

*Full Length Research Paper*

# Oral hygiene practice of adult diabetic patients and their awareness about oral health problems related to diabetes

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Diabetes mellitus is a major public health problem in the Kingdom of Saudi Arabia. Several studies have shown that diabetic patients are at a greater risk of developing oral health problems than non-diabetics. This study aims to evaluate the oral hygiene practices of adult diabetic patients and their awareness of oral health problems related to the disease. In this cross-sectional, Internet-based descriptive study, a self-administered questionnaire was uploaded online and any adult diabetic patient living in Saudi Arabia was allowed to take part. The participants were asked to complete the questionnaire and submit it online. A total of 278 diabetic patients, ranging from 18 to 64 years of age (115 male and 163 female), responded and submitted their questionnaires. In the section on oral hygiene practice, the results showed 45.6% of the respondents brush their teeth once daily, 10.4% floss once daily, and only 11.5% use mouthwash regularly. Regarding patients' awareness, the majority (81%) are aware that diabetes may increase the risk of oral health problems; 75.9% are aware that diabetes may increase the risk for periodontal problems including gum bleeding and teeth mobility and 36.3% are aware that diabetes may reduce salivary flow. The main source of information was the media (31%), followed by dentists and dental hygienists (23%), physicians (21%) and the Internet (16%). Majority of the participants are aware of the importance of controlling diabetes in order to minimize oral health complication (74.4%) but only 15.1% of them visits the dentist regularly. Patients with higher levels of education (graduate and postgraduate) showed statistically significantly better brushing habits and more awareness regarding oral health problems related to diabetes in comparison with those with low levels of education ( $p$  value  $<0.05$ ). Grouping patients by age and gender did not reveal any statistical difference in their level of awareness or brushing habits. Diabetic patients' level of awareness of their increased risk of oral health problems was generally acceptable. Further educational programs should be established for diabetic patients, especially those with low levels of education, in order to improve their oral health knowledge and dentists should take on more responsibility for this task.

**Key words:** Oral health, awareness, knowledge, diabetes.

## INTRODUCTION

Diabetes is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin

secretion, insulin action or both. The chronic hyperglycemia of diabetes is associated with long-term

damage to, dysfunction of, and failure of different organs, especially the eyes, kidneys, nerves, heart and blood vessels (American Diabetes Association, 2010).

Diabetes mellitus is a major public health problem in the Kingdom of Saudi Arabia. Its prevalence is on the increase, reported to be at 23.7% among adult citizens in 2004 (Al-Nozha et al., 2004) and 30% among adults in 2009 (34.1% in males and 27.6% in females) (Alqurashi et al., 2011).

Many studies have reported that people with diabetes are at greater risk for oral and dental health problems, such as gingivitis and periodontitis, delayed mucosal wound healing, dental caries, mucosal neuro-sensory disorders, oral candidiasis and tooth loss as compared to those without diabetes. Poor control of diabetes and increased duration of the condition are associated with more severe periodontal disease (Yuen et al., 2009; Jansson et al., 2006; Lamster et al., 2008).

The systemic inflammatory response generated by inflamed periodontal tissue may, in turn, exacerbate diabetes, worsen cardiovascular outcomes, and increase the likelihood of mortality. Thus, medical and dental health professionals are vital in treating oral pathology, recognizing new cases of diabetes, and counseling people with diabetes on oral their health (Skamagas et al., 2008).

Taylor et al. (2004) reported that substantial evidence exists to support the role of diabetes as an important risk factor for periodontal disease. Additionally, the evidence supports the view that the relationship between diabetes and periodontal diseases is bidirectional. They assert that additional research is necessary to firmly establish that treating periodontal infections can contribute to glycemic control management and possibly to the reduction of type 2 diabetes complications. Grossi (2001) suggested that chronic periodontal infection increases the severity of diabetes and complicates its control, and the treatment of chronic periodontitis infections is essential for controlling diabetes. This two-way relationship was also documented by Soskolne and Klinger (2001) review. An analysis of the National Health and Nutrition Examination Survey (NHANES) III data set confirms the previously reported significantly higher prevalence of periodontitis in diabetics than in non-diabetics (17.3 versus 9%). The analysis of the data also shows that the prevalence of diabetes in patients with periodontitis is double as compared to that seen in patients without periodontitis (12.5 versus 6.3%).

Poor oral health knowledge and awareness of the relationship between diabetes mellitus and oral health problems have been found in most of the previous studies in different areas worldwide (Yuen et al., 2009; Bowyer et al., 2011; Eldarrat, 2011; Al Habashneh et al., 2009; Allen et al., 2008). Allen et al. (2008) reported that

only 33% of the diabetic patients they studied were aware that diabetes may increase the risk of periodontal disease, while 84% were aware of their increased risk of heart disease, 98% of eye disease, 99% of circulatory problems and 94% of kidney disease. Half of the participants who were aware of their increased risk for periodontal disease had received this information from a dentist. This poor oral health knowledge in comparison with general health knowledge was also reported by Eldarrat (2011). Yuen et al. (2009) reported that about half of all diabetic patients had insufficient oral health knowledge related to diabetes, and most of them had not received any education from health professionals about these problems.

Al Habashneh et al. (2009) found that 48% of diabetic patients were aware that diabetics are more prone to gum diseases and oral health complications. Television and the Internet were the main sources of knowledge for dentists, with a rate of 50%. They concluded that knowledge on diabetes and periodontal health among diabetic patients is low, and majority of the patients were unaware of the potential oral health complications of their disease and the need for proper preventive care.

In order for patients with diabetes to self-manage their oral health effectively, they need to be informed about the link between diabetes and oral health and be given appropriate advice. Awareness of the potential associations between diabetes, oral health and general health problems needs to be increased in diabetic patients. Bowyer et al. (2011) reported that 69.1% of diabetic patients in the United Kingdom had never received any oral health advice related to their diabetes. He concluded that training and advice for both healthcare professionals and patients concerning the importance of good oral health for diabetics are needed. The role of dentists in diabetes screening and support requires further investigation.

Bahammam (2015) reported in his study on Saudi diabetic patients that 94% of diabetic patients never received health advice from health professionals. Family and friends were the main source of information, while the Internet was the smallest source. Yuen et al. (2009) and Al Habashneh et al. (2010) recommended that health professionals (medical or dental) should provide appropriate education program for their patients with diabetes, on the oral symptoms and complications of diabetes and to promote proper oral health behavior.

In 2015, Bahammam made a recommendation in his study in Saudi Arabia that a national program to prevent diabetes and address the modifiable risk factors at the community level, targeting high-risk groups, should be implemented soon. Optimal control of diabetes, appropriate oral hygiene, and regular visits to the dentist

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**Table 1.** Characteristic of the respondents.

Characteristic	Frequency	Percentage
<b>Gender</b>		
Male	115	41.4
Female	163	58.6
<b>Age (years)</b>		
18-39	143	51.4
40-59	105	37.8
>59	30	10.8
<b>Type of diabetes</b>		
Type I	113	40.6
Type II	136	48.9
I don't know	29	10.5
<b>Length of diagnosis (years)</b>		
<1	26	9.3
1-5	84	30.3
>5	168	60.4
<b>Level of education</b>		
Intermediate school or below	23	8.3
Secondary school	120	43.2
University level	108	38.8
Post graduate	27	9.7

all have important roles in prevention of the oral manifestations of diabetes. Diabetic adults should be educated about the need to improve their level of oral self-care and the importance of a regular dental checkups to compensate for their increased risk (Almas et al., 2003; Bakhshandeh et al., 2008).

The wide spread of diabetes mellitus among population in Saudi Arabia emphasizes the importance of improving patients' knowledge and awareness about oral complications of diabetes. The objective of this study was to evaluate oral health behavior and knowledge of adult diabetic patients living in Saudi Arabia about oral health problems related to diabetes.

#### MATERIALS AND METHODS

In this cross-sectional, Internet-based descriptive survey, a questionnaire containing twenty questions were uploaded online, and adult diabetic patients living in Saudi Arabia were asked to participate. The link for the questionnaire was posted on different health-related social media pages throughout the Internet. In addition to personal data and level of education, the questionnaire was designed to assess diabetic patients' oral self-care practices and their knowledge on the relationship between diabetes and oral health problems. The study was approved by the ethical committee in the research center of Riyadh Colleges of Dentistry and Pharmacy. The participants were asked to follow a link and to

submit their answers after reading a few instructions including the aim and importance of the study. A completed questionnaire indicated the consent to participate in the study. Anonymity and confidentiality were assured. Data were collected over a period of 4 weeks. Descriptive analysis was undertaken to present an overview of the characteristics of the participants, their oral hygiene practices, and their awareness of different oral health problems related to diabetes (Table 3). The Statistical Package for the Social Sciences (SPSS) software package, version 20.0, was used for data analysis.

#### RESULTS

A total of 278 diabetic patients, ranging from 18 to 64 years of age (115 male and 163 female), responded and completed the questionnaire. The mean age of the participants was 47 years. The participants' characteristics, including demographic data, level of education, type of diabetes and number of years since diagnosed are shown in Table 1.

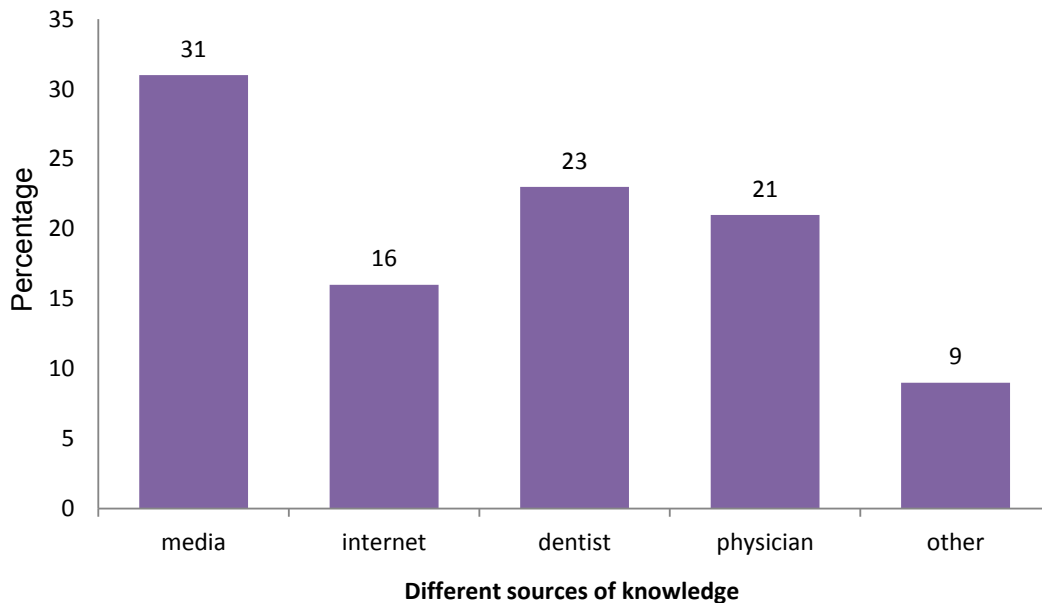
Regarding the oral hygiene practices of the participants, the results showed that 45.6% of them brush their teeth once daily in a regular manner, 10.4% floss their teeth regularly, and only 11.5% use mouth rinse at least once a day. The participants' other oral hygiene behaviors are presented in Table 2.

**Table 2.** Oral hygiene habits.

Oral hygiene habit	Never	Irregular	Once daily	> Once daily
Brushing	8.3%	15.6%	45.6%	19.1%
Flossing	75.2%	13.4%	10.4%	1%
Use of Mouth wash	40.5%	48%	11.5%	0%

**Table 3.** Level of awareness of the participants on oral health problems related to diabetes.

	Yes/aware N (%)	No/not aware (%)
Diabetes may increase risk of developing oral health problems	225(81)	53(19)
Diabetes may increase risk of periodontal problems (gum bleeding, teeth mobility, etc)	211(75.9)	67(24.1)
Diabetes may cause reduction in salivary flow	101(36.3)	177(63.7)
As a diabetic, I have to perform more oral self-care practice than normal people	221(79.5)	57(20.5)
Controlling diabetes is important to minimize oral health complications	207(74.4)	71(25.6)
Saliva is important to maintain oral health resistance to disease such as caries and gum inflammation	162(58.3)	116(41.7)
Regular dental visit is more important for diabetic patients than non-diabetics	225(81)	53(19)
I am visiting the dentist regularly	42(15.1)	236(84.9)
When visiting the dentist, it is important to inform him about my general health including diabetes	256(92)	22(8)



**Figure 1.** The source of knowledge (%) among the participants on the relationship of diabetes with oral health problems.

In the section questioning their awareness of oral health problems in relation to diabetes (Table 3), the majority of the participants (81%) reported that they are aware of the relationship between diabetes and oral health problems. About 75.9% of them believe they are at higher risk of developing periodontal disease including gum bleeding and teeth mobility; and 36.3% are aware

that diabetes may reduce salivary flow. Among those who are aware of the relationship between diabetes and oral health problems, 21% received this information from their physician, 23% from their dentist, 31% from the media, 16% from the Internet, and 9% from other sources (Figure 1).

Majority of the participants believe in the importance of

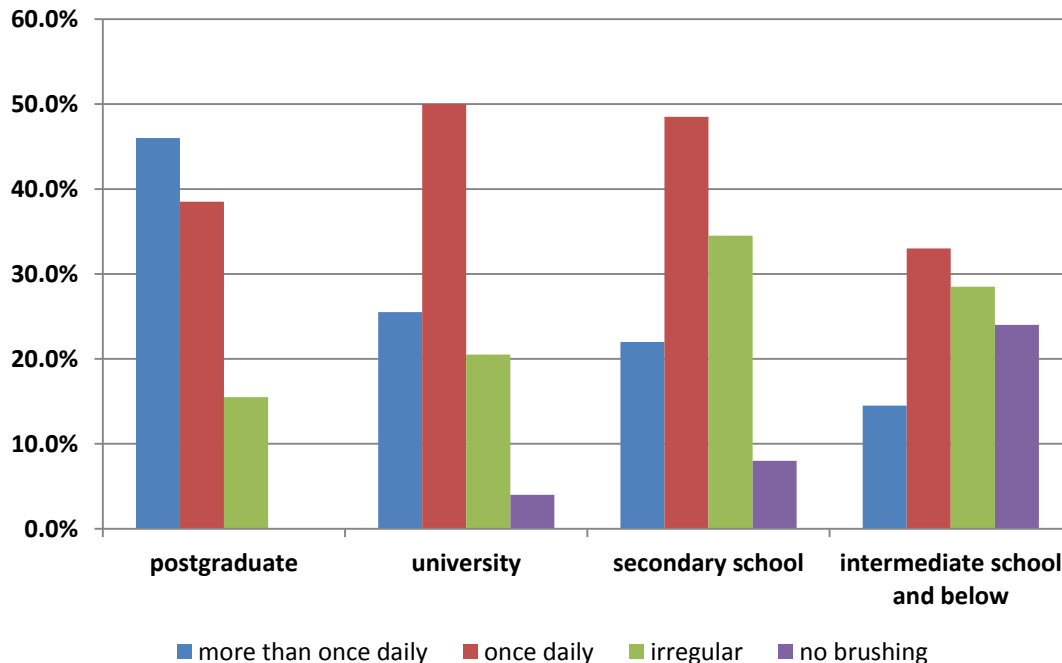


Figure 2. Level of education and brushing habits.

visiting the dentist regularly for diabetic patients, but only 15.1% actually visit the dentist regularly. More than 90% of the respondents answered that it is necessary to inform the dentist of their diabetes before starting any dental treatment. About 79.5% of the participants believe they have to focus more on daily oral self-care practices as compared to non-diabetic persons, and 74.4% believe that controlling their diabetes is very important for minimizing the risk of developing oral health problems. Different age and gender groups did not show any statistically significant difference in brushing habits and in level of awareness of the increased risk of oral health problems for diabetic patients ( $p > 0.05$ ).

Patients with higher levels of education (graduate and postgraduate) had significantly better oral hygiene practices than those with lower levels of education (primary and secondary school), as presented in Figure 3. Also, patients with higher levels of education showed significantly better awareness of the increased risk of developing oral health problems (Figure 2).

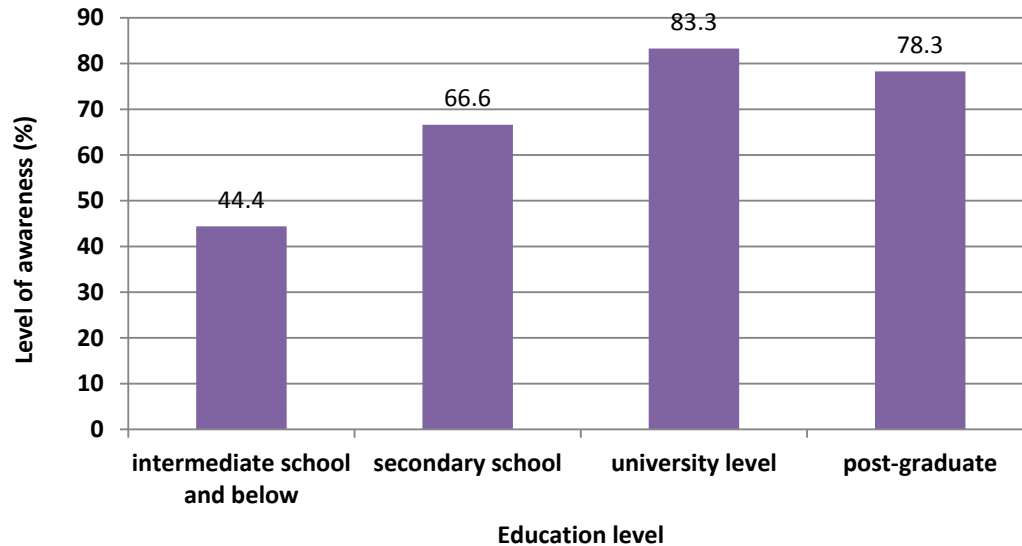
## DISCUSSION

The correlation between diabetes mellitus and periodontal disease has been reported in several studies (Yuen et al., 2009; Jansson et al., 2006; Soskolne and Klinger, 2001; Taylor et al., 2004).

This study aimed to evaluate adult diabetic patients' level of awareness of their increased risk of developing oral health problems. An online self-administered

questionnaire was utilized for this purpose. The sample was mainly comprised of adult diabetic subjects who are living in Saudi Arabia. This implies that the culture around health they are exposed to is mainly derived from their local communities. The study has relied exclusively on a self-reported questionnaire completed online by the patients themselves. The number of Internet users in Saudi Arabia has increased rapidly in the last years whereas it increased from 41% in 2010 to reach 70.4% by the end of quadrant two- 2016 (Communications and Information Technology Commission, 2016).

The technology for online survey research is young and evolving. Today, online survey services make web-based studies much easier and faster. Advantages of web-based studies include ease of data collection, automation of data input and handling, minimal cost and time. The participants may find this type of surveys more convenient since they could respond to questions freely and honestly without worrying. However, one should consider the limitations and drawbacks of an online studies such as fraud, absence of reviewer and inability of non internet users to participate. In the study and in order to minimize frauds, we followed different filtering methods including: IP address restriction (to prevent multiple submission and to restrict geographic location eligibility); trap questions (to ensure respondents are thoroughly reading the survey questions and not rushing); time stamp (too short time spent to take the study indicates no seriousness in reading and answering the questions); filtering question (to exclude any submission from non diabetic respondents).



**Figure 3.** Level of education in relation to the awareness of increased risk of developing oral health problems.

Results of this study revealed that about 76% of the participants are aware that diabetes may increase the risk of oral health problems. This level of awareness could be considered acceptable to good if compared to previous studies evaluating the same issue. This percentage is much larger than that found in most of the reports from different areas worldwide (Al Habashneh et al., 2010; Allen et al., 2008; Yuen et al., 2009). This could be attributed to the fact that the study population is made up of Internet users, who may have a higher level of general health knowledge. Furthermore, about half of the respondents in this study have under-graduate or postgraduate degrees (48.5%), which probably reflects a higher level of general knowledge and awareness. Most of the studies that reported a lower level of awareness were conducted on diabetic patients visiting hospitals and outpatient clinics (Bahammam, 2015; Allen et al., 2008).

Many adults with diabetes who have poor awareness of the oral health complications associated with diabetes are receiving limited advice from healthcare professionals. In this study, 44% of the participants received oral health advice in relation to diabetes from health professionals (physicians, dentists and hygienists). Although, oral health care advice and education is an important responsibility of dental professionals, dentists and hygienists were providing this education and advice for only 23% of the population of the study. This could be linked to the fact that only 15.1% of the participants are visiting the dentist regularly or for routine checkups, and most of their visits were emergencies. Or it could simply be that many dentists do not take on the responsibility of providing oral hygiene education and advice. Similar findings have been reported in many previous studies (Allen et al., 2008; Al Habashneh et al., 2010; Bahammam, 2015; Bowyer et al., 2011).

The main source of knowledge on this association was the media (31%), followed by dental professionals (23%), while the Internet was the source of information for 16% of the respondents. In Bahammam (2015) study, it was reported that family and friends were the main source of information and the Internet was the last source.

Although most of the respondents believe they have to focus more on oral hygiene than non-diabetic people, only 45.6% of them brush their teeth once daily, and 75.2% do not use dental floss. Only 15.1% of the respondents visit the dentist regularly, and their visits are mainly in response to pain or observing an abnormality. This reflects that our communities lack sufficient awareness of the importance of routine dental checkups.

The study, in general, reveals that subjects who have a lower level of education (secondary school and below) lack knowledge on oral health problems related to diabetes. Many of the diabetic patients with low levels of education or who are older either do not use the internet or have limited access to it. That is to say, we must emphasize the role of health professionals in educating their diabetic patients about the health problems related to diabetes. It is one of the limitations of this study that it targeted only diabetic patients using the Internet, who may not reflect the population at large.

The importance of the maintenance and promotion of periodontal health must be emphasized among people with diabetes because of their high risk for periodontal diseases. The high prevalence of diabetes mellitus in the population of Saudi Arabia and the importance of improving their knowledge about the increased risk of oral health problems necessitate the creation of organized educational programs for these patients. It is important that patients receive relevant oral self-care instructions so that the oral health complications

associated with diabetes are minimized. Training and advice for both healthcare professionals and diabetes patients concerning the importance of maintaining good oral health is needed at this time.

## Conclusion

Within the limitations of this study, the level of awareness of diabetic patients on the relationship between diabetes and oral health problems is generally acceptable, especially in patients with higher education (university and above). Better brushing habits were found in those with this level of education. Less than half of the participants received their information on oral health problems related to diabetes from health professionals (physicians, dentists and hygienists).

Further educational programs should be established for diabetic patients, especially those with a low level of education, in order to improve their oral health knowledge and behavior, and dentists and hygienists should be entrusted with more responsibility in this task. It is also recommended to conduct such studies on diabetic patients visiting primary health care centers and hospitals in different areas of Saudi Arabia.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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