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CLINICO-DEMOGRAPHIC PROFILE OF ONYCHOMYCOSIS AMONG THE PATIENTS OF DIABETES MELLITUS: A CROSS-SECTIONAL STUDY IN A TERTIARY CARE HOSPITAL OF NORTHERN ODISHA.

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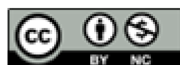

ABSTRACT

Background: Onychomycosis is a common fungal infection of the nails and accounts for a significant proportion of nail disorders worldwide. Diabetes mellitus is a well-established risk factor for onychomycosis due to altered immunity, peripheral vascular disease and poor glycemic control. In India, the rising burden of diabetes along with lifestyle changes has led to an increasing prevalence of onychomycosis among diabetic patients. However, there is paucity of data regarding the clinico-demographic spectrum and clinical patterns of onychomycosis in diabetic patients, particularly from northern Odisha. Therefore, the present study intends to identify the various clinical spectrums of onychomycosis in diabetic patients attending a tertiary care hospital in northern Odisha. **Materials and Methods:** This was a cross-sectional study conducted in the Department of Dermatology and Venereology of a tertiary care hospital in northern Odisha from March 2023 to February 2025. A total of 487 diabetic patients with clinical suspicion of onychomycosis were included. Detailed socio-demographic data, clinical history, nail findings, diabetic status and laboratory investigations were recorded. Diagnosis was confirmed by KOH mount and fungal culture wherever indicated. The severity and clinical types of onychomycosis were assessed and data were analyzed using descriptive statistics. **Result:** Majority of patients (64.3%) were above 50 years of age with male preponderance (1.5:1). Most patients were overweight or obese (74.5%) and belonged to urban areas (64.1%), with a sedentary lifestyle observed in 61.2%. Type 2 diabetes mellitus was present in 95% of cases and 59.3% had diabetes duration of more than 10 years. Poor glycemic control (HbA1c >6.5%) was seen in 53.8% of patients. Mild nail involvement was noted in 43.5%, moderate in 33.9% and severe in 22.6%. Distal lateral subungual onychomycosis was the most common clinical type (48.7%). KOH positivity was seen in 76.3% of tested cases. **Conclusion:** Onychomycosis was more common in elderly diabetic patients with male preponderance and long-standing, poorly controlled diabetes. Distal lateral subungual onychomycosis was the most common clinical pattern, with a substantial proportion showing moderate to severe nail involvement. Early diagnosis, good glycemic control and proper foot care are essential to reduce disease burden and prevent complications in diabetic patients.

INTRODUCTION

Onychomycosis (OM) is a prevalent nail disease that accounts for 40-50% of all onychopathies globally.[1] OM may be caused by yeasts, dermatophytes and molds that are not dermatophytes; nonetheless, dermatophytes are the agents that are considered to be the most usually implicated.[2] With a universal incidence and a disease with relapses most often in adult populations, onychomycosis is a significant

global public health issue that affects a number of patients in different regions across the globe.

Numerous large-scale epidemiological investigations have produced contrasting findings; nonetheless, onychomycosis is responsible for up to 50% of all nail diseases and 30% of all superficial skin fungal infections that are detected by dermatologists.[3] Clinically, onychomycosis may be broken down into many different forms, including distal & lateral subungual onychomycosis (DLSO), superficial white onychomycosis (SWO), proximal subungual onychomycosis (PSO), Endonyx onychomycosis and Total dystrophic onychomycosis (TDO).

Up to 5% of people in India are affected by this condition. OM is connected with a number of risk factors, some of which include diabetes mellitus (DM), peripheral vascular disease, immunosuppression, tinea pedis, smoking, repeated trauma, psoriasis and sharing public bathing facilities.[4] A total of around 61.3 million people in India have been diagnosed with diabetes, and it is anticipated that this figure will increase to 101.2 million by the year 2030.[5]

The clinico-demographic and mycological aspects of onychomycosis in diabetic population are still incompletely studied, despite the fact that diabetes mellitus is a known risk factor for OM. In addition to this, it was attempted to determine whether or not, there was any association between the number of nails involved and the levels of glycemic control, if any. Particularly in the case of diabetes mellitus, they have the potential to have a significant influence on the vital and functional prognosis as well as the quality of life.[6]

With the exception of diabetic foot, there have been very few studies conducted in Odisha, particularly northern Odisha, that have concentrated on examining the specifics of the many clinical manifestations of onychomycosis that are seen in diabetic patients. There is paucity of data available to assess the clinic-demographic profile of onychomycosis in this region. Therefore, this study intends to identify the various clinical spectrums of onychomycosis in diabetic patients who visited the dermatology department of a tertiary care hospital in northern Odisha.

MATERIALS AND METHODS

The present study was a cross-sectional study undertaken by the Department of Dermatology and Venereology at the Fakir Mohan Medical College and Hospital, Balasore, India. The study was conducted over 2 years i.e. from March 2023 to Feb 2025 after receiving due approval from the institutional ethical committee (60/IEC dated 15/02/23). A total of 487 patients, who attended diabetic clinic of this institution were included in the study using the following criteria.

Inclusion Criteria

Diabetic patients, diagnosed on the basis of the American Diabetic Association criteria, who presented with onychomycosis were included in the study. An informed written consent was taken from all the patients, before their inclusion.

Exclusion Criteria

Patients with gestational diabetes mellitus, trauma, patients receiving antifungal or immunosuppressive treatment for last 1 year and lactating females were excluded from the study.

Study Tool

The demographic data of the diabetic patients and controls were obtained by a detailed questionnaire. The following information was obtained: age, gender, occupation, level of education, duration of diabetes, presence of foot ulcer, other co-morbid disease, family history of onychomycosis, trauma, contact with pets/animals, fungal infections at other sites, vascular insufficiency and mean blood sugar values in the last 6 months. Associated medical illnesses, such as hypertension, coronary artery disease, thyroid disorders, etc., were also recorded. Examination included an evaluation of the dorsalis pedis, posterior tibial and radial pulses. Clinical diagnosis of onychomycosis was suspected based on one or more of the following signs: thickening and yellowish to white changes of the nail; hyperkeratosis below the nail; partial or total detachment of the nail from the nail bed; linear, single, or multiple white, yellow, orange or brown bands on the nail plate. The patients were classified according to the following four major clinical presentations of onychomycosis: distolateral subungual onychomycosis (DLSO), superficial white onychomycosis (SWO), proximal subungual onychomycosis (PSO), endonyx onychomycosis and complete dystrophic onychomycosis. Taking into account the number of nails and the area of nail plate involvement, the severity of onychomycosis was recorded. The severity of onychomycosis was evaluated globally for all nails as mild (<25% involvement or <4 nails involved), moderate (26–74% involvement or 5–8 nails involved) or severe (75% involvement or ≥ 9 nails involved).

Data Collection Method: Using the data abstraction form, the data of 487 patients were extracted from the questionnaire provided to patients in diabetic clinic of Fakir Mohan Medical College and Hospital from March 01, 2023 to February 28, 2025. The study variables, such as socio-demographic information, complete patient history and clinical and dermatological findings of all the diabetic patients with onychomycosis were obtained. In addition to this, laboratory investigations, such as complete blood count, blood sugar, liver function test, renal function test and thyroid profile were done. In cases where clinical diagnosis was not possible, microbiological study of specimens, i.e. nail clippings was done. In patients having inconclusive nail findings, mycological sampling was performed. The specimens were examined using a 20%

potassium hydroxide (KOH) solution to see the presence or absence of fungal elements. In KOH negative cases, specimens were inoculated on Sabouraud dextrose agar with 0.05% chloramphenicol and 0.5% cycloheximide at 25°C for duration of up to four weeks to rule out any type of fungal infection.

Data Analysis: After data collection, the data obtained were cleaned, compiled, and tabulated year-wise from 2023 to 2025. Data were analyzed with the help of IBM SPSS Statistics, version 21.0 (IBM Corp., Armonk, NY). All the descriptive data were presented with frequency and percentage. N=487.

RESULTS

Table 1

Age group	Number	Percentage
≤50	174	35.7%
>50	313	64.3%
Gender		
Male	293	60.2%
Female	194	39.8%
BMI		
Underweight	22	4.5%
Normal	102	20.9%
Overweight	225	46.2%
Obese	138	28.3%
Occupation		
Farmer	98	20.1%
Laborer	67	13.8%
Business	109	22.4%
Independent profession	168	34.5%
Unemployed	45	9.2%
Area distribution		
Rural	175	35.9%
Urban	312	64.1%
Education		
Uneducated	26	5.3%
Primary	67	13.8%
Secondary	226	46.4%
Graduate	168	34.55
Sedentary lifestyle		
Present	298	61.2%
Absent	189	38.8%
Diabetes		
Type 1	24	4.9%
Type 2	463	95%
Diabetes duration		
1-10 years	198	40.6%
>10 years	289	59.3%
Hba1c level		
≤6.4%	225	46.2%
>6.5%	262	53.8%
Diabetic complications		
Nephropathy	41	8.4%
Neuropathy	89	18.3%
Retinopathy	37	7.6%
History of Trauma	43	8.8%
Bare foot walking	63	12.9%
Frequent water usage	97	19.9%
Family history	32	6.6%
Contact with pets	26	5.3%
Nail involvement		
Mild (1–4 nails)	212	43.5%
Moderate (5-8 nails)	165	33.9%
Severe (>9 nails)	110	22.6%
Types of OM		
DLSO	237	48.7%
PSO	34	6.9%
SWO	23	4.7%
TDO	67	13.8%
Endonyx	28	5.7%
DLSO+TDO	98	20.1%
Cases where KOH was done	93	
Positive	71	76.3%
Negative	22	23.6%
Cases where culture was done	22	

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Positive	8	36.3%
Negative	14	63.6%

DISCUSSION

Onychomycosis (OM) continues to be the most frequent nail infection worldwide, accounting for nearly 40–50% of all nail pathologies (onychopathies). Its significance is amplified in diabetic patients, where it not only causes cosmetic and functional impairment but also predisposes to serious sequelae such as cellulitis, secondary bacterial infections, ulceration and impaired wound healing.[7]

In our study, spanning over two years from year 2023 to 2025, 487 diabetic patients were analyzed. Out of 487 patients, males outnumbered females by 1.5 times. Among them, 212 (43.5%) had mild nail involvement, 165 (33.9%) had moderate involvement and 110 (22.6%) presented with severe nail involvement. This gradient emphasizes the progressive burden of OM with advancing age, poor glycemic control and associated complications. This finding is similar to other studies done by Gupta et al,[8] and Yadav et al.[9] In our study out of the 487 patients, 313 (64.3%) were above 50 years, while 174 (35.7%) were aged ≤50 years. It may be due to advancing age which was associated with greater severity of disease, corroborating earlier reports that older individuals are nearly three times more predisposed to OM than younger populations. This finding is similar to the studies done by Sharma and Basnet et al,[10] and Nagaraju GV et al.[11] The mechanisms are multifactorial, including reduced peripheral circulation, immunosenescence, slower nail growth and the presence of multiple complications.

Gender distribution in our cohort showed 293 males (60.2%) and 194 females (39.8%), with the risk of OM being 1.5 times higher in men. This aligns with prior studies such as Dogra et al. (1.4:1),[11] Gupta et al,[8] (2.06:1) Yadav et al,[9] (7.4:1) and Garg et al. (2.7:1).[10] Factors such as use of occlusive footwear, outdoor occupations, greater exposure to trauma, and reduced attention to foot hygiene likely explain this male predominance.

A large proportion of our patients (312; 64%) belonged to urban areas compared with 175 (36%) from rural regions. Occupation-wise, independent professionals (34.5%) and business workers (22.4%) constituted the majority, followed by farmers (20.1%) and laborers (13.8%). This indicates that OM affects individuals across all occupational strata, but sedentary lifestyle—reported in 298 (61.2%) of our participants—was strongly associated with disease prevalence. This finding is similar to the studies done by Gupta AK, Konnikov N et al and Garg et al.[9,10]

Education levels also reflected a gradient: most patients were educated up to secondary school (46.4%) or graduates (34.5%), while only a small minority were uneducated (5.3%). Interestingly, higher education did not necessarily translate into better preventive practices, underscoring the importance of targeted health education regarding foot care and nail hygiene, even among the literate population.

In terms of BMI, 225 patients (46.2%) were overweight and 138 (28.3%) obese, while only 102 (21%) were of normal weight and 22 (4.5%) underweight. Overweight and obese individuals together constituted nearly three-fourths of the cohort, emphasizing the strong link between higher BMI and OM. This supports our earlier interpretation that a sedentary lifestyle, metabolic syndrome and peripheral microangiopathy may create favorable conditions for fungal nail infections. Previous studies have not consistently highlighted BMI as a determinant, making our findings particularly noteworthy.

The majority of patients (463; 95%) had type 2 diabetes, while only 24 (5%) had type 1 diabetes, mirroring the known epidemiological dominance of type 2 disease in the Indian context. Importantly, disease duration showed a significant trend: 289 patients (59.3%) had diabetes for more than 10 years, while 198 (40.7%) had it for ≤10 years. Longer disease duration clearly emerged as a risk factor, likely due to chronic microvascular complications, impaired immunity, and cumulative exposure to hyperglycemia.

Correlation with glycemic control was another key observation. Among 487 patients, 262 (53.8%) had poor control (HbA1c > 6.5%), and this subgroup exhibited more severe OM (greater number of nails involved) compared to those with HbA1c ≤ 6.4% (225; 46.2%). A statistically significant correlation ($P = 0.014$, $r = 0.14$) was found between HbA1c levels and severity, making this the first study, to our knowledge, that quantitatively links OM severity with long-term glycemic control.

The distribution of clinical subtypes in our study revealed distal-lateral subungual onychomycosis (DLSO) as the predominant form, affecting 237 patients (48.7%). Total dystrophic onychomycosis (TDO) was present in 67 (13.7%), endonyx type in 28 (5.7%), proximal subungual onychomycosis (PSO) in 34 (7%), and superficial white onychomycosis (SWO) in 23 (4.7%). Mixed infections (DLSO + TDO) were recorded in 98 patients (20.1%). This pattern closely resembles previous studies where DLSO was the most common type, possibly due to its association with distal trauma, poor circulation, and easy fungal entry through the nail bed.

Among the study population, 89 (18.3%) had neuropathy, 41 (8.4%) nephropathy, and 37 (7.6%) retinopathies. These complications further predispose to OM through impaired sensation, vascular compromise and immune dysfunction. Lifestyle and environmental risk factors were also

notable: 97 patients (19.9%) reported frequent water exposure, 63 (12.9%) walked barefoot, 43 (8.8%) had a history of trauma, 32 (6.6%) had a positive family history, and 26 (5.3%) reported pet contact. These observations emphasize that a multifactorial set of behavioral, genetic and environmental contributors interacts with the metabolic milieu of diabetes to enhance OM susceptibility.

Diagnostic confirmation was performed using KOH mount, culture, onychoscopy and histopathology. Among 93 patients tested by KOH, 71 (76.3%) were positive, while only 8 (36.4%) out of 22 tested by culture yielded fungal growth. This underlines the limited sensitivity of culture alone, a limitation well-documented in earlier studies. Importantly, the combination of diagnostic modalities such as direct microscopy, Onychoscopy, and histopathology substantially improved diagnostic yield in our cohort, achieving positivity rates of 97–99%. Although histopathology with PAS staining is resource-intensive, it consistently demonstrated superior sensitivity compared with KOH and culture, echoing previous literature.

The findings of our study carry important clinical and public health implications. First, the high prevalence of OM in diabetics—particularly those with advanced age, male sex, obesity, sedentary lifestyle, poor glycemic control, and long-standing diabetes—underscores the necessity of regular screening. Second, early diagnosis and treatment of OM can prevent serious diabetic foot complications, thereby reducing morbidity and healthcare costs. Third, the correlation between OM severity and HbA1c levels reinforces the importance of multidisciplinary management, integrating dermatological care with metabolic control. Finally, patient education regarding foot hygiene, appropriate footwear, avoidance of barefoot walking, and early medical consultation should be prioritized to mitigate risk.

CONCLUSION

Our study provides comprehensive insights into the burden, clinical patterns, and determinants of OM among diabetic patients. The high prevalence across diverse sociodemographic groups, the predominance of DLSO, and the strong associations with BMI, sedentary lifestyle, disease duration, and poor glycemic control highlight the multifactorial nature of OM in diabetes. By combining traditional and advanced diagnostic modalities, we achieved high diagnostic accuracy. To our knowledge, this is the first study correlating the severity of nail involvement directly with HbA1c. These findings call for greater emphasis on routine screening, multidisciplinary care, and preventive education to reduce the burden of OM and its complications in diabetic populations.

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