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PRELIMINARY DEMOGRAPHIC TRENDS IN ORAL FUNCTION DECLINE: AGE AND SEX DIFFERENCES IN TOOTH LOSS AMONG OLDER ADULTS

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ABSTRACT

Background: Tooth loss (edentulism) is a common oral health problem among older adults that negatively affects chewing ability, aesthetics, and quality of life. Posterior teeth, particularly molars, are more susceptible to loss due to their functional load and anatomical position. Biological factors such as age and gender may contribute to variations in tooth loss; however, community-level evidence remains limited in specific local settings.

Purpose: This study aimed to describe the pattern of tooth loss and explore its potential association with age and gender among elderly individuals in Banjar Kebon Kori, Kelurahan Kesiman, East Denpasar.

Methods: A descriptive observational study was conducted involving 17 elderly participants selected through total sampling. Data were collected through direct clinical oral examinations. Statistical analysis was primarily descriptive (frequency and percentage), and bivariate analysis was performed using Fisher's Exact Test due to the small sample size. **Results:** Tooth loss was predominantly observed in posterior teeth, particularly the first molars (21.6%). Females showed a slightly higher proportion of tooth loss (53.4%) compared to males (46.6%). A higher proportion of tooth loss was also observed among participants aged ≥ 70 years compared to those aged 60–69 years. However, these findings should be interpreted with caution due to the small sample size ($n = 17$) and unequal group distribution. **Conclusion:** This study suggests that tooth loss among elderly individuals tends to be more frequent in posterior teeth and may vary according to age and gender. However, the findings are exploratory and do not establish causal relationships. Further studies with larger and more representative samples are needed to confirm these observations.

Keywords: Age, Elderly, Gender, Posterior teeth, Tooth loss.

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INTRODUCTION

Tooth loss (edentulism) is a common oral health problem among older adults that significantly affects chewing ability, speech, and self-confidence.¹ In Indonesia, the prevalence remains high, with approximately 19% of the population affected and an average loss of 11 teeth among individuals aged 65 years or older.² This condition reflects not only the burden of oral diseases but also limited utilization of dental prosthetic rehabilitation, leading to further deterioration in oral function and quality of life.³ Posterior teeth, especially molars, are more prone to early loss due to their greater functional load and anatomical position, making them harder to clean.⁹ More than 70% of older adults experience posterior tooth loss, particularly in the mandibular region, and the first molar, being the earliest permanent tooth to erupt, is exposed to longer functional stress, increasing its risk of damage and eventual loss.^{3,4}

Beyond local dysfunction, tooth loss in the elderly has systemic health consequences, including higher risks of malnutrition, gastrointestinal disorders, cognitive decline, reduced self-esteem, social isolation, and depression.^{13,19} The World Health Organization recommends that older adults retain at least 20 functional teeth to preserve optimal oral function, yet many fall below this threshold.⁷ Multiple factors contribute to tooth loss, including periodontal disease, dental caries, systemic conditions, behavioral factors (such as poor oral hygiene and smoking), oral microbiome dysbiosis, chronic inflammation, and hormonal changes in postmenopausal

women.^{8, 10, 11, 22} Additionally, a study by Kumar confirmed that traditional beliefs can inhibit dental care seeking behavior, leading individuals to leave tooth loss untreated.²¹ A study conducted by Kumar confirmed that traditional beliefs can inhibit dental care seeking behavior and tend to leave it untreated.²¹ Several factors contribute to tooth loss in older adults, including periodontal disease, dental caries, systemic conditions.²²

Despite the well established global associations between age and gender with tooth loss, there is a lack of community level data from specific localities in Bali, Indonesia. Most existing studies rely on national surveys or clinical samples, which may not capture local sociocultural factors, such as traditional beliefs, or healthcare access patterns that influence tooth retention in elderly populations. In Banjar Kebon Kori, Kelurahan Kesiman, East Denpasar, no prior investigation has examined how age and gender relate to the incidence of tooth loss. Addressing this gap is scientifically important because community based findings can inform targeted preventive strategies that align with the unique demographic and cultural characteristics of the area.

Therefore, this study aims to evaluate the relationship between age and gender and the incidence of tooth loss among elderly individuals in Banjar Kebon Kori, Kelurahan Kesiman, East Denpasar. The findings are expected to provide a clearer understanding of demographic risk factors in this specific community and to support the development of evidence based, locally adapted oral health promotion programs, ultimately contributing to better quality of life and overall well being of older adults.^{17, 20}.

MATERIALS AND METHODS

Material

This study was a descriptive observational study conducted to assess the relationship between age, gender, and tooth loss among elderly individuals. The study was carried out in Banjar Kebon Kori, Kelurahan Kesiman, East Denpasar, on April 26, 2024, involving 17 elderly participants selected through total sampling. This sample meets the following criteria: aged 60 years or older according to WHO guidelines, being a native resident of Banjar Kebon Kori, living permanently in the area, able to communicate and cooperative, and willing to dental examination. In this study, tooth loss was operationally defined as the absence of one or more natural teeth due to extraction, mobility, or other causes, excluding congenitally missing teeth. Tooth loss was further categorized into partial tooth loss, defined as the loss of one or more teeth, and complete tooth loss (edentulism), defined as the loss of all natural teeth. Data collection was carried out through direct clinical oral examinations using standardized instruments, including dental mirrors, periodontal probes, tongue depressors, portable lighting, and structured examination forms to ensure systematic and consistent data recording. All procedures were conducted in accordance with ethical principles, including obtaining informed consent from all participants prior to examination. The confidentiality and anonymity of participants' data were strictly maintained throughout the research process.

Methods

The study applied a descriptive quantitative approach with limited bivariate analysis to describe patterns of tooth loss based on anatomical location and demographic characteristics. Tooth loss was categorized into anterior teeth (incisors and canines) and posterior teeth (premolars and molars) to identify its distribution. Given the small sample size ($n = 17$), statistical analysis was primarily conducted using descriptive statistics, including frequencies and percentages. Bivariate analysis was performed using Fisher's Exact Test as an alternative to the chi-square test, considering that the expected cell frequencies did not meet the assumptions required for chi-square analysis. Logistic regression analysis was not performed due to the limited sample size, which could result in overfitting and unstable estimates. Therefore, this study focuses on describing patterns and identifying preliminary associations rather than establishing causal relationships. The use of total sampling in a small population also limits the external validity and generalizability of the findings.

Given the small sample size ($n = 17$), the use of the chi-square test may violate the minimum expected frequency assumptions in contingency tables. Therefore, bivariate analysis in this study was conducted using Fisher's Exact Test, which is more appropriate for small sample sizes. Furthermore, logistic regression analysis was not performed, as the limited sample size increases the risk of overfitting and may produce unstable and unreliable estimates. Consequently, regression parameters such as odds ratios (OR) and confidence intervals (CI) were not reported. This study therefore focuses on descriptive statistics and bivariate analysis to identify preliminary associations rather than to establish robust causal relationships. This approach was chosen to ensure the validity of the analysis, and the findings should be interpreted as exploratory in nature.

Steps of Procedure

The procedure began with participant registration followed by the assessment of vital signs and general health status prior to oral examination. Each participant then underwent a clinical oral examination to identify missing teeth, with findings recorded systematically using standardized forms based on RISKESDAS guidelines. After the examination, participants were provided with brief oral health education, including instructions on proper oral hygiene practices, denture care if applicable, and the importance of regular dental check-ups to prevent further tooth loss.

RESULTS

The study included 17 elderly participants from Banjar Kebon Kori, Kelurahan Kesiman, East Denpasar, selected using a total sampling technique based on predefined inclusion criteria. The majority of participants were female (64.7%, $n = 11$), while males accounted for 35.3% ($n = 6$). Based on the revised age classification, most participants were in the 60–69 years group (76.5%, $n = 13$), while 23.5% ($n = 4$) were aged ≥ 70 years. This categorization was applied to reduce imbalance between age groups and improve data interpretability. However, the proportion of participants in the ≥ 70 years group remains relatively small and may influence comparisons across groups. A complete description of the demographic characteristics is presented in Table 1.

Table 1. Demographic Characteristics of Participants

Characteristics	Number	Percentage (%)
Gender		
Male	6	35.3
Female	11	64.7
Age Group		
60–69 years	13	76.5
≥ 70 years	4	23.5

The distribution of tooth loss based on tooth type showed that posterior teeth were more frequently affected than anterior teeth. The highest proportion of tooth loss was observed in the first molars (21.6%), followed by second molars (18.4%), premolars (13.6%), canines (12.8%), and incisors (8–12%). In addition, mandibular teeth generally showed higher frequencies of tooth loss compared to maxillary teeth in several categories. However, these percentages should be interpreted with caution, as small absolute differences may appear exaggerated due to the limited sample size. A detailed distribution of tooth loss by tooth type is presented in Table 2.

Table 2. Distribution of Tooth Loss by Tooth Type

Tooth Type	Maxilla	Mandible	Total	Percentage (%)
I1	4	6	10	8.0
I2	9	6	15	12.0
C	7	9	16	12.8
P1	9	8	17	13.6
P2	7	10	17	13.6
M1	11	16	27	21.6
M2	11	12	23	18.4

Further descriptive analysis based on demographic variables showed that females contributed a slightly higher proportion of total tooth loss compared to males, with 47 cases (53.4%) in females and 41 cases (46.6%) in males. In terms of age, the distribution of tooth loss followed the proportion of participants, with most cases observed in the 60–69 years group. Participants aged ≥ 70 years showed a smaller proportion of total tooth loss, reflecting the lower number of individuals in this category. However, this distribution should be interpreted with caution, as it is influenced by the unequal number of participants between age groups. The detailed distribution is presented in Table 3.

Table 3. Distribution of Tooth Loss by Gender and Age Group

Variable	Category	Total Tooth Loss	Percentage (%)
Gender	Male	41	46.6
	Female	47	53.4
Age Group	60–69 years	77	87.5
	≥ 70 years	11	12.5

Bivariate analysis was conducted using Fisher's Exact Test to explore the association between gender, age, and tooth loss. The descriptive results suggest that females tended to have a higher proportion of tooth loss compared to males. Similarly, participants aged ≥ 70 years appeared to show a relatively higher proportion of tooth loss compared to those aged 60–69 years.

However, these findings should be interpreted with caution. The small sample size and imbalance in group distribution, particularly in the ≥ 70 years category, may lead to unstable estimates and potential overestimation of statistical significance. Therefore, the results are considered exploratory and indicative of possible trends rather than definitive evidence.

Table 4. Association Between Gender, Age, and Tooth Loss

Variable	Category	No Tooth Loss n (%)	Tooth Loss n (%)	Total n (%)	p-value
Gender	Male	3 (17.6)	3 (17.6)	6 (35.3)	0.21*
	Female	2 (11.8)	9 (52.9)	11 (64.7)	
Age Group	60–69 years	4 (23.5)	9 (52.9)	13 (76.5)	0.28*
	≥ 70 years	1 (5.9)	3 (17.6)	4 (23.5)	

Note: Fisher's Exact Test was applied. P-values should be interpreted with caution due to the small sample size.

Overall, the findings indicate that tooth loss among elderly participants tends to be slightly higher among females and older age groups. However, due to the limited sample size and unequal group distribution, these findings should be interpreted cautiously and considered as preliminary rather than conclusive.

DISCUSSION

The findings of this study indicate that tooth loss among elderly individuals was predominantly observed in posterior teeth, particularly the first molars. This pattern can be explained by the functional role of posterior teeth in mastication, which exposes them to higher occlusal forces and mechanical stress compared to anterior teeth.⁹ In addition, the first molars are the earliest permanent teeth to erupt, resulting in longer exposure to cariogenic and periodontal risk factors over time. Furthermore, the anatomical position of posterior teeth makes them more difficult to clean, which may contribute to plaque accumulation and increased susceptibility to dental caries and periodontal disease.¹⁰ These findings are consistent with previous studies reporting that posterior tooth loss is more common and has important implications for masticatory function and nutritional status in older adults.^{13, 16}

In terms of gender, this study showed that females tended to have a slightly higher proportion of tooth loss compared to males. Although this pattern was observed descriptively, the findings should be interpreted with caution due to the limited sample size. Nevertheless, this observation is in line with previous studies suggesting that biological and hormonal factors may contribute to differences in oral health outcomes between males and females.¹ One of the contributing factors is the decline in estrogen levels during menopause, which may affect bone metabolism and reduce alveolar bone density, thereby increasing susceptibility to periodontal disease and tooth loss.¹⁰

Regarding age, the descriptive findings suggest that older individuals (≥ 70 years) may have a higher proportion of tooth loss compared to those aged 60–69 years. However, this pattern should be interpreted cautiously due to the unequal distribution of participants between age groups. Despite this limitation, the findings are consistent with existing literature indicating that tooth loss is a cumulative process associated with aging and prolonged exposure to risk factors such as dental caries, periodontal disease, and systemic conditions.^{14, 15} In addition, age-related physiological changes, including reduced salivary flow, impaired immune response, and alterations in oral microbiota, may further increase susceptibility to oral diseases.¹¹

Tooth loss in elderly individuals is not only a clinical condition but also has broader functional and psychosocial implications. Reduced chewing ability may lead to poor nutritional intake and increased risk of malnutrition, while aesthetic and functional impairments may affect self-confidence, social interaction, and overall quality of life.^{12, 13, 19} These findings highlight that oral health is closely related to general health and well-being in older populations.

It is important to note that, due to the small sample size and the use of a descriptive observational design with limited bivariate analysis, the findings of this study should be considered exploratory. The results do not establish causal relationships but rather provide an initial description of potential patterns and associations. Tooth loss is a multifactorial condition influenced by various factors, including oral hygiene practices, socioeconomic status, access to dental care, and systemic health conditions.^{17, 18}

From a clinical and public health perspective, these findings highlight the importance of preventive and promotive strategies targeting elderly populations. Regular dental check-ups, improved oral hygiene practices, and early management of dental and periodontal conditions should be emphasized. In addition, appropriate prosthetic rehabilitation, such as dentures, may help restore oral function, improve nutritional status, and enhance quality of life among elderly individuals.^{3, 21} Future studies with larger and more representative samples are needed to confirm these findings and provide stronger evidence regarding the determinants of tooth loss.

This study suggests that tooth loss among elderly individuals tends to be more frequent in posterior teeth and may vary according to age and gender. However, these findings should be interpreted with caution due to the small sample size and unequal distribution of participants across groups. We suggest that further research should use a larger sample size with a broader research scope to further strengthen the results.

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