

A Study on Prevalence of Candida Infection in Type II Diabetes Mellitus Patients

Roquaiya Nishat¹, Wagisha Barbi², Neha³, Abhishek Vardhan⁴, Vijay Kumar⁵, Prakash Chandra Jha^{6*}

¹Department of Dentistry, Nalanda Medical College and Hospital, Patna, Bihar, India.

²Department of Dentistry, All India Institute of Medical Sciences, Patna.

³NVHCP, State Health Society, Patna, Bihar, India.

⁴Department of Orthodontics and Dentofacial Orthopedics, Vananchal Dental College, Garhwa, Jharkhand, India.

⁵Department of Oral Pathology and Microbiology, Dental Practitioner, White Gold Dental Chamber, Bhubaneswar, Odisha, India.

⁶Department of Dentistry, Nalanda Medical College and Hospital, Patna, Bihar, India.

Abstract

Background: Diabetes mellitus, a significant global public health problem, wherein oral health also gets hampered. Uncontrolled diabetes mellitus is a predisposing factor to several opportunistic infections, including fungal infections, especially those caused by *Candida* species. This study aimed to assess the prevalence of *Candida* species in diabetic individuals and to explore the relationship, if any between Candidal carriage and glycemic control. **Materials and Methods:** A total of 87 previously diagnosed type II diabetic patients formed the study population. After performing a comprehensive oral examination of the patients, unstimulated saliva samples were collected, inoculated into Saborauds dextrose agar medium, and incubated at 37°C for 3 days. The cultures were considered positive when smooth creamy white colonies were observed, and negative when no colonies were seen. **Results:** The culture test of 48 (55.17%) individuals was positive for *Candida* species. The results obtained showed that the frequency of occurrence of *Candida* species was more in poorly controlled diabetics when compared to moderately and well controlled diabetic individuals. **Conclusion:** Oral Candidal prevalence was higher in diabetic patients, and the carriage rate increased as the glycemic control worsened.

Keywords: *Candida*, Diabetes mellitus, Glycemic control, Prevalence, Saborauds dextrose agar.

INTRODUCTION

Diabetes, a chronic degenerative metabolic disorder, characterized by chronic hyperglycemia stemming from insulin deficiency or insulin resistance, or both often results in complications such as retinopathy, nephropathy, and neuropathy in the long term.^[1,2] This condition has emerged to be the biggest threat to public health in the 21st century, affecting different parts of the human body including the oral cavity.^[3]

In the oral cavity, diabetes can result in several complications such as xerostomia, tooth decay (including root caries), gingivitis, periodontal diseases, oral candidiasis, burning mouth, altered taste, geographic tongue, coated and fissured tongue, oral lichen planus, recurrent aphthous stomatitis, increased susceptibility to infections, and defective wound healing.^[4-8] Factors such as impaired neutrophil function, increased collagenase activity, reduction in collagen synthesis, microangiopathy, and neuropathy are attributed to the oral complications in diabetes.^[9]

A variety of microorganisms can result in opportunistic infections in the oral cavity, among which members of the genus *Candida* are considered to be the most common commensals.^[10] Several host factors facilitate Candidal colonization and subsequent infection among diabetic individuals including yeast adhesion to epithelial cell surfaces, higher salivary glucose levels, reduced salivary flow, change in salivary pH, microvascular degeneration, and impaired candidacidal activity of neutrophils.^[11-13]

The aim of this study was to assess the prevalence of *Candida* species in diabetic individuals, the results of which might help in understanding the potential complications of the disease, and thus help in improving patient treatment outcomes.

Address for correspondence: Dr. Prakash Chandra Jha, Department of Dentistry, Nalanda Medical College and Hospital, Patna, Bihar, India. E-mail: drprakashjha@gmail.com

Received: Dec. 01, 2021; **Accepted:** Jan. 15, 2022; **Published:** Mar. 25, 2022

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

How to cite this article: Nishat R, Barbi W, Neha, Vardhan A, Kumar V, Jha PC. A Study on Prevalence of *Candida* Infection in Type II Diabetes Mellitus Patients. J Res Adv Dent 2022;13(3):168-170.

Access this article online

Website:
www.jrad.co.in

DOI:
<https://doi.org/10.53064/jrad.2022.13.3.178>

MATERIALS AND METHODS

Study group

A total of 87 individuals attending the clinics of private dental practitioners in Patna, Bihar during for 1 year formed the study population. The study group comprised previously diagnosed type II diabetes mellitus patients with fasting serum glucose higher than 126 mg/dl and records of glycosylated hemoglobin (HbA1C) values. Participants having any known disease or condition predisposing to oral candidiasis and patients with type I diabetes mellitus were excluded from the study. Patients with recent history of antibiotic or corticosteroid therapy, anemic patients, pregnant women, and individuals with the previous history of treated mucosal diseases were also not included in the study. Informed consent was obtained from all the study participants, and ethical clearance obtained (IEC/067/2021).

A detailed medical history (including fasting blood sugar level, postprandial blood sugar level, HbA1c level, duration of the disease, and medications taken) along with demographic data was recorded. The study population was grouped into three groups on the basis of their glycemic index: 28 in Group I (well controlled diabetes with HbA1C level ≤ 7), 25 in Group II (moderately controlled diabetes with HbA1C level ranging between 7 and 8), and 34 in Group III (poorly controlled diabetes with HbA1C level ≥ 8).

Microbial sampling and culture

A comprehensive oral examination of the study participants was done, after which unstimulated saliva samples were collected in the morning hours. Patients were given 10 ml sterile phosphate buffered solution, instructed to rinse mouth thoroughly for a minute and then expel into a sterile container. Mycological tests were performed on the expectorated solution.

The solution was inoculated into Sabourauds dextrose agar medium and incubated at 37°C for 3 days. The culture was considered positive when smooth creamy white colonies were observed, and negative when no colonies were seen.

RESULTS

Of the 87 individuals forming the study population, 53 were male, while 34 were female, ranging between 39 and 87 years of age. The value of HbA1C ranged between 5 and 14. The culture test of 48 (55.17%) individuals was positive for *Candida* species. Among the 28 well controlled diabetics, 11 (39.28%) showed positive *Candida* cultures. Likewise, of the 25 moderately controlled diabetic individuals, 14 (56%) were positive for *Candida* and of the 34 poorly controlled diabetics, 23 (67.64%) showed positive cultures for the fungi (Table 1). The results obtained show that the frequency of occurrence of *Candida* species was more in poorly controlled diabetics when compared to moderately and well controlled diabetic individuals.

DISCUSSION

The hyperglycemic environment in diabetes mellitus aids in immune dysfunction, resulting in increased frequency of infectious diseases and oral lesions, which increases the morbidity and mortality of the affected individuals.^[14] Amidst these potential oral lesions, oral candidiasis is the most common lesion, which manifests as different patterns of mucosal changes such as erythematous, pseudomembranous, and curd-like plaques.^[15] Although *Candida* is an oral commensal, its colonization increases and also runs a complex course in diabetic individuals.^[16] Factors such as type of diabetes, degree of glycemic control, and mode of treatment, and other local predisposing factors such as oral hygiene, smoking, and presence of dentures in mouth significantly affects the oral carriage of *Candida* in diabetic patients.^[17] The present study was conducted to assess the prevalence of *Candida* in diabetic patients and to find out the relationship between Candidal carriage and glycemic control.

Our study showed a prevalence rate of 55.17% in the study population. This was in accordance with results obtained by various authors. Pallavan *et al.* studied oral Candidal colonization using exfoliative cytological method and observed that 43.3% of diabetic patients showed severe colonization, which could be due to their increased tissue glucose level, facilitating the growth of *Candida*.^[16] Mohammadi *et al.* reported a prevalence of 55%, with the most frequently encountered species being *Candida albicans* followed by *Candida krusei*, *Candida glabrata*, and *Candida tropicalis*.^[10] Ruchi *et al.* reported a prevalence rate of 61% among diabetic individuals with high colony forming units.^[18] Belazi *et al.*, in their study, noted a 64% prevalence rate.^[19] According to Kumar *et al.*, 37 (68.52%) out of 54 type 2 diabetes mellitus patients were found to carry Candidal carriage in their oral cavity.^[20] Premkumar *et al.* reported a much higher prevalence rate of 87% in their study.^[21] On the contrary, Bhuyan *et al.* reported a comparatively lower prevalence rate of 38% among their study population.^[15] Al-Attas *et al.* reported Candidal carriage in 25% of type II diabetics.^[22] This variance in results might reflect the differential ability of the fungus for epithelial cell adherence and genetic susceptibility of the patients with diabetes toward infection.^[15]

The diabetic group in the present study was divided into three groups depending on the level of glycated hemoglobin concentration, as it gives an overview of the average blood glucose level for 3 months. In our study, frequency of occurrence of *Candida* species was more in poorly controlled diabetics (67.64%) when compared to moderately (56%) and well controlled (39.28%) diabetic individuals indicating that the rate of Candidal carriage was correlated with the degree of glycemic control, with maximum carriage in poorly controlled diabetics. This was in accordance with results obtained by Bhuyan *et al.* and Darwazeh *et al.*^[15,23] On the contrary, Zomorodian *et al.* did not find any significant difference in growth of *Candida* between diabetic and healthy individuals.^[24]

Table 1: Correlation between the diabetic status and Candidal carriage

S. No.	HbA1C levels	Diabetic status	Number of individuals showing positive Candidal culture	Number of individuals in the group	Percentage
1.	≤7	Well controlled	11	28	39.28
2.	7–8	Moderately controlled	14	25	56
3.	≥8	Poorly controlled	23	34	67.64

Similar contradicting results were also reported by Kumar *et al.* and Belazi *et al.*^[19,20]

Results obtained from studies on Candidal carriage in diabetic patients are often contrasting. This may be since different sampling techniques, varied patient and control populations are elected by the investigators.^[18] The drawback of the present study is a small sample size. Further studies with larger sample size and more parameters such as identification of the various *Candida* species and their susceptibility toward anti-fungal medications are necessary to determine the relations between other important combinations of risk factors and oral *Candida*.

CONCLUSION

Oral Candidal prevalence was higher in diabetic patients, and the carriage rate increased as the glycemic control worsened. Disambiguity in the microenvironment is observed in the oral cavity of diabetic individuals, which makes them more susceptible toward opportunistic infections. An increased proportion of strains of different *Candida* species isolated from unstimulated saliva of diabetic individuals and their varied susceptibility to commonly prescribed antifungals mandates special mode of diagnostic and therapeutic management. Moreover, routine Candidal speciation and appropriate selection of prophylactic antifungal regimen after susceptibility testing should be done to prevent systemic dissemination, and further complications.

REFERENCES

- Kumar H, Nishat R, Desai A. A study on oral manifestations in type II diabetes mellitus patients. *Int J Psychosoc Rehabil* 2020;24:7558-63.
- Mealey BL, Ocampo GL. Diabetes mellitus and periodontal disease. *Periodontol* 2000 2007;44:127-53.
- Indurkar MS, Maurya AS, Indurkar S. Oral manifestations of diabetes. *Clin Diabetes* 2016;34:54-7.
- Cicmil S, Mladenović I, Krunić J, Ivanović D, Stojanović N. Oral alterations in diabetes mellitus. *Balk J Dent Med* 2018;22:7-14.
- Al-Maskari AY, Al-Maskari MY, Al-Sudairy S. Oral Manifestations and complications of diabetes mellitus: A review. *Sultan Qaboos Univ Med J* 2011;11:179-86.
- Mauri-Obradors E, Estrugo-Devesa A, Jané-Salas E, Viñas M, López-López J. Oral manifestations of diabetes mellitus: A systematic review. *Med Oral Patol Oral Cir Bucal* 2017;22:e586-94.
- Trentin MS, Verardi G, De C Ferreira M, de Carli JP, da Silva SO, Lima IF, *et al.* Most frequent oral lesions in patients with type 2 diabetes mellitus. *J Contemp Dent Pract* 2017;18:107-11.
- Khan T. Oral manifestations and complications of diabetes mellitus: A review. *Int J Med Health Res* 2018;4:50-2.
- Cicmil A, Govedarica O, Lečić J, Mališ S, Cicmil S, Čakić S. Oral symptoms and mucosal lesions in patients with diabetes mellitus type 2. *Balk J Dent Med* 2017;21:50-4.
- Mohammadi F, Javaheri MR, Nekoeian S, Dehghan P. Identification of *Candida* species in the oral cavity of diabetic patients. *Curr Med Mycol* 2016;2:1-7.
- Nguyen TD, Nguyen TT, Tran QV. The incidence of oral Candidiasis in patients with diabetes mellitus: A cross-sectional study in Southern Vietnam. *J Crit Rev* 2020;7:82-6.
- Kadir T, Pisiriciler R, Akyüz S, Yarat A, Emekli N, Ipbüker A. Mycological and cytological examination of oral candidal carriage in diabetic patients and non-diabetic control subjects: Thorough analysis of local aetiological and systemic factors. *J Oral Rehabil* 2002;29:452-7.
- Brownlee M, Cerami A, Vlassara H. Advanced glycosylation end products in tissue and the biochemical basis of diabetic complications. *N Engl J Med* 1988;318:1315-21.
- Tanaka Y. Immunosuppressive mechanisms in diabetes mellitus. *Nihon Rinsho* 2008;66:2233-7.
- Bhuyan L, Hassan S, Dash KC, Panda A, Behura SS, Ramachandra S. *Candida* species diversity in oral cavity of type 2 diabetic patients and their *in vitro* antifungal susceptibility. *Contemp Clin Dent* 2018;9:83-8.
- Pallavan B, Ramesh V, Dhanasekaran BP, Oza N, Indu S, Govindarajan V, *et al.* Comparison and correlation of candidal colonization in diabetic patients and normal individuals. *J Diabetes Metab Disord* 2014;13:66.
- Lamey PJ, Darwaza A, Fisher BM, Samaranayake LP, Macfarlane TW, Frier BM. Secretor status, candidal carriage and candidal infection in patients with diabetes mellitus. *J Oral Pathol* 1988;17:354-7.
- Ruchi M, Sandeep KB, Archana B, Nisha D, Sukriti M, Deepika. *Candida* prevalence in the saliva of controlled and uncontrolled diabetic patients-a clinical study. *J Indian Acad Oral Med Radiol* 2021;33:301-5.
- Belazi M, Velegraki A, Fleba A, Gidarakou I, Papanau L, Baka D, *et al.* Candidal overgrowth in diabetic patients: Potential predisposing factors. *Mycoses* 2005;48:192-6.
- Kumar BV, Padshetty NS, Bai KY, Rao MS. Prevalence of *Candida* in the oral cavity of diabetic subjects. *J Assoc Physicians India* 2005;53:599-602.
- Premkumar J, Ramani P, Chandrasekar T, Natesan A, Premkumar P. Detection of species diversity in oral *Candida* colonization and anti-fungal susceptibility among non-oral habit adult diabetic patients. *J Nat Sci Biol Med* 2014;5:148-54.
- Al-Attas SA, Amro SO. Candidal colonization, strain diversity, and antifungal susceptibility among adult diabetic patients. *Ann Saudi Med* 2010;30:101-8.
- Darwazeh AM, MacFarlane TW, McCuish A, Lamey PJ. Mixed salivary glucose levels and candidal carriage in patients with diabetes mellitus. *J Oral Pathol Med* 1991;20:280-3.
- Zomorodian K, Kavooosi F, Pishdad GR, Mehrriar P, Ebrahimi H, Bandegani A, *et al.* Prevalence of oral *Candida* colonization in patients with diabetes mellitus. *J Mycol Med* 2016;26:103-10.