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Dental and Oral Health Knowledge in Elderly Type 2 Diabetes Mellitus Patients with Periodontitis Incidence in Surabaya - Indonesia

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ABSTRACT Type 2 Diabetes Mellitus (T2DM) is a chronic condition that affects various aspects of health, including dental and oral health. Diabetes and periodontitis are the most prevalent human diseases. Diabetes worsens the periodontal condition, but periodontitis also hampers glycemic control in diabetic patients. The study aimed to analyze the relationship between knowledge of oral health maintenance and the incidence of periodontitis among elderly patients with Type 2 Diabetes Mellitus (T2DM) at the Tanah Kalikedinding Health Center, Surabaya. The cross-sectional study involved 46 elderly participants diagnosed with T2DM. Data were collected using a dental and oral health maintenance knowledge questionnaire and the Community Periodontal Index of Treatment Needs (CPITN). The majority of respondents were women (73.9%) aged 60-70 years (91.3%), with most having only a junior high school education (47.8%). Knowledge levels were generally low, with 54.35% of respondents classified as having poor knowledge. Most respondents (80.4%) had severe periodontitis, as indicated by CPITN scores. The Pearson correlation test revealed no significant relationship between knowledge levels and CPITN scores ($r = -0.134$, $p = 0.374$), suggesting that knowledge about dental and oral health maintenance does not significantly influence the incidence of periodontitis in this sample. The findings emphasize the need for integrated interventions to improve oral health in elderly T2DM patients by enhancing knowledge, expanding access to care, and promoting healthy lifestyles. Addressing severe periodontitis in this population is vital to prevent systemic complications, reduce healthcare burdens, and guide policies that support routine screening, targeted education, and multidisciplinary management.

INDEX TERMS Knowledge, Dental and Oral Health, Periodontitis, Elderly Type 2 Diabetes Mellitus, Indonesia.

I. INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disorder characterized by elevated blood glucose levels due to insulin resistance and relative insulin deficiency. This condition not only affects systemic health but also has significant implications for oral and dental health, as evidenced by a growing body of research [1], [2], [3], [4]. Among the various oral health complications associated with T2DM, periodontal disease stands out as one of the most concerning. Both diabetes mellitus (DM) and periodontitis are among the most common chronic diseases affecting the global population.

There exists a bidirectional relationship between these two conditions. On one hand, poorly controlled diabetes can exacerbate the severity and progression of periodontal disease by altering the host immune response and increasing susceptibility to infections. On the other hand, the presence of chronic periodontitis can negatively impact glycemic control in individuals with diabetes, thus creating a vicious cycle that complicates disease management [5], [6], [7]. The pathophysio-logical mechanisms linking T2DM and periodontal disease underscore the importance of integrated care approaches that consider both systemic and oral health in diabetic patients.

A growing body of research has consistently demonstrated that individuals diagnosed with Type 2 Diabetes Mellitus (T2DM) face a significantly higher risk of developing periodontitis, a chronic inflammatory condition affecting the gums and supporting tissues of the teeth [8], [9], [10]. Among elderly individuals with T2DM, one of the most critical risk factors contributing to the incidence of periodontitis is poor glycemic control. When blood glucose levels remain consistently high, it can impair the body's immune response, making it less effective in combating infections, including those in the oral cavity [11], [12], [13]. Moreover, hyperglycemia leads to the accumulation of advanced glycation end-products (AGEs), which stimulate the release of pro-inflammatory cytokines and exacerbate the destruction of periodontal tissues[11], [12], [13]. As a result, elderly patients with uncontrolled diabetes often exhibit more severe periodontal symptoms, such as increased pocket depth, clinical attachment loss, and bleeding on probing [11], [12], [13]. Additionally, inadequate oral hygiene practices and limited knowledge regarding proper dental and oral care

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further increase the likelihood of developing periodontitis in this group [14], [15].

In Indonesia, the prevalence of T2DM continues to rise steadily, with the elderly being the most vulnerable segment of the population [16], [17]. This is particularly concerning because aging itself already increases susceptibility to various chronic conditions, including oral health problems [16], [17]. Local data obtained from the Tanah Kalikedinding Health Center in Surabaya reveal that a considerable portion of the elderly population in the area suffers from T2DM and is consequently at a high risk of developing periodontitis. However, the level of knowledge among these individuals regarding dental and oral health maintenance is often low, which may contribute to poor oral hygiene behaviors and, consequently, a higher prevalence of periodontitis in this group.

By gaining a clearer understanding of the correlation between knowledge levels and the occurrence of periodontal disease, healthcare professionals and policymakers can design more effective health education interventions aimed at improving oral hygiene practices. The ultimate goal is to enhance the dental and oral health status of elderly individuals with T2DM and to help reduce the incidence and severity of periodontitis in this vulnerable group. Therefore, this study aims to analyze the relationship between the level of knowledge about dental and oral health maintenance and the incidence of periodontitis among elderly individuals with T2DM at the Tanah Kalikedinding Health Center in Surabaya.

II. METHOD

A. STUDY DESIGN AND RATIONALE

This research is an analytical survey study using a cross-sectional design, which examines the dynamics of the correlation between risk factors and outcomes. The study is conducted by collecting data from the population at a specific point in time (point in time approach) [18].

B. STUDY SETTING

This study adopted a cross-sectional analytical design and was conducted in the service area of the Tanah Kalikedinding Health Center, Surabaya, during the period from February 1 to March 31, 2024. The research activities encompassed several phases, including preparation, implementation, data collection, and data analysis. The study site was selected based on considerations of accessibility and the presence of respondents relevant to the research objectives.

C. PARTICIPANTS AND SAMPLING METHOD

The study population comprised elderly individuals diagnosed with Type 2 Diabetes Mellitus (T2DM) who were registered at the Tanah Kalikedinding Health Center. A total of 46 participants, aged between 60 and 70 years, were included in the sample. Participants were selected through purposive sampling based on specific inclusion criteria. Eligible participants were those in generally good health, cooperative, free from communication impairments, and who had provided informed consent to participate in the study.

Exclusion criteria included individuals who were uncooperative or declined to participate (i.e., did not sign the informed consent form), those without a confirmed T2DM diagnosis, completely edentulous individuals, and those who were acutely ill at the time of data collection. This study utilized two primary instruments, one of which was a Dental and Oral Health Maintenance Knowledge Questionnaire. This instrument was designed to assess respondents' knowledge regarding proper dental and oral hygiene practices. The level of knowledge was categorized into three levels: good, moderate, and poor. Community Periodontal Index of Treatment Needs (CPITN) [19] used to assess the severity of periodontitis in the elderly. The CPITN score is divided into five categories: 0 (healthy), 1 (gingivitis), 2 (mild periodontitis), 3 (moderate periodontitis), and 4 (severe periodontitis).

D. DATA COLLECTION INSTRUMENTS AND PROCEDURE

Data collection in this study was conducted through the administration of a knowledge questionnaire and a clinical examination for periodontitis using the Community Periodontal Index of Treatment Needs (CPITN). The process was carried out in two stages: the first stage involved interviews to obtain information regarding participants' knowledge of dental and oral health maintenance, and the second stage consisted of a clinical examination to assess periodontal status and determine the CPITN score. The estimated total time required for each participant to complete both stages was approximately 40 minutes.

E. DATA ANALYSIS

Data analysis was performed using the Spearman rank correlation test with SPSS (Statistical Product and Service Solutions) for Windows. Statistical analyses are employed to test hypotheses and draw conclusions from research data, enabling researchers to identify patterns, relationships, or differences within the findings. In this study, the correlation test was selected to assess the strength and direction of the relationship between two variables: participants' knowledge of dental and oral health maintenance and their Community Periodontal Index of Treatment Needs (CPITN) scores. As both variables were measured on an ordinal scale, the non-parametric Spearman rank correlation test was deemed the most appropriate analytical method. Table X presents the interpretation guidelines for the Spearman correlation coefficient.

F. ETHICAL CONSIDERATIONS

This research has obtained ethical feasibility from the Ethics Commission of the Surabaya Ministry of Health Poltekkes (number: EA/2950/KEPK-Poltekkes_Sby/V/2024). All participants were fully informed the study's purpose and procedures, subsequently signed the informed consent form. The research complied with ethical guidelines for vulnerable groups, guaranteeing the anonymity and confidentiality, participants were allowed to discontinue at any time without facing any consequences or risks.

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III. RESULTS

According to the information presented in TABLE 2, the majority of respondents showed poor knowledge about dental and oral health maintenance, with more than half of the respondents (54.35%) falling into the category of poor knowledge. Good knowledge of dental and oral health is important for the prevention of periodontal disease and the maintenance of overall oral health. Although there are some respondents with good knowledge, the majority still need to improve their understanding.

TABLE 1
Characteristics Respondent's Knowledge of Dental and Oral Health with Periodontitis in the Elderly with Type 2 Diabetes in Surabaya – Indonesia

Gender	**Frequency**	**%**
Man	12	26,1
Woman	34	73,9
Age	**Frequency**	**%**
60 – 70	42	91,3
71 – 80	4	8,7
Last Education	**Frequency**	**%**
No	2	4,3
Elementary School	22	47,8
Junior	10	21,7
High School	9	19,6
Academic	3	6,5
Level of Knowledge	**Frequency**	**%**
Good	8	17,4
Medium	20	43,5
Less	18	39,1
CPITN Score	**Frequency**	**%**
0	0	0
1	0	0
2	0	0
3	9	19,6
4	37	80,4

TABLE 2
Respondents' Knowledge About Maintaining Dental and Oral Health

Questionnaire	**Number of Correct Answers**	**Number of Wrong Answers**	**Percentage of Wrong Answers (%)**	**Percentage of Correct Answers (%)**
Proper brushing time	11	35	76	24
To maintain dental and oral health	32	14	30	70
How often to brush your teeth in a day	38	8	17	83
Duration of brushing	19	27	59	41
The correct way to brush your teeth	34	12	26	74
The tongue also needs to be brushed	37	9	20	80
Toothbrush position	9	37	80	20
Brushing your teeth should not be too hard	34	12	26	74
Gargling after brushing your teeth	5	41	89	11
Recommended ingredients in toothpaste	32	14	30	70
Function of fluoride in toothpaste	34	12	26	74
If you don't brush your teeth regularly	17	29	63	37
Foods that contain sugar and acids	2	44	96	4
Foods that can be healthy for teeth	20	26	57	43
The right time to replace the toothbrush	34	12	26	74
Diseases that often occur in the oral cavity	34	12	26	74
Effects of dental plaque that builds up and hardens	5	41	89	11
Dental control needs to be done at least once every six months	23	23	50	50
Causes of plaque on teeth	1	45	98	2
Which parts of the teeth should be brushed	1	45	98	2

TABLE 3
Cross-tabulation Knowledge of Dental and Oral Health with Periodontitis in the Elderly with Type 2 Diabetes in Surabaya – Indonesia

Level of Knowledge	**CPITN Score**					**f**	**%**
	0	**1**	**2**	**3**	**4**		
Good	0	0	0	3	5	8	17,4
Keep	0	0	0	3	17	20	43,5
Less	0	0	0	3	15	18	39,1
Total	0	0	0	9	37	46	100,0

TABLE 4
Analysis of the Relationship between Knowledge of Dental and Oral Health Maintenance of Elderly with T2DM and the Incidence of Periodontitis at the Tanah Kalikedinding Health Center, Surabaya in 2024

	CPITN score of the elderly with T2DM
Knowledge of Dental and Oral Health Maintenance for Elderly Patients with T2DM	r = –0,134 ρ = 0,374 (>0,05) n = 46

The frequency distribution of respondent characteristics showed that the majority were women (73.9%) with the age of 60-70 years (91.3%). The last education of the majority was junior high school (47.8%). The level of knowledge is mostly in the moderate category (43.5%). The CPITN score showed that the majority of respondents experienced severe periodontitis (80.4%). Relationship Analysis The results of the Pearson correlation test showed that there was no significant relationship between the level of knowledge of dental and oral health maintenance and the CPITN score (r = -0.134, p = 0.374). This suggests that knowledge of the maintenance of dental and oral health did not significantly affect the incidence of periodontitis in this study sample.

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IV. DISCUSSION

A. KNOWLEDGE OF ORAL AND DENTAL HEALTH MAINTENANCE IN ELDERLY INDIVIDUALS WITH TYPE 2 DIABETES MELLITUS (T2DM)

Based on the results of this study on elderly individuals with type 2 diabetes mellitus (T2DM) at the Tanah Kalikedinding Public Health Center in Surabaya, the level of knowledge regarding oral and dental health maintenance was categorized as moderate. This finding aligns with previous research by [20], [21], [22] also reported that most elderly respondents fell into the moderate knowledge category concerning oral hygiene practices.

Further analysis of the data indicated that many respondents demonstrated inadequate knowledge about proper oral health care, as reflected in their incorrect responses to basic questions such as the appropriate time to brush teeth, the effective duration of brushing, correct brushing techniques, and the recommended frequency of rinsing after brushing. The majority of respondents were elementary school graduates, indicating that educational attainment plays a significant role in influencing health knowledge. As noted by [18], education is a key factor affecting an individual's level of knowledge.

In addition to educational background, physical limitations such as joint stiffness or fatigue from walking, can hinder elderly individuals from accessing dental services regularly, thereby limiting their exposure to updated oral health information. Sensory impairments, including declining vision and hearing, further restrict the elderly from effectively receiving and processing information. Cognitive decline, such as dementia, which is common in the elderly, can also affect their memory and application of oral health knowledge. Interview findings revealed that the lack of accessible sources of education, such as schools, healthcare services, and mass media—also contributes to the limited knowledge among elderly individuals with T2DM.

B. LEVEL OF KNOWLEDGE ABOUT DENTAL AND ORAL HEALTH

The findings of this study on elderly individuals with type 2 diabetes mellitus (T2DM) at the Tanah Kalikedinding Public Health Center in Surabaya revealed that the highest proportion of respondents had periodontal pockets deeper than 6 mm. This result is supported by previous studies conducted by [23], [24], [25], which reported that most respondents diagnosed with diabetes mellitus exhibited a severe level of periodontal disease, with an average CPITN score of 4, indicating pockets greater than 6 mm. The relevance of these prior findings is strongly reflected in the present study, where most elderly T2DM respondents were found to have deep periodontal pockets. This indicates a serious issue within the periodontal tissues that requires appropriate medical intervention. However, many elderly individuals with this condition rarely undergo routine dental check-ups at community health centers. During interviews, a common obstacle identified was limited access to healthcare facilities. Many elderly patients depend on family members for transportation, and often, no one is available to accompany them, making it difficult for them to obtain essential dental information and care.

In addition, a lack of understanding about the importance of regular dental check-ups was also observed. Many elderly individuals with T2DM tend to prioritize blood glucose monitoring over oral health, under the assumption that losing teeth (edentulism) eliminates the need for dental examinations. This misperception overlooks the fact that oral and dental health problems can significantly impact overall health and glycemic control. Poor oral hygiene and untreated periodontal disease may contribute to systemic inflammation, which complicates diabetes management.

C. RELATIONSHIP BETWEEN KNOWLEDGE AND CPITN SCORE

The findings of this study on elderly individuals with type 2 diabetes mellitus (T2DM) at the Tanah Kalikedinding Public Health Center in Surabaya revealed that the highest percentage of respondents had a moderate level of knowledge, deep periodontal pockets, and only elementary school-level education. Statistical analysis showed that there was no significant relationship between oral and dental health knowledge and the incidence of periodontitis among elderly T2DM patients in this setting, as the null hypothesis (H_0) was accepted and the alternative hypothesis (H_1) was rejected.

These findings are consistent with research by [26], who reported that there was no significant influence of knowledge on the incidence of periodontitis. Similarly,[27] found no correlation between knowledge and oral hygiene status among individuals with diabetes mellitus. In the current study, respondents demonstrated poor understanding of oral health maintenance. This was evident from the high number of respondents who were unable to correctly answer several questionnaire items. Many believed that dental plaque was caused by low-quality toothpaste, whereas in fact, plaque is the result of bacterial accumulation that hardens over time. Most respondents brushed their teeth only in the morning while bathing, despite recommendations brush after breakfast and before bedtime to effectively prevent enamel erosion and gingivitis[28][29].

Additionally, many respondents assumed that effective brushing lasted only 30–60 seconds, whereas the recommended duration is approximately 2 minutes. A majority were also unaware of the correct angle for brushing; the optimal brushing angle is 45 degrees. Many believed that irregular brushing would only lead to discomfort or bad breath, overlooking the fact that unremoved plaque can calcify into tartar (calculus), creating pockets in the gums that can lead to advanced gum inflammation and destruction of periodontal tissue and bone, a condition known as periodontitis. However, these findings contradict those of [20] who observed a significant relationship between oral health knowledge and periodontitis. Likewise, [20] found a correlation between knowledge and oral hygiene status among the elderly, noting that the better the knowledge, the better the oral hygiene outcomes.

Given the multifactorial influences on periodontitis in elderly T2DM patients, targeted interventions should address both behavioral and systemic barriers to oral health. Community-based oral health education programs, specifically designed for elderly individuals with diabetes, could focus on practical skills such as proper toothbrushing and interdental cleaning techniques, dietary modifications to reduce sugar intake, and smoking cessation support[30][31][32]. Integration of oral health counseling into routine diabetes care at primary health centers may improve

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patient awareness and encourage consistent preventive practices. Mobile dental clinics and home-visit services could be implemented to overcome accessibility challenges, particularly for patients with limited mobility or those living in underserved areas[33].

Future research should evaluate the effectiveness of such interventions through longitudinal or randomized controlled studies, measuring not only clinical periodontal outcomes but also sustained behavioral changes over time. Additionally, qualitative studies exploring patient perceptions, cultural beliefs, and barriers to care could inform the development of more tailored, culturally sensitive strategies. By combining educational, behavioral, and systemic approaches, healthcare providers can better manage periodontitis risk and improve overall health outcomes in this vulnerable population.

V. CONCLUSION

Based on the results of the study entitled "Oral and Dental Health Maintenance Among Elderly Individuals with Type 2 Diabetes Mellitus and the Incidence of Periodontitis: A Study at Tanah Kalikedinding Public Health Center, Surabaya", it can be concluded that the level of knowledge regarding oral and dental health maintenance among elderly individuals with T2DM at the Tanah Kalikedinding Public Health Center was categorized as moderate. The majority of respondents were found to have deep periodontal pockets measuring more than 6 mm, with a CPITN score of 4, indicating a severe condition of periodontal tissue. Furthermore, the results of the Spearman correlation test showed that there was no significant relationship between the level of knowledge on oral and dental health maintenance and the incidence of periodontitis among elderly individuals with T2DM in this setting.

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DATA AVAILABILITY

No datasets were generated or analyzed during the current study.

AUTHOR CONTRIBUTION

Dyah Harum Kartika designed and researched this study, also collected and analyzed the data. Ratih Larasati contributed to the development of education, also managed the implementation. Sunomo Hadi contributed to data analysis and suggested critical feedback the manuscript. All authors reviewed, revised, and approved the manuscript paper.

DECLARATIONS

The study has obtained ethical feasibility from the Ethics Commission of the Surabaya Ministry of Health Poltekkes [number: EA/2950/KEPK-Poltekkes_Sby/V/2024]. Informed consent paper was considered by the all respondents during the research process. The respondents anonimity were maintained for this entire study.

CONSENT FOR PUBLICATION PARTICIPANTS.

Consent for publication was given by all participants.

COMPETING INTERESTS

The authors declare no competing interests.

REFERENCE

[1] N. Kurinami *et al.*, "Reduced Number of Remaining or Healthy Teeth in Patients with Type 2 Diabetes Mellitus: A Cross-sectional Study Assessed by Dentists or Dental Hygienists in Japan," *Internal Medicine*, vol. 62, no. 7, pp. 9773–22, Apr. 2023, doi: 10.2169/internalmedicine.9773-22.

[2] S. Utami, H. Kusnanto, and D. Pramono, "Evaluation of dental caries status among elderly people with type 2 diabetes mellitus: A cross-sectional study," in *AIP Conference Proceedings*, 2024, p. 020012. doi: 10.1063/5.0216045.

[3] H. Khatri, "Dental Cavities in People with Type 2 Diabetes Mellitus: an Analysis of Risk Indicators," *Georgian Med News*, vol. 345, no. 12, pp. 140–145, 2023.

[4] S. A. López-Gómez *et al.*, "Factors Associated with Self-Report of Type 2 Diabetes Mellitus in Adults Seeking Dental Care in a Developing Country," *Int J Environ Res Public Health*, vol. 20, no. 1, p. 218, Dec. 2022, doi: 10.3390/ijerph20010218.

[5] R. D. Ridwan, W. S. Juliastuti, and R. D. Setijanto, "Effect of electrolyzed reduced water on Wistar rats with chronic periodontitis on malondialdehyde levels," *Dental Journal (Majalah Kedokteran Gigi)*, vol. 50, no. 1, p. 10, Mar. 2017, doi: 10.20473/j.djmkg.v50.i1.p10-13.

[6] A. Syaify, M. HNES, S. Sudibyo, and S. Suryono, "Calprotectin mRNA (MRP8/MRP14) expression in neutrophils of periodontitis patients with type 2 diabetes mellitus," *Dental Journal (Majalah Kedokteran Gigi)*, vol. 42, no. 3, p. 130, Sep. 2009, doi: 10.20473/j.djmkg.v42.i3.p130-133.

[7] I. Nathania, N. A. Harsas, Natalina, and F. M. Tadjoedin, "Relationship between the levels of awareness and knowledge of periodontitis in diabetic patients at a Dental Hospital during the COVID-19 pandemic," *Dental Journal (Majalah Kedokteran Gigi)*, vol. 56, no. 4, pp. 243–250, Sep. 2023, doi: 10.20473/j.djmkg.v56.i4.p243-250.

[8] P. kumar yadalam *et al.*, "Prediction of interactomic hub genes in PBMC cells in type 2 diabetes mellitus, dyslipidemia, and periodontitis," *BMC Oral Health*, vol. 24, no. 1, p. 385, Mar. 2024, doi: 10.1186/s12903-024-04041-y.

[9] Q. Ma, Y. Hu, H. Li, Y. Kuang, J. Li, and J. Song, "Developmental endothelial locus-1 promotes osteogenic differentiation and alveolar bone

e-ISSN:2808-6422; p-ISSN:2829-3037
Vol. 5 No. 5, pp. 214-220, October 2025

regeneration in experimental periodontitis with type 2 diabetes mellitus," *J Periodontal Res*, vol. 59, no. 2, pp. 355–365, Apr. 2024, doi: 10.1111/jre.13219.

[10] S.-Y. Lin, J.-S. Sun, I.-P. Lin, M.-C. Hung, and J. Z.-C. Chang, "Efficacy of adjunctive local periodontal treatment for type 2 diabetes mellitus patients with periodontitis: A systematic review and network meta-analysis," *J Dent*, vol. 148, p. 105212, Sep. 2024, doi: 10.1016/j.jdent.2024.105212.

[11] K. Torrungruang, P. Vathesatogkit, R. Mahanonda, and L. Thienpramuk, "Periodontitis and hypertension are linked through systemic inflammation: A 5-year longitudinal study," *J Clin Periodontol*, vol. 51, no. 5, pp. 536–546, May 2024, doi: 10.1111/jcpe.13942.

[12] E. Montero *et al.*, "Cross-sectional association between severe periodontitis and diabetes mellitus: A nation-wide cohort study," *J Clin Periodontol*, vol. 51, no. 4, pp. 368–379, Apr. 2024, doi: 10.1111/jcpe.13937.

[13] M. Liu, Y. Wu, J. Song, and W. He, "Association of Sleep Duration with Tooth Loss and Periodontitis: Insights from the National Health and Nutrition Examination Surveys (2005-2020)," *Sleep and Breathing*, vol. 28, no. 2, pp. 1019–1033, May 2024, doi: 10.1007/s11325-023-02966-2.

[14] P. Petropoulou, I. Kalemikerakis, E. Dokoutsidou, E. Evangelou, T. Konstantinidis, and O. Govina, "Oral Health Education in Patients with Diabetes: A Systematic Review," *Healthcare*, vol. 12, no. 9, p. 898, Apr. 2024, doi: 10.3390/healthcare12090898.

[15] A. F. Vera Veloz and A. M. Cleonares Borbor, "Description of oral health in older adults at the Gerontological Center 'Los Rosales' in Ecuador," *Salud, Ciencia y Tecnología*, vol. 4, p. 919, Apr. 2024, doi: 10.56294/saludcyt2024919.

[16] Z. Zahra, C. T. Ramadhani, T. Mamfaluti, S. R. Pamungkas, and S. Firdausa, "Association between depression and HbA1c levels in the elderly population with type 2 diabetes mellitus during COVID-19 pandemic," *Narra J*, vol. 2, no. 1, Apr. 2022, doi: 10.52225/narra.v2i1.51.

[17] S. Utami, H. Kusnanto, D. Pramono, N. Oktavia, and S. Puspita, "The Severity of Periodontitis in Elderly Patients with Type 2 Diabetes Mellitus: A Community-Based Study," *European J Gen Dent*, vol. 13, no. 02, pp. 099–104, May 2024, doi: 10.1055/s-0043-1776319.

[18] Notoatmodjo. S, "Metodologi penelitian kesehatan," 2018.

[19] S. BASHİRİAN *et al.*, "Assessment of the Community Periodontal Index of Treatment Needs (CPITN) in Pregnant Women Referring to the Health Centers in Arak, Iran," *Cumhuriyet Dental Journal*, vol. 25, no. 3, pp. 258–262, Oct. 2022, doi: 10.7126/cumudj.1112636.

[20] P. Solavide Br Sijabat *et al.*, "Hubungan Pengetahuan, Sikap, Dan Tindakan Lansia Dengan Status Kebersihan Gigi Dan Mulut (Tinjauan Pada Panti Sosial Tresna Werdha Di Kalimantan Selatan)," *Dentin Jurnal Kedokteran Gigi*, vol. IV, no. 2, 2020.

[21] B. Muhida, Isnanto, and H. Suharnowo, "Karakteristik dan Pengetahuan Lansia tentang Kesehatan Gigi dan Mulut di Dusun Koloran Kabupaten Probolinggo Tahun 2020," 2020.

[22] R. R. Riani, I. Hatta, and R. Hamdani, "Hubungan Pengetahuan, Sikap Dan Tindakan Terhadap Tingkat Karies Penderita Diabetes Melitus Tipe 2 Pada Lanjut Usia," *Dentin*, vol. VI, no. 3, 2022.

[23] V. D. Arifiana and N. Prandita, "Penatalaksanaan Periodontitis Kronik Pada Penderita Diabetes Mellitus," *STOMATOGNATIC - Jurnal Kedokteran Gigi*, vol. 16, no. 2, 2019, doi: 10.19184/stoma.v16i2.23093.

[24] L. Agustina, E. Sri, and C. Nugroho, "Perilaku Pemeliharaan Kesehatan Gigi dan Mulut dengan Status Periodontal Lansia Penderita Diabetes Melitus," *Jurnal Ilmiah Keperawatan Gigi (JIKG)*, vol. 5, 2024.

[25] Rts Rosmiati, I. Wiradona, and Supriyana, "Influence of Diabetes Mellitus Status To The Severity Of Periodontal Disease And Saliva PH On Diabetes Mellitus Patient at Puskesmas Pudak Payung Semarang," *Journal of Applied Health Management and Technology*, vol. 5, no. 2, 2023.

[26] T. Sugiarti *et al.*, "Kejadian Periodontitis Di Kabupaten Magelang," *Universitas Negeri Semarang*, vol. 1, no. 4, 2017.

[27] B. Sari, I. Halid, and P. Razi, "The relationship of knowledge and oral hygiene status in diabetes mellitus patients in Puskesmas Rawang Jambi," *Jurnal Kesehatan Gigi*, vol. 4, no. 1, 2017, doi: 10.31983/jkg.v4i1.2564.

[28] A. Llera-Fábregas, N. Pérez-Ríos, D. M. Camacho-Monclova, M. Ramirez-Vick, and O. M. Andriankaja, 'Diabetes self-care activities and perception and glycemic control in adult Puerto Rican residents with Type 2 Diabetes: The LLIPDS Study', *J. Public health Res.*, vol. 11, no. 4, 2022, doi: 10.1177/22799036221125337.

[29] T. H. Kwon, I. B. Lamster, and L. Levin, 'Current Concepts in the Management of Periodontitis', *Int. Dent. J.*, vol. 71, no. 6, pp. 462–476, 2021, doi: 10.1111/idj.12630.

[30] P. M. Preshaw *et al.*, 'Treatment of periodontitis reduces systemic inflammation in type 2 diabetes', *J. Clin. Periodontol.*, vol. 47, no. 6, pp. 737–746, 2020, doi: 10.1111/jcpe.13274.

[31] H. Ateeq, A. Zia, Q. Husain, M. S. Khan, and M. Ahmad, 'Effect of inflammation on bones in diabetic patients with periodontitis via RANKL/OPG system-A review', *J. Diabetes Metab. Disord.*, vol. 21, no. 1, pp. 1003–1009, 2022, doi: 10.1007/s40200-021-00960-7.

[32] M. Mata-Monterde, A. Serrano-Valcarce, P. J. Almiñana-Pastor, P. Micó-Martínez, and A. López-Roldán, 'miRNAs as Epigenetic Biomarkers in the Study of the Bidirectional Relationship between Type 2 Diabetes Mellitus and Periodontitis: A Systematic Review', *Int. J. Mol. Sci.*, vol. 25, no. 19, 2024, doi: 10.3390/ijms251910723.

[33] O. M. Andriankaja, R. Adatorwovor, A. Kantarci, H.

e-ISSN:2808-6422; p-ISSN:2829-3037
Vol. 5 No. 5, pp. 214-220, October 2025

Hasturk, L. Shaddox, and M. A. Levine, 'Periodontal Disease, Local and Systemic Inflammation in Puerto Ricans with Type 2 Diabetes Mellitus', *Biomedicines*, vol. 11, no. 10, pp. 1–15, 2023, doi: 10.3390/biomedicines11102770.