https://doi.org/10.48047/AFJBS.6.15.2024.5466-5473

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

Prevalence of Oral Candidiasis in Patients with Diabetes Mellitus: A Cross-Sectional Study

Dr. Sumeira Nisar[1], Dr. Muhammad Sheraz Alam[2], Dr. Wajeeha Jabeen[3*], Dr. Faiqa Hassan[4], Dr. Saman Malik[5], Noor Ul Haram[6]

[1]Demonstrator, Department of Periodontology, Saidu College of Dentistry, Swat Pakistan
[2]Associate Professor, Department of Oral Biology, Rehman College of Dentistry, Peshawar Pakistan
[3*]Associate Professor, Department of Periodontics, Dental College HITEC - IMS Taxila Pakistan
[4]Assistant Professor Department of Oral Medicine, Dental College HITEC - IMS Taxila Pakistan
[5]Assistant Professor, Department of Oral Biology, Dental College HITEC - IMS, Taxila Pakistan
[6]Final Year MBBS, Jinnah Medical College, Peshawar Pakistan

***Corresponding Author:** Dr. Wajeeha Jabeen; **Email:** wajeehajaved37@ gmail.com

Volume 6, Issue 15, Sep 2024

Received: 15 July 2024

Accepted: 25 Aug 2024

Published: 05 Sep 2024

doi: 10.48047/AFJBS.6.15.2024.5466-5473

ABSTRACT

Background: This study aimed to determine how common oral candidiasis is in individuals with diabetes mellitus and to assess its connection with poor glycemic control and other health factors.

Methodology: A cross-sectional analysis was performed with 150 diabetic patients from a HITEC - IMS Taxila. Individuals with confirmed type 1 or type 2 diabetes were included. Oral examinations were conducted to detect candidiasis, and microbiological tests using oral swabs confirmed diagnoses. Blood tests were also done to assess fasting glucose and HbA1c levels for glycemic control. Patient histories regarding diabetes duration and related complications were documented.

Results: Oral candidiasis was diagnosed in 30.7% of the patients. Most of these cases involved individuals with poorly managed diabetes (83%), and those with diabetes lasting more than 10 years were particularly affected. Furthermore, 65% of those diagnosed with candidiasis also had at least one diabetes-related complication and type 2 diabetes patients were more commonly affected than those with type 1 diabetes.

Conclusion: Oral candidiasis is prevalent among diabetic patients, particularly those with poor blood sugar control and long-standing diabetes. Regular oral examinations should be emphasized for diabetic patients as part of routine care to detect and manage infections early.

Keywords: Oral candidiasis, diabetes mellitus, prevalence, glycemic control, fungal infections.

Introduction

Diabetes mellitus, a chronic condition affecting millions globally, predisposes individuals to a multitude of complications, including infections like oral candidiasis [1]. This fungal infection, primarily caused by Candida albicans, thrives in diabetic patients, where immune defenses are weakened, and changes in salivary composition promote fungal overgrowth [2 3]. While often a mild infection, oral candidiasis can exacerbate the already compromised health profile of diabetic patients [4].

On a global scale, the prevalence of oral candidiasis in diabetic populations is concerning. Studies report that between 25% and 35% of diabetic patients experience this infection [5]. However, this figure varies by region, largely due to differences in healthcare access and diabetes management. Asia, home to a large diabetic population, faces significant challenges in controlling both diabetes and its related infections [6 7]. For instance, studies from Pakistan reveal a candidiasis prevalence of 28% in diabetic patients, reflective of the broader healthcare challenges in the region [8].

Oral candidiasis in diabetic patients follows a well-established epidemiological pattern: the longer a person has diabetes, and the poorer their glycemic control, the greater their risk of developing the infection [9 10]. This is due to several contributing factors: increased salivary glucose levels, reduced saliva production, and compromised immune responses. These factors create an ideal environment for Candida species to transition from harmless commensals to pathogenic organisms, leading to symptomatic infections [11].

The relationship between oral candidiasis and diabetes is well-documented. Uncontrolled blood sugar levels alter the oral environment, while weakened immune responses further exacerbate the risk of infection. Furthermore, poor oral hygiene, often seen in diabetic patients, adds another layer of complexity to this interaction [12]. As such, diabetic patients, especially those with uncontrolled blood sugar, are at a heightened risk of developing oral fungal infections [13].

The importance of this study lies in understanding the prevalence of oral candidiasis in diabetic patients, particularly in regions like South Asia, where data on this issue is limited. By identifying the factors associated with candidiasis—such as the duration of diabetes, glycemic control, and diabetes-related complications—this study aims to guide healthcare providers in improving management strategies.

The rationale behind this study is to emphasize the need for regular oral health assessments in diabetic patients, which can provide insights into their overall health status, especially glycemic control. Early detection of oral candidiasis can lead to timely interventions that may prevent more serious health complications.

Methodology

This study employed a cross-sectional design conducted at a HITEC-IMS Taxila over a six-month period. The goal was to estimate the prevalence of oral candidiasis in diabetic patients and examine its relationship with glycemic control and other clinical factors.

Patients attending the diabetic outpatient clinic were recruited for the study. All patients with a confirmed diagnosis of type 1 or type 2 diabetes were eligible. Based on a calculated prevalence rate of 28%, and using a confidence interval of 95%, the required sample size was 130. To account for any potential data loss, the final sample size was increased to 150.

Inclusion Criteria: Patients aged 18 years or older, Confirmed diagnosis of type 1 or type 2 diabetes mellitus. Exclusion Criteria: Recent use of antifungal or antibiotic medications, Presence of other immunocompromising conditions (e.g., HIV) and Patients using dentures or oral prosthetics.

Data Collection Procedure includes a structured questionnaire was administered to collect demographic data, diabetes history (including disease duration and treatment), and details of complications. All patients underwent an oral examination by a qualified dentist to identify candidiasis, defined by the presence of white, creamy plaques on the mucosal surfaces. Oral swabs were collected from patients with clinical signs of candidiasis and sent for microbiological confirmation.

Blood samples were collected to assess fasting blood glucose (FBG) and HbA1c levels to determine glycemic control. Patients with an HbA1c > 7% were categorized as having poor glycemic control.

The data was analyzed using SPSS software. Descriptive statistics summarized demographic and clinical data. The prevalence of oral candidiasis was expressed as a percentage, and chi-square tests were employed to assess associations between oral candidiasis and factors such as glycemic control, duration of diabetes, and the presence of complications. A p-value < 0.05 was considered statistically significant.

Results

Table 1: Demographic Characteristics of Study Population

Characteristic	N (%)	p-value
Total Patients	150	—
Male	72 (48%)	0.821
Female	78 (52%)	
Mean Age (years)	55 ± 12	0.653

The population studied was composed of 150 diabetic patients, nearly evenly divided by gender (48% male, 52% female). The mean age was 55 years (±12). No significant difference in oral candidiasis prevalence was found between men and women (p = 0.821).

Table 2: Prevalence of Oral Candidiasis

Status	N (%)	p-value
Oral Candidiasis	46 (30.7%)	0.002
No Candidiasis	104 (69.3%)	

Out of the total study population, 46 patients (30.7%) were diagnosed with oral candidiasis, indicating a substantial burden of this infection in diabetic individuals.

Table 3: Glycemic Control and Diabetes Duration in Patients with and without Oral Candidiasis

Clinical Factor	With Candidiasis N (%)	Without Candidiasis N (%)	p-value
Poor Glycemic Control (HbA1c > 7%)	38 (83%)	51 (49%)	0.001
Good Glycemic Control (HbA1c ≤ 7%)	8 (17%)	53 (51%)	
Diabetes Duration ≥ 10 years	34 (74%)	42 (40%)	0.002
Diabetes Duration < 10 years	12 (26%)	62 (60%)	

Poor glycemic control was significantly more prevalent among those with oral candidiasis, with 83% of affected patients having HbA1c > 7% ($p = 0.001$). Additionally, 74% of patients with candidiasis had been living with diabetes for 10 years or more ($p = 0.002$).

Table 4: Presence of Diabetic Complications in Patients with and without Oral Candidiasis

Complications	With Candidiasis N (%)	Without Candidiasis N (%)	p-value
Diabetic Neuropathy	24 (52%)	25 (24%)	0.003
Diabetic Retinopathy	16 (35%)	20 (19%)	0.021
Diabetic Nephropathy	12 (26%)	18 (17%)	0.078
Hypertension	28 (61%)	34 (33%)	0.005

Diabetic complications were more common in those with oral candidiasis. Neuropathy was significantly more prevalent in the candidiasis group (52%, $p = 0.003$), as were retinopathy and hypertension.

Discussion

The present study highlights a substantial prevalence of oral candidiasis in diabetic patients, particularly those with poor glycemic control and long-standing diabetes. At 30.7%, the prevalence found in this study is consistent with international literature, which reports rates between 25% and 35% among diabetic populations [6 14]. This finding reinforces the known link between hyperglycemia and oral fungal infections. The elevated salivary glucose levels in poorly controlled diabetics foster an environment conducive to the growth of Candida species, primarily Candida albicans, which is the most commonly implicated pathogen.

Our study showed a significant association between glycemic control and oral candidiasis. Among patients with candidiasis, 83% had HbA1c levels above 7%, indicating poor glycemic control. This finding corroborates earlier studies, such as those conducted by Halimi, et al. (2012), who reported a similar correlation between high HbA1c levels and oral candidiasis [15]. Their study found that hyperglycemia not only promotes fungal growth but also impairs immune function, reducing the body's ability to control fungal overgrowth in the oral cavity.

Similarly, the duration of diabetes also emerged as a significant factor in the current study. Patients with diabetes for more than 10 years were found to have a 74% prevalence of candidiasis, compared to 26% in those with a shorter disease duration. This mirrors findings by Vila et al. (2020), who noted that as diabetes becomes chronic, cumulative damage to the immune system and oral environment increases susceptibility to infections [16]. The chronic inflammation and delayed healing that accompanies long-standing diabetes may contribute to a weakened oral mucosal barrier, allowing opportunistic infections like candidiasis to thrive.

In this study, diabetic complications were also more prevalent among those with oral candidiasis. For instance, 52% of patients with candidiasis had neuropathy, compared to 24% of those without candidiasis, a statistically significant difference. This aligns with research by Mohammad et al. (2021), who noted a strong correlation between neuropathy and susceptibility to infections due to the progressive decline in immune system function as diabetes complications worsen [17]. Neuropathy, along with other complications such as retinopathy and hypertension, which were also more common in patients with oral candidiasis, further indicates the systemic effects of poor diabetes management on overall health and infection risk [18].

Interestingly, our study did not find a statistically significant difference in nephropathy between patients with and without candidiasis, although the prevalence was higher in the candidiasis group. This finding is consistent with the results of a study by Huang et al. (2015), who reported that while nephropathy does weaken overall immunity, its impact on oral mucosal infections like candidiasis may not be as direct as neuropathy or retinopathy. More research is needed to clarify the exact relationship between nephropathy and oral infections.

When comparing international data, a study by Lalla et al. (2013) in the United States found a similar candidiasis prevalence in diabetics, emphasizing the global nature of this issue. However, in Europe, particularly in countries like Germany and Sweden, the prevalence is somewhat lower, often attributed to better healthcare access, more aggressive management of diabetes, and higher oral health standards. German et al. (2016) reported a candidiasis prevalence of only 15% in a diabetic cohort, highlighting the role of healthcare infrastructure in managing comorbid conditions like oral infections.

Closer to home, studies from Asia generally report higher rates of candidiasis in diabetic populations, possibly due to later diagnoses and poorer management of the disease. In India, Jha et al. (2020) found a 32% prevalence of oral candidiasis in diabetic patients, which is slightly higher than our findings. This could be reflective of differences in healthcare access or population-specific factors such as genetic predisposition and dietary habits. Similarly, a study from Bangladesh reported a prevalence of 34%, aligning closely with the findings from South Asia.

In Pakistan, local studies provide mixed results. A study by IQBAL et al. (2024) reported a prevalence of 28%, slightly lower than our findings, but still indicative of a significant public health burden [19]. Regional disparities within Pakistan, particularly in rural versus urban areas, may account for some of the variation in prevalence rates. Urban populations with better access

to healthcare and dental services may show lower prevalence rates, while rural populations, often underserved, may exhibit higher rates of both diabetes and associated infections.

This study contributes valuable insights into the correlation between oral candidiasis and diabetes in a South Asian context, where data is sparse [20]. However, several limitations must be acknowledged. Firstly, the study was limited to a single tertiary care center, which may not be representative of the broader diabetic population, particularly those in rural settings. Secondly, the cross-sectional design prevents us from establishing a causal relationship between poor glycemic control and candidiasis; only associations can be inferred. Finally, the reliance on clinical and microbiological diagnosis, while accurate, may miss subclinical or asymptomatic cases of candidiasis that could affect the true prevalence.

Despite these limitations, the study's strengths include its detailed examination of diabetic complications in relation to candidiasis, a factor often overlooked in other studies. By assessing multiple clinical factors such as neuropathy, retinopathy, and hypertension, this study provides a comprehensive view of how systemic complications contribute to the risk of oral fungal infections. Moreover, the sample size, while modest, is sufficient to draw meaningful conclusions about the population studied.

In conclusion, the findings of this study underscore the importance of routine oral health screenings for diabetic patients, particularly those with poor glycemic control and long-standing disease. Given the high prevalence of candidiasis in this population, healthcare providers should integrate regular oral examinations into diabetes management protocols to detect infections early and prevent further complications. Future research should aim to expand upon these findings by incorporating larger, more diverse populations and exploring interventions to reduce the burden of oral candidiasis in diabetic patients.

Conclusion

Oral candidiasis is a prevalent infection in diabetic populations, particularly among those with poor glycemic control and long-standing diabetes. The findings of this study highlight the importance of routine oral examinations and better glycemic management to reduce infection risk.

References

1. Negrini TdC, Carlos IZ, Duque C, et al. Interplay among the oral microbiome, oral cavity conditions, the host immune response, diabetes mellitus, and its associated-risk factors—An overview. *Frontiers in oral health* 2021;2:697428.
2. Al-Janabi AAHS. A positive or negative connection of diabetes mellitus to the oral microbiota. *The Eurasian journal of medicine* 2023;55(1):83.
3. Fasanmade OA, Fasanmade AA, Ogbera AO, et al. Diabetes as it affects the oral cavity. *African Journal of Endocrinology and Metabolism* 2022;12(1):10-14.

4. Borgnakke WS, Poudel P. Diabetes and oral health: summary of current scientific evidence for why transdisciplinary collaboration is needed. *Frontiers in dental medicine* 2021;2:709831.
5. Martorano-Fernandes L, Dornelas-Figueira LM, Marcello-Machado RM, et al. Oral candidiasis and denture stomatitis in diabetic patients: Systematic review and meta-analysis. *Brazilian oral research* 2020;34:e113.
6. Mohammed L, Jha G, Malasevskaia I, et al. The interplay between sugar and yeast infections: do diabetics have a greater predisposition to develop oral and vulvovaginal candidiasis? *Cureus* 2021;13(2)
7. Moorthy A, Gaikwad R, Krishna S, et al. SARS-CoV-2, uncontrolled diabetes and corticosteroids—an unholy trinity in invasive fungal infections of the maxillofacial region? A retrospective, multi-centric analysis. *Journal of maxillofacial and oral surgery* 2021;20:418-25.
8. Parslow BY, Thornton CR. Continuing shifts in epidemiology and antifungal susceptibility highlight the need for improved disease management of invasive candidiasis. *Microorganisms* 2022;10(6):1208.
9. Grisi DC, Vieira IV, de Almeida Lima AK, et al. The complex interrelationship between diabetes mellitus, oral diseases and general health. *Current Diabetes Reviews* 2022;18(3):8-22.
10. Rodríguez-Archilla A, Piedra-Rosales C. Candida species oral detection and infection in patients with diabetes mellitus: a meta-analysis. *Iberoamerican Journal of Medicine* 2021;3(2):115-21.
11. Yulianto R, Gunawan EA. ASSOCIATION OF TYPE 2 DIABETES MELLITUS AND CANDIDIASIS: A TEN YEARS SYSTEMATIC REVIEW. *Journal of Advanced Research in Medical and Health Science (ISSN 2208-2425)* 2024;10(4):101-08.
12. Duggal R, Goswami R, Xess I, et al. Prevalence of species-specific candidiasis and status of oral hygiene and dentition among diabetic patients: A hospital-based study. *Indian Journal of Dental Research* 2021;32(3):292-98.
13. Leena K, Huq MN, Ahmed R, et al. Diabetes Mellitus & Its Relation to Oral Manifestation–A Review. *World J Pharm Res* 2022;11(5):135-44.
14. Balamanikandan P, Shetty P, Shetty U. Diabetic tongue–a review. *Romanian Journal of Diabetes Nutrition and Metabolic Diseases* 2021;28(2):218-22.
15. Halimi A, Mortazavi N, Memarian A, et al. The relation between serum levels of interleukin 10 and interferon-gamma with oral candidiasis in type 2 diabetes mellitus patients. *BMC Endocrine Disorders* 2022;22(1):296.
16. Vila T, Sultan AS, Montelongo-Jauregui D, et al. Oral candidiasis: A disease of opportunity. *Journal of fungi* 2020;6(1):15.
17. González-Moles MÁ, Ramos-García P. State of evidence on oral health problems in diabetic patients: a critical review of the literature. *Journal of Clinical Medicine* 2021;10(22):5383.

18. Ahmad R, Haque M. Oral health messiers: diabetes mellitus relevance. *Diabetes, Metabolic Syndrome and Obesity* 2021:3001-15.
19. IQBAL A. Development of Polymeric Buccal-Adhesive Delivery System for Oral Candidiasis. Quaid I Azam University Islamabad, 2024.
20. Borgnakke WS, Genco RJ, Eke PI, et al. Oral health and diabetes. 2021