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Understanding the Link Between Diabetes and Periodontitis: Insights into Knowledge, Awareness, and Attitudes

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Abstract

Periodontitis, an inflammatory disease of the periodontium, is considered the sixth complication of diabetes mellitus. It not only affects the progression of diabetes but also contributes to its complications. Adequate knowledge and a positive attitude towards periodontitis among diabetic patients can significantly reduce the risk of periodontal diseases and improve their diabetic control. This study aimed to investigate the knowledge, awareness, and attitude of diabetic patients towards periodontal disease. A total of 400 diabetic patients, aged over 35 years and with a confirmed history of diabetes, were selected from Karad, Maharashtra. All participants agreed to participate in the survey. A structured one-on-one interview was conducted using a pretested, close-ended questionnaire consisting of 20 questions. The data were analyzed using SPSS version 21 software. Out of the 400 respondents, 194 (54.8%) were male and 206 (45.2%) were female. The results showed that most subjects lacked sufficient knowledge, had limited awareness, and displayed poor attitudes toward the association between periodontitis and diabetes. Overall, the awareness, knowledge, and attitudes about periodontal health were found to be insufficient. These findings emphasize the need for targeted education and awareness campaigns for diabetic patients, especially those with poor glycemic control, regarding the importance of maintaining oral hygiene and preventing periodontal complications.

Keywords: Diabetes mellitus, Periodontitis, Oral health awareness, Questionnaire, Survey, Association

Introduction

Diabetes mellitus (DM) is a metabolic disorder characterized by either insufficient insulin production or the body's inability to effectively use insulin, resulting in elevated blood glucose levels. It affects nearly every organ system and can lead to significant complications, potentially resulting in disability or even death. The prevalence of diabetes is steadily increasing worldwide, with rural India reporting a rate of 2.4% and urban areas at 11.6% [1].

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Periodontal disease is recognized as a major concern for individuals with diabetes, as DM is a known risk factor for the condition. Periodontal disease is a leading cause of tooth loss in adults and typically worsens in patients with poorly controlled blood glucose levels [2, 3]. The relationship between diabetes and periodontal disease has been widely studied, and dental professionals are in a unique position to manage and monitor the periodontal health of diabetic patients, particularly those whose diabetes is not well-controlled.

Periodontal disease begins with gingivitis and, if left untreated, can progress to periodontitis, causing inflammation and the destruction of the tissues supporting the teeth, potentially leading to tooth loss [4-6]. Periodontitis also triggers systemic inflammation, which may worsen other health conditions such as cardiovascular disease, arthritis, and diabetes [7]. Research has shown a bidirectional relationship between DM and periodontal disease, with each condition

exacerbating the other. Periodontal disease is considered the sixth complication of diabetes, negatively impacting glycemic control and contributing to the severity of diabetes-related complications [8-18].

Understanding the level of knowledge and awareness diabetic patients have about periodontitis is essential to improve their oral health outcomes. Additionally, assessing their attitudes toward oral health and periodontal care can provide valuable insight into their willingness to seek treatment and engage in preventive care. This study aims to gather baseline data on the awareness, attitudes, and practices related to periodontal health among diabetic patients in Karad, Maharashtra, to enhance dental health education and promote better oral health habits in this population.

Materials and Methods

Study design

A cross-sectional survey was carried out at the dental hospital of Krishna Institute of Medical Sciences (KIMSDU), Karad, to assess the knowledge and attitudes of diabetic patients regarding periodontal disease. The study received ethical approval from the Institutional Ethical Committee (EIC) of KIMSDU, with reference number KIMSDU/EC/06/2021 (dated: 25/08/2021). All participants provided informed verbal consent before participation. The survey took place from November 2021 to January 2022.

Sample size

To determine the sample size, the study used a diabetic prevalence rate of 2.4% based on a national survey and an allowable error of 5%. The sample size was calculated using the formula:

$$n = Z^2pq / L^2 \text{ [19].} \quad (1)$$

Inclusion and exclusion criteria

The study included patients aged 35 and above with a confirmed diagnosis of type II diabetes. Pregnant or breastfeeding women, individuals with other significant systemic conditions, and those who declined to participate were excluded.

Data collection

A pre-tested questionnaire was used for data collection, available in English, Hindi, and Marathi, and focused on awareness of diabetes-related complications and periodontal disease. This questionnaire, consisting of 20 questions divided into three sections, was based on a comprehensive review of the literature. It underwent validation through face and content validation, as well as reliability testing with 30 pilot subjects [20].

Statistical analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 21. Descriptive statistics, including frequency and percentage, were calculated. The Chi-square test was used to evaluate the relationship between responses across the three domains: knowledge, awareness, and attitude, with a significance level set at 0.05.

Results and Discussion

The study included 400 participants, with ages ranging from 36 to 75 years. The majority of participants were in the 41 to 50 age group. When analyzing gender concerning overall knowledge, it was found that females exhibited significantly lower knowledge regarding the connection between periodontal disease and diabetes mellitus (DM). The educational background of participants varied, with 20.5% having education beyond secondary school, 17.75% having below-secondary education, and 61.75% being illiterate. Analysis of education level and its correlation with knowledge revealed that the illiterate group showed the most pronounced lack of awareness about the relationship between periodontal disease and DM.

Gender breakdown of the study population

Out of the 400 participants, 194 (48.5%) were male and 206 (51.5%) were female, ensuring a fairly equal gender distribution **(Tables 1 and 2)**.

Table 1. Age distribution

	Mean	S.D	Minimum	Maximum
Age (in years)	47.69	8.43	0.42	26.0

Table 2. Gender distribution

Gender	N (%)
Male	194 (48.5%)
Female	206 (51.5%)
Total	400 (100%)

Educational background of the participants

Out of the total participants in the study, 82 individuals (20.5%) had completed their graduation, 71 (17.75%)

had received secondary education, and the remaining 247 participants (61.75%) were illiterate. Detailed demographic information is provided in **Tables 1-3**.

Table 3. Educational qualification

Education level	n (%)
Illiterate	247 (61.75%)
< 12th standard	71 (17.75%)
> 12 standard	82 (20.5%)
Total	84 (100%)

Knowledge responses

A large portion of the participants (64.5%, P < 0.001), understood that dental treatments could effectively manage gum diseases. However, more than half (52.5%) were unaware of any link between diabetes and gum health, and 50.8% did not recognize the increased risk of gum issues associated with diabetes. A considerable number of respondents acknowledged the need for regular dental visits for gum disease treatment. Interestingly, 58.8% of the participants were unaware of the connection between diabetes and early tooth loss, while 50.2% recognized the impact of diabetes on delayed wound healing. Furthermore, a significant 90.8% (P < 0.001) were unaware that periodontal disease is a potential complication of diabetes mellitus **(Table 4)**.

Table 4. Knowledge level of study participants

Knowledge (n = 400)	Yes (n, %)	No (n, %)	Chi-square test	P-value
Are you aware that dental treatment can cure gum diseases?	258 (64.5%)	142 (35.5%)	33.64	0.001**
Do you think there is a relationship between diabetes and gum health?	190 (47.5%)	210 (52.5%)	1.00	0.317
Does diabetes increase the risk of developing gum problems?	197 (49.2%)	203 (50.8%)	0.09	0.764
Do you believe treatment for gum disease requires regular dentist visits for checkups and treatment?	178 (44.5%)	222 (55.5%)	4.84	0.028*
Did you know diabetes can cause early tooth loss?	165 (41.2%)	235 (58.8%)	12.25	0.001**
Do you think your wound healing differs from non-diabetic individuals?	201 (50.2%)	199 (49.8%)	0.01	0.920
Were you aware that periodontal disease (periodontitis) is a complication of Diabetes Mellitus?	37 (9.2%)	363 (90.8%)	265.6	0.001**

Response to awareness questions

Over half of the participants (55%) were not aware of bleeding gums as a symptom. However, a substantial proportion, 73.8%, were informed about their periodontal health by their doctors. Additionally, 67.2% had been referred to a dentist for consultations by their physician, and 73% were advised on the extra oral care required due to their diabetic condition. A lot of the participants (63%) reported experiencing dry mouth, while 56.5% experienced bad breath. Many were unaware that maintaining good oral hygiene could prevent the worsening of diabetes. Additionally, awareness of cleaning tools beyond toothbrushes and toothpaste was notably low **(Table 5)**.

Table 5. Awareness level of participants in the study

Awareness (n = 400)	Yes (n (%))	No (n (%))	Chi-square test	P-value
Do your gums bleed when brushing?	180 (45%)	220 (55%)	4.213	0.04*
Has your dentist informed you about having a gum-related disease?	105 (26.2%)	295 (73.8%)	90.25	0.001**
Did your physician recommend seeing a dentist?	131 (32.8%)	269 (67.2%)	47.61	0.001**
Have you been advised to take extra care of your oral health due to diabetes?	108 (27%)	292 (73%)	84.64	0.001**
Do you experience dry mouth?	148 (37%)	252 (63%)	27.04	0.001**

Do you experience bad breath?	174 (43.5%)	226 (56.5%)	6.76	0.009*
Are you aware that maintaining good oral hygiene helps in preventing or worsening diabetes?	106 (26.5%)	294 (73.5%)	88.36	0.001**
Have you heard of interdental cleaning aids other than toothpaste and toothbrushes?	133 (33.2%)	267 (66.8%)	44.89	0.001**

Attitude towards gum health and diabetes

A majority of participants (86.2%) acknowledged that gum problems could be connected to their overall health. Most respondents (77.5%) considered it important to inform their dentist about their diabetes. Despite this, 92% of participants had never used interdental cleaning aids. Additionally, 74% expressed an interest in gaining more knowledge about gum diseases, while 53.8% were open to receiving treatment for gum-related issues **(Table 6)**.

Table 6. Attitude of participants in the study

Attitude (n = 400)	Yes (n (%))	No (n (%))	Chi-square test	P-value
Do you think gum problems could be linked to your overall health?	55 (13.8%)	345 (86.2%)	210.2	0.001**
Do you feel it is important to inform your dentist about your diabetes?	90 (22.5%)	310 (77.5%)	121.0	0.001**
Do you use any interdental cleaning aids?	32 (8%)	368 (92%)	282.2	0.001**
Would you like to receive more information about gum-related diseases?	104 (26%)	296 (74%)	92.16	0.001**
Are you willing to receive treatment for gum disease?	215 (53.8%)	185 (46.2%)	2.25	0.134

Periodontal disease is a multifactorial condition characterized by inflammation, which results from the complex interaction between harmful microorganisms and the host's immune system [6]. Various systemic diseases, including diabetes mellitus (DM), can affect oral health and tissues. Research has long questioned the bidirectional relationship between DM and periodontitis. Periodontal disease is frequently regarded as the sixth complication of DM [15]. Multiple studies support a strong link between uncontrolled blood sugar levels and the worsening of periodontal disease parameters [20-27]. Previous research emphasizes the need to enhance awareness about the relationship between periodontitis and diabetes among diabetic patients. The current questionnaire-based study aimed to evaluate diabetic patients' knowledge, awareness, and attitudes towards periodontal disease. Research indicates a higher prevalence of diabetes in individuals aged between 35 and 70 years [28]. In our study, awareness of periodontal disease among diabetic patients appeared to be independent of age.

The study sample included more male participants than female, although female participants displayed a higher level of awareness and knowledge. This result is consistent with the findings by Shanmukappa *et al*. [20]. Furthermore, two-thirds of the participants were uneducated, which was associated with lower levels of knowledge and awareness compared to their educated counterparts. This contrasts with Hegde *et al*. study, which found that even educated participants often lacked adequate awareness [15]. The knowledge about the connection between diabetes and gum health was relatively low among our study participants, similar to the results from Shanmukappa *et al*. and Sandberg *et al*. [20, 29]. The high percentage of uneducated participants (61.67%) in our study could explain this lack of knowledge. Additionally, many participants did not recognize the importance of regular dental check-ups and treatments for gum disease.

In this study, a majority of participants were aware of the delayed wound healing associated with diabetes, which corresponds with Shanmukappa's study, where 62.2% of participants shared the same knowledge [15]. However, unlike Murugesan *et al*. findings [30], most of our participants were unaware of early tooth loss linked to the progression of periodontitis. Furthermore, the participants did not recognize periodontal disease as a complication of diabetes, similar to the results found by Kamath *et al*. [31].

When it came to the issue of bleeding gums, a significant number of participants were unaware, which aligns with Renatus *et al*. observations [32]. A notable finding from

our study was that the majority of participants were informed by their doctors about their periodontal disease, contrasting with Shanmukappa *et al*. research, where participants reported a lack of information regarding gum problems from their healthcare providers [20]. Additionally, very few participants were advised to take extra precautions with their oral health due to diabetes, which reflects the findings of Jansson *et al*. [33].

Less than half of the participants were referred to a dentist by their physician, a finding consistent with Al Habashneh *et al*. and Bowyer *et al*. [34]. This lack of referral could be attributed to limited awareness about the link between diabetes and periodontal disease. A larger proportion of participants in our study experienced bad breath and dry mouth, which corresponds with the results of Eldarrat *et al*. [35]. Furthermore, many participants failed to recognize that periodontal disease could influence their blood sugar levels, similar to Shanmukappa *et al*. findings [20].

The majority of participants were unaware of the connection between gum problems and overall health, which mirrors findings by Moore *et al*. and Almas *et al*. [36, 37]. This lack of awareness might be due to limited education or neglecting personal health. Nevertheless, a significant portion of our study participants recognized the importance of informing their dentist about their diabetes, which aligns with the conclusion of Jansson *et al*. [33].

A larger proportion of participants in this study were unaware of interdental cleaning aids and did not use them, which contrasts with findings from Jansson *et al*. and Sandberg *et al*. where half of the participants reported using such aids regularly [29, 33]. The lack of awareness regarding interdental cleaning aids could be attributed to insufficient knowledge and limited availability, especially in rural areas.

While a majority of participants expressed interest in learning more about gum-related diseases, only an average proportion was willing to undergo treatment for gum disease, indicating a general neglect of oral health and reluctance to accept treatment. These findings suggest that diabetic patients' knowledge, awareness, and attitudes toward periodontal disease are inadequate. Similar observations were made by Hegde *et al*. where most participants showed poor awareness of the impact of diabetes on oral health [15]. According to Tang *et al*. lower literacy levels and awareness are negatively associated with better diabetic control, whereas Bakhshandeh *et al*. found that diabetics with lower education levels were more prone to periodontal disease [38, 39]. This study shows that improving knowledge of the relationship between diabetes and periodontal disease could motivate patients to better manage their oral health, potentially improving their overall glycemic control.

Limitations and future directions

The primary limitation of this study was the high proportion of participants from uneducated rural backgrounds, which may have biased the results due to their lower levels of awareness and knowledge. Future studies could consider stratifying participants by educational level to reduce this bias. Additionally, since the participants were mainly dental patients, the findings may not be generalizable to the broader population. A multi-center study involving several hospitals could improve the generalizability of the results.

Conclusion

The findings of this study indicate that there is a significant lack of knowledge, awareness, and understanding regarding the connection between diabetes and periodontitis among the rural population of Karad city, Maharashtra, India. It is crucial to educate diabetic patients about the potential complications that can arise if oral health and related diseases are neglected. Additionally, patients should be motivated to maintain proper oral hygiene and seek necessary treatments for periodontal diseases. General physicians who treat diabetic patients should also inform them about the bidirectional relationship between diabetes and periodontal disease. This will help in timely referrals to dental healthcare providers, ultimately improving the overall health and well-being of diabetic patients.

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