



Oral Health Screening Status of Diabetes Patients in Selected Hospitals of Addis Ababa, Ethiopia, 2018

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Objective: The study assessed the oral health screening status of diabetes patients and its associated factors in selected public hospitals of Addis Ababa, 2018.

Patients and Methods: An institutional-based cross-sectional study was conducted on 388 diabetes patients selected on the bases of a systematic random sampling method from March to May 2018 at two selected public hospitals in Addis Ababa. Data were collected with a pre-tested, structured, and translated questionnaire. Bi-variable and multivariable logistics regression were undertaken to identify predictors of oral health screening among diabetes with their respective 95% CI and a p-value of less than 5% level of significance.

Results: The oral health screening status among diabetes patients in this study was 21.1%. The odds of having had an oral health screening was 82.4% higher in those with an educational status of college and above than those who cannot read and write and it was ten and five folds higher in participants with a monthly income of less than 750 birr than those with above 2,000 birr and those who brushed their tooth twice or more times a day than occasionally, respectively. The odds of having had an oral health screening was 17, four, and five folds higher among participants with perceived susceptibility, perceived severity, and benefit, respectively, whilst it was 8.8% lower in participants with a perceived barrier and it was as high as 19.782 times among participants with malocclusion.

Conclusion: A lower level of oral health screening was observed. A higher educational level, a lower monthly income, a higher frequency of tooth brushing per day, positive perceptions of susceptibility, severity, and benefits, and presence of malocclusions were statistically associated with a higher frequency of oral health screening. Concerned bodies were recommended to work on the identified predictors and improve the oral health screening of diabetes patients.

Keywords: oral health screening, diabetes patients, associated factors

Introduction

Globally 4.6 million deaths attributed to diabetes mellitus (DM) occur annually.¹ About 366 million people had DM, most of which were type 2 DM (90%)² and found in low- and middle-income countries.³ By the year 1994, the Center for Disease Control and Prevention (CDC) declared DM as an epidemic in the US.⁴ Periodontal disease and DM share common risk factors and bidirectional relationships.^{3,5}

The global burden of oral disease is predominantly periodontal disease, ranging from 20–50%⁶ and is the most common complication of diabetes.⁷ The estimated

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prevalence of diabetes in Ethiopia ranges from 2–5% nationally.⁸ Evidence suggests that its prevalence could be greater than 5% in people older than 40 years of age.⁹

There was a positive link between diabetes status and undertaking oral health screening.¹⁰ As the attitude of diabetes patients about oral health problems affects their oral health screening status,¹¹ raising awareness about oral health care had a pivotal role in the improvement of the daily practice of oral health care.¹²

Though DM was associated with poor oral health status,¹³ it was evidenced that only a few proportions of DM patients were aware of their increased risk of periodontal disease,¹⁴ and hence very few utilized oral health care. Some of the reasons for lower oral health care utilization among diabetes were the perceived lack of necessity for a dental check-up, and the perception that dental problems were not serious.¹⁰

A higher cost of dental care, lower awareness among diabetes patients about oral health care, cost of transportation, and dental fears were among factors affecting oral health screening of diabetes patients.^{15,16}

To the best of our knowledge there was a shortage of published works in Ethiopia which primarily focused on the oral health screening status of diabetes patients and its associated factors in Addis Ababa, this study was planned to assess the oral health screening status of diabetes patients and its associated factors in selected hospitals of Addis Ababa, Ethiopia, and would hopefully fill the existing gap in the literature.

Methods

Participants and Study Design

An institution-based cross-sectional study was undertaken on 388 participants at the two conveniently selected hospitals from March to May 2018. The study received ethical approval from the University of South Africa Research review ethics committee and Addis Ababa Health Bureau research and Ethics office then conducted at Menelik II Referral Hospital and Zewditu Memorial Hospital. All participants were provided written informed consent. The source population was all diabetes patients within the catchment area of the two conveniently selected Hospitals. The study population included 388 diabetes patients who were available during the data collection period at the study settings. The sample was determined based on a single population proportion with the premises of the proportion of oral health screening status to be 50%, where the final sample size was

403, inclusive of a 5% non-response rate. Diabetes participants who were on follow-up at diabetes clinics during the study period, not-admitted, not with severe complication were included in the study. Participants were selected on the bases of systematic random sampling methods with the sampling interval of $K=8$. The sampling frame was a medical record number of diabetes patients in both selected hospitals ($N=1680$ for Menelik II Hospital and $N=1513$ for Zewditu Memorial Hospital per three months). Data were collected with a pre-tested interviewer-administered questionnaire where a pre-test was conducted on 5% of cases at Yekatit 12 Hospital Medical College two weeks before actual the data collection period. The questionnaire was first developed by the investigators after rigorous review of literatures^{17–22} then given to senior researchers, and dentists for the incorporation of their inputs. Data collection was performed by five nurses after trained for two days; after which training was given by the researcher.

For this study, the outcome variable (oral health screening status) was measured as ‘yes’ or ‘no,’ whether the diabetes patients have visited a dentist every six months or twice a year, considered as ‘yes’ otherwise ‘no’ as per the recommendation of CDC.²³ The health belief model in line with other factors was used to identify factors affecting oral health screening.

Statistical Analysis

Descriptive statistics were used for the summarization of data. With an inter-item reliability coefficient for the health belief model constructs of perceived susceptibility, perceived severity, perceived benefits, and perceived barriers; 0.705, 0.731, 0.857, and 0.899 respectively. For the identification predictors of oral health screening, binary (bi-variable and multivariable) logistics regression was used, with their respective 95% Confidence Interval (CI) and p-value of less than 0.05 as statistically significant level.

Results

Socio-Demographic Characteristics of Participants

A total of 388 participants were enrolled in the study with a response rate of 96.3%. More than half (52.1%) of respondents were female. The mean age of participants was 52.27 years with a standard deviation of 14.797. Two hundred sixty-four (68%) of the respondents were married (Table 1).

Table 1 Socio-Demographic Characteristics of Respondents at Selected Public Hospitals in Addis Ababa, Ethiopia, May 2018 (n=388)

Characteristics	Categories	Number	%
Sex	Male	186	47.9
	Female	202	52.1
Age in years	<20	4	1.0
	20–29	29	7.5
	30–39	53	13.7
	40–49	58	14.9
	50–59	102	26.3
	60–69	96	24.7
	70–79	39	10.1
	≥80	7	1.8
Mean+ (Standard dev.)		52.27(14.797)	
BMI	<18.5KG/M ²	7	1.8
	18.5–24.9 KG/M ²	146	37.2
	25–29.9 KG/M ²	159	41.6
	>30 KG/M ²	76	19.4
Marital status	Married	264	68.0
	Single	58	14.9
	Widowed	47	12.1
	Separated	16	4.1
	Divorced	3	0.8
Occupational status	Daily Laborer	7	1.8
	NGO Employed	13	3.4
	Government Employed	69	17.8
	Private work	83	21.4
	Jobless	216	55.7
Educational status	Cannot Read and Write	72	18.6
	Read and Write	39	10.1
	Primary Education	73	18.8
	Secondary Education	106	27.3
	College and Above	98	25.3
Monthly income in birr	≤750	57	14.7
	751–1,300	76	19.6
	1,301–2,000	87	22.4
	>2,000	168	43.3

Abbreviations: Note, BMI, body mass index; KG, kilo gram; M², meter square; birr, Ethiopian currency.

Behavioral and Physical Measurements

Most (71%) of participants were type 2 diabetes patients, where most (60%) took injection and 80% of the participants had a current fasting blood glucose level of 126 g/dl

Table 2 Behavioral and Physical Characteristics of Diabetes Participants at Selected Public Hospitals in Addis Ababa, Ethiopia, May 2018 (n=388)

Characteristics	Categories	Number	%
Diabetes mellitus type	Type 1	111	28.6
	Type 2	277	71.4
Medication type	Oral	157	40.5
	Injection form	231	59.5
Current fasting blood glucose level in g/dl	<100	38	9.8
	100–125	40	10.3
	126 and more	310	79.9
Past fasting blood glucose level in mg/dl	<100	23	5.9
	100–125	44	11.3
	126 and more	321	82.7
Duration since diagnosis in years	<5	141	36.3
	5–10	104	26.8
	10–15	62	16.0
	15–20	53	13.7
	>20	28	7.2
Family history of diabetes mellitus	Yes	130	33.5
	No	250	64.4
	I do not know	8	2.1
Tooth brushing	Yes	308	79.1
	No	80	20.9
Number tooth brushing per day (n=308)	2 and more	59	19.2
	Once	168	54.5
	Occasionally	81	26.2
Have you been used of alcohol?	Yes	77	19.8

and more. Most (64.4%) of respondents had no family history of DM (Table 2).

Perceptions of Oral Health

Less than one fifth (18.8%) of participants agreed that a person with diabetes has a higher risk of getting periodontal disease, and 25.5% of participants perceived that periodontal disease can result in heart disease. Most (64%) of participants believed complications of periodontal disease are dangerous whereas

Table 3 Perception of Diabetes Participants at Selected Public Hospitals in Addis Ababa, Ethiopia, May 2018 (n=388)

Characteristics	Agree		Neither Agree nor Disagree		Disagree	
	N	%	N	%	N	%
Perceived Susceptibility						
A person with diabetes mellitus have a higher risk of periodontal disease	73	18.8	100	25.8	215	55.4
Presence of periodontal disease will result me in getting heart disease	99	25.5	226	58.2	63	16.2
Smoking Cigarette will lead to periodontal disease	193	49.7	160	41.2	35	9.0
I know a person with periodontal disease even it will affect me as well	149	38.4	152	39.2	87	22.4
While taking drugs of diabetes, blood sugar level will remain high.	288	74.2	42	10.8	58	14.9
I am likely to get periodontal disease	215	55.4	53	13.7	120	30.9
I had a problem of accepting the advice of health professionals	99	25.5	23	5.9	266	68.6
Perceived Severity						
Someone can have periodontal disease while unaware of the condition	303	78.1	34	8.8	51	13.1
Periodontal disease is non-curable disease	96	24.7	59	15.2	233	60.1
Complication of periodontal disease is dangerous	248	63.9	80	20.6	60	15.5
A relative tooth loss following periodontal disease motivated me to have check-up at dental clinic strictly	220	56.7	59	15.2	109	28.1
Periodontal disease is a fatal disease	109	28.1	81	20.9	198	51.0
Periodontal disease in diabetes can affect the family income	327	84.3	20	5.2	41	10.6
Perceived Benefits						
Diabetes control prevents periodontal disease	116	29.9	144	37.1	128	33.0
Medicine stop symptoms and I feel good	214	55.2	85	21.9	89	22.9
Dental check-up reduces periodontal disease	170	43.8	124	32.0	94	24.2
Tooth brushing reduces the risks of periodontal disease	214	55.2	134	34.5	40	10.3
Having oral check-up prevents tooth loss	217	55.9	107	27.6	64	16.5
Having oral check-up reduces mal-odor related stigma	224	57.7	94	24.2	70	18.0
Dental check-up reduces periodontal related mortality and morbidity	182	46.9	119	30.7	87	22.4
Perceived Barriers						
There is long waiting time to have oral health check up	122	31.4	197	50.8	69	17.8
There is long distance between diabetic and dental clinics	104	26.8	208	53.6	76	19.6
There is no stigma if tooth is lost	239	61.6	35	9.0	114	29.4
Procedure of oral health check-up is exhausting	114	29.4	151	38.9	123	31.7
Health professionals are disrespecting patients	88	22.7	22	5.7	278	71.6
Cost of treatment is high	162	41.8	118	30.4	108	27.8
The side effects of oral drugs are high	86	22.2	201	51.8	101	26.0

more than half (53%) of respondents perceived that oral health screening had benefits for the prevention and control of periodontal disease.

Less than one third (31.4%) of respondents agreed that there was a long waiting time to have oral health check-ups and 26.8% agreed that the long distance between diabetes clinic and dental clinic prevented them from having oral health screening.(Table 3)

Oral Health Screening and its Predictors

The oral health screening level in this study was 21.1% (95% CI: 17.2–25.5%), whereas, the majority (78.9%) had less than two oral health screens per year (Figure 1).

Marital status, perception of susceptibility, severity, benefit and barriers were independently associated with oral health screening at $p < 0.05$.

The odds of having had an oral health screening was as higher as 82.4% in participants with an educational level of college and above, compared to those who cannot read and write (AOR: 0.176, 95CI: 0.035–0.892, $P < 0.05$).

The odds of having had an oral health screening was ten fold higher among participants with a monthly salary of fewer than 750 birr against those with a monthly salary of 2,000 birr and more (AOR: 9.847, 95% CI:1.878–51.644, $P < 0.001$). Possibly, this might happen due to an increase in income may lead to tightness with duties to have the follow up regularly.

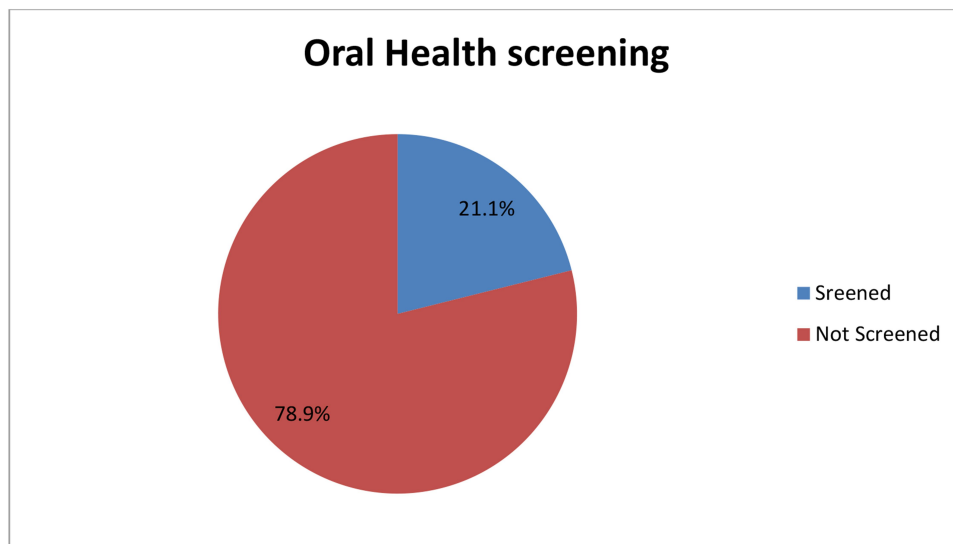


Figure 1 Oral health screening status of diabetes participants at selected public hospitals in Addis Ababa, Ethiopia, May 2018 (n=388).

The odds of having had an oral health screening was five times higher in those who brush their teeth at least twice a day compared to those who brush occasionally (AOR: 5.070, 95% CI:1.117–23.016, $P<0.05$).

The odds of having had oral health screening was 17.272, and 4.070 times higher in people with perceived susceptibility to, and severity of periodontal disease (AOR: 17.272, 95% CI: 4.161–71.705, $P<0.001$) and (AOR: 4.070, 95% CI:1.371–12.083, $P<0.05$) respectively.

The odds of having had an oral health screening was 4.75 times higher in participants with perceived benefits that taking preventive actions can prevent oral health problems (AOR: 4.751, 95% CI: 1.666–13.550, $P<0.05$).

The odds of having had an oral health screen was lower in participants with barrier perceptions (AOR: 0.088, 95% CI: 0.033–0.231, $P<0.001$) and the odds of having had an oral health screening was as high as 20 times among participants with malocclusion than their counterparts (AOR: 19.782, 95% CI: 6.387–61.270, $P<0.001$) (Table 4).

Discussion

In this study, one-fifth of diabetes patients reported having had two or more oral health screenings per year. Which was lower than the findings; 55% in France,²⁴ 79% in England,²⁵ 58.6% in the US,¹⁷ 63.8% in Brazil,²⁰ and 85.1% in Sweden.²⁶ These differences might be due to the lower oral health care coverage, and awareness in Ethiopia.

One-third (33%) of diabetes patients were aware of their increased risk for periodontal disease,¹⁴ which was almost

consistent with the current study. The oral health screening status in this study was almost consistent with the findings; 27% in India,²² 17% and 33.3% in Malaysia, during 2016 and 2012.^{10,27}

In this study, the level of oral health screening was higher than the findings; 12.6% and 15.1% in Saudi Arabia,^{28,29} and 10% in Jordan.³⁰ This difference might be due to variations in types of population demographics and study time.

In this study, being in education, college-level and above, was associated with more oral health screening than those who cannot read and write, which was supported by a study in Nigeria which stated; a higher educational status was associated with more frequency of oral screening than their counterparts.³¹

In this study, the presence of malocclusion was statistically associated with higher oral health screening status, but not well investigated in other studies. In this study, tooth brushing at least twice per day was associated with a higher oral health screening status than occasional tooth brushing, and was supported by a study in India that stated a higher frequency of tooth brushing was associated with a higher frequency of dental visits.³²

The more diabetes patients know about oral health problems, the more they visit dental clinics,³³ but in this study knowledge of diabetes patients did not show an association with oral health screening. This might be due to variability in the application and use of available information regarding oral health in diabetes patients.

A low level of knowledge about dental problems, fear of having treatment, and financial issues were associated

Table 4 Predictors of Oral Health Screening of Diabetes Participants at Selected Public Hospitals in Addis Ababa, May 2018 (n=388)

Characteristics	Categories	Oral Screening		COR(95% CI)	AOR(95% CI)
		Yes	No		
Marital status	Married	54	210	1	1
	Single	9	49	1.400(0.647–3.027)	3.467(0.765–15.710)
	Widowed	12	35	0.750(0.365–1.542)	1.442(0.323–6.441)
	Separated/divorce	7	12	0.441(0.118–0.928)*	0.799 (0.144–4.423)
Educational status	Cannot Read and Write	12	60	1	1
	Read and Write	9	30	0.667(0.253–1.757)	0.766(0.114–5.159)
	Primary Education	21	52	0.495(0.222–1.103)	0.429(0.094–1.956)
	Secondary Education	16	90	1.125(0.497–2.546)	1.581(0.356–7.019)
Monthly Income in birr	College and Above	24	74	0.617(0.285–1.335)	0.176(0.035–0.892)*
	Less than 750	14	43	1	1
	751–1300	17	59	1.130(0.503–2.538)	3.652(0.700–19.054)
	1,301–2,000	14	73	1.698(0.739–3.898)	4.416(0.875–22.294)
Duration after diagnosis for DM in years	Greater 2,000	37	131	1.153(0.570–2.333)	9.847(1.878–51.644)**
	≤5	23	118	1	1
	5–10	23	81	0.686(0.361–1.306)	0.788(0.244–2.547)
	10–15	16	46	0.560(0.272–1.155)	0.319(0.085–1.193)
Frequency tooth brushing per a day	≥15	20	61	0.543(0.255–1.157)	0.550(0.152–1.984)
	2 and more	10	29	1	1
	Once	31	124	1.418(0.725–2.775)	2.751(0.649–11.662)
	Occasionally	29	85	1.984(0.885–4.448)	5.070(1.117–23.016)*
Ever use of Alcohol	Yes	14	63	0.794(0.419–1.504)	0.570(0.165–1.965)
Knowledge status	Good Knowledge	48	157	1	1
	Poor knowledge	34	149	1.340(0.818–2.194)	0.700(0.268–1.827)
Perceived Susceptibility	Yes	78	171	15.395(5.497–43.114)**	17.272(4.161–71.705)**
Perceived severity	Yes	71	151	6.626(3.379–12.993)**	4.070(1.371–12.083)*
Perceived benefit	Yes	68	154	4.794(2.586–8.888)**	4.751(1.666–13.550)*
Perceived barriers	Yes	18	184	0.186(0.105–0.330)**	0.088(0.033–0.231)**
Oral Condition	Good	2	15	1	1
	Fair	14	76	0.724(0.149–3.520)	1.274(0.087–18.637)
	Poor	66	215	0.434(0.097–1.948)	0.509(0.034–7.590)
Malocclusion	Yes	71	137	7.962(4.059–15.620)**	19.782(6.387–61.270)**
Calculus	Yes	75	270	1.429(0.611–3.339)	0.847(0.145–4.947)

Notes: *p<0.05, **p<0.001-statistically significant association.

with lower oral health screening status.¹⁶ Whilst diabetes patients with perceived susceptibility, severity, and benefits of undertaking oral health preventive measures had a higher oral health screening experience than their counterparts.

Conclusion and Recommendation

In this study, a lower level of oral health screening was observed. A higher educational level (college and above), a lower monthly income (less than 750birr), a higher (two or more) frequency of tooth brushing per day, positive perceptions of susceptibility, severity, and benefits, and presence of malocclusions were statistically significantly associated with a higher

frequency of oral health screening in the study settings. Whereas the presence of a perceived barrier was statistically significantly associated with a lower frequency of an oral health screening. Researchers were recommended to undertake a large scale community-based study. Policymakers and health professionals were also recommended to work jointly to enhance the oral health screening of diabetes patients in the study settings.

Consent for Publication

Consent for publication of the manuscript was not applicable due to the fact that there were no participant's individual data videos or images.

Abbreviations

AOR, Adjusted Odds Ratio; CDC, Center for Disease Control; DM, Diabetes Mellitus; WHO, World Health Organization.

Data Sharing Statement

A finding of this study was generated from the data collected and analyzed on the basis of stated methods and materials hence all data were already available in the manuscript.

Ethics Approval and Consent to Participate

The study protocol was performed in accordance with the ethical principle. Ethical approval was obtained from ethics review board of the University of South Africa. The ethics approval was given in accordance with the Declaration of Helsinki. The data collectors obtained written informed consent from all participants.

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Author Contributions

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest for this work.

References

- Whiting DR, Guariguata L, Weil C, Shaw J. IDF diabetes atlas: global estimates of the prevalence of diabetes for 2011 and 2030. *Diabetes Res Clin Pract.* 2011;94(3):311–321. doi:10.1016/j.diabres.2011.10.029
- Diabetes UK. *Diabetes in the UK 2010: Key Statistics on Diabetes.* London: Diabetes UK; 2010.
- Taylor GW. Bidirectional interrelationships between diabetes and periodontal diseases: an epidemiologic perspective. *Ann Periodontol.* 2001;6(1):99–112. doi:10.1902/annals.2001.6.1.99
- Smyth S, Heron A. Diabetes and obesity: the twin epidemics. *Nat Med.* 2006;12(1):75–80. doi:10.1038/nm0106-75
- Preshaw P, Alba A, Herrera D, et al. Periodontitis and diabetes: a two-way relationship. *Diabetologia.* 2012;55(1):21–31. doi:10.1007/s00125-011-2342-y
- Nazir MA. Prevalence of periodontal disease, its association with systemic diseases and prevention. *Int J Health Sci.* 2017;11(2):72.
- Saini R, Saini S, Sugandha R. Periodontal disease: the sixth complication of diabetes. *J Family Community Med.* 2011;18(1):31. doi:10.4103/1319-1683.78636
- Megerssa Y, Gebre M, Birru S, Goshu A, Tesfaye D. Prevalence of undiagnosed diabetes mellitus and its risk factors in selected institutions at Bishoftu Town, East Shoa, Ethiopia. *J Diabetes Metab.* 2013;S12:008.
- Abebe SM, Berhane Y, Worku A, Assefa A. Diabetes mellitus in North West Ethiopia: a community based study. *BMC Public Health.* 2014;14(1):97. doi:10.1186/1471-2458-14-97
- Sahril N, Aris T, Asari A, et al. Oral health seeking behaviour among Malaysians with type II diabetes. *J Public Health Aspects.* 2014;1(1):1–8. doi:10.7243/2055-7205-1-1
- Poudel P, Griffiths R, Wong VW, et al. Oral health knowledge, attitudes and care practices of people with diabetes: a systematic review. *BMC Public Health.* 2018;18(1):577. doi:10.1186/s12889-018-5485-7
- Mirza KM, Khan AA, Ali MM, Chaudhry S. Oral health knowledge, attitude, and practices and sources of information for diabetic patients in Lahore, Pakistan. *Diabetes Care.* 2007;30(12):3046–3047. doi:10.2337/dc07-0502
- Jansson H, Lindholm E, Lindh C, Groop L, Bratthall G. Type 2 diabetes and risk for periodontal disease: a role for dental health awareness. *J Clin Periodontol.* 2006;33(6):408–414. doi:10.1111/j.1600-051X.2006.00929.x
- Allen E, Ziada H, O'halloran D, Clerehugh V, Allen P. Attitudes, awareness and oral health-related quality of life in patients with diabetes. *J Oral Rehabil.* 2008;35(3):218–223. doi:10.1111/j.1365-2842.2007.01760.x
- Moore PA, Orchard T, Guggenheimer J, Weyant RJ. Diabetes and oral health promotion: a survey of disease prevention behaviors. *J Am Dent Assoc.* 2000;131(9):1333–1341. doi:10.14219/jada.archive.2000.0388
- Dodd VJ, Logan H, Brown CD, Calderon A, Catalanotto F. Perceptions of oral health, preventive care, and care-seeking behaviors among rural adolescents. *J Sch Health.* 2014;84(12):802–809. doi:10.1111/josh.12215
- Yuen HK, Wolf BJ, Bandyopadhyay D, Magruder KM, Salinas CF, London SD. Oral health knowledge and behavior among adults with diabetes. *Diabetes Res Clin Pract.* 2009;86(3):239–246. doi:10.1016/j.diabres.2009.09.010
- Macek MD, Tomar SL. Dental care visits among dentate adults with diabetes and periodontitis. *J Public Health Dent.* 2009;69(4):284–289. doi:10.1111/j.1752-7325.2009.00136.x
- Orlando VA, Johnson LR, Wilson AR, et al. Oral health knowledge and behaviors among adolescents with type 1 diabetes. *Int J Dent.* 2010;2010:1–8. doi:10.1155/2010/942124
- Alves C, Brandão M, Andion J, Menezes R. Oral health knowledge and habits in children with type 1 diabetes mellitus. *Braz Dent J.* 2009;20(1):70–73. doi:10.1590/S0103-64402009000100012
- Arunkumar S, Amur S, Sambrani U, Burde KM. Survey on awareness and knowledge about the effect of diabetes mellitus on systemic and oral health in patients visiting general medicine outpatient Department in Dental Hospital. *J Krishna Inst Med Sci.* 2015;4(2):100–106.
- Kejriwal S, Bhandary R, Thomas B. Assessment of knowledge and attitude of diabetes mellitus type 2 patients about their oral health in Mangalore, India. *Univ Res J Dent.* 2014;4(1):44–47. doi:10.4103/2249-9725.127077

23. Control CfD. *The Prevention and Treatment of Complications of Diabetes: A Guide for Primary Care Practitioners*. Atlanta, GA: US Department of Health and Human Services; 1991.
24. Azogui-Lévy S, Dray-Spira R, Attal S, Hartemann A, Anagnostou F, Azerad J. Factors associated with oral health-related quality of life in patients with diabetes. *Aust Dent J*. 2018;63(2):163–169. doi:10.1111/adj.12577
25. Bowyer V, Sutcliffe P, Ireland R, et al. Oral health awareness in adult patients with diabetes: a questionnaire study. *Br Dent J*. 2011;211(6):E12. doi:10.1038/sj.bdj.2011.769
26. Sandberg GE, Sundberg HE, Wikblad KF. A controlled study of oral self-care and self-perceived oral health in type 2 diabetic patients. *Acta Odontol Scand*. 2001;59(1):28–33. doi:10.1080/000163501300035742
27. Badiah B. A preliminary survey on awareness of periodontal risk and oral health practices among diabetic patients in hospital Kuala Lumpur. *Malays Dent J*. 2012;34(1).
28. Bahammam MA. Periodontal health and diabetes awareness among Saudi diabetes patients. *Patient Prefer Adherence*. 2015;9:225. doi:10.2147/PPA.S79543
29. Al Amassi BY, Al Dakheel RS. Oral hygiene practice of adult diabetic patients and their awareness about oral health problems related to diabetes. *J Dent Oral Hyg*. 2017;9(2):8–14. doi:10.5897/JDOH2017.0219
30. Al Habashneh R, Khader Y, Hammad MM, Almuradi M. Knowledge and awareness about diabetes and periodontal health among Jordanians. *J Diabetes Complications*. 2010;24(6):409–414. doi:10.1016/j.jdiacomp.2009.06.001
31. Taiwo JO, Moronke N. Pattern of dental clinic attendance of registered diabetic patients in Ibadan. 2006.
32. DeDonno MA. Dental anxiety, dental visits and oral hygiene practices. *Oral Health Prev Dent*. 2012;10(2).
33. Wiener RC, Shockey AT. Oral health knowledge and dental visits in community living older adults in rural Appalachia-West Virginia: a cross-sectional analysis. *J Stud Soc Sci*. 2014;8(1):1.

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