

# Knowledge Levels and Attitudes of Type 2 Diabetic Patients on Periodontal Health: A Cross-sectional Study

## Tip 2 Diyabet Hastalarının Periodontal Sağlık Hakkındaki Bilgi Düzey ve Tutumları: Kesitsel Bir Çalışma

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### Abstract

**Objective:** In our research, we determined the oral health behaviors and knowledge levels of the Turkish population with diabetes.

**Materials and Methods:** In this cross-sectional study, a self-reported questionnaire was used to assess the oral health practices, knowledge, and awareness items of the patients with a confirmed diagnosis of type 2 diabetes.

**Results:** A total of 439 respondents completed the questionnaire in a 6-month period. A majority of the participants (67%) were unaware about diabetes-periodontal disease relationship. However, only 9.6% of patients with diabetes were referred to a dentist for oral health. The rate of participants who received information about diabetes related increased periodontal risks by dentists was 19.4%.

**Conclusion:** Our findings showed that type 2 patients with diabetes had poor attitudes and knowledge about oral health.

### Keywords

Oral hygiene, diabetes, periodontal disease

### Anahtar Kelimeler

Oral hijyen, diyabet, periodontal hastalık

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### Öz

**Amaç:** Araştırmamızda, diyabetli Türk popülasyonunda ağız sağlığına ilişkin davranışlar ve bilgi düzeyleri değerlendirilmiştir.

**Gereç ve Yöntemler:** Kesitsel çalışmamızda, tip 2 diyabet hastalarında ağız sağlığına ilişkin tutumlar, bilgi düzeyleri ve farkındalık öğeleri bir anket ile değerlendirildi.

**Bulgular:** Altı aylık bir süreçte, 439 katılımcı anketi tamamladı. Katılımcıların büyük çoğunluğunun (%67) diyabet-periodontal hastalık ilişkisi hakkında yeterli farkındalığa sahip olmadığı belirlendi. Diyabetli bireylerin ağız sağlığına ilişkin diş hekimine yönlendirilme oranı çok düşük bulundu. Ayrıca diş hekimlerinin diyabete ilişkin artmış periodontal riskler hakkında hastalarını uyarma oranı %19,4 idi.

**Sonuç:** Bulgularımız tip 2 diyabetik bireylerin ağız sağlığına ilişkin zayıf tutum sergiledikleri ve yetersiz bilgi düzeyine sahip olduklarını göstermiştir.

### Introduction

Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycaemia resulting from damage to insulin secretion or insulin activity or both (1). It is estimated that the prevalence of diabetes among adults in developing countries will have increased by

69% between 2010 and 2030, affecting 439 million individuals worldwide (2).

Periodontal diseases are inflammatory disorders of the periodontal supporting tissues that causes attachment loss and alveolar bone destruction (3). That the risk of periodontal disease occurrence in diabetic patients is two to three times higher (4). The severity of periodontal disease also increases, especially in long-term diabetic individuals with poor metabolic control (5).

Periodontal diseases can have significant effects on glycemic control in diabetics by inducing increased systemic chronic inflammatory condition (6). There is an increased risk of diabetes related complications such as cardiovascular events in diabetic patients with severe periodontitis (7). Several studies have shown that the treatment of periodontal diseases improves metabolic control of diabetes (8,9).

As evidence supporting the bi-directional relationship between diabetes and periodontal diseases has increased, prevention and control of periodontal diseases has become important for diabetic patients. However, several studies have shown that there is insufficient knowledge and awareness about oral and periodontal health among patients with diabetes (10,11).

The aim of this study is to evaluate the oral hygiene habits of diabetics in a small Turkish population and determine patients' knowledge of the link between diabetes and periodontal health.

## Materials and Methods

Participants for the study were recruited from those patients attending to the outpatient clinic at the Department of Endocrinology in Pamukkale University Hospital. All patients had a confirmed diagnosis of type 2 diabetes mellitus. Patients who agreed to participate in the study signed consent forms before filling out the questionnaire. In a 6-month period, a total of 439 diabetic patients completed the survey.

The first part of the questionnaire recorded the demographic characteristics of participants metabolic control of diabetic patients was evaluated with glycated haemoglobin (HbA1c) levels. They were obtained from patient's medical records. Glycemic control was classified as three degrees. HbA1c <7% was considered as good controlled, HbA1c  $\geq$ 7 to <8% as fair controlled and HbA1c  $\geq$ 8 as poor controlled (12).

In the second part, gingival health data and the knowledge of the relationship between periodontal disease and diabetes were evaluated. Participants were asked if their dentists informed them about the risk of diabetes-related periodontal diseases and if their physicians referred to a dentist for periodontal health.

The study protocol was approved by the Ethics Committee of Pamukkale University with 60116787-020/44409 protocol number (date: 26.06.2018).

## Statistical Analysis

Data were analysed by using Statistical Package for the Social Sciences (SPSS) version 22. Categorical variables were given as numbers and percentages. Pearson chi-square analysis was used for the differences between categorical variables. Statistical significance was considered as  $p \leq 0.05$ .

## Results

A total of 439 (276 females and 163 males) patients completed the questionnaire. Demographic characteristics of participants are as shown in Table 1. The length of the diagnosis of diabetes was more than 10 years for 46% of the participants. The rate of diabetic patients with poor glycemic control was 36.2%. About 39% of the participants had one or more systemic diseases accompanying diabetes.

### Periodontal Health Awareness and Attitudes to Dental Care

Dental care and oral hygiene behaviours of the respondents were shown in Table 2. The proportion of participants who had a dentist visit within last one year was 43.1% (189/439). The main reason for not visiting a dentist was finding unnecessary (68%, 170/250). Majority of the participants (62%) stated that they did not have any knowledge about gingival diseases. The rate of respondents who noticed bleeding in their gums was 31%. About 66% of the participants reported that they brush their teeth regularly.

### Awareness of Diabetic Patients Related to Periodontal Disease

Participants were asked whether there is a relationship between diabetes and periodontal disease (Table 2). Nearly 67% of the respondents stated that they did not have any knowledge about the possible association between periodontal disease and diabetes. Majority of diabetic patients (90.4%)

Characteristic		n	Percent
Gender	Female/male	276/163	37.1/62.9%
Age	20-29 years	12	2.7%
	30-39 years	32	7.3%
	40-49 years	82	18.7%
	>50 years	313	71.3%
Education	Elementary	295	67.2%
	High school	70	15.9%
	Collage	57	13%
	PhD	17	3.9%
Monthly income (TL)	<2000	262	59.7%
	2000-4000	146	33.3%
	4000-6000	28	6.4%
	>6000	3	0.7%
Smoking status	Smoker	78	17.8%
	Non-smoker	361	82.2%
Waist circumference	Male		
	Over-weight/ obese	67/85	41.1/58.9%
	Female		
	Over-weight/ obese	49/223	17.7/82.3%
Length of diagnosis of diabetes (years)	<1	32	7.3%
	1-5	102	23.2%
	5-10	103	23.5%
	>10	202	46%
HbA1c levels (mmol/mol)	<7	90	20.5%
	≥7 to 8<	190	43.3%
	≥8	159	36.2%
Presence of diabetic co-morbidities	Yes	168	38.3%
	No	271	61.7%
Diabetes treatment	Oral medication	255	58.1%
	Insulin	174	39.6%
	Only diet	10	2.3%
Diet control	Yes	259	59%
	No	180	41%
Exercise	Yes	164	37.4%
	No	275	62.6%

TL: Turkish Lira, HbA1c: Hemoglobin A1c

were not referred to a dentist for their periodontal health. Similarly, 81% reported that their dentist did

Characteristic		n	Percent
Dentist visit (within last year)	Yes	189	43.1%
	No	250	56.9%
Reasons for not visiting a dentist in the past year	Lack of necessity	170/250	68%
	Anxiety	37/250	14.8%
	Lack of time	31/250	12.4%
	Afraid of dental treatments	12/250	4.8%
Knowledge of gingival disease	Yes	167	38%
	No	272	62%
Gingival bleeding	Yes	136	31%
	No	303	69%
Frequency of tooth brushing	1/Day	159	36.2%
	2/Day	113	25.7%
	>2/Day	17	3.9%
	1/2-3 Day	72	16.4%
	Less than 1/2-3 Day	78	17.8%
Change of toothbrush	3 months	176	40.1%
	6 months	139	31.7%
	1 year	61	13.9%
	Less than 1 year	63	14.4%
Interdental cleaning	Yes	206	46.9%
	No	233	53.1%
Do you think there is an association between diabetes and periodontal health?	Yes	148	33.7%
	No	291	66.3%
Referral to a dentist by physician	Yes	42	9.6%
	No	397	90.4%
Information by a dentist on oral health	Yes	85	19.4%
	No	354	80.6%

not inform them about the importance of periodontal health relating to their diabetes.

Distribution of the questions determining knowledge and awareness according to gingival health attitudes are shown in Table 3. 80.2% of those who have knowledge about gingival diseases and 84.4% of the participants who are aware of diabetes is a risk factor for periodontal diseases reported brushing their teeth at least once a

**Table 3. Distribution of the attitudes to gingival health by knowledge and awareness items**

	Knowledge of gingival disease n (%)			Awareness of association between diabetes and periodontal health n (%)		
	Yes	No	P-value	Yes	No	p-value
<b>Dentist visit (within last year)</b>						
Yes	79 (47.3)	116 (42.6)	NS	74 (50)	121 (41.6)	NS
No	88 (52.7)	156 (57.4)		74 (50)	170 (58.4)	
<b>Frequency of tooth brushing</b>						
1/day	67 (40.1)	92 (33.8)	0.000	58 (39.2)	101 (34.7)	0.000
2/day	59 (35.3)	54 (19.9)		56 (37.8)	57 (19.6)	
>2/day	8 (4.8)	9 (3.3)		4 (7.4)	13 (4.5)	
1/2-3 day	16 (9.6)	56 (20.6)		19 (12.8)	53 (18.2)	
Less than 1/2-3 day	17 (10.2)	61 (22.4)		11 (7.4)	67 (23)	
<b>Interdental cleaning</b>						
Yes	90 (53.9)	116 (42.6)	0.022	86 (58.1)	120 (41.2)	0.001
No	77 (46.1)	156 (57.4)		62 (41.9)	171 (58.8)	
<b>Information by a dentist on oral health</b>						
Yes	83 (49.7)	2 (0.7)	0.000	61 (58.8)	24 (8.2)	0.000
No	84 (50.3)	270 (99.3)		87 (41.2)	267 (91.8)	
<b>Knowledge of gingival disease</b>						
Yes				92 (62.2)	75 (25.8)	0.000
No				56 (37.8)	216 (74.2)	
NS: Not significant						

day. Participants who were informed by a dentist on periodontal health had significantly higher percentages of the knowledge of gingival diseases and diabetes-periodontal disease relationship (p=0.000). Awareness of the relationship in diabetes and periodontal diseases was significantly higher in respondents who have knowledge about gingival disease (p=0.000).

The attitudes to gingival health of diabetic patients who are at high risk for periodontal diseases were also evaluated separately and presented in Table 4. Those participants were less likely to report regular dentist visit, gingival bleeding, use an interdental cleaning tool, referral to dentist by physician and being informed in possible periodontal disease risk. About two thirds of these participants were unaware of diabetes is a risk factor for periodontal diseases.

**Discussion**

The key finding of our survey is that type 2 diabetic patients have insufficient knowledge and awareness

about importance of periodontal health. These results are consistent with studies in the literature especially conducted in developing countries (10,13,14).

The rate of those who reported brushing their teeth more than once daily (29.6%) was lower than the proportions in the studies performed by Bowyer et al. (13) (67.2%). It has been reported that as the educational level and financial income increases, dental care and periodontal health status improves (15). Thirty-four percent of the participants remarked that they do not have regular brushing habits in present study. The fact that this rate is higher than the findings of Sandberg et al. (16) (8.7%) can be explained by the low education and economic status of our study group.

Regular dental visits are important for the maintenance of gingival health and prevention of periodontal complications, especially in diabetics. In a review, it was emphasised that the proportions of utilization dental services are very low, especially in

**Table 4. Distribution of oral health variables by diabetes related factors with a high risk for periodontal diseases**

	HbA1c level (≥8 mmol/ mol) n (%)	Length of diagnosis (>10 years) n (%)	Presence of systemic diseases accompanying diabetes n (%)
<b>Dentist visit (within last year)</b>			
Yes	68 (42.8)	90 (44.6)	81 (48.2)
No	91 (57.2)	112 (55.4)	87 (51.8)
<b>Knowledge of gingival disease</b>			
Yes	52 (37.7)	71 (35.1)	59 (35.1)
No	107 (67.3)	131 (64.9)	109 (64.9)
<b>Gingival bleeding</b>			
Yes	48 (30.2)	54 (26.7)	51 (30.4)
No	111 (69.8)	148 (73.3)	117 (69.6)
<b>Frequency of tooth brushing</b>			
1/day	56 (35.2)	69 (34.2)	71 (42.3)
2/day	26 (16.4)	52 (25.7)	36 (21.4)
>2/day	7 (4.4)	9 (4.5)	5 (3)
1/2-3 day	36 (22.6)	36 (17.8)	23 (13.7)
Less than 1/2-3 day	34 (21.4)	36 (17.8)	33 (19.6)
<b>Interdental cleaning</b>			
Yes	76 (47.8)	92 (45.5)	82 (48.8)
No	83 (52.2)	110 (54.5)	86 (51.2)
<b>Awareness of association between diabetes and periodontal health</b>			
Yes	48 (30.2)	72 (35.6)	55 (32.7)
No	111 (69.8)	130 (64.4)	113 (67.3)
<b>Referred to a dentist by physician</b>			
Yes	13 (8.2)	20 (9.9)	16 (9.6)
No	146 (91.8)	182 (90.1)	152 (90.5)
<b>Information by a dentist on oral health</b>			
Yes	29 (18.2)	40 (19.8)	33 (19.6)
No	130 (81.8)	162 (80.2)	135 (80.4)
HbA1c: Hemoglobin A1c			

low- and middle-income countries (17). Similarly, in present study, 43.1% of patients reported a dental visit within past 12 months which was consistent with studies conducted in low income countries (18), but lower than in high-income countries (13,16). Poudel et al. (17) stated that in high-income countries, dental care cost was the leading reason that discourage

participants from using dental services, while the main underlying reasons are lack of necessity and dental anxiety in low-income countries. In our study, 68% of the participants who did not attend regular dental visits stated that they did not need it which can be due to not having sufficient knowledge about gingival health. Bahammam (19), have reported that diabetic patients who have regular dentist visits know that they are more vulnerable to gum problems than non-diabetics, also the rate of taking advice from their dentists about oral health care is 75%. While the rate of dental visit within last year was 43%, the proportion of patients who had been informed about periodontal disease risk related to diabetes by the dentist was below 20% in present study. This data may indicate that dental professionals do not take the medical history of patients on diabetes or not to take on responsibility of educating on diabetes related periodontal health. Those who are taken advice from healthcare professionals for dental check-up at least twice a year are more likely to visit a dentist in the last 12 months (14). In our study, the low rate of referral of the participants to a dentist by physicians for oral examination may have decreased dental attendance rates.

Nearly 67% of our study population were unaware that diabetes is a risk factor for periodontal diseases in line with most of the studies which reported more than half of diabetic patients have a lower knowledge about diabetes-periodontal disease relationship (19). On the internet-based survey of Amassi and Dakheel (20), 76% of the diabetic patients were aware of the adverse effects of diabetes on periodontal health, which is much higher than our results (33%). Furthermore, they emphasised that almost half of the participants in their study have under-graduate or postgraduate. This difference may be due to the fact that our population consist of only the patients attending to diabetes outpatient clinic and have lower education level.

The severity of periodontal disease is higher in individuals with poor metabolic control and long-term diabetes (5). As well as there is some evidence that periodontal infections influence the incidence of diabetic complications adversely (21), it has been reported that the number of microvascular complications is a risk factor for severe periodontal disease (22). These findings are important because at

least one co-morbidity was detected in 98.5% of Turkish patients diagnosed with type 2 diabetes for minimum 5 years (23). Therefore, in present study, we also evaluated the distribution of gingival health variables in respondents with poor metabolic control (HbA1c  $\geq$  8 mmol/mol), diagnosed with diabetes for more than 10 years and with co-morbidities accompanying diabetes. We found that gingival health practices were insufficient in these participants. However, the percentages of self-reported gingival bleeding, knowledge with gingival diseases and awareness of diabetes-periodontal disease relationship were low. Long-term periodontal care with regular periodontal maintenance visits ensured reductions in HbA1c levels of type 2 diabetic patients (24). As well as in a great majority of our study population, the percentages of referral and information provided by health and dental professionals about diabetes related periodontal diseases in patients with diabetic risk factors for periodontitis, were very low. It has been known that good oral health is strongly associated with regular dental visits.

The results of our study cannot be inferred from the general diabetic population in the country, due to the small study population and the low socio-economic status and education level of the respondents in our study. This is a limitation of our survey.

## Conclusion

Our findings support that there is an essential requirement for increasing the awareness of association between periodontal disease and diabetes for maintaining periodontal health in diabetic patients. Therefore, it will be beneficial to enhance the knowledge of physicians and dentists on the bi-directional relationship between diabetes and periodontal diseases and to organize education programs to increase awareness about the importance and improvement of periodontal health in diabetic population. It will bring great benefit to include detailed periodontal examination and periodontal maintenance therapy to the program that planned for the management of diabetes in our society.

## Ethics

**Ethics Committee Approval:** The study protocol was approved by the Ethics Committee of Pamukkale University with 60116787-020/44409 protocol number (date: 26.06.2018).

**Informed Consent:** Patients who agreed to participate in the study signed consent forms before filling out the questionnaire.

**Peer-review:** Externally and internally peer-reviewed.

## Authorship Contributions

Concept: G.T.C., S.M.F., Design: G.T.C., S.M.F., Data Collection or Processing: S.M.F., Analysis or Interpretation: G.T.C., Literature Search: G.T.C., Writing: G.T.C.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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## References

1. American Diabetes Association, Diagnosis and classification of diabetes mellitus. *Diabetes Care* 2006; (29 Suppl 1): S43-8.
2. Shaw JE, Sicree RA, Zimmet PZ. Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Res Clin Pract* 2010; 87: 4-14.
3. Løe H, Anerud A, Boysen H, Morrison E. Natural history of periodontal disease in man. Rapid, moderate and no loss of attachment in Sri Lankan laborers 14 to 46 years of age. *J Clin Periodontol* 1986; 13: 431-45.
4. Mealey BL, Ocampo GL. Diabetes mellitus and periodontal disease. *Periodontology* 2000 2007; 44: 127-53.
5. Kim EK, Lee SG, Choi YH, Won KC, Moon JS, Merchant AT, et al. Association between diabetes-related factors and clinical periodontal parameters in type-2 diabetes mellitus. *BMC Oral Health* 2013; 13: 64.
6. Lalla E, Papapanou PN. Diabetes mellitus and periodontitis: a tale of two common interrelated diseases. *Nat Rev Endocrinol* 2011; 7: 738-48.
7. Saremi A, Nelson RG, Tulloch-Reid M, Hanson RL, Sievers ML, Taylor GW, et al. Periodontal disease and mortality in type 2 diabetes. *Diabetes Care* 2005; 28: 27-32.
8. Mauri-Obradors E, Merlos A, Estrugo-Devesa A, Jané-Salas E, López-López J, Viñas M. Benefits of non-surgical periodontal treatment in patients with type 2 diabetes mellitus and chronic periodontitis: A randomized controlled trial. *J Clin Periodontol* 2018; 45: 345-53.
9. Rodrigues DC, Taba MJ, Novaes AB, Souza SL, Grisi MF. Effect of non-surgical periodontal therapy on glycemic control in patients with type 2 diabetes mellitus. *J Periodontol* 2003; 74: 1361-7.
10. Al Habashneh R, Khader Y, Hammad MM, Almuradi M. Knowledge and awareness about diabetes and periodontal health among Jordanians. *J Diabetes Complications* 2010; 24: 409-14.
11. Shanmukappa SM, Nadig P, Puttannavar R, Ambareen Z, Gowda TM, Mehta DS. Knowledge, Attitude, and Awareness among Diabetic Patients in Davangere about the Association between Diabetes and Periodontal Disease. *J Int Soc Prev Community Dent* 2017; 7: 381-8.

12. American Diabetes Association. 2. Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes-2020 Diabetes Care 2020; 43: S14-S31.
13. Bowyer V, Sutcliffe P, Ireland R, Lindenmeyer A, Gadsby R, Graveney M, et al. Oral health awareness in adult patients with diabetes: a questionnaire study. *Br Dent J* 2011; 211: E12.
14. 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: 239-46.
15. Gundala R, Chava VK. Effect of lifestyle, education and socioeconomic status on periodontal health. *Contemp Clin Dent* 2010; 1: 23-6.
16. 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: 28-33.
17. Poudel P, Griffiths R, Wong VW, Arora A, Flack JR, Khoo CL, et al. Oral health knowledge, attitudes and care practices of people with diabetes: a systematic review. *BMC Public Health* 2018; 18: 577.
18. Sahril N, Aris T, Asari ASM, Yaw SL, Saleh NC, Omar A, et al. Oral Health Seeking Behaviour among Malaysians with type II diabetes. *Journal of Public Health Aspects* 2014; 1: 1-8.
19. Bahammam MA. Periodontal health and diabetes awareness among Saudi diabetes patients. *Patient Prefer Adherence* 2015; 9: 225-33.
20. Amassi BY, Al Dakheel RS. Oral hygiene practice of adult diabetic patients and their awareness about oral health problems related to diabetes. *Journal of Dentistry and Oral Hygiene* 2017; 9: 8-14.
21. Taylor GW, Borgnakke WS. Periodontal disease: associations with diabetes, glycemic control and complications. *Oral Dis* 2008; 14: 191-203.
22. Nitta H, Katagiri S, Nagasawa T, Izumi Y, Ishikawa I, Izumiyama H, et al. The number of microvascular complications is associated with an increased risk for severity of periodontitis in type 2 diabetes patients: Results of a multicenter hospital-based cross-sectional study. *J Diabetes Investig* 2017; 8: p. 677-86.
23. Akın S, Bölük C. Prevalence of comorbidities in patients with type-2 diabetes mellitus. *Prim Care Diabetes* 2020; 14: 431-4.
24. Merchant AT, Georgantopoulos P, Howe CJ, Virani SS, Morales DA, Haddock KS. Effect of Long-Term Periodontal Care on Hemoglobin A1c in Type 2 Diabetes. *J Dent Res* 2016; 95: 408-15.