# Description of Periodontal Disease Risk Factors in Elderly and Older Adults with Diabetes Mellitus Comorbidity: A Case Study in Dukuh Kupang District, Surabaya City

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ORIGINAL ARTICLE

# Description of Periodontal Disease Risk Factors in Elderly and Older Adults with Diabetes Mellitus Comorbidity: A Case Study in Dukuh Kupang District, Surabaya City

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## ABSTRACT

**Introduction:** Diabetes mellitus (DM) is a chronic disease commonly found among elderly and older adults, and it is known to increase the risk of periodontal disease. At the Dukuh Kupang Public Health Center in Surabaya, DM is among the top ten most prevalent diseases, predominantly affecting older adults, with a high prevalence of periodontal problems reported in the same group. This study aimed to describe the risk factors of periodontal disorders among elderly and older adults with DM comorbidity based on the PRECEDE-PROCEED framework. **Methods:** A descriptive cross-sectional design was employed using questionnaires distributed to elderly and older adult patients with DM who reported periodontal complaints and consented to participate in the study. Data were analyzed using IBM SPSS Statistics for Windows. **Results:** The findings revealed that periodontal risk factors in this group were influenced by predisposing factors such as limited knowledge regarding oral health and diabetes, reinforcing factors including support from community health cadres and primary healthcare workers, and enabling factors such as the availability of elderly health post programs. Most respondents demonstrated suboptimal oral hygiene, with a considerable prevalence of gingivitis and periodontitis, alongside limitations in systemic disease self-management and oral health maintenance behaviors. **Conclusion:** This study highlights a strong interrelation between DM management behavior, oral hygiene practices, and sociodemographic factors in determining periodontal disease risk among elderly and older adults. The results emphasize the importance of behaviorally grounded health promotion interventions and improved oral health literacy to reduce the burden of periodontal disease in this vulnerable population.

**KEYWORDS**

Diabetes mellitus, periodontal disease, elderly, risk factors, oral hygiene

## INTRODUCTION

Diabetes mellitus (DM) is a chronic disease that is commonly found among the elderly and older adults.[1] According to the International Diabetes Federation (2021), the estimated number of people with diabetes worldwide in the 20–79 years age group was 536.6 million, and this figure is projected to reach 783.2 million by 2045. According to WHO data, in 2022 approximately 422 million people worldwide were living with diabetes. Based on data published by the World Health Organization (WHO), diabetes will be one of the top ten causes of death globally in 2022 (WHO, 2022). According to the Global Cardiovascular Risk Consortium (2023), the prevalence of diabetes mellitus in Asia was 5.1%.[2] The prevalence of diabetes mellitus in China was reported to be 24%.[3] In Malaysia, Akhtar et al. (2021) reported a prevalence of 18.3%.[4] In Indonesia, the prevalence of diabetes

mellitus in the population was 10.6%.[5–6] In East Java Province, diabetes mellitus cases were most common in the late elderly age group (56–65 years), accounting for 6.29%, with an observed increase in prevalence of 0.5%.[7] The prevalence of this disease in Surabaya City reached 94,076 cases in 2019.[8]

In a preliminary study, secondary data were obtained from a population of 1,936 elderly and older adults during the period of May 2023 to May 2024. It was found that diabetes mellitus was most prevalent in the older adult group (>65 years), with 762 patients (39.35%), followed by the late elderly group (56–65 years) with 710 patients (36.67%), and the early elderly group (46–55 years) with 464 patients (23.96%). From the total population, 162 individuals were also found to experience a double burden in the form of hypertension, with older adults (39.35%) ranking first. This situation requires particular attention since diabetes mellitus is among the top ten most prevalent diseases in the elderly population at Dukuh Kupang Primary Health Center during the May 2023–May 2024 period, with a total of 1,936 cases. The most common oral diseases recorded in Dukuh Kupang District in 2024 were pulpal and periapical diseases, dental caries, and periodontal disorders. Among the elderly and older adult groups, 515 patients (38.3%) were affected by pulpal and periapical diseases, 160 patients (18.4%) by dental caries, and 172 patients (15.9%) by periodontal disease. Data from the Global Burden of Disease study (1990–2010) showed that severe periodontitis was the sixth most prevalent disease globally (11.2%), affecting approximately 743 million people, with a 57.3% increase in prevalence over a 10-year period.[9] The prevalence of periodontitis in Indonesia remains high. Based on the RISKESDAS 2018 report, the percentage of periodontitis cases in Indonesia reached 74.1%.[10] An epidemiological study also found that the highest prevalence of periodontal disease occurred in the elderly population, at 82%.[11]

Several studies have shown that diabetes mellitus (both type 1 and type 2) is a risk factor for periodontitis, increasing the risk by approximately threefold compared to non-diabetic subjects, particularly among those with poor glycemic control.[12] Diabetes exacerbates inflammation in periodontal tissues due to elevated levels of inflammatory mediators such as interleukin-1β (IL-1β) and tumor necrosis factor-α (TNF-α). Periodontal disease is strongly associated with increased levels of inflammatory mediators (e.g., TNF-α) in individuals with diabetes. The accumulation of reactive oxidative species (ROS), oxidative stress, and the interaction of advanced glycation end products (AGEs) with their receptor (RAGE) within periodontal tissues all contribute to the heightened inflammatory response observed in diabetic patients.[13]

Diabetes is a well-established risk factor for periodontal disease, which may become more severe in individuals with poor glycemic control.[14] Multiple risk factors make patients with diabetes more susceptible to periodontal disease, particularly those with poor oral hygiene, inadequate metabolic control, and longer disease duration. These conditions contribute to damage of the supporting structures, potentially resulting in gingival recession, alveolar bone resorption, tooth mobility, and ultimately tooth loss. Such deterioration often causes discomfort during mastication. Both periodontal disease and diabetes are known to exert negative effects on quality of life. Patients with periodontal disease frequently experience functional limitations, pain, discomfort, and psychological distress, along with physical, emotional, and social impacts that impair their overall well-being. Similarly, diabetes has profound implications for health-related quality of life, particularly concerning physical, psychological, and social dimensions. Poor self-perception of oral health further influences the quality of life in patients with type 2 diabetes.[15]

Between May 2023 and May 2024, a total of 172 cases of gingivitis and periodontal disease were identified among the elderly. During the same period, 515 elderly individuals were reported to have pulpal and periapical disorders, which represent the early stages of infection that may progress into more serious conditions affecting the soft tissues, such as gingivitis and periodontal disease.

These 515 elderly individuals are therefore at risk of developing periodontal disease within a year if preventive measures are not taken. There is concern that this group may face a double burden of disease, particularly periodontal disease. Preventive strategies through the identification of potential diabetes mellitus risk factors must be implemented to reduce the likelihood of periodontal complications. Based on this background, in order to minimize the risk of an increasing double burden of disease and to assess the periodontal status of the elderly population at Dukuh Kupang Primary Health Center, an epidemiological study was conducted and recommendations were formulated for interventions to improve their periodontal health.

## METHODS

This study employed a descriptive observational design with a cross-sectional approach. The research was conducted at the Elderly Health Post (Posyandu Lansia) of Dukuh Kupang Primary Health Center, Surabaya, from June 4 to June 7, 2024. The study population consisted of all elderly and older adults with diabetes mellitus comorbidity in the service area of Dukuh Kupang Primary Health Center. A total of 33 respondents were selected using purposive sampling based on the following inclusion criteria: (1) elderly and older adults diagnosed with diabetes mellitus, (2) presenting with periodontal complaints, and (3) willing to participate in the study through informed consent. The research instrument consisted of a structured questionnaire covering sociodemographic characteristics, periodontal risk factors (predisposing, reinforcing, and enabling factors), and oral hygiene behaviors. Data were collected through direct interviews conducted by the researcher. Quantitative descriptive analysis was performed using IBM SPSS Statistics for Windows, and the results were presented in frequency distribution tables and percentages. The characteristics of respondents are presented in Table 1.

**Table 1. Characteristics of respondents**

| Characteristics | Frequency (n=33) | Percentage (%) |
|---|---|---|
| **Gender** | | 33.3% |
| Male | 11 | 66.7% |
| Female | 22 | |
| **Age group** | | |
| Early elderly (46-55 th) | 8 | 24.2% |
| Late elderly (56-65 th) | 13 | 39.4% |
| Older adults (>65 th) | 12 | 36.4% |
| **Educational level** | | |
| No formal education | 1 | 3% |
| Elementary school or equivalent | 15 | 45.5% |
| Junior high school or equivalent | 8 | 24.2% |
| Senior high school or equivalent | 7 | 21.2% |
| Diploma/Bachelor's degree or higher | 2 | 6.1% |
| **Occupation** | | |
| Employed | 7 | 21.2% |
| Unemployed | 26 | 78.8% |

## RESULTS

A total of 33 respondents consisting of elderly and older adults with diabetes mellitus comorbidity were successfully interviewed. The majority of respondents were female (66.7%), with the largest age group being late elderly (56–65 years, 39.4%). Most respondents had a low level of education (elementary school or equivalent, 45.5%) and were unemployed (78.8%) (Table 1).

The majority of respondents demonstrated suboptimal oral hygiene conditions. Most plaque index scores fell within the moderate to high categories, with the prevalence of gingivitis and periodontitis being more dominant among older age groups and those with lower educational levels.

Analysis of the distribution of periodontal risk factors showed that female respondents experienced more periodontal risk factors compared to males. By age group, late elderly (56–65 years) had the highest proportion of periodontal risk factors. In terms of education, respondents with a low educational background (elementary school or equivalent) represented the largest proportion, while in terms of occupation, unemployed respondents were more likely to present periodontal risk factors than those who were employed (Table 2).

**Table 2. Distribution of periodontal risk factors by sociodemographic characteristics**

| Characteristics | Moderate (%) | High (%) | Total (%) |
|---|---|---|---|
| **Gender** | | | |
| Male | 5(29.4%) | 6 (37.5%) | 11 (33.3%) |
| Female | 12 (70.6%) | 10 (62.5%) | 22 (66.7%) |
| **Age group** | | | |
| Early elderly (46-55 th) | 5 (29.4%) | 3 (18.8%) | 8 (24.2%) |
| Late elderly (56-65 th) | 7 (41.2%) | 6 (37.5%) | 13 (39.4%) |
| Older adults (>65 th) | 5 (29.4%) | 7 (43.8%) | 12 (36.4%) |
| **Educational level** | | | |
| No formal education | 1 (5.9%) | 0 (0%) | 1 (3%) |
| Elementary school or equivalent | 6 (35.3%) | 9 (56.3%) | 15 (45.5%) |
| Junior high school or equivalent | 5 (29.4%) | 3 (18.8%) | 8 (24.2%) |
| Senior high school or equivalent | 4 (23.5%) | 3 (18.8%) | 7 (21.2%) |
| Diploma/Bachelor's degree or higher | 1 (5.9%) | 1 (6.3%) | 2 (6.1%) |
| **Occupation** | | | |
| Employed | 2 (11.8%) | 5 (31.3%) | 7 (21.2%) |
| Unemployed | 15 (88.2%) | 11 (68.8) | 26 (78.8%) |

In addition to the distribution by sociodemographic characteristics, the overall analysis indicates that periodontal risk is divided relatively evenly between the moderate (51.5%) and high (48.5%) categories (Table 3).

**Table 3. Percentage of respondents by periodontal disease risk**

| Risk category | Frequency (N) | Percentage (%) |
|---|---|---|
| Moderate | 17 | 51.5% |
| High | 16 | 48.5% |
| Total | 33 | 100% |

The oral examination revealed varied health conditions. Most respondents had healthy lips (69.7%), whereas the tongue was predominantly in a transitional condition (60.6%). Most respondents also ranged from transitional to diseased status for the teeth and oral mucosa (66.6%), with 12.1% already classified as diseased. Healthy teeth were observed in only 9.1% of respondents, while more than half (54.5%) were in the diseased category. Overall oral hygiene was relatively poor, with 39.4% of respondents classified as diseased. Although most respondents did not experience tooth pain (78.8% healthy), about one-third had tooth mobility (33.3%), underscoring the association between poor diabetes control and periodontal health (Table 4).

**Table 4. Distribution of respondents' periodontal disease risk factors**

| Oral cavity condition | Healthy n (%) | Transitional n (%) | Diseased n (%) | Total n (%) |
|---|---|---|---|---|
| Lips | 23 (69.7%) | 10 (30.3%) | 0 | 33 (100%) |
| Tongue | 13 (39.4%) | 20 (60.6%) | 0 | 33 (100%) |
| Teeth and oral mucosa | 11 (33.3%) | 18 (54.5%) | 4 (12.1%) | 33 (100%) |
| Saliva | 20 (60.6%) | 11 (33.3%) | 2 (6.1%) | 33 (100%) |
| Teeth condition | 3 (9.1%) | 12 (36.4%) | 18 (54.5%) | 33 (100%) |
| Dentures | 3 (9.1%) | 2 (6.1%) | 0 | 5 (15.2%) |
| Oral hygiene | 3 (9.1%) | 17 (51.5%) | 13 (39.4%) | 33 (100%) |
| Tooth pain | 26 (78.8%) | 7 (21.2%) | 0 | 33 (100%) |
| Tooth mobility | 22 (66%) | 0 | 11 (33.3%) | 33 (100%) |

Most respondents had plaque index scores above the mean (60.6%), whereas only 39.4% were below the mean. By age group, the proportion with plaque scores ≥ the mean was higher among the late elderly (69.2%) and the oldest-old (66.7%) than among the early elderly (37.5%). These findings suggest that increasing age is associated with a greater likelihood of dental plaque accumulation, which can elevate the risk of periodontal disease (Table 5).

**Table 5. Distribution of respondents' plaque index scores**

| Plaque score category | Frequency | Percentage (%) | Early elderly n (%) | Late elderly n (%) | Oldest-old n (%) |
|---|---|---|---|---|---|
| Below the mean | 13 | 39.4% | 6 (75%) | 6 (42.2%) | 5 (41.7%) |
| Above the mean | 20 | 60.6% | 2 (25%) | 7 (53.8%) | 7 (58.3%) |

Most respondents had **poor oral hygiene management** (97%); only one person (3%) had **adequate** management, and none were classified as **good** (Table 6).

**Table 6. Distribution of respondents' oral hygiene management**

| Oral hygiene management category | Frequency (n) | Percentage (%) |
|---|---|---|
| Good | 0 | 0 (%) |
| Adequate | 1 | 3 (%) |
| Poor | 32 | 97 (%) |

## DISCUSSION

This study aimed to describe periodontal risk factors and oral-health behaviors among older adults and the oldest-old with diabetes mellitus in the service area of Puskesmas Dukuh Kupang, Surabaya, involving 33 respondents recruited from various *posyandu lansia* (community elderly health posts). The findings show that most respondents had primary-level education (elementary school or equivalent). Community knowledge about diabetes mellitus is crucial as a foundation for shaping preventive behaviors. This is consistent with the literature indicating that education contributes to increased knowledge and the adoption of healthy behaviors. Conversely, low educational attainment can limit understanding of health information, including the management of chronic diseases such as diabetes mellitus.[13-14]

Respondent characteristics also showed that most were unemployed and the majority were homemakers (IRT). This finding is consistent with previous studies reporting a predominance of homemakers among older adults with diabetes mellitus. Physical activity in this group tended to be light or even limited by age-related factors, thereby increasing the risk of type 2 diabetes. Insufficient physical activity can cause an energy imbalance that contributes to insulin resistance and metabolic complications. The literature likewise affirms that individuals with low

levels of physical activity have a higher risk of developing diabetes than those who are regularly active.[15]

The oral examination showed that most respondents had high plaque scores, with a maximum plaque index of 18, indicating poor oral hygiene in the majority. Older adults are more susceptible to periodontal infection due to age-related decline in immune function. Disrupted host immunity and suboptimal dietary choices can allow the hundreds of bacterial species in dental plaque to grow beyond homeostatic limits; recurrent episodes may trigger periodontitis.[16] In patients with diabetes mellitus, poor glycemic control and increased formation of advanced glycation end-products (AGEs) induce oxidative stress in the gingiva, which gradually damages periodontal tissues. Elevated inflammatory cells in the gingival crevicular fluid likewise render the periodontium more vulnerable to infection and drive alveolar bone loss. In addition to impairing leukocyte function, diabetes-related microvascular thickening limits nutrient delivery. Slower blood flow reduces the body's capacity to control infection, thereby worsening periodontitis in people with diabetes.[17]

According to Lawrence Green (1991), two broad groups of determinants influence a person's health behavior: behavioral factors and non-behavioral factors. Behavioral factors are shaped by three components: predisposing factors, reinforcing factors, and enabling factors. Predisposing factors include a person's knowledge, attitudes, and perceptions. Reinforcing factors include social, family, and community support. Enabling factors include health facilities and personnel, as well as the accessibility and affordability of health resources.[18] In this study, the DSMBQ was used, which includes items encompassing predisposing, reinforcing, and enabling factors. The results show that most respondents were in the adequate category; however, many were still nonadherent in regulating diet, taking medication regularly, and engaging in physical exercise. This low level of adherence is likely related to respondents' limited knowledge and educational attainment. Reinforcing factors, such as family support, played an important role in improving adherence: patients who received support were more consistent in managing their disease than those with limited support. Meanwhile, enabling factors, such as the availability of *posyandu lansia* (elderly health posts), routine check-ups, and health education programs had not been fully utilized by the respondents.

In the domain of oral health, the findings indicate low health behaviors, with nearly all respondents falling into the poor category. Most did not brush their teeth twice daily, did not use mouthwash, and rarely visited a dentist. Limited education from healthcare workers and *posyandu* cadres is one reason for the low awareness of the importance of oral hygiene. Previous studies affirm that effective oral health education can improve correct toothbrushing behavior and reduce the risk of caries and periodontitis.[19-20] Therefore, more structured and sustained educational interventions are needed.

Overall, the findings of this study strengthen the evidence for a close association between diabetes mellitus and periodontal disease. Older adults with diabetes mellitus are not only at high risk of systemic complications but are also more susceptible to periodontal tissue damage due to hyperglycemia, chronic inflammation, and vascular impairment. Low levels of education, physical activity, and self-care behaviors further exacerbate this condition. Therefore, a holistic approach is needed that includes health education, enhanced family support, and optimization of the role of *posyandu lansia* to improve the quality of life of older adults with diabetes mellitus.

## CONCLUSION

Based on this study, it can be concluded that among patients with periodontal disease and comorbid diabetes mellitus, the predominant sociodemographic profile comprised late elderly individuals, women, those with primary-school

education (or equivalent), and those who were unemployed. The data also indicate that most respondents achieved adequate DSMBQ scores and demonstrated adequate oral-hygiene management. Several determinants (predisposing, reinforcing, and enabling factors) contributed to the suboptimal outcomes observed.

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