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Lack of Association between Gender, Age, and Severity of Periodontitis in Type 2 Diabetic Patients: A Cross-Sectional Study in Banjarbaru, Indonesia

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Abstract: Periodontal disease is more prevalent and severe in patients with type 2 diabetes mellitus. This study aimed to describe periodontal status and examine its association with gender and age among diabetic patients enrolled in the Prolanis program. A cross-sectional analytical survey was conducted on all 65 Prolanis participants with confirmed type 2 diabetes mellitus at Banjarbaru Selatan Community Health Center, Indonesia. Periodontal status was assessed using the Community Periodontal Index of Treatment Needs (CPITN). Severity was dichotomized as not severe (score 0–2) and severe (score 3–4). Associations with gender and age groups were tested using chi-square tests ($\alpha = 0.05$). Participants were predominantly female (84.6%) with a mean age of 58 years. Severe periodontitis (pocket ≥4 mm) was found in 63.1% of patients. No significant association was observed between periodontal disease severity and gender ($p = 0.733$) or age group ($p = 0.114$). A high burden of moderate-to-severe periodontitis exists among diabetic patients in the Prolanis program, irrespective of gender or age. Regular periodontal screening and integrated diabetes–oral health management are strongly recommended.

Keywords: Community periodontal index of treatment needs; Cross-sectional study; Diabetes mellitus; Gender; Indonesia; Periodontal disease; Prolanis

Introduction

Periodontal disease is a chronic inflammatory condition that affects the supporting tissues of the teeth and remains a significant global public health issue. Its strong and well-established association with diabetes mellitus has been extensively documented across epidemiological, clinical, and mechanistic studies. Diabetes—particularly type 2 diabetes mellitus (T2DM)—is recognized as one of the most influential systemic risk factors for the initiation and progression of periodontal tissue destruction, with diabetic individuals experiencing a higher prevalence, severity, and rate of periodontal breakdown than non-diabetic populations (Fitriana et al., 2023; C.-Z. Wu et al., 2020; Zheng et al., 2021). Meta-analyses consistently demonstrate that individuals with diabetes have approximately double the risk of developing periodontitis, and this risk increases in the presence of poor glycemic control (Negrato et al., 2013).

Mechanistically, diabetes accelerates periodontal destruction through multiple pathways, including chronic hyperglycemia, oxidative stress, and the accumulation of advanced glycation end-products (AGEs), which amplify inflammatory signaling and impair host immune defense (Graves et al., 2020; Y. Y. Wu et al., 2015). Levated levels of pro-inflammatory cytokines such as IL-1β, TNF-α, and IL-6 result in exaggerated periodontal inflammation, reduced tissue healing, and increased alveolar bone loss. Furthermore,

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diabetes-induced alterations in neutrophil function, fibroblast activity, and oral microbiome composition further exacerbate periodontal deterioration (Graziani et al., 2012; B. L. Mealey & Oates, 2006).

Importantly, the relationship between diabetes and periodontitis is bidirectional. While diabetes worsens periodontal status, periodontitis can also lead to systemic inflammation, contributing to poorer metabolic control and increased insulin resistance. Evidence shows that individuals with severe periodontitis have a significantly higher likelihood of poor glycemic control and increased risk of diabetes-related complications such as cardiovascular disease, nephropathy, and retinopathy (Enteghad et al., 2024; Nguyen et al., 2020; Păunică et al., 2023). Periodontal therapy has been shown to reduce HbA1c levels by 0.3–0.6% in many clinical trials, reinforcing the importance of integrated medical–dental care in diabetic populations (Buchwald et al., 2013; Schwendicke et al., 2017).

The clinical implications of this interrelationship are profound. Poorly controlled diabetes not only accelerates the progression of periodontal disease but also increases the risk of serious complications such as cardiovascular disease, nephropathy, neuropathy, and retinopathy. Studies consistently report that diabetic patients with periodontitis have higher rates of these complications and increased mortality compared to those without periodontal disease. This underscores the need for regular periodontal screening and proactive management in diabetic populations, as well as the importance of maintaining optimal glycemic control to reduce the burden of oral and systemic complications (Genco et al., 2020; Lalla & Papapanou, 2011).

Despite the wealth of evidence supporting the connection between diabetes and periodontal disease, several challenges remain. Variability in diagnostic criteria, differences in study populations, and the influence of confounding factors such as age, smoking, and oral hygiene practices can complicate data interpretation. Further research, particularly large-scale, prospective, and ethnically diverse studies, is needed to clarify the mechanisms linking these diseases and to determine the most effective strategies for prevention and treatment (Mealey & Oates, 2006; Negrato et al., 2013).

In summary, the interplay between diabetes mellitus and periodontal disease is well-established and clinically significant. Diabetes markedly increases the risk and severity of periodontal disease through mechanisms involving chronic inflammation, immune dysfunction, and altered bone metabolism. Conversely, periodontal disease can worsen glycemic control and contribute to the development and progression of diabetes-related complications. Effective management of both conditions requires a collaborative, multidisciplinary approach that emphasizes prevention, early detection, and integrated care. By addressing both oral and systemic health, healthcare providers can help reduce the burden of these interrelated chronic diseases and improve quality of life for affected individuals (Graves et al., 2020; Wu et al., 2015).

Method

This study used an analytical cross-sectional design, which is widely applied in epidemiological investigations assessing associations between periodontal status and systemic conditions such as diabetes mellitus (Albandar, 2002; Kassebaum et al., 2014) was conducted from June to August 2024 at the Banjarbaru Selatan Community Health Center (Puskesmas Banjarbaru Selatan), Banjarbaru City, South Kalimantan Province, Indonesia. This primary health center serves as one of the main facilities implementing the Prolanis (Program Pengelolaan Penyakit Kronis – Chronic Disease Management Program) under the Indonesian National Health Insurance (BPJS Kesehatan.

The target population consisted of all patients with confirmed type 2 diabetes mellitus enrolled in the Prolanis program at the study site. Total population sampling is recommended in small, accessible cohorts to minimize selection bias and ensure full representation of the target population (Bennadi & Reddy, 2013), whereby all 67 active Prolanis members who met the inclusion criteria were invited to participate. Two patients declined participation, resulting in a final sample of 65 participants (response rate 97%).

Inclusion criteria consisted of a confirmed diagnosis of T2DM, age ≥18 years, active participation in the Prolanis program, and informed consent. Exclusion criteria included systemic conditions other than diabetes that could affect periodontal status, such as immunosuppression, malignancy, or recent periodontal therapy. These criteria are consistent with recommendations in periodontal–diabetes research methodology to avoid confounding factors (D'Aiuto et al., 2013).

Periodontal status was assessed using the Community Periodontal Index of Treatment Needs (CPITN), a standardized WHO-endorsed tool for community-level surveys. The WHO probe was used to evaluate bleeding, calculus, and pocket depths across sextants. CPITN is widely used in epidemiological studies due to its simplicity, reliability, and suitability for large populations (Ababneh et al., 2012). For analytical purposes, periodontal severity was dichotomized into not severe (0–2) and severe (3–4), a common approach in population-based periodontal research (Susin et al., 2014).

Data analysis was conducted using the chi-square test to evaluate associations between gender, age, and periodontal severity. The chi-square test is commonly used for categorical data in periodontal research due to its robustness and interpretability (Kim, 2017). A significance level of $\alpha = 0.05$ was applied. When expected cell counts were insufficient, Fisher's exact test was used, following recommendations for small sample categorical analysis (Morgan, 2017). This methodological approach aligns with established protocols in periodontal–diabetes epidemiology and supports comparability with previous studies across global settings (Stadlinger et al., 2009). This study was approved by the Health Research Ethics Committee of Banjarbaru Selatan Community Health Center (No. 045/KEPK-PKBS/VIII/2024). All participants provided written informed consent prior to examination

This methodological framework draws from similar cross-sectional studies examining periodontal disease in diabetic cohorts, incorporating total sampling and CPITN assessments for robust comparability. Adjustments for potential confounders, such as glycemic control (measured via recent HbA1c levels where available), were considered descriptively, though not included in primary analyses due to data limitations. Future iterations could integrate multivariate logistic regression for deeper insights, as seen in gender-specific investigations of periodontitis-diabetes links.

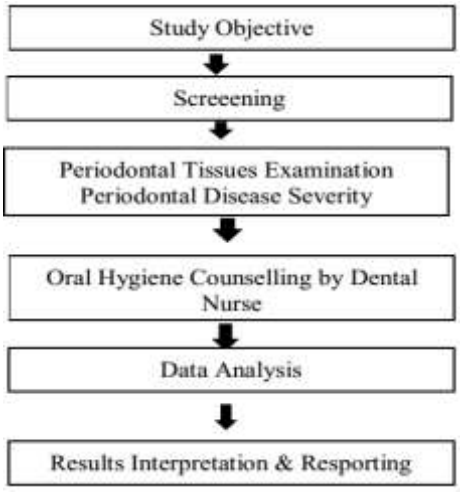

Figure 1. Research process flow diagram

Result and Discussion

Results

Participant Characteristics

A total of 65 patients with type 2 diabetes mellitus enrolled in the Prolanis program participated in this study. Based on the data, the following results were obtained:

Table 1. Frequency Distribution Based on Gender of the Prolanis Group of Diabetes Mellitus

CPITN score	N	%
Male	10	15.38
Female	55	84.62

The present study included 65 participants with type 2 diabetes mellitus enrolled in the Prolanis program. The majority were female (84.6%), and the mean age was 58 years. Based on CPITN assessment, 63.1% of participants demonstrated moderate-to-severe periodontal disease (scores 3–4), consistent with global reports showing high periodontal burden in diabetic populations (Su et al., 2018; Zhao et al., 2023).

Periodontal Status by Age Group

Table 2 presents the distribution of highest CPITN scores according to age group. The majority of participants in all age groups had CPITN scores of 2 or 3, indicating the widespread presence of calculus and shallow-to-moderate pockets.

Table 2. Based on Age Group and Periodontal Disease Status Score South of Banjarbaru City, South Kalimantan Province

Age Group	Highest score of periodontal disease					Total
	0	1	2	3	4	
26 – 35	1 (1.6%)	0	1 (1.6%)	0	0	2 (3.1%)
36 – 45	3 (4.7%)	0	0	0	0	3(4.62%)
46 – 55	6 (9.3%)	4 (6.2%)	10 (15.4%)	0	0	20 (30.8%)
56 – 65	3 (4.7%)	0	17 (26.2%)	5 (7.69%)	0	25(38.%)
66 – 75	6 (9.3%)	0	4 (6.2%)	4 (6.15%)	0	14 (21.6%)
76 – 85	1 (1.6%)	0	0	0	0	1(1.6%)
Total	20 (30.7%)	4 (6.2)	32 (49.3%)	9 (13.9%)	0	65 (100%)

Based on the Table 2 the 30-40 age group included 7 individuals, with the highest periodontal disease scores being 0 for 2 people and 2 for 5 people. The 41-50 age group consisted of 5 individuals, with scores of 0 for 2 people, 2 for 2 people, and 3 for 1 person. The 51-60 age group comprised 30 individuals, with scores of 0 for 2 people, 2 for 22 people, and 3 for 6 people. The 61-70 age group had 22 individuals, with scores of 0 for 3 people, 2 for 12 people, and 3 for 7 people. Lastly, the 71-80 age group featured 4 individuals, with scores of 0 for 2 people, 2 for 1 person, and 3 for 1 person, resulting in a total of 65 respondents.

Association between Gender and Periodontal Disease Severity

Severe periodontal disease (CPITN 3–4) was observed in 41 participants (63.1%). Chi-square test showed no significant association between gender and severe periodontal disease ($p = 0.733$) (Table 3).

Table 3. Chi- Square Test Results Gender of Diabetes Mellitus Patients with Periodontal Disease

Variable	Categories	Frequency	Df	P Value
Gender	Male	10	1	.733
	Female	55		
CIPTN	Not Severe	24		
	Severe	41		

The chi-square test results indicate no significant relationship between gender and periodontal disease severity (measured via CPITN) among 65 diabetes mellitus patients at South Banjarbaru Community Health Center, with 10 males (15.38%) and 55 females (84.62%), and CPITN scores categorized as not severe (24 individuals, 36.92%) or severe (41 individuals, 63.08%). The test yielded a p-value of 0.733 (df=1), exceeding α = 0.05, leading to acceptance of the null hypothesis (Ho) and rejection of the alternative hypothesis (Ha), suggesting gender does not influence periodontal disease severity in this cohort, possibly due to the skewed gender distribution or unmeasured factors like glycemic control.

The present study found no statistically significant association between gender and periodontal disease severity, despite a predominance of female participants. This diverges from multiple large-scale epidemiological studies showing that males generally present with more severe periodontitis, including among diabetic cohorts. For instance, Liu et al. reported that men with type 2 diabetes were significantly more likely to have moderate-to-severe periodontitis, even after controlling for age, education, smoking, and oral hygiene variables (Liu et al., 2018; Oates & Khandelwal, 2020; Wolff, 2014).

In contrast, other studies—particularly those incorporating detailed covariate control—have reported no gender difference, aligning more closely with the present findings. For example, Costa et al. found that periodontal severity in type 1 diabetic patients was primarily influenced by age, bleeding on probing, and smoking status rather than gender (Costa et al., 2025).

The current results suggest that gender alone may not be a reliable predictor of periodontal severity in diabetic populations—especially when the sample is gender-imbalanced—supporting the view that behavioral and systemic factors override gender-related biological differences (Bui et al., 2019; Fitriana et al., 2023; Leman, 2016; Llambés, 2015; López et al., 2017; Sima & Glogauer, 2013)

Association between Age Group and Periodontal Disease Severity

There was no statistically significant association between age group and severe periodontal disease (Fisher's exact test, p = 0.114) (Table 4).

Table 4. Chi- Square Test Results Age of Diabetes Mellitus Patients with Periodontal Disease Severity

Variable	Categories	Frequency	df	P Value
Age	Adults	5	2	.114
	Pre-Elderly	32		
	Elderly	28		
Ciptn	Not Severe	24		
	Severe	41		

Based on table 4, the p value in the Asymp. Sig (2 sided) = 0.114 with α = 0.05. Thus p < α then Ho is accepted and Ha is rejected. Although aging is consistently recognized as a contributing factor in periodontal deterioration, this study did not observe a statistically significant association between age group and disease severity. Nevertheless, comparisons with prior research highlight important contextual nuances.

Large population studies—such as the Fourth National Oral Health Survey in China—have demonstrated a strong age-related increase in both prevalence and severity of periodontitis, with severe cases rising from 10.6% among adults aged 35–44 to 43.5% among those aged 55–64 (Jiao et al., 2021).

Biologically, this trend is well-supported by the processes of immunosenescence and inflammaging, through which aging impairs immune responsiveness and increases systemic inflammatory load, leading to poorer periodontal tissue resilience (Ebersole et al., 2016).

Yet, the story is not entirely bleak. While the elderly face a higher risk, improvements in oral hygiene and dental care can help slow the progression of disease. Studies from various countries confirm that, despite the biological challenges of aging, maintaining good oral health habits and regular dental visits can make a significant difference. The narrative of age and periodontal disease, then, is shaped by both the inevitability of biological aging and the choices we make throughout life (Ebersole et al., 2016; Jiao et al., 2021; López et al., 2017).

Conclusion

This study showed that most Prolanis participants with type 2 diabetes experienced moderate-to-severe periodontitis, as indicated by CPITN scores of 3–4. The findings confirmed that gender and age were not significantly associated with periodontal disease severity, demonstrating that periodontal conditions in diabetic patients may deteriorate regardless of demographic factors. These results reinforce the high periodontal burden among diabetic individuals and suggest that diabetes itself is a major contributing factor to periodontal breakdown. In general, the results highlight the need to classify diabetic patients as a high-

risk group for periodontal problems. Therefore, regular periodontal screening, early identification of periodontal pockets, and integrated diabetes–oral health management should be prioritized in Prolanis and other chronic disease programs. Strengthening oral hygiene education and professional scaling practices is essential to prevent disease progression and support overall health management in diabetic populations.

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Author Contributions
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Conflicts of Interest
The authors declare no conflict of interest.

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