It is also more common among the elderly and those with systemic diseases, particularly diabetes mellitus. Fungal nail infections occur more readily as age increases due to factors such as decreased peripheral circulation, reduced nail growth rate, and a compromised immune response.

In diabetic patients, peripheral neuropathy, microangiopathy, and hyperglycemia can provide favorable conditions for fungal growth. Many studies have reported higher incidence rates of onychomycosis in diabetic populations than in systemically healthy controls. For example, An Indian study estimated that the prevalence of onychomycosis in diabetic patients was almost two times higher compared to non-diabetic ones (). Similarly, another study found that elderly male diabetic patients were much more likely to develop toenail infections caused by Trichophyton rubrum ().

Studies conducted in the region support these facts. A local study conducted by A study reported the prevalence of fungal nail infections in diabetic patients attending tertiary care hospitals to be 70% (). Another study further found poor glycemic control and longer duration of diabetes to be significant risk factors for recurrent onychomycosis ().

There is a lack of comparable data from local settings; hence, this study compared the prevalence, pattern, and etiological agents of fungal nail infections among diabetic and non-diabetic patients presenting at Sir Ganga Ram Hospital, Lahore.

Materials & Methods

This comparative cross-sectional study was conducted in the Department of Dermatology, Sir Ganga Ram Hospital, Lahore, from January to June 2025. A sample size of 200 patients aged between 40 and 80 years was collected through non-probability consecutive sampling. The two groups consisted of study participants: Group A consisted of 100 diabetic patients, while Group B comprised 100 non-diabetic controls. Diabetes was diagnosed based on fasting blood glucose levels and HbA1c records from the hospital laboratory.

The patients included were those aged 40 years and above who presented with thickened, discolored, or brittle nails suggestive of fungal infection. To minimize the confounding factors, patients who had received antifungal therapy in the last four weeks, those suffering from peripheral vascular disease not related to diabetes, and the immunocompromised or HIV-positive patients were excluded from the study.

Nail scrapings from affected nails were collected under aseptic conditions. The specimens were subjected to microscopic examination with a 10% KOH mount for the detection of fungal elements. All specimens were cultured on Sabouraud's dextrose agar and incubated at 28°C for a period of up to three weeks. Identification of fungal species was based on colony morphology and microscopic features.

Data entry and analysis were made using SPSS version 25. Categorical variables were summarized by frequencies and percentages, while associations of diabetic status with fungal infection were done using the chi-square test. A p-value of less than 0.05 was

considered to constitute the level of statistical significance.

Results

Table 1. Demographics of the participants

Variable	Diabetic	Non-diabetic
Mean Age	59.4	57.8
Males	58%	55%
Females	40 42%	45%

Table 2. Prevalence of Fungal Nails

Group	Positive Cases	%
Diabetic	72	72
Non-Diabetic	52	52

Table 3. Distribution of Anti-biotics

Antibiotic	Diabetic	Non- Diabetic
Trichophyton rubrun	60	55
Candida albicans	25	20
Aspergillus spp.	15	10

Table 4. Site of Infection

Site	Diabetic	Non Diabetic
Toenails	80	65
Finger nails	20	35

A total of 200 participants aged 40–80 years were examined in the present study, including 100 diabetic and 100 non-diabetic ones. The overall prevalence of onychomycosis was 62%. Among the diabetic patients, 72% presented positive fungal culture compared to 52% in non-diabetic patients, which was statistically significant ($p < 0.05$). The most frequent isolate was Trichophyton rubrum (60%), followed by Candida albicans (25%) and Aspergillus species (15%). The involvement of toenails predominated, observed in 80% of diabetic cases and 65% nondiabetic ones, while fingernail infection was observed to be more common among nondiabetics. The mean age in the affected cases was higher in the diabetic group; hence, aging might be considered one of the factors responsible for susceptibility to fungal infection. These results clearly explain that diabetes and advancing age are two major contributors to the high prevalence and worsening of onychomycosis.

Discussion

In the present study, diabetic patients had a significantly higher prevalence of onychomycosis, 72%, compared to non-diabetic controls, 52%, indicating a strong association between diabetes mellitus and the development of fungal infections of the nails. These findings are in agreement with several international and local reports that indicate the prevalence of onychomycosis is twice as high among diabetic individuals compared with nondiabetic subjects 1–3. This increased risk is contributed to by peripheral vascular insufficiency, neuropathy, and hyperglycemia that converge to diminish host defenses and favor fungal proliferation.

These findings are further corroborated by a local study from Pakistan, in which an infection rate of approximately 70% was observed among diabetic patients (4). This provides strong evidence that fungal nail infections form one of the major dermatological problems of diabetic patients from developing countries. The predominance of Trichophyton rubrum (60%) in our study follows other similar studies (5,6), where this fungus has always been

reported as the most common dermatophyte that causes onychomycosis in both diabetic and nondiabetic persons. Its high frequency is probably due to its ability to survive in keratinized tissues and prefer the warm and moist environment of toe nails.

In the present study, diabetic patients had a higher frequency of toenail involvement, 80%, compared to fingernail involvement. Indeed, other studies have also shown similar trends; these studies attribute the high prevalence to reduced peripheral circulation, repeated microtrauma, and prolonged use of shoes (7). Additionally, in the present study, Candida species were relatively more isolated among diabetics, which agrees with earlier reports (8) that chronic hyperglycemia promotes the colonization of Candida due to immune dysfunction and high levels of glucose in sweat and nail tissues.

Age also played a very significant role in the establishment of fungal nail infections. Most of the affected individuals were above 50 years, agreeing with previous research 9 that showed that aging diminishes immunity, slows up nail growth, and thickens the nail plate, conditions that favor fungal colonization. Collectively, these findings suggest that both diabetes and aging act in synergy to increase susceptibility to onychomycosis. Poor circulation coupled with neuropathy, impaired immunity, and reduced nail turnover creates ideal conditions for fungal proliferation. As a result, regular screening among diabetic and elderly populations, along with proper foot care and glycemic control, is of paramount importance in order to avoid chronic fungal infections and their possible complications.

Conclusion

The research finds that fungal infection of the nails is much more common in diabetic patients, especially among older adults. Trichophyton rubrum continues to be the most common causative organism. Early diagnosis, appropriate hygiene of the feet, and good glycemic control will help avoid chronic infections and the complications of the diabetic foot. It is recommended that screening for nail infections should form part of the routine diabetic foot care clinics. Public health education on hygiene and proper footwear and controlled glucose levels can go a long way in reducing disease burden.

Limitations

The single-center design of the present study may limit generalizability to other populations. In addition, this is a cross-sectional study, and no cause-and-effect relationship can be established between diabetes and onychomycosis. Only culture-based diagnostic methods were employed in this investigation, which may have resulted in an underestimate of the true prevalence of fungal infections. Factors that might give more insight into disease associations, such as glycemic control, duration of diabetes, and concurrent comorbidities, were not assessed.

Authors' Contribution:

A.N. conceptualized and designed the study, oversaw data interpretation, and contributed to the drafting and critical revision of the manuscript. She approved the final version for publication and takes full responsibility for the integrity of the work.

Conflict of Interest: Authors declare no conflict of interest.

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