



Oral Health and Patterns of Dental Visits Among Diabetic Patients in the Eastern Province of Saudi Arabia

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Purpose: Diabetes is a big public health threat in Saudi Arabia. However, there is limited evidence about dental problems, oral hygiene practices, and dental visits among diabetic patients. The study aimed to evaluate self-perceived oral health status and patterns of dental attendance among diabetic patients in the Eastern province of Saudi Arabia.

Methodology: This cross-sectional study included 486 diabetic patients (mean age 50.14±13.59 years) registered with the Saudi Diabetes Society, Saudi Arabia (October–November 2020). The World Health Organization's oral health questionnaire for adults was administered to collect information about oral health status, oral hygiene practices, and dental attendance, in addition to sociodemographic data. Descriptive and analytical statistics were performed.

Results: Most participants (66.3%) reported having dental pain or discomfort during the last year. Bad breath (60.50%), tooth cavities (55.10%), difficulty in biting hard food (55.10%), tooth sensitivity (53.30%), and bleeding gums (52.90%) were common oral problems among participants. More than half the sample (55.1%) reported visiting the dental office during the last year. However, pain or trouble with teeth, gums or mouth was the most common (40.5%) reason for the last dental visit. Only 7.8% of participants visited the dentist for a routine dental check-up. Multiple logistic regression analysis showed that Saudi nationality (AOR 2.68, P 0.008), family history of diabetes (AOR 1.88, P 0.022), and having pain during the last year (AOR 4.01, P <0.001) were the significant factors associated with the last dental visit due to pain.

Conclusion: This sample of participants demonstrated a high prevalence of dental problems. Few participants performed routine dental visits and most visits were due to pain. Saudis and patients with family history of diabetes and dental pain were more likely to perform pain related dental visits. Multidisciplinary efforts are needed to develop and implement preventive educational and clinical care models for positive oral and general health outcomes.

Keywords: access to oral care, oral health, dental problems, diabetes

Introduction

Diabetes mellitus is a disorder of insulin either in its production or action and it is associated with body organ damage, dysfunction, or even failure.¹ There were 366 million diabetic patients globally in 2011, and this number was expected to increase to 552 million by 2030.² According to the World Health Organization (WHO), the prevalence of diabetes mellitus in Saudi Arabia was the second highest in the Middle Eastern region and it was ranked the seventh worldwide.³

Dental visits are important for the provision of necessary dental treatment and maintenance of optimal oral health among diabetes patients.⁴ Early management of dental conditions can lead to positive outcomes for natural and functional dentition.

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Most populations do not regularly visit the dentist in developing countries,⁵ whereas about half of the population (52%) in the US performs regular dental visits.⁶

Patients without diabetes are more likely to visit a dentist than those with diabetes.⁷ A National Health Survey in the U.S showed that diabetic adults were less likely to visit the dentist in the previous year in comparison with non-diabetic adults (56.8% diabetic to 64.7% non-diabetic).⁸ It was also reported that the diabetic adults who visited the dentists were more likely to receive periodontal treatment, tooth extraction, and removable prosthesis.⁹

Evidence showed that more than 86% of dentists educate diabetic patients about the complications of diabetes on periodontal and oral tissues.¹⁰ Similarly, a vast majority of physicians and dentists were shown to advise diabetic patients to visit the dental office for a regular dental check-up.¹¹ However, most diabetic patients were found to have low awareness about oral problems and lacked the need for preventive dental care.¹² In fact, lack of knowledge about dental health was one of the reasons for non-adherence to oral hygiene practices in diabetic patients.¹³

Diabetes is one of the biggest public health threats in Saudi Arabia and is strongly associated with negative oral health outcomes.¹⁴ However, there is limited data about oral health status and dental attendance among diabetic patients in Saudi Arabia. Therefore, it is critical to understand dental problems, oral hygiene behaviors, and patterns of dental visits among diabetic patients. The study aimed to evaluate self-perceived oral health status and dental visits among diabetic patients in the Eastern province of Saudi Arabia.

Materials and Methods

Study Design and Participants

This cross-sectional study included adult diabetic patients from the Eastern Province of Saudi Arabia. Diabetic patients (both male and female) were recruited from the Saudi Diabetes Society (October-November 2020). The Society provides education and management of diabetes to the Saudi and non-Saudi populations in the country. Adult diabetic patients from the Eastern province and those who agreed to voluntary participation were eligible to participate in the study. A sample of 547 patients, calculated based on 95% confidence interval, the precision of estimate (4%), expected proportion (65%), and

sampling frame ($\geq 20,000$), was adequate for valid study results.

Measurement of Study Variables

The World Health Organization's Oral Health Questionnaire for Adults was used to collect information about the oral health status of the participants, oral hygiene practices, dental attendance, and medical history, in addition to sociodemographic information.¹⁵ The structured questionnaire was divided broadly into three sections. The first section of the questionnaire inquired about gender, age, level of education, medical history, and duration of diabetes. The questions about oral health status were included in the second section of the questionnaire. The participants were asked about tooth cavities, bad breath (malodor), bleeding gums, tooth sensitivity, loosening of teeth/ tooth mobility, dental pain or discomfort, difficulty in biting and chewing food, embarrassed due to the appearance of teeth, and feeling tense because of dental problems. The responses about oral hygiene practices were also sought in this section. The third section included questions about dental visits. The patients provided their responses about the reason for dental visits, types of dental visit, and duration of the last dental visits. The questions about patients' willingness to receive instructions about oral health were included in the last section of the questionnaire. The questionnaire was drafted in English language and discussed among researchers, then it was translated into the Arabic language according to a previously validated Arabic version.¹⁶ The Arabic version of the questionnaire was reviewed for cultural adaptation by an Arab faculty member outside of the study. Arabic questionnaire was administered among study participants. A pilot testing of the Arabic questionnaire was done on 20 diabetic patients in Dammam and AlKhobar to assess their understanding of the questionnaire. However, no changes were indicated in pilot testing and data of these patients were not included in the final analysis.

Study Procedure and Ethics

The study (EA 202002) was approved by ethics committee at the College of Dentistry, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia. The permission to conduct the study was obtained from the administration of the Saudi Diabetes Society who sent an online questionnaire produced in Google Drive through WhatsApp contacts to its registered diabetic patients in the Eastern province. The participants were introduced to the consent

form and those willing to participate continued with filling up an online questionnaire. The consent form included aim and objectives of the study including its benefits and the privacy and confidentiality of participants' responses. The study was conducted in accordance with the guidelines of the Helsinki Declaration.

Statistical Analysis

Data were analyzed using Statistical Package for Social Sciences (IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp). Means, and standard deviations were calculated for quantitative variables and frequencies and percentages for qualitative variables of the study. Chi-square test was used for bivariate analysis of independent variables (age, gender, education, etc.) with dependent variable (pain related last dental visit). The multiple logistic regression analysis was performed to assess the influence of independent variables on dependent variable. Statistical significance was set at $p < 0.05$.

Results

The study included data of 486 patients with a mean age of 50.14 ± 13.59 years. There were 66.3% of males and 33.7% of females in the study. Most participants were Saudis (88.5%) and educated (91.2%). The majority of participants (88.5%) had a family history of diabetes and reported dental pain or discomfort during the past 12 months (66.3%). Regarding daily oral hygiene behaviors, 61.5% reported brushing teeth, using mouth wash (21.8%), and using dental floss (12.6%) every day. The study also showed that 86.4% of participants were willing to receive oral health instructions to improve their oral health (Table 1). The most common oral problems included bad breath (60.50%), tooth cavities (55.10%), difficulty in biting hard food (55.10%), tooth sensitivity (53.30%), and bleeding gums (52.90%). On the other hand, difficulty in speech (15.20%), oral ulcers (23.30%), and tooth mobility (24.30%) were the least common problem in the study (Figure 1).

Table 2 displays data of timing and reasons for the last dental visit and reasons for not visiting the dentist. Almost half the sample (55.1%) reported visiting dental office during the last year. However, pain or trouble with teeth, gums, or mouth was the most common (40.5%) reason for the last dental visit. Only 7.8% of the participants visited the dentist for a routine dental check-up. Difficulty in getting an appointment (29.8%) and non-affordability of dental treatment (29.2%) were the most common reasons for not visiting the dentist.

Table 1 Demographic and Oral Health Information of Study Participants

Variables	Frequency (%) N= 486
Gender:	
Male	322 (66.3)
Female	164 (33.7)
Age	
Adults (22–64 years)	415 (85.4)
Older adults (≥ 65 years)	71 (14.6)
Nationality:	
Saudi.	430 (88.5)
Non-Saudi	56 (11.5)
Level of education:	
No education.	43 (8.8)
School education.	258 (53.1)
University or higher level.	185 (38.1)
Level of Income	
Low: less than 5000 SAR/month	213 (43.8)
Middle: 5001–20,000 SAR/month	248 (51.0)
High: 20,000 SAR/month and above	25 (5.1)
Family history of Diabetes:	
Yes	430 (88.5)
No	56 (11.5)
Diabetes duration	
0–10 years	379 (78.0)
More than 10 years	107 (22.0)
Dental pain or discomfort during the past 12 months	
Yes.	322 (66.3)
No.	121 (24.9)
I do not remember/know	43 (8.8)
Oral hygiene behaviors	
Daily tooth brushing	
Yes	299 (61.5)
No	187 (38.5)
Daily use of mouth wash	
Yes	106 (21.8)
No	380 (78.2)
Daily use of dental floss	
Yes	61 (12.6)
No	425 (87.4)
Willingness to receive oral health instructions	
Yes	420 (86.4)
No	66 (13.6)

Results of bivariate analysis and multiple logistic regression analysis are shown in Table 3. In bivariate analysis, Saudi participants (OR 3.12, $P = 0.001$), those with a family history of diabetes (OR 2.12, $P = 0.003$), and those who had pain during the last year (OR 4.12,

Distribution of dental problems

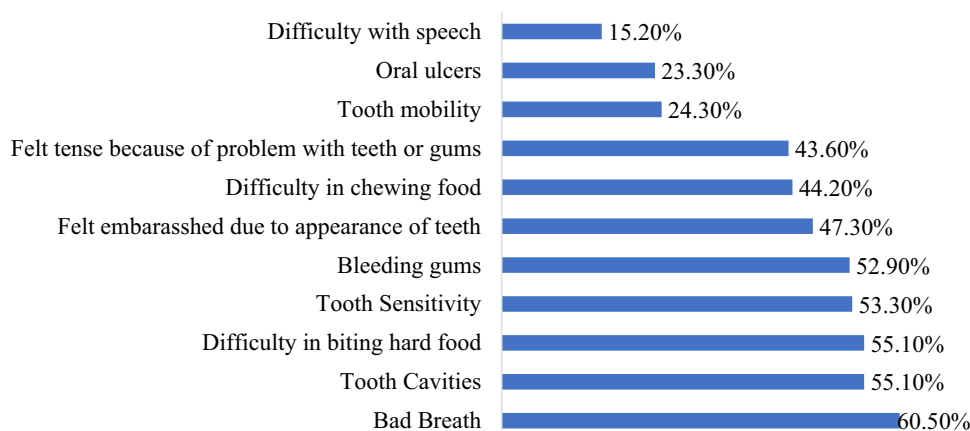


Figure 1 Distribution of participants' responses about the self-perceived oral problems.

$P < 0.001$) were significantly more likely to perform pain related dental visit. Saudi nationality (AOR 2.68, P 0.008), family history of diabetes (AOR 1.88, P 0.022), and having pain during the last year (AOR 4.01, $P < 0.001$) were the significant factors associated with the last dental visit due to pain after controlling for other factors.

Figure 2 provides information about sources of oral health instructions among study participants. Dental office (50%) was

the most source of oral health instructions, followed by social media (30.7%), and family and friends (28%).

Discussion

Saudi and non-Saudi diabetic patients in the present study demonstrated a high prevalence of dental pain, bad breath, tooth cavities, difficulty in biting hard food, tooth sensitivity, and bleeding gums. The literature also indicates the

Table 2 Dental Attendance Patterns Among Study Participants

Variables	Frequency (%)
How long is it since you last saw a dentist?	
≤ 1 year.	268 (55.1)
>1 year but < 2 years.	76 (15.6)
≥ 2 years but < 5 years.	91 (18.7)
≥ 5 years.	51 (10.5)
What was the reason of your last visit to the dentist?	
Consultation/advice.	52 (10.7)
Pain or trouble with teeth, gums or mouth.	197 (40.5)
Treatment/ follow-up treatment.	127 (26.1)
Routine check-up/treatment.	38 (7.8)
Do not know/do not remember.	72 (14.8)
Reasons for not visiting the dentist	
I do not have dental insurance.	111 (22.8)
I cannot afford to have dental treatment.	142 (29.2)
I do not have time to visit the dentist.	72 (14.8)
I have dental anxiety/ I am afraid of dental treatment.	73 (15.0)
I must travel a long distance to receive dental treatment.	2 (0.4)
It is difficult to get a dentist's appointment.	145 (29.8)
I am not satisfied with the quality of oral care services.	29 (6.0)
I do not think oral care is important for good health.	26 (5.3)

Table 3 Association of Factors with the Last Dental Visit Due to Pain Among Study Participants

Variables	Unadjusted Odds Ratio (95% CI)	P-value	Adjusted Odds Ratio (95% CI)	P-value
Gender: Male Female	1.10 (0.75, 1.61)	0.628	1.32 (0.86, 2.01)	0.201
Age Adults Older adults	1.21 (0.72, 2.04)	0.467	1.03 (0.58, 1.82)	0.924
Nationality: Saudi. Non-Saudi	3.12(1.57, 6.20)	0.001	2.68 (1.29, 5.55)	0.008
Level of education No/school education. University or higher level.	0.67 (0.46, 0.97)	0.036	0.71 (0.46, 1.10)	0.125
Level of income Low income Middle/high income	0.86 (0.60, 1.24)	0.419	0.99 (0.65, 1.50)	0.948
Family history of Diabetes Yes No	2.12(1.28, 3.49)	0.003	1.88 (1.10, 3.22)	0.022
Diabetes duration 0–10 years More than 10 years	0.92 (0.60, 1.43)	0.717	1.28 (0.79, 2.05)	0.313
Pain or discomfort during the past 12 months Yes. No.	4.12 (2.65, 6.40)	<0.001	4.23 (2.67, 6.67)	<0.001

high occurrence of pain, periodontal diseases, bad breath/halitosis, tooth decay, delay wound healing, and other oral complications among diabetic patients.¹⁴ It is known that hyperglycemia in diabetic patients is associated with the development of periodontal and other oral diseases.¹⁴ Hyperglycemia disrupts salivary composition and functions and increases cytokines and other inflammatory mediators in saliva and gingival crevicular fluid leading to exacerbation of inflammation and deterioration of periodontal and oral tissues.^{14,17} In addition, reduced salivary flow diminishes cleansing and buffer capacity of saliva and enhances plaque accumulation thus compromising oral health of diabetic patients.¹⁸ Bad breath was common in our sample which can be related to the production of volatile sulfur compounds from odoriferous microorganisms.¹⁹ These oral complications in diabetic patients are known to lower their quality of life.²⁰

Diabetes is associated with multiple health risks, however, regular dental care visits are known for positive oral

health outcomes for diabetic adults.⁸ A study by Lopez et al found that regular dental visits for diabetic patients resulted in a significant improvement in probing depth, bleeding on probing, and sites with plaque after 3 months.²¹ Despite optimal oral health benefits of regular dental visits, a very small proportion of diabetic patients in our sample performed routine dental check-ups. Similar patterns of fewer regular dental visits were reported in previous studies of diabetic adults in Saudi Arabia.^{22–24} More than 90% of diabetic patients who visited primary health care centers in Riyadh did not get their routine dental check-up every six months.²² A study by Al Amassi and Al Dakheel found only 15.1% of diabetic patients regularly visiting the dentist in Saudi Arabia.²³ Similarly, a low prevalence of dental visits in the last year (13%) among diabetic patients in Riyadh was reported by Bahammam.²⁴ Likewise, only 14% of diabetic patients in the United Arab Emirates were found to visit a dentist for a regular dental check-up.²⁵ This consistent finding of

Sources of oral health instructions

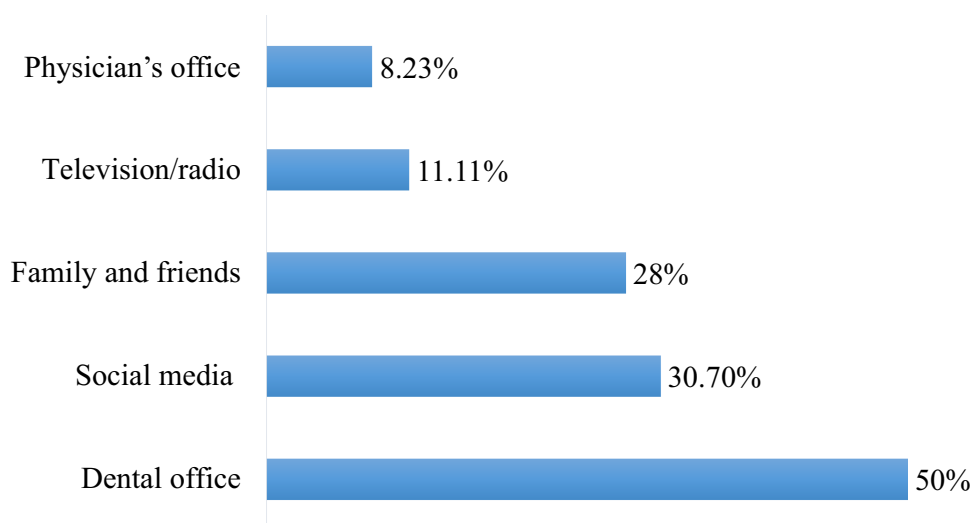


Figure 2 Distribution of participants' responses about sources of oral health instructions.

fewer regular dental visits among diabetic patients was also reported in a systematic review of 28 studies from 14 countries.¹⁷ Recently, the researchers also observed lower odds of preventive dental visits among diabetic patients than those without diabetes in the U.S.²⁶

Dental pain was the most frequent reason for dental visits in our sample. Diabetic patients demonstrate a high prevalence of oral diseases resulting in painful sensation in the oral cavity which may account for an increased likelihood of pain related dental visits in our sample.^{14,27} The present study also showed that Saudi nationals were more likely to perform pain related dental visits. This pattern of increased dental visits due to pain in Saudi Arabia is also supported by the results of a previous study where most adult patients performed pain related dental visits in the Eastern region.²⁸ Family history of diabetes is a strong risk factor associated with the development of diabetes.²⁹ Therefore, these subjects are more likely to have increased distribution of oral diseases and subsequently dental pain. This may explain why participants with a family history of diabetes were about twice (AOR 1.88) more likely to perform pain related dental visits than those without a family history in the present study.

Difficulty in getting a dental appointment was the most common reason for not performing dental visits in the present study. These findings corroborate with the results of a study by Almutlaqah et al who reported difficulty in getting an appointment as one of the main barriers to dental care in Saudi Arabia.³⁰ The affordability of dental treatment was the second most common reason for not

visiting the dentist among our sample of diabetic patients. A study by Moore et al indicated that the majority of diabetic patients in the US avoided visiting a dental office because of the cost of dental treatment.¹² Moreover, a systemic review cited the cost of dental treatment as the main barrier to dental care in diabetic patients.¹⁷ The lack of insurance was the third most important reason for not visiting the dentist in the present study. There is a significant association between not having health insurance and avoiding the dental visit.³¹

Health care providers can play an important role in improving oral health behaviors of diabetic patients by providing oral health education.¹⁷ In the present study, the dental office was the main source of oral health education. This is contrary to a study of diabetic patients by Al Amassi and Al Dakheel who reported that social media was the main source of oral health information followed by dentists and dental hygienists.²³ Almainan et al showed that 67.7% of social media users seek online oral health related information in Saudi Arabia.³² In the present study, 30.70% of patients indicated social media as an important source of oral health education. Given the important and emerging role of social media, it is suggested that high-quality evidence-based oral health information should be provided through social media outlets to raise awareness about the importance of oral health including access to oral care services.

The present study provided valuable data that may be used to reduce oral health disparity among diabetic patients in Saudi Arabia. However, there are certain limitations to the study.

Adult diabetic patients from the Eastern province of Saudi Arabia participated in the study, therefore study results should not be generalized to diabetic patients from all over the country. Moreover, the use of a non-probability convenience sample of diabetic patients may lead to bias in the study. A standardized World Health Organization's oral health questionnaire was used in the study to obtain valid and reliable results. However, self-reported data are limited because of under and over reporting of responses. More accurate information about oral problems and dental visits can be obtained by performing clinical oral examination and review of dental records, respectively. However, there were challenges of oral screening of diabetic patients and data collection from clinics due to infection control protocols during the COVID-19 pandemic. Future studies should investigate clinically diagnosed oral problems and associated factors in a large sample of diabetic patients from all regions of Saudi Arabia.

Conclusion

This study showed a high prevalence of dental pain or discomfort during the past 12 months among diabetic patients. Most participants reported bad breath, tooth cavities, difficulty in biting hard food, tooth sensitivity, and bleeding gums. Pain or trouble with teeth, gums, or mouth was the most common reason for the last dental visit. There was a very low prevalence of routine dental check-ups among participants. Significant factors associated with the last dental visit due to pain included Saudi nationality, family history of diabetes, and pain during the past year. The study results underscore the need for public health measures to promote routine dental care and reduce the prevalence of oral problems among diabetic patients.

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Disclosure

The authors report no conflicts of interest in this work.

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