



## Impact of COVID-19 pandemic on the oral health condition of diabetic patients in Al-Qassim, Saudi Arabia

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### ABSTRACT

**Aim:** The present study aimed to assess the awareness of diabetic patients in Al-Qassim, Saudi Arabia, about the relationship between diabetes, oral health, and the COVID-19 pandemic.

**Materials and Methods:** A cross-sectional questionnaire-based survey was conducted following systematic random sampling in four medical centers in Al-Qassim. Survey responses to 19 multiple choice questions were collected from 120 participants and subsequently analyzed.

**Results:** Most study participants had some information about the relationship between oral health and diabetes and knew that maintaining good oral hygiene can help control diabetes. However, none of the study participants, all of whom were diabetic patients, followed the recommended guideline of visiting a dentist at least once every six months. Most had not visited a dental clinic since the start of the pandemic. Further, most study participants were not interested in learning more about diabetes and oral health management during the COVID-19 pandemic or keeping their knowledge about COVID-19 up to date, even though they lacked an adequate understanding of these concepts. Moreover, most participants relied on social media for information about the relationship between diabetes and COVID-19.

**Conclusion:** This study underscores the crucial role that healthcare providers, including dentists, must play in the dissemination of information about COVID-19, diabetes, and oral health to their patients to improve their overall oral health status and promote regular oral care among diabetic patients, more so during the COVID-19 pandemic.

**Keywords:**

Al-Qassim, Saudi Arabia, diabetes, oral health, dentist

**Introduction**

The prevalence of diabetes in Saudi Arabia is shockingly increasing, with over 25% of the population affected by the disease in 2020 (Robert & Al Dawish, 2020). Diabetes and oral health are intimately linked to one another, with a significant correlation between diabetes and the occurrence of several oral conditions, such as periodontitis, tooth loss, caries, etc. (Kaur et al., 2009, Patiño et al., 2007). Indeed, maintaining good oral hygiene can help control blood glucose levels in diabetic patients (Ship, 2003).

The US Centers for Disease Control and Prevention (CDC) recommend that diabetic patients visit a dentist at least once every six months (Tomar & Lester, 2000). However, oral healthcare is often not afforded the same relevance as other kinds of healthcare by the government and citizens alike (Vujicic & Fosse, 2022). As such, visits to dental clinics reduced significantly in many countries during the peak of the COVID-19 pandemic (Kranz et al., 2021; Guo et al., 2020). Several people around the world were either unable to or decided not to visit a dentist during the COVID-19 pandemic for various reasons, ranging from socioeconomic problems to cancellation of dentist appointments to avoid the spread of infection (Matsuyama et al., 2021; Attia & Howaldt, 2021). Not surprisingly, the pandemic also saw an increase in the rate of oral and dental infections and overall dental pain (Guo et al., 2020, Matsuyama et al., 2021). This trend is particularly concerning because poor oral health has been hypothesized to aggravate COVID-19 by many scholars (Takahashi et al., 2021; Pfütznner et al., 2020; Campisi et al., 2020).

Given the high prevalence of diabetes in Saudi Arabia, the present study assesses the awareness of diabetic patients about the interaction between oral health, diabetes, and the COVID-19 pandemic. The primary research question was: did the COVID-19 pandemic pose a barrier to people visiting or accessing dental clinics? The study was conducted in the Al-

Qassim province of Saudi Arabia through a randomized survey of diabetic patients visiting various hospitals, most prominently from the Endocrine and Diabetes Center at King Fahad Hospital in Buraydah, the capital of Al-Qassim beside King Saud Hospital in Onizah, AlRaas General hospital and Al Methnab General Hospital. The survey was conducted using a questionnaire designed to understand the lifestyle of diabetic patients, the measures they adopt to manage their condition, and how they have addressed oral health since the beginning of the COVID-19 pandemic. Answers to such questions and the related collection of relevant statistical data will not only help determine the awareness of the survey population about the interaction between oral health, diabetes, and COVID-19 but also how to improve the awareness of healthcare workers, especially the dental team, about this pertinent patient-centric topic.

**Materials and Methods****Study Population**

The present study comprised participants aged between 18 and 60 years, who were sampled systematically from four medical centers in Al-Qassim, namely (King Fahad Hospital in Buraydah, King Saud Hospital in Onizah, AlRaas General Hospital and Al Methnab General Hospital). The statistically relevant number of participants (minimum sample size) was determined using the following

$$\text{equation: } \text{Sample size} = \frac{z^2 \times \frac{p(1-p)}{e^2}}{1 + (z^2 \times \frac{p(1-p)}{e^2 N})}$$

Where,

e = maximum acceptable random sampling error (selected as 7% in the present study),

z = probability that e is not exceeded (an e score of 1.645 corresponds to 90% confidence level).

p = expected prevalence (estimated to be 0.367), and

N = target population size 120

Based on this formula, the minimum sample size was determined to be 120 participants. All

participants were asked to fill out a survey questionnaire.

### Survey questionnaire

A cross-sectional survey questionnaire comprising 19 multiple choice questions was prepared (Table 1). The questions were designed to seek information about the participants' oral healthcare habits, their knowledge of the relationship between diabetes and oral health, any significant effects they may have noticed in their oral health since their diabetes diagnosis, the frequency and reasons of their dentist visits, their COVID-19 and COVID-19 vaccination status, and how their dentist visits had been impacted by the pandemic. These questions were framed based on an analysis of previous literature (Eldarrat, 2011; Kamath et al., 2015; Shanmukappa et al., 2017). The survey was conducted in a paper-based manner in July and August of 2022. In addition to their responses to the questions, the participants were asked to share their age, sex, location (medical center), date of filling out the survey form, as well as the type of diabetes they had (diabetes mellitus I/II).

### Ethical Considerations

Ethical approval was obtained from the Regional Research Ethics Committee, Qassim Province. Additional permission to conduct this study was taken from the Ministry of Health. Written consent was obtained from each study participant before collecting the survey responses after explaining the purpose of the present research and assuring them of confidentiality. No information that can identify any specific study participant was collected.

### Results

Survey responses were collected from 120 study participants from three medical centers. The average age of the surveyed population was 38 years. 68 of the 120 participants (56%) were male, while the other 52 (44%) were female. Further, 16 of the 120 participants (13%) had diabetes mellitus I, and the remaining 104 (86%) had diabetes mellitus II. The results of the survey have been tabulated in Table 1.

**Table 1: Survey responses of the study participants.**

Q. no.	Survey Question	Answer choices (% of survey participants who selected each choice)
1	What tools do you use to clean your mouth?	No tools ( %); traditional tools / "Muswak" (7%); brush only (83%); brush and floss (0 %); other (0%)
2	How many times a day do you brush your teeth?	Zero (29%); once (57 %); twice (7%); ≥ 3 times (0 %); other (7 %)
3	How often do you see your dentist?	Never go unless I am in pain (93 %); every 3-6 months (0 %); every 6-12 months (0%); once every 2 years (0%); other (7%)
4	How well is your knowledge of the relationship between diabetes and oral health?	Have no idea (14%); little information (79%); average knowledge (7 %); complete conception (0%); other (0 %)
5	Do you know that good oral hygiene can help control your diabetes?	I did not know (35%); Yes, I do know (65%); I knew but do not believe so (0%); Yes, I know and work on maintaining good oral health (0%); other (0%)
6	Do you have taste alteration?	Yes (0%); no (65 %); sometimes (28 %); happened only once before (7%); other (0%)
7	Do you have a burning sensation?	Yes (14%); no (57%); sometimes (29%); happened only once before (0 %); other (0 %)
8	Do you bleed while brushing?	Yes (7%); no (35 %); sometimes (43 %); happened only once before (0 %); other (15 %)
9	Does diabetes cause dental	I do not know (21%); yes, I do know (79%); I know but do

	problems?	not believe so (0%); yes, I know and work on maintaining good oral health (0%); other (0%)
10	Are you interested in learning about diabetes and oral health management during the COVID-19 pandemic?	Yes, I am (50%); no, I am not interested (50%); I want my caregiver to learn that (0%); I do not believe it is worth learning (0%); other (0%)
11	When do you like to visit your dentist?	Only when I have pain (64%); for a regular check-up (28%); when I have bad breath or heavy plaque (0%); when I need cleaning (scaling) (0%); other (8%)
12	Have you been to a dental clinic since the pandemic started?	Yes, regular visit (0%); yes, urgent visit (14%); no, I did not need to see a dentist (78%); no, because of COVID-19 (8%); other (0%)
13	How do you evaluate your information about COVID-19?	Have no idea (14%); little information (50%); average knowledge (14%); complete conception (22%); other (0%)
14	What source do you use when you need information about COVID-19 and its relationship with diabetes?	TV program (21%); I read some medical journals (7%); social media (65%); call 937 (0%); other (7%)
15	Have you ever had COVID-19?	Yes (50%); no (50%); not sure (0%)
16	What concerned you the most about COVID-19?	Lack of information (21%); lack of awareness (7%); the media scared me (65 %); the number of deaths from COVID-19 (0 %); other (7%)
17	Did the COVID-19 pandemic keep you from seeing your doctor?	Yes (35%); I decided not to see my doctor (0%); no (65%)
18	Did you get all the COVID-19 vaccines provided to you?	Yes, I received all three doses (40%); I received only 2 doses (60%); I received only 1 dose (0%); I have not received any dose because of my health condition (0%); no, I do not want to take them (0 %)
19	Are you interested in keeping your knowledge about COVID-19 up to date?	Yes (21%); no (79%)

## Discussion

Most participants in the present study used a toothbrush to clean their teeth (83%). Most brushed their teeth once a day (57%), but a fair share of the participants did not brush their teeth at all (29%). Furthermore, none of the study participants, all of whom were diabetic patients, followed the recommended guideline (for diabetic patients) of visiting a dentist at least once every six months (Tomar & Lester, 2000). Rather, 93 % of the participants visited the dentist only when they experienced pain. Several studies have reported that the frequency of dental visits decreased significantly during the peak periods of the COVID-19 pandemic (Guo et al., 2020; Kranz et al., 2021). In the present study, it was found

that 78% of the study participants had not visited a dental clinic since the start of the pandemic because they did not need to, while another 8% did not visit the dentist specifically because of the pandemic. However, “need” is difficult to define since it is possible that non-urgent dental visits that the patients would have made in the absence of the pandemic were deemed to be “unnecessary” by the study participants in the presence of the pandemic. Yet, 65% of the study participants were not deterred by the pandemic when they needed to visit a doctor. Meanwhile, 65% of the surveyed people admitted to being scared of the media reports on the COVID-19 pandemic. It is possible that this fear, induced by the media,

resulted in fewer people visiting their dentists during the pandemic.

The awareness of diabetic patients about the relevance of oral health has historically been poor (Eldarrat, 2011; Shanmukappa et al., 2017; Kamath et al., 2015). Moreover, in the cases where study participants are aware of the relationship between diabetes and oral health, their knowledge did not come from healthcare professionals (Almehmadi et al., 2020). However, consistent with the recent survey from Jeddah, Saudi Arabia (Almehmadi et al., 2020), the majority of the study participants (79%) had some information about the relationship between oral health and diabetes, and 65% knew that maintaining good oral hygiene can help control diabetes.

At the same time, it is important to note that most of the study participants were not interested in learning more about diabetes and oral health management during the COVID-19 pandemic (50%) or in keeping their knowledge about COVID-19 up to date (79%). This trend is more significant and surprising given that 50% of the participants acknowledged that they only had little information about COVID-19, and none completely understood the relationship between diabetes and oral health. Concerningly, 65% of the study participants rely on social media to gain information about COVID-19 and its relationship with diabetes. It is important to note that health literacy is known to be strongly and positively correlated with better oral health and patient-dentist communication (Guo et al., 2014). This strongly suggests that healthcare providers, including dentists, need to better disseminate information about COVID-19, diabetes, and oral health to their patients to improve their overall oral health status and promote regular oral care among diabetic patients, more so during the COVID-19 pandemic.

### Conclusion

The present study aimed to assess the awareness of diabetic patients about the relationship between diabetes, oral health, and the COVID-19 pandemic. Several interesting observations were made. Most study participants had some information about the

relationship between oral health and diabetes and knew that maintaining good oral hygiene can help control diabetes. However, none of the study participants, all of whom were diabetic patients, followed the recommended guideline of visiting a dentist at least once every six months. Most had not visited a dental clinic since the start of the pandemic. It is possible that fear induced by the media resulted in fewer people visiting their dentists during the pandemic. Further, most of the study participants were not interested in learning more about diabetes and oral health management during the COVID-19 pandemic or keeping their knowledge about COVID-19 up to date, even though they lacked an adequate understanding of these concepts. Moreover, most participants relied on social media for information about the relationship between diabetes and COVID-19. Thus, this study underscores the crucial role that healthcare providers, including dentists, must play in disseminating information about COVID-19, diabetes and oral health to their patients to improve their overall oral health status and promote regular oral care among diabetic patients, more so during the COVID-19 pandemic. COVID-19 is a respiratory disease and dental clinics foster an environment to spread the virus. This played an important role in preventing patients with diabetes from visiting their dentists; therefore, poor oral hygiene was expected.

### References

1. Almehmadi, A. H., Alzaid, G., Quqandi, S., Almalki, G., Bannan, A., Alhindi, A., Idrees, A., Habiballah, A., Al-Shareef, K. & Alhazzazi, T. 2020. Awareness of the effect of diabetes on oral health among a population in Jeddah, Saudi Arabia. *Oral Health Prev Dent*, 18, 27-34.
2. Attia, S. & Howaldt, H.-P. 2021. Impact of COVID-19 on the dental community: part I before vaccine (BV). *Journal of Clinical Medicine*, 10, 288.
3. Campisi, G., Bizzoca, M. E. & Muzio, L. L. 2020. A new exciting hypothesis: direct correlation between periodontitis and

- clinical evolution of COVID-19 patients. *Qeios*.
4. Eldarrat, A. H. 2011. Diabetic patients: their knowledge and perception of oral health. *Libyan Journal of Medicine*, 6, 5691.
  5. Guo, H., Zhou, Y., Liu, X. & Tan, J. 2020. The impact of the COVID-19 epidemic on the utilization of emergency dental services. *Journal of Dental Sciences*, 15, 564-567.
  6. Guo, Y., Logan, H. L., Dodd, V. J., Muller, K. E., Marks, J. G. & Riley Iii, J. L. 2014. Health literacy: a pathway to better oral health. *American Journal of Public Health*, 104, e85-e91.
  7. Kamath, D. G., Nayak, S. U., Pai, K. K. & Shenoy, R. 2015. Knowledge and awareness of oral health among diabetic patients—a cross-sectional study from Mangalore City. *International Journal of Diabetes in Developing Countries*, 35, 71-75.
  8. Kaur, G., Holtfreter, B., Rathmann, W. G., Schwahn, C., Wallaschofski, H., Schipf, S., Nauck, M. & Kocher, T. 2009. Association between type 1 and type 2 diabetes with periodontal disease and tooth loss. *Journal of Clinical Periodontology*, 36, 765-774.
  9. Kranz, A. M., Chen, A., Gahlon, G. & Stein, B. D. 2021. Trends in visits to dental offices during the 2020 COVID-19 pandemic. *Journal of the American Dental Association*, 152, 535.
  10. Matsuyama, Y., Aida, J., Takeuchi, K., Koyama, S. & Tabuchi, T. 2021. Dental pain and worsened socioeconomic conditions due to the COVID-19 pandemic. *Journal of Dental Research*, 100, 591-598.
  11. Patiño, M. N., Loyola, R., Medina, S., Pontigo, L., Reyes, M. & Ortega, R. 2007. Caries, periodontal disease and tooth loss in patients with diabetes mellitus types 1 and 2. *Acta Odontol Latinoam*, 21, 127-33.
  12. Pfützner, A., Lazzara, M. & Jantz, J. 2020. Why do people with diabetes have a high risk for severe COVID-19 disease?—A dental hypothesis and possible prevention strategy. *Journal of Diabetes Science and Technology*, 14, 769-771.
  13. Robert, A. A. & Al Dawish, M. A. 2020. The worrying trend of diabetes mellitus in Saudi Arabia: an urgent call to action. *Current Diabetes Reviews*, 16, 204-210.
  14. Shanmukappa, S. M., Nadig, P., Puttannavar, R., Ambareen, Z., Gowda, T. M. & Mehta, D. S. 2017. Knowledge, attitude, and awareness among diabetic patients in Davangere about the association between Diabetes and Periodontal Disease. *Journal of International Society of Preventive & Community Dentistry*, 7, 381.
  15. Ship, J. A. 2003. Diabetes and oral health: an overview. *The Journal of the American Dental Association*, 134, 4S-10S.
  16. Takahashi, Y., Watanabe, N., Kamio, N., Kobayashi, R., Iinuma, T. & Imai, K. 2021. Aspiration of periodontopathic bacteria due to poor oral hygiene potentially contributes to the aggravation of COVID-19. *Journal of Oral Science*, 63, 1-3.
  17. Tomar, S. L. & Lester, A. 2000. Dental and other health care visits among US adults with diabetes. *Diabetes Care*, 23, 1505-1510.
  18. Vujicic, M. & Fosse, C. 2022. Time for dental care to be considered essential in US health care policy. *AMA Journal of Ethics*, 24, 57-63.