Dental Journal
Majalah Kedokteran Gigi

Dental Journal
(Majalah Kedokteran Gigi)
2023 December; 56(4): 243–250

Original article

Relationship between the levels of awareness and knowledge of periodontitis in diabetic patients at a Dental Hospital during the COVID-19 pandemic

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ABSTRACT

Background: *Diabetes mellitus (DM) and periodontitis are the most prevalent human diseases. Diabetes worsens the periodontal condition, but periodontitis also hampers glycemic control in diabetic patients. Based on staging and grading, the latest periodontitis classification puts DM as one of the grade modifiers. Periodic periodontal maintenance prevents reinfection and could help people with diabetes maintain effective glycemic control. Dental health education and periodontal disease awareness are crucially needed for diabetic patients, especially during the pandemic.* ***Purpose:*** *This study aimed to examine the relationship between levels of awareness and knowledge of periodontitis in diabetic patients during the COVID-19 pandemic.* ***Methods:*** *A closed-ended questionnaire was distributed to new patients referred to the Periodontology Clinic of the Dental Hospital of Universitas Indonesia. Patients' data were collected during the COVID-19 pandemic from January to June 2021.* ***Results:*** *Eighty-four patients participated, of which 34.5 % were diabetic patients with periodontitis. Statistically, significant differences ($P < 0.05$) were found between levels of awareness and knowledge of periodontitis among diabetic patients and nondiabetic patients (both groups are suffering periodontitis). Awareness and knowledge of periodontitis are inversely correlated with their current clinical periodontal status, therefore patients with less awareness and knowledge have more severe periodontitis.* ***Conclusion:*** *Lack of awareness and knowledge of periodontitis was found among both nondiabetic and diabetic periodontitis patients. Dental health education is required to improve understanding and awareness of the relationship between periodontitis and DM.*

Keywords: *awareness and knowledge; diabetes mellitus; education level; medicine; periodontitis*
Article history: *Received 16 November 2022; Revised 17 January 2023; Accepted 28 March 2023; Published 1 December 2023*

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INTRODUCTION

The two most prevalent human diseases, diabetes mellitus (DM) and periodontitis, are frequently encountered together in individuals.[1] According to numerous studies assessing the connection between diabetes and periodontal disease, periodontitis is a common complication in diabetic patients.[1,2] Type 2 diabetes and periodontitis are parallely correlated. Previous studies found that diabetes patients had a considerably higher prevalence, severity, and progression of periodontal disease.[3–5]

Diabetes mellitus worsens the periodontal condition, but periodontitis also worsens glycemic control in diabetic patients.[4,6] The 2017 World Workshop of the American Academy of Periodontology (AAP) and the European Federation of Periodontology (EFP) for classifying periodontal and peri-implant diseases and conditions developed a new periodontitis classification based on stages and grading.[7] Diabetes mellitus is one of the grade modifiers, indicating the severity or progression of periodontitis, determining the therapy required, and estimating the impact of periodontitis on general systemic health.[2,7]

Patients with uncontrolled diabetes frequently experience oral problems affecting the periodontal tissues, calcified tissues, and oral mucosa.[5,8] Studies have shown

DOI: 10.20473/j.djmkg.v56.i4.p243–250

patients cannot achieve effective plaque control without motivational procedures based on education and information on periodontal diseases and their initiating and etiological factors.[9] Oral health education is a primary defense against periodontal diseases.[10,11] To promote periodontal health and increase the significance of its prevention, a new paradigm approach for a public health model is urgently required because dental chairside treatment and education for periodontal disease are ineffective for most of the population.[12] Studies by Boillot et al.[11] and Ramirez et al.[13] found that people with low levels of education are more likely to develop chronic periodontitis than those with higher levels of education.

Diabetic patients with periodontitis may benefit from periodontal education. Morales et al.[14] reported that periodontitis affects the severity and course of the disease and the quality of life of diabetic patients. Unfortunately, during the COVID-19 pandemic, many dental and oral care services had to be suspended due to the high potential risk of coronavirus transmission during specific dental procedures.[14] Diabetic patients require dental health education and periodontal disease awareness, especially during the current COVID-19 pandemic.[8,15] A study by Abdulkareem et al.[16] showed that socioeconomic factors contributed to the COVID-19 pandemic's detrimental effects on oral hygiene awareness among Middle Eastern populations. Although most people had experienced dental problems at some time, fear and economic concerns compromised their understanding of oral hygiene and influenced their attitudes toward dental treatment during the pandemic.[16,17]

An epidemiological study on the relationship between periodontal health and diabetes during the COVID-19 pandemic in Indonesia was urgently required. The World Health Organization (WHO)[18] estimates that more than one billion cases of severe periodontal disease exist worldwide, affecting around 19% of the adult population. Periodontitis is emerging as one of the primary oral health concerns in Indonesia. Based on the 2018 Indonesia National Health Survey[19], periodontitis was placed as the oral disease with the second highest prevalence. Meanwhile, oral health seems to be the last priority for policymakers and the people.

Non-communicable diseases like diabetes, cardiovascular disease, and periodontitis are chronic diseases afflicting populations and expanding over time.[12] Gender, age, and educational level should all be considered when modifying periodontal health and oral hygiene practices.[20] One of Indonesia's major dental treatment facilities, the Dental Hospital of Universitas Indonesia, offers comprehensive care for communities and, therefore, plays a significant role in educating people about the significance of maintaining dental health and its impact on general systemic health. Therefore, this study aimed to examine the relationship between levels of awareness and knowledge of periodontitis in diabetic patients at the Dental Hospital of Universitas Indonesia during the COVID-19 pandemic.

MATERIALS AND METHODS

This research uses a cross-sectional design with a qualitative questionnaire. A closed-ended questionnaire was given to all new patients referred to the periodontology clinic of the Dental Hospital of Universitas Indonesia. Inclusion criteria for eligible patients were adults aged 20–75 who agreed to have thorough periodontal examinations and random blood glucose tests and had not received periodontal treatment for over a year. Exclusion criteria were patients with disabilities who did not brush their teeth or assess their periodontal health.

The questionnaire was pre-tested, reviewed, and approved by the Ethics Committee of the Faculty of Dentistry, Universitas Indonesia (Protocol No: 090390820). The Cronbach Alpha and validity test tested the questionnaire for reliability and validity. The study was conducted between January and June 2021 during the COVID-19 pandemic.

The questionnaire recorded demographic data, such as gender, age, education level, and body mass index (BMI). BMI was determined by collecting data on body weight and height. Education level was divided into three groups, high school, diploma, and undergraduate to postgraduate. The last set of questions examined participants' awareness and knowledge of periodontitis and diabetes mellitus, including the etiology, symptoms, risk factors, and relationship. The questions referred to studies by Ummadisetty et al.[21], Lestari et al.[22], Indurkar et al.[23], and Eke et al.[24]. The questionnaire was then processed and rephrased in the local language in Bahasa, Indonesia.

The study also collected data on smoking status and systemic disorders such as DM, hypertension, and cardiovascular disease. Participants diagnosed with or suspected of DM were asked for permission to check their HbA1c levels. Following the AAP and EFP 2017 in periodontitis grade modifiers, HbA1c levels $\geq$ 7.0 % are considered high and may shift the disease into higher grades. Participants diagnosed with DM with high HbA1c levels ($\geq$ 7.0 %) and high random blood glucose levels, do not seek doctor/internist regularly, or neither taking diabetes medication regularly, are put as uncontrolled DM. Random blood glucose levels were performed using the Blood Glucose Monitoring System with a self-test device (GlucoDr^{TM} Meter AGM-2100, All Medicus Co. Ltd., Korea). Periodontal examinations such as probing depth, gingival recession, loss of attachment, papilla bleeding index (PBI), and mobility degree were performed by a single examiner using a periodontal probe (UNC15 Probe, Hu-Friedy, Chicago, IL) on all the remaining teeth. The data were then classified into periodontal status according to the periodontitis case definition system developed by the 2017 World Workshop for staging and grading.[7] Stage I-IV of periodontitis is defined based on the severity of the disease. Meanwhile, grades A-B-C (slow-moderate-rapid, respectively) showed the progression rate estimated using direct and indirect evidence.[7]

DOI: 10.20473/j.djmkg.v56.i4.p243–250

Completed questionnaires were collected and statistically analyzed using the IBM® SPSS® version 28.0 software. All of the study groups were compared using the Chi-square test. A P value < 0.05 was considered statistically significant.

RESULTS

The study was conducted during the COVID-19 pandemic, from January to June 2021. The sample size was determined using the Roscoe guidelines to study the behavior characteristics of a sample, where the sample size should be more than 30 and less than 500. If the sample were divided into three groups, the minimal sample size would be 30 per group.[25] Unfortunately, fewer new patients came to the Dental Hospital of Universitas Indonesia during the COVID-19 pandemic. Hence, 84 adult patients, 44% males, and 56% females, participated in this study.

In this study, 28.6% were found clinically to have good gingival health, 38.1% were nondiabetic patients with periodontitis, and 33.3% were diabetic patients with periodontitis. Approximately based on their age, 36.9% of the participants were elderly. Most of the study sample (79.8%) were undergraduates and postgraduates. More than half (51.2%) had a normal body mass index. All the participants were clinically examined to determine periodontitis staging (Table 1).

Most participants (94%) had been to a dentist, and approximately 64.3% brushed their teeth twice daily. Of the participants, 98.8% knew that oral hygiene had to be maintained daily, but only 77.4% knew that poor oral hygiene could lead to risk factors for periodontal disease. Although 13.1% acknowledged having poor gum health, 27.4% and 38.1% had redness and swelling, and bleeding gums, respectively, in the last three months. Over half of the participants (67.9%) knew severe gum inflammation could cause further periodontal tissue destruction. However, only a few were aware that the symptoms of periodontitis were redness and swelling of the gums (26.2%), bleeding gums (23.8%), dental calculus (26.2%), mobile teeth (28.6%), spontaneous tooth loss (23.8%), and shorter/longer appearance of the teeth (23.8%) (Table 2).

Approximately 67.9% of the participants knew that DM might impact systemic health. However, only 35.7% were aware that DM was related to periodontal health, and 36.9% were aware that periodontal health might be affected by DM. 42.9% and 39.3% of the participants were aware that DM could increase the severity of periodontitis and may lead to symptoms of periodontitis, respectively. Only 33.3% knew maintaining oral hygiene could prevent DM (Table 3).

Almost half of the participants (45.2%) had family history of DM, and 33.3% had diabetes mellitus. Most participants (96.4%) had a normal random blood glucose level. Of the diabetic participants, 62.1% had higher levels

Table 1. Demographic characteristics of the study sample

Parameters		N	Percentage (%)	Chi-Square	P value
Gender	Male	37	44	0.392	0.822
	Female	47	56		
Age	Adult (20-44yrs)	30	35.7	24.044	0.000*
	Middle Aged (45-59yrs)	23	27.4		
	Elderly (≥ 60yrs)	31	36.9		
Education Level	High school	10	11.9	8.526	0.074
	Diploma	7	8.3		
	Undergraduate - Postgraduate	67	79.8		
Body Mass Index (BMI)	Underweight (<18.5)	1	1.2	7.640	0.266
	Normal (18.5-24.9)	43	51.2		
	Overweight (25-29.9)	29	34.5		
	Obese (>30)	11	13.1		
Oral Health Status	Clinically Gingival Health[a]	24	28.6	-	-
	Healthy Periodontitis[b]	32	38.1		
	Diabetic Patients with Periodontitis	28	33.3		
Periodontal Status[c]					
Interdental CAL	1-2 mm	0			
	3-4 mm	2	4.3	2.971	0.085
	≥ 5 mm	44	95.7		
Tooth Loss (Due to periodontitis)	No tooth loss	58	69	28.507	0.000*
	≤ 4 teeth	18	21.4		
	≥ 5 teeth	8	9.5		
Maximum Probing Depth	≤ 4 mm	5	10.4	10.992	0.027*
	≤ 5 mm	4	8.3		
	≥ 6 mm	39	81.3		

*Significance level (P<0.05). CAL: clinical attachment level. [a]Subjects who have no periodontitis nor diabetes mellitus, [b]Periodontitis patients without diabetes mellitus, [c]Periodontal status data were collected from all the study sample to determine the staging of periodontitis, according to the 2017 World Workshop.

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Table 2. General knowledge and awareness of periodontitis among the study sample

Question		N	Percentage (%)	Chi-Square	P Value
Have you ever been to a dentist?	Yes	79	94	9.089	0.011*
	No	5	6		
How many times do you brush your teeth?	Once daily	9	10.7	18.143	0.001*
	Twice daily	54	64.3		
	Thrice daily	21	25		
What do you think of the health of your gums?	Excellent	5	6	22.556	0.004*
	Good	48	57.1		
	Not Sure	19	22.6		
	Poor	11	13.1		
	Very Poor	1	1.2		
Recognizes brushing of teeth can affect gum health	Yes	67	79.8	8.329	0.080
	No	15	17.9		
	I don't know	2	2.4		
Knows oral hygiene needs to be maintained daily	Yes	83	98.8	1.730	0.421
	No	1	1.2		
	I don't know	0	0		
Poor oral hygiene can lead to risk factors for periodontal diseases	Yes	65	77.4	24.420	0.000*
	No	14	16.6		
	I don't know	5	6		
Severe gum inflammation can cause further periodontal tissue destruction	Yes	57	67.9	30.152	0.000*
	No	17	20.2		
	I don't know	10	11.9		
In the last three months, have you had this condition?					
Redness and Swelling of Gums	Yes	23	27.4	15.962	0.003*
	No	58	69		
	I don't know	3	3.6		
Bleeding Gums	Yes	32	38.1	20.892	0.000*
	No	52	61.9		
	I don't know	0	0		
Calculus Deposits	Yes	48	57.1	8.185	0.085
	No	31	36.9		
	I don't know	5	6		
Tooth Mobility	Yes	25	29.8	14.506	0.001*
	No	59	70.2		
	I don't know	0	0		
Tooth Loss	Yes	5	6	7.209	0.125
	No	78	92.9		
	I don't know	1	1.2		
Teeth appear shorter/longer	Yes	21	25	18.546	0.001*
	No	56	66.7		
	I don't know	7	8.3		
Mobile Teeth without trauma	Yes	11	13.1	14.899	0.005*
	No	72	85.7		
	I don't know	1	1.2		
Redness and swelling gums are symptoms of periodontitis	Yes	22	26.2	25.724	0.000*
	No	33	39.3		
	I don't know	29	34.5		
Bleeding gums while brushing teeth is one of the symptoms of periodontitis	Yes	20	23.8	30.921	0.000*
	No	36	42.9		
	I don't know	28	33.3		
Dental calculus is a risk factor for periodontitis	Yes	22	26.2	25.702	0.000*
	No	35	41.7		
	I don't know	27	32.1		
Mobile teeth are one of the symptoms of periodontitis	Yes	24	28.6	22.275	0.000*
	No	33	39.3		
	I don't know	27	32.1		
Spontaneous loose teeth are a symptom of periodontitis	Yes	20	23.8	31.067	0.000*
	No	36	42.9		
	I don't know	28	33.3		
Teeth looking shorter/longer is a symptom of periodontitis	Yes	19	22.6	34.233	0.000*
	No	37	44		
	I don't know	28	33.3		

*Significance level (P<0.05).

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Table 3. Knowledge and awareness of the relationship between periodontitis and diabetes mellitus

Question		N	Percentage (%)	Chi-Square	P Value
Diabetes mellitus is related to periodontal health	Yes	30	35.7	36.583	0.000*
	No	28	33.3		
	I don't know	26	31		
Periodontal health can be affected by diabetes mellitus	Yes	31	36.9	27.787	0.000*
	No	29	34.5		
	I don't know	24	28.6		
Diabetes mellitus could increase the severity of periodontitis	Yes	36	42.9	41.085	0.000*
	No	26	31		
	I don't know	22	26.2		
Diabetes mellitus can cause gum inflammation, tooth mobility, and malodor	Yes	33	39.3	40.527	0.000*
	No	28	33.3		
	I don't know	23	27.4		
Diabetes mellitus can have an impact on systemic health	Yes	57	67.9	34.054	0.000*
	No	15	17.9		
	I don't know	12	14.3		
Maintaining oral hygiene can prevent diabetes mellitus	Yes	28	33.3	17.583	0.001*
	No	32	38.1		
	I don't know	24	28.6		

*Significance level (P<0.05).

Table 4. Periodontitis risk factors among the study sample

Question		N	Percentage (%)	Chi-Square	P Value
Diabetes Mellitus					
Diabetes Mellitus	Yes	28	33.3	86.432	0.000*
	No	43	51.2		
	I don't know	13	15.5		
Had family history of DM	Yes	38	45.2	35.916	0.000*
	No	33	39.3		
	I don't know	13	15.5		
Random blood glucose level[1]	< 200mg/dL	81	96.4	5.900	0.052
	≥ 200 mg/dL	3	3.6		
HbA1c level[2]	< 7.0 %	11	37.9	-	-
	≥ 7.0 %	18	62.1		
Diabetic status[3]	Controlled	19	65.5	-	-
	Uncontrolled	10	34.5		
Physician/Internist referral to dentist[4]	Yes	3	10.7	-	-
	No	26	89.7		
Other Systemic Diseases					
Hypertension	Yes	30	35.7 %	12.179	0.002*
	No	54	64.3 %		
Cardiovascular Disease	Yes	6	7.1 %	7.164	0.028*
	No	78	92.9 %		
Smoking Status					
Smoking	Current smoker	11	13.1 %	8.610	0.072
	Former smoker	12	14.3 %		
	Never smoke	61	72.6 %		
Current Smoker[5]	< 10 cigarettes per day	6	54.5 %	0.917	0.632
	≥ 10 cigarettes per day	5	45.5 %		

*Significance level (P<0.05). [1]Random blood glucose level was tested on all study sample, [2]HbA1c level tested on study sample with diabetes mellitus and one of the grade modifiers in periodontitis, [3]Diabetic status determined by the auto-anamnesis, drugs, and medical histories of the diabetic patients, [4]Referral to dentist made by the physician/internist who taken care of the diabetic study sample, [5]Smoking status as one of the risk factors and grade modifiers in periodontitis, [2,4]Classified according to the 2017 World Workshop on the new classification of staging and grading periodontitis.

DOI: 10.20473/j.djmkg.v56.i4.p243–250

of HbA1c (≥ 7.0 %), and 34.5% had uncontrolled diabetes. Participants with DM who has higher levels of HbA1c (≥ 7.0 %) and high random blood glucose levels, and also do not see the doctor/internist nor taking the medication regularly, are considered as having uncontrolled diabetes. Meanwhile, only 10.7% of the diabetes patients had a dentist recommended by their physician/internist. Among other systemic diseases in the study sample, 35.7% had hypertension, and 7.1% had cardiovascular disease. Of the participants, 13.1% were active smokers, and 54.5% smoked less than ten cigarettes daily (Table 4).

DISCUSSION

During the COVID-19 pandemic, people often neglected their oral hygiene routines due to lockdown measures and rarely visited a dentist, except for emergency dental treatment, for fear of contracting coronavirus.[16] At the beginning of the COVID-19 pandemic, the Indonesian Association of Dentists recommended specified emergency treatment for dental practice. The number of patients visiting the Dental Hospital of Universitas Indonesia decreased in 2020, during the COVID-19 pandemic, to only a third of the 2019 numbers. Although this study did not investigate a connection between periodontitis and COVID-19, awareness and knowledge of the relationship between periodontitis and DM became an important issue during the pandemic.

Preshaw et al.[26] reported that severe periodontitis affects up to 15% of adult populations, and dental health is a neglected aspect of overall health. Tonetti et al.[27] also stressed the need for global action because periodontal disease contributes to the global disease burden impacting human health, nutrition, and well-being. The Global Burden of Disease study, 1990–2010, stated that severe periodontitis is probably the sixth most prevalent disease in the world (11.2%) and has increased by 57.3% since 2005.[27] In this study, 38.1% of periodontitis patients were found to be healthy without any systemic diseases, and 33.3% were diabetic. This result agreed with Indonesia's national health research, which reported that the prevalence of periodontitis in Indonesia was 74.1% in 2018 and ranked second highest after dental caries.[19]

This study demonstrated a lack of knowledge and awareness of periodontitis among the study sample. Although most participants acknowledged themselves as having good gum health, the study's findings revealed that many were unaware of periodontitis symptoms like redness, swelling of the gums, bleeding while brushing teeth, mobile teeth, tooth loss, and shorter/longer appearance of teeth. Most participants had calculus deposits indicating the progression of periodontitis. Unfortunately, only a few knew dental calculus is a risk factor for periodontitis.

Smoking and DM are two additional risk factors that may hasten the rate of progression of periodontitis.[7] Tonetti et al.[7] suggested a new periodontitis staging and grading framework. The primary goals of grading a patient with periodontitis are to estimate the likelihood of periodontitis progression and response to treatment and the possible negative effects on a patient's health from the manifestations of systemic diseases.[7] The metabolic status of patients with DM may be significantly impacted by periodontitis since it might worsen glycemic control.[1,5,23,28,29] The WHO reported a national prevalence of diabetes of 6.6% in Indonesia in 2015, with an increased prevalence in older people and females.[30] Diabetic patients are three times more likely than healthy people to develop periodontitis, which can lead to subsequent tooth loss.[23,28,31–33]

Hereditary factors are also associated with periodontitis, making some people (including diabetic patients) more susceptible to the disease than others.[5,32] Most participants had family history of diabetes mellitus, indicating they are prone to be diabetic in the future. One of the participants denied having DM but had family history of DM and was diagnosed to be diabetic after the random blood glucose and HbA1c levels were found to be high. According to the International Diabetes Federation, 371 million persons worldwide were expected to have diabetes in 2012.[34] Indonesia is one of the ten countries with the highest numbers of people living with diabetes and occupies the fourth position after the United States.[33,34]

Periodontitis may affect blood sugar levels and increase systemic inflammation. A study by Wu et al.[2] stated a strong bidirectional association between type 2 DM and periodontitis, with each disease potentially enhancing the severity of the other. Patients with periodontitis are more likely to develop diabetes, while those with diabetes have an increased risk of oral diseases.[35] Clinicians should initially presume grade B periodontitis and look for specific evidence to move to grade A or C, as diabetes is now considered a grade modifier of periodontitis.[36] Moreover, smoking is also one of the risk factors for periodontitis and acts as a grade modifier. Many participants had high glycemic levels, demonstrating poor glycemic control. Active smokers comprised only a small percentage, and more than half smoked less than ten cigarettes daily. A higher glycemic status of diabetic patients and a greater number of cigarettes per day may modify the severity of periodontitis to grade C, indicating a rapid progression rate.[36]

Poor glycemic control, periodontal disease, dental caries, xerostomia, and fungal infections can coexist in diabetic individuals. Besides proper routine periodontal care, dental and oral health education is vital for people with diabetes.[37] This study demonstrated that many participants knew the relationship between periodontitis and DM. However, only a small percentage knew that maintaining oral hygiene can prevent DM. A Finnish study of diabetic individuals showed that self-efficacy in oral hygiene maintenance could lower HbA1c levels.[26] Poor oral hygiene status was often found in diabetic patients with

DOI: 10.20473/j.djmkg.v56.i4.p243–250

poor glycemic control.[37] These results agreed with previous studies that showed worse glycemic control significantly influenced oral hygiene status and, therefore, more severe periodontal destruction.[33,37,38]

Good control of diabetes may significantly decrease or prevent the risk of infections and diabetic complications, including retinopathy, nephropathy, and neuropathy, and may also reduce the prevalence of bacterial pneumonia.[5,15,28] A study by Mealey and Oates[28] showed patients with poorly managed diabetes exhibited more substantial gingival bleeding, but as glycemic control improved, the number of bleeding sites reduced. Some diabetic participants had uncontrolled diabetes due to a lack of self-awareness of the importance of maintaining oral and systemic health.

Previous studies also showed a lack of knowledge about the relationship between periodontitis and DM among diabetic study populations due to a lack of dental health education and information provided by physicians or internists.[21,22,24] In contrast, 61.2% of dentists in China referred patients with severe periodontitis for a diabetes evaluation, while only a small number of endocrinologists (26.6%) commonly recommended that diabetic patients see dentists.[4] Indurkar et al.[23] also reported that periodontal therapy for diabetic patients improved glycemic control by 17.1%, and effective periodontal treatment reduced their HbA1c levels. These studies suggested that the involvement of dental teams in the management of diabetes and the self-maintenance of oral hygiene in diabetic patients would improve diabetic control. According to Morales et al.[14], periodontal therapy enhances the oral-health-related quality of life for people with diabetes and periodontitis. Other studies have proven that successful periodontal therapy for periodontitis patients helps improve serum markers of systemic inflammation and metabolic control.[39] These results indicate that periodontal health maintenance should be included in care plans for diabetic patients, especially during the COVID-19 pandemic.

This study has several limitations, including the low number of participants due to fewer patients visiting dentists, and restriction of dental visit especially for elderly patients. Awareness and knowledge of periodontitis and DM are still lacking. Because of the increasing prevalence of DM, dentists should be more aware of the disease and its relationship with periodontal disease. Further dental health education is required to enhance the understanding of the relationship between periodontal disease and DM. A broader public health approach is urgently needed to fight periodontal disease and support oral hygiene behavior changes.[12] Healthcare professionals should have better knowledge and awareness of DM and periodontitis to educate the public about oral hygiene maintenance and promote a better understanding of the impact of oral and systemic health on their quality of life. Improved awareness of oral hygiene behaviors may improve the oral health of patients with diabetes, particularly during the COVID-19 pandemic.

ACKNOWLEDGEMENT

This work was supported by the Publikasi Terindeks Internasional (PUTI) Saintekes of Universitas Indonesia [Grant No: NKB-4832/UN2.RST/HKP.05.00/2020].

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