Journal of Endocrinology, Tropical Medicine, and Infectious Disease (JETROMI) Vol.07, No.03 (2025) 97-105

talenta PUBLISHER

Journal of Endocrinology, Tropical Medicine, and Infectious Disease (JETROMI)

Journal homepage: https://talenta.usu.ac.id/jetromi

PERIODONTAL STATUS IN PERIODONTITIS PATIENTS WITH TYPE 2 DIABETES MELLITUS

Martina Amalia[*1], Jesika Gihon Aprelia Siagian[1], Okie Anggie Jelita Aritonang[1]

Department of Periodontics, Faculty of Dentistry, Universitas Sumatera Utara, Medan, Indonesia

[*]Corresponding Author: martina.amalia@usu.ac.id

ARTICLE INFO

Article history:
Received 06 October 2024
Revised 10 March 2025
Accepted 01 August 2025
Available online 01 August 2025

E-ISSN: 2686-0856
P-ISSN: 2686-0872

How to cite:
Martina Amalia, Jesika Gihon Aprelia Siagian, Okie Anggie Jelita Aritonang (2025). Periodontal Status In Periodontitis Patients With Type 2 Diabetes Mellitus. Journal of Endocrinology, Tropical Medicine, an Infectiouse Disease, 7(3), 84–93.

ABSTRACT

Background: Periodontitis is an inflammation of the periodontal tissue characterized by loss of attachment and the formation of periodontal pockets. Periodontitis impairs the metabolic control of patients with diabetes mellitus by increasing inflammation and insulin resistance, according to researchers. This study aims to determine the periodontal status and level of gingival inflammation in patients with periodontitis and type 2 diabetes mellitus at the Tiga Dolok Health Center.

Method: This research is a descriptive study with a cross-sectional research design. The study's population and sample are patients with type 2 diabetes mellitus accompanied by periodontitis who visit the Tiga Dolok Health Center and meet the established inclusion and exclusion criteria, with a total sample size of 42 samples taken.

Results: The research findings indicate that the average pocket depth is 4.052 mm, the average clinical attachment loss is 5.200 mm, and the level of gingival inflammation based on the gingival index shows that 18 individuals (42.9%) fall into the mild category and 24 individuals (57.1%) fall into the moderate category. Additionally, the papillary bleeding index shows that 31 individuals (73.8%) are in the >1 category, and 11 individuals (26.2%) are in the ≤1 category.

Conclusion: The periodontal health is moderate. The pocket depth is 4.052 ± 0.402 mm, the clinical attachment loss is 5.200 ± 0.822 mm, and the gingival index shows moderate gingival inflammation. In contrast, the papillary bleeding index falls into the category of >1.

Keywords: Type 2 Diabetes Mellitus, Periodontitis, Periodontal Status, Gingival Index

ABSTRAK

Latar Belakang: Periodontitits merupakan inflamasi pada jaringan periodontal yang ditandai dengan kehilangan perlekatan dan terbentuknya poket periodontal.Periodontitis ditemukan memberikan

efek negatif terhadap kontrol metabolik penderita diabetes melitus dengan meningkatkan inflamasi dan resistensi insulin. Tujuan dari penelitian ini adalah untuk mengetahui status periodontal dan tingkat inflamasi gingiva pasien periodontitis disertai diabetes melitus tipe 2 di Puskesmas Tiga Dolok.

Metode: Penelitian ini merupakan penelitian deskriptif dengan desain penelitian cross-sectional. Populasi dan sampel penelitian adalah pasien diabetes melitus tipe 2 disertai periodontitis yang datang berobat ke Puskesmas Tiga Dolok yang memenuhi kriteria inklusi dan eksklusi yang sudah ditetapkan dengan total sampel yang diambil sebanyak 42 sampel.

Hasil: Hasil penelitian menunjukkan nilai rerata kedalaman poket adalah 4,052 mm ,nilai rerata kehilangan perlekatan klinis adalah 5,200 mm, tingkat inflamasi gingiva berdasarkan indeks gingiva dengan kategori ringan 18 orang (42.9%) dan sedang 24 orang (57.1%) dan indeks perdarahan papila dengan kategori >1 sebesar 31 orang (73.8%) dan kategori ≤1 sebesar 11 orang (26.2%).

Kesimpulan: Status periodontal yang dinilai dari kedalaman poket adalah ringan (4,052 ± 0,402 mm), kehilangan perlekatan klinis adalah parah (5,200 ± 0,822 mm), dan tingkat inflamasi gingiva berdasarkan indeks gingiva umumnya di kategori sedang dan indeks perdarahan papila di kategori >1.

Kata Kunci: Diabetes Melitus Tipe 2, Periodontitis, Status Periodontal, Inflamasi Gingiva

http://doi.org/10.32734/jetromi.v7i3.18393

1. Introduction

Dental and oral health is an important aspect affecting quality of life. Researchers have found a reciprocal relationship between dental and oral health and systemic health. Periodontitis is a dental and oral disease that has a reciprocal relationship with systemic diseases, one of which is diabetes mellitus. Periodontitis is an inflammation of the periodontal tissue characterized by loss of attachment and the formation of periodontal pockets [1]. Dental plaque initiates periodontitis, but risk factors also contribute to its exacerbation. Some risk factors for periodontal disease include genetics, local factors, systemic diseases, age, gender, nutrition, and smoking [2].

Insulin deficiency and peripheral insulin resistance cause diabetes mellitus, a condition that prevents sufferers from producing enough insulin or from effectively using the insulin they produce to maintain blood sugar balance [3]. Insulin deficiency and peripheral insulin resistance cause type 2 diabetes mellitus [4]. There is a relationship between type 2 diabetes mellitus and periodontitis. The severity and prevalence of periodontal disease have been found to increase in patients with diabetes mellitus, particularly in those with poor blood sugar control [1,5]. Hyperglycemia in patients with type 2 diabetes mellitus leads to an increase in glucose levels in the gingival sulcus fluid and blood, resulting in changes to the gingiva and microflora, which in turn causes inflammation [6]. Periodontitis also hurts the metabolic control of patients with diabetes mellitus by increasing inflammation and insulin resistance. Researchers found a correlation between the severity of periodontitis and an increase in type 2 diabetes mellitus complications [7].

Inflammation is the main link between diabetes mellitus and periodontitis. Hyperglycemia contributes to increased inflammation, oxidative stress, and apoptosis, while periodontitis is an inflammation of the periodontal [8]. The heightened inflammation in both conditions amplifies the inflammatory response and causes damage to the periodontal tissue [1,5]. Patients with periodontitis and type 2 diabetes exhibit worse gingival inflammation compared to those without type 2 diabetes. The findings

indicate that patients with uncontrolled type 2 diabetes mellitus and periodontitis have higher levels of AGE in their gingival sulcus fluid compared to those with controlled type 2 diabetes mellitus and those without type 2 diabetes mellitus [9]. The interaction between AGE and RAGE causes too much inflammation and harm to periodontal tissue, as shown in clinical studies on animal models [7]. The damage to the periodontal tissue in patients with periodontitis and type 2 diabetes mellitus also indicates a worse periodontal status. The prevalence of periodontitis, average pocket depth, and attachment loss in patients with diabetes are significantly higher compared to those without diabetes mellitus [10]. Patients with chronic periodontitis and type 2 diabetes mellitus have greater pocket depth and attachment loss compared to those without type 2 diabetes mellitus [11].

Knowledge and understanding of the relationship between periodontitis and type 2 diabetes are essential in providing appropriate care and raising awareness of the importance of maintaining oral and dental health. This study aims to investigate the periodontal status and gingival inflammation of patients with periodontitis and type 2 diabetes mellitus.

2. Method

This research is a descriptive study with a cross-sectional research design. After receiving the ethical approval letter from the USU Health Research Ethics Committee with the number 1096/KEPK/USU/2023, the research period will begin at the Tiga Dolok Health Center from January to February 2024. We collected 42 samples from patients with type 2 diabetes mellitus and periodontitis. The sample taken must meet the inclusion and exclusion criteria. The inclusion criteria for this study are patients aged ≥ 35 years, suffering from type 2 diabetes mellitus accompanied by periodontitis, with a minimum of 15 teeth in the oral cavity, not having undergone periodontal treatment in the last 3 months, willing to sign the informed consent and undergo examination, and having attachment loss on ≥ 2 teeth. The exclusion criteria for this study are patients who are pregnant or breastfeeding, as well as patients who have consumed vitamins, anti-inflammatories, and antibiotics in the last month. The researchers examined the random blood glucose level at the time, assessed pocket depth, evaluated clinical attachment loss, measured the oral hygiene index (OHI-S), measured the gingival index (GI), and measured the papillary bleeding index.

3. Result

This study aims to determine the periodontal status using periodontal pocket depth and attachment loss and to assess gingival inflammation using the gingival index and papillary bleeding index in patients with periodontitis and type 2 diabetes mellitus.

There were a total of 42 samples obtained from the population with random blood glucose level= 307.40 ± 115.67 mg/dl. Based on table 1, presents the characteristics of the study's subjects, the majority of whom are females. The majority of the age group that is the subject of this research is between 55-64 years old, with a total of 18 individuals (42.9%). According to the research subjects' last education, high school (SMA) is the most common level of education among the subjects, with a total of 33 individuals (78.6%). Out of the research subjects, 35 individuals (83.3%) hold employment. Most of the research subjects do not smoke, with 27 individuals (64.3%). The majority of the research subjects have a family history of type 2 diabetes, with 22 individuals (52.4%), which is 2 more than those without a family history of type 2 diabetes. The blood sugar levels at the time of the study for most subjects were ≥200 mg/dL, with a total of 34 individuals (81%). We measured the distribution of the oral hygiene index among the research subjects using OHI-S. The most common category of oral hygiene is moderate, with 29 individuals (69%), followed by severe with 12 individuals (28.6%), and good with 1 individual (2.4%).

Table 1. Characteristics of research subjects at Tiga Dolok Health Center.

Socio demographics	N (42)	%
Gender		
Male	17	40.5
Female	25	59.5
Age (year)		
35-44	2	4.8
45-54	13	31
55-64	18	42.9
≥ 65	9	21.4
Education Level		
Primary School	1	2.4
Junior School	2	4.8
High School	33	78.6
Undergraduate	6	14.3
Employed		
Employed	35	83.3
Not	7	17.1
Smoking		
Current smoker	12	28.6
Former smoker	3	7.1
Never smoker	27	64.3
Had a Family History of Type 2 Diabetes Mellitus		
Ya	22	52.4
Tidak	20	47.6
Random blood glucose level (mg/dL)		
< 200	8	19
≥ 200	34	81
Oral Hygiene Index		
Good	1	2.4
Moderate	29	69
Bad	12	28.6

Based in Table 2 indicates that the subjects' pockets have an average depth of 4.052 millimeters, with a standard deviation of 0.402 millimeters. This indicates that the subjects have a mild classification. The participants had a clinical attachment loss that was 5.200 millimeters on average with a standard variation of 0.822 millimeters, which places them in the severe category

Table 2. Average pocket depth values and clinical attachment loss

Variable	Subject (n)	Mean ± SD (mm)	Note
Pocket Depth	42	4.052 ± 0.402	Mild
Clinical Attachment Loss	42	5.200 ± 0.822	Severe

Based on Table 3, it is evident that in the category of pocket depth ≥4 mm, the random blood glucose level at ≥200 mg/dL is the dominant factor, with a total of 24 persons (70.6%). Similarly, in the category of clinical attachment loss ≥5, the random blood glucose level at ≥200 mg/dL is likewise the dominant factor, with a total of 20 individuals (58.8%). In light of the facts, it can be concluded that there is no substantial connection between periodontal condition and random blood glucose levels at present.

Table 3. The relationship between periodontal status and random blood glucose level at the time in patients with type 2 diabetes mellitus accompanied by periodontitis at the Tiga Dolok Health Center.

Variable	Pocket Depth				Clinical Attachment Loss				P Value
	<4		≥4		<5		≥5		
	n	%	n	%	n	%	n	%	
Random Blood glucose (mg/dL)									
< 200	2	25	6	75	3	37.5	5	62.5	0.804
≥ 200	10	29.4	24	70.6	14	41.2	20	58.8	0.849

Chi-square test, *p < 0,005

Based on Table 4, it provides the distribution of the gingival index of the persons who participated in the research. The moderate category has the largest position with a total of 24 individuals (57.1%), followed by the mild category with 18 individuals (42.9%), and there are no individuals in the severe gingival index group.

Table 4. Distribution of gingival index among research subjects at Tiga Dolok Health Center.

Gingival Index	n (42)	(%)
Mild	18	42.9
Moderate	24	57.1
Severe	0	0

Based on Table 5, the distribution of study participants is shown by the papilla bleeding index. The category that holds the highest position is Category>1, which includes 31 individuals (including 73.8% of the total), whereas Category ≤1 includes 11 persons (including 26.2% of the total).

Table 5. Distribution of papilla bleeding indices of research subjects at Tiga Dolok Health Center

Papillary Bleeding Index	n (42)	(%)
≤1	11	26.2
>1	31	73.8

Based on Table 6, provides information regarding the correlation between the gingival index and the levels of blood sugar that were present in the research subjects at the time. When the random blood glucose level is greater than or equal to 200 mg/dL, the gingival index category is largely in the moderate position. This corresponds to a total of 21 people, or 61.8 percent of the total.

Table 6. The relationship between the gingival index and random blood glucose level during the research subjects at the Tiga Dolok Health Center

Variable	Gingival Index				Total		P value
	Mild		Moderate				
	n	%	n	%	n	%	
Random Blood glucose (mg/dl)							
< 200	5	62.5	3	37.5	8	100	0,21
≥ 200	13	38.2	21	61.8	34	100	2

*p <0.05

Based on Table 6, provides information regarding the correlation between the papilla bleeding index and the blood sugar levels of the individuals who participated in the research at the time. A total of 23 individuals, or 67.6% of the population, have a papilla bleeding index greater than 1. This category is primarily associated with having a random blood glucose level of at least 200 mg/dL.

Table 7. The relationship between the papilla bleeding index and random blood glucose level of the research subjects in Tiga Dolok Health Center

Variable	Papillary Bleeding Index				P value
	≤1		>1		
	n	%	n	%	
OHI-S					
Good	1	100	0	0	
Moderate	6	20.7	23	79.3	0.166
Bad	4	33.3	8	66.7	
Random Blood glucose (mg/dL)					
< 200	0	0	8	100	0.086
≥ 200	1	32.4	23	67.6	

*p <0,05

4. Discussions

Based on the results of the research conducted, the subjects of the study were predominantly female. Based on Trentin's research, women tend to seek medical check-ups more often than men, resulting in a higher incidence among women [12]. The age group that dominates the research subjects is 55-64. This is in line with Preshaw's statement that type 2 diabetes mellitus tends to develop in individuals aged 40 to 50 [8]. Trentin's research on patients with type 2 diabetes mellitus also showed a predominance in the age group of 50 and above [12]. The majority of the research subjects do not smoke. Smoking affects the level of gingival inflammation. Pranckviciene's research shows that patients with a smoking habit have a lower bleeding index during probing compared to non-smokers, with an average probing bleeding index of 29.9±20.8 for smokers and 58±8.7 for non-smokers [13]. Nicotine's vasoconstriction effects are responsible for this. This stands in contrast to Wayeni's research, which reveals that the smoking study's overall subjects have a severe gingival index of 100%, while the majority of non-smoking subjects have a moderate gingival index of 77.3% [14]. The study revealed that the research subjects had a family history of type 2 diabetes mellitus. According to the Alasqah study, 72% of the research subjects had a family history of type 2 diabetes mellitus. Individuals with type 2 diabetes mellitus and a family history of the condition showed significant differences in experiencing chronic periodontitis compared to those without a family history [15]. A person with a family history of diabetes mellitus has a higher risk of developing type 2 diabetes mellitus. The majority of the blood sugar levels of the research subjects were ≥ 200 mg/dL. The study participants were patients already diagnosed with type 2 diabetes mellitus at the Tiga Dolok Health Center. According to the ADA guidelines, an individual diagnosed with type 2 diabetes mellitus has a random blood sugar level of ≥ 200 mg/dL [16].

The distribution of oral hygiene indices among this study's subjects is mostly in the moderate-poor range. Trentin's research consistently finds the oral hygiene index of patients with diabetes mellitus in the moderate to poor category [12]. Harsas's research also found that the OHI-S of patients with type 2 diabetes mellitus mostly fell into the poor category, with a total of [11]. Oral hygiene is an important factor in determining the severity of gingival inflammation. The accumulation of dental plaque is the primary initiator of gingival inflammation, so the level of oral hygiene plays a crucial role in determining the severity of gingival inflammation. Pranckeviciene's research found that OHI-

S significantly affects the severity of periodontal parameters [13]. Lertpimonchai's research also states that poor oral hygiene has a 2-5 times higher risk of developing periodontitis compared to good oral hygiene [17].

Habits in maintaining oral hygiene determine the level of cleanliness of the oral cavity. These habits pertain to the frequency, timing, duration, and regularity of tooth brushing, as well as the frequency of toothbrush changes and dental visits. Oral hygiene habits are a key determinant of oral health. The majority of the subjects in this study brush their teeth regularly, with a frequency of brushing once at the time of showering, and the duration of brushing is uncertain, and they replace their toothbrush every three months. The majority of the research subjects have never visited a dentist. Lertpimonchai's research also revealed that inconsistency in daily tooth brushing frequency carries a higher risk of periodontitis. The results of Lertpimonchai's study indicate that regular tooth brushing can reduce periodontitis and dental visits by 32% and 34%, respectively [13].

According to the research findings, the average pocket depth in the subjects is 4.052 mm (mild), with an average attachment loss of 5.200 mm (severe). This is due to a significant recession in the research sample, with an average value of 3 mm, and a correlation between the occurrence of gingival recession and age. The majority of the research sample is under 42 years old, indicating a longer exposure period to the factors causing gingival recession [18]. Pham and Tran's 2018 research, which demonstrated significantly higher average pocket depth and clinical attachment loss in patients with type 2 diabetes mellitus and periodontitis, is consistent with this result [10]. Preshaw PM reinforces this by stating that diabetes mellitus can increase the risk of periodontitis, and poor glycemic control can worsen the severity and prevalence of attachment loss, which can progress in patients with type 2 diabetes mellitus [19].

The pocket depth ≥4 mm category is dominated by random blood glucose levels at ≥200 mg/dL with a total of 24 individuals (70.6%). The clinical attachment loss category ≥5 is also dominated by random blood glucose levels at ≥200 mg/dL with 20 individuals (58.8%). The risk of periodontitis can increase 2-3 times compared to individuals without diabetes mellitus, and glycemic control is the most important factor in determining the risk of complications from diabetes. With poor glycemic control, the risk of periodontitis rises. Diabetes increases the risk of periodontitis by causing more inflammation in the periodontal tissues [19]. Changes in periodontal status, such as pocket depth and loss of attachment, begin with hyperglycemia, which leads to microvascular issues due to an increase in advanced glycation end products (AGE) in plasma and tissues. In patients with type 2 diabetes mellitus, hyperglycemia, which produces AGE, is associated with the receptor for advanced glycation end products (RAGE), resulting in oxidative stress. Stress conditions can trigger vascular disorders in periodontal tissue. Vascular disturbances will disrupt the distribution of nutrients and oxygen in the periodontal tissue, making anaerobic negative bacteria more pathogenic. In addition, it can affect the disposal of metabolic waste in the periodontal tissue, leading to toxicity in the periodontal and gingival tissues [20]. In this study, this condition is characterized by the presence of periodontal pocket depth and loss of attachment.

The majority of the research subjects' gingival index is at a moderate level. This aligns with Wayeni's research, where a moderate gingival index of 56.7% predominated [14]. Monoarfa's study showed different results, dominated by a severe gingival index of 45% [21] Patients with type 2 diabetes mellitus tend to have higher gingival inflammation compared to those without type 2 diabetes mellitus. Hyperglycemia in patients with diabetes mellitus contributes to microvascular and macrovascular complications, leading to increased inflammation, oxidative stress, and apoptosis. Increased hyperinflammation alters the condition of periodontal tissue, making it more susceptible to gingival inflammation. The clinical picture of gingival inflammation, such as redness and edema,

often precedes gum bleeding. The papillary bleeding index (PBI) is one of the indices used to assess gingival bleeding. The research subjects were predominantly characterized by a papillary bleeding index greater than 1. This condition indicates that patients with diabetes mellitus are more susceptible to bleeding due to inflammation of the gums. Based on Mariyum's research, the majority of patients with diabetes mellitus experience bleeding indices in the severe category [22]. Researchers state that education significantly increases the risk of type 2 diabetes mellitus and periodontitis. The Alasqah study revealed that control patients (17%) outnumber patients with type 2 diabetes mellitus (11%) in terms of higher education. The Alasqah study also found that the habit of brushing teeth is lower among patients with type 2 diabetes mellitus (19%) compared to controls [15]. If linked to the lower level of education of type 2 diabetes patients, their perception of oral cavity maintenance may be lower compared to control patients.

5. Conclusion

At the Tiga Dolok Health Center, individuals with type 2 diabetes and periodontitis exhibit mild periodontal disease and gingival inflammation, as evidenced by a pocket depth of 4.052 ± 0.402 mm. Additionally, they exhibit a moderate gingival index, a papillary bleeding index of >1, and extensive clinical attachment loss (5.200 ± 0.822 mm). The average blood sugar level of patients with type 2 diabetes mellitus and periodontitis at the Tiga Dolok Health Center is 307.40 ± 115.67 mg/dL. There is no substantial correlation between blood sugar levels, periodontal status, and gingival inflammation in patients with type 2 diabetes mellitus and periodontitis at the Tiga Dolok Health Center.

Acknowledgments

This study would not have been possible without the help and guidance of the staff and lecturers from the Department of Periodontics, Faculty of Dentistry Universitas Sumatera Utara. The researcher would also like to thank the Dental and Oral Hospital of the Faculty of Dentistry Universitas Sumatera Utara and Tiga Dolok Health Center, for assisting with the study's implementation.

Conflict of interest

There is no conflict of interest

References

[1] Leite RS, Marlow NM, Fernandes JK. Oral health and type 2 diabetes. The American Journal of the Medical Sciences 2013; 345 (4): 271-3.

[2] Kinane DF, Stathopoulou PG, Papapanou PN. Periodontal diseases. Nat Rev Dis Primers 2017; 3: 1-14.

[3] International Diabetes Federation. IDF diabetes atlas. Ed.10. Belgium: International Diabetes Federation, 2021: 14; 34.

[4] American Diabetes Association. Classification and diagnosis of diabetes: Standards of medical care in diabetes-2021. Diabetes Care 2021; 44 (Suppl 1): 15-S33.

[5] Preshaw PM. Diabetes and periodontitis: What's it all about? Practical Diabetes 2013; 30(1): 9-10a.

[6] Singh M, Bains VK, Jhingran R, Srivastava R, Madan R, Chandra S, Maurya, Rizvi I. Prevalence of periodontal disease in type 2 diabetes mellitus patients: A cross-sectional study. Journal of Periodontology 2015; 86(7): 839-46.

[7] Chapple IL, Genco R; working group 2 of the joint EFP/AAP workshop. Diabetes and periodontal diseases: consensus report of the Joint EFP/AAP Workshop on Periodontitis and Systemic Diseases. J Periodontol 2013; 84(4 Suppl): 106-12.

[8] Preshaw, PM, Alba AL, Herrera D, Jepsen S, Konstantinidis A, Makrilakis K, Taylor R. Periodontitis and diabetes: A two-way relationship. Diabetologia 2012; 55: 21-31.

[9] Akram Z, Alqahtani F, Alqahtani M, Al-Kheraif AA, Javed F. Levels of advanced glycation end products in the gingival crevicular fluid of chronic periodontitis patients with and without type-2 diabetes mellitus. J Periodontol 2020; 91(3): 396-402.

[10] Pham T A V, Tran T T P. The interaction among obesity, type II diabetes mellitus, and periodontitis in Vietnamese patients. Clinical and Experimental Dental Research 2018:1-9.

[11] Harsas N A, et al. Periodontal status differences between chronic periodontitis patients with and without type 2 diabetes mellitus. Journal of International Dental and Medical Research 2019; 12(1): 175-180.

[12] Trentin MS, dkk. Prevalence and of periodontal disease in type 2 diabetes mellitus patients: A cross-sectional study. J Biosci 2018; 34(4): 1114-23.

[13] Pranckeviciene A, Siudikiene J, Ostrauskas R, Machiulskiene V. Severity of periodontal disease in adult patients with diabetes mellitus about the type of diabetes. Biomed Pap Med Fac Univ Palacky Olomouc Czezh Repub. 2014; 158(1): 117-23.

[14] Wayeni C, Susanto HS, Wuryanto A. Gambaran perilaku *oral hygiene,* skor plak dan skor gingiva pada penderita diabetes melitus (Studi di RSUD Tugurejo Semarang). Jurnal Kesehatan Masyarakat (e-Journal) 2019; 7(3): 145-9.

[15] Alasqah M, Mokeem S, Alrahlah A, Al-Hamoudi N, Abduljabbar T, Akram Z, Vohra F, Javed F. Periodontal parameters in prediabetes, type 2 diabetes Mellitus, and non-diabetic patients. Braz Oral Res 2018; 32(e81): 1-7.

[16] American Diabetes Association. Classification and diagnosis of diabetes: Standards of medical care in diabetes-2021. Diabetes Care 2021; 44 (Suppl 1): 15-S33.

[17] Lertpimonchai A, Rattanasiri S, Vallibhakara SA, Attia J, Thakkinstian A. The association between oral hygiene and periodontitis: a systematic review and meta-analysis. Int Dent J 2017: 67(6): 332-343.

[18] Chrysanthakopoulos N A. Occurrence, extension, and severity of the gingival recession in a Greek adult population sample. J Periodontal Implant Dent 2010; 2(1): 37-42.

[19] Preshaw PM. Periodontitis and diabetes. British Dental Journal 2019;227 (7):577-584.

[20] Erma T. Periodontitis dan diabetes melitus. Jurnal Kedokteran Gigi Unej 2012; 9(3): 152-154.

[21] Monoarfa OO, Pandelaki K, Mintjelungan CN. Gambaran status gingiva pada penderita diabetes melitus tipe 2 di rumah sakit umum gmim pancaran kasih manado. Jurnal e-Gigi (eG) 2015; 3(1): 18-24.

[22] Mariyum S, Saleem N, Iqbal A, Iqbal S, Khattak M, Obaid S. A comparison between type-2 diabetics and non-diabetics in terms of papillary bleeding index (PBI). Journal of Gandhara Medical and Dental Sciences 2022; 9(1): 28-32.