



## RESEARCH ARTICLE

## Sociodemographic and Dietary Determinants of Oral Health Among the Elderly: A Cross-Sectional Study in Batouri District, Cameroon

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## ABSTRACT

Global aging brings physiological and psychological changes that often result in poor oral health. Common conditions among the elderly, such as caries, gingivitis, and edentulism, impair chewing and increase the risk of malnutrition. In Batouri, Cameroon, these problems are further aggravated by socio-demographic factors and dietary habits. This study aimed to investigate the association between dietary habits, socio-demographic determinants, and oral health among older adults in this region. A community-based cross-sectional study was carried out from February 22 to June 22, 2020, involving 410 individuals aged 60 and above. Data collection combined a structured questionnaire covering demographic characteristics, dietary habits, and oral health status with oral examinations and interviews. Additionally, the Food Diversity Score (FDS), an indicator of food variety, was assessed. Statistical analysis employed the chi-square test with a significance threshold of  $p = 0.05$ . The results revealed that age, gender, and education significantly influenced oral health outcomes ( $p = 0.001$ ). Specifically, gingivitis was most frequent among participants aged 66–70 (19.5%), while caries was more prevalent in the 71–75 (9.3%) and 81+ (15.9%) age groups. Edentulism peaked at 15.9% in individuals aged 81 and over. Gender differences were evident, with women exhibiting higher rates of gingivitis (36.6%) and caries (16.1%), whereas men showed more cases of edentulism (17.6%). Moreover, uneducated individuals were disproportionately affected by gingivitis (39.5%) and caries (13.7%). A low FDS correlated with a higher prevalence of gingivitis (40%), and caries was common (45.9%) among those consuming sweet products three times per week. These findings underscore a strong link between oral health, dietary patterns, and socio-demographic factors in the elderly population of Batouri. Consequently, targeted community-based oral health programs that address local dietary habits and socio-demographic profiles are recommended, emphasizing nutrition education, improved access to dental care, and culturally sensitive preventive measures.

**Keywords:** Demographics, Dietary Habits, Oral Health, Batouri, Elderly

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## INTRODUCTION

Population aging is a global phenomenon that leads to physiological, psychological, and social changes. According to the World Health Organization (WHO), a person is considered elderly from the age of 60 onwards (Bréchat et al., 2008). With the increase in life expectancy, the threshold for advanced age has been raised to 60–65 years in Cameroon (Mabiama, 2022). Although aging is a natural process, it impairs physiological and psychological functions, thereby affecting functional capacities (Mabiama, 2022). This process is influenced by various factors, including nutrition, but also physiological factors (deterioration of bodily functions), psychological factors (cognitive or emotional disorders), and social factors (isolation, loss of status), which interact and affect overall aging (Mabiama, 2022 ; Bréchat et al., 2008). Oral health among older adults is of particular concern due to its direct impact on nutrition. Oral pathologies such as dental caries, gingivitis, and edentulism impair chewing function and may lead to swallowing difficulties, loss of appetite, and an increased risk of malnutrition (Chauva, 2021). With age, reduced salivation, the use of dental prostheses, and gingival inflammation exacerbate these problems (Chauva, 2021).

Oral diseases are a major global public health issue, affecting around 3.5 billion people (Kassebaum et al., 2017), 75% of whom live in low-income and developing countries reference. Caries affects 60% to 90% of children and 90% to 92% of adults, while periodontitis affects 5% to 20% of the global population (Kassebaum et al., 2017). In Africa, the number of people affected has increased significantly, reaching 480 million, which is about 55% of the continent's population (Williams et al., 2021; Kassebaum et al., 2017). In Cameroon, the prevalence of dental caries and periodontal diseases is estimated at 29.90% and 39.20%, respectively (Dieng et al., 2016 ; Boukeng et al., 2024).

Nutrition plays a key role in maintaining health throughout life, especially in older adults. Age-related physiological changes, such as reduced appetite and decreased senses of taste and smell, often lead to poor dietary intake (Alhousseny et al., 2024). These issues are exacerbated by oral health problems, contributing to malnutrition and increased morbidity and mortality (Bert & Bodineau-Mobarak, 2010). In Cameroon, the prevalence of malnutrition among older adults is estimated at 19.70% (Mabiama, 2022). In this context, it is crucial to examine the relationship between oral health and dietary habits of older adults, particularly in specific regions such as the Batouri district, where available data are extremely limited or even nonexistent. This knowledge gap prevents a thorough understanding of the local factors influencing oral health and complicates the implementation of appropriate prevention and intervention strategies.

In view of the above, this study aimed to examine the association between dietary habits, sociodemographic determinants, and oral health (gingivitis, dental caries, edentulism) among older adults in the Batouri district, Cameroon.

## METHODS

### *Study Design*

This study was designed as a descriptive cross-sectional survey. It aimed to assess the association between dietary habits, socio-demographic factors, and oral health status among older adults.

### *Study Setting*

The research was conducted in the Batouri district, located in the East region of Cameroon. This predominantly rural area includes several villages and neighborhoods such as Pana-Selo, Yoko, Vallé, Tassongo, Taparé, Nyabi, Njira II, Nguemo I and II, and Ngoura II. Batouri was selected based on its accessibility and the absence of recent data on the oral health of its elderly population. Data were collected over a four-month period, from February 22 to June 22, 2020 (Pereira et al., 2023).

### *Study Population*

The target population consisted of individuals aged 60 years and above, living at home in the Batouri district. Eligible participants were those capable of understanding the questions and providing informed consent.

### *Inclusion and Exclusion Criteria*

Inclusion criteria were: (i) age  $\geq 60$  years, (ii) residence in one of the selected villages, (iii) ability to respond to the questionnaire, and (iv) provision of informed consent. Exclusion criteria included institutionalized individuals, those with significant cognitive impairments, and those unable to participate in the survey.

### *Sample Size Determination*

The minimum sample size was calculated using the following formula:

$$N = (Z_{1-\alpha/2}^2 p(1-P)/d)^2$$

Where:

- i.  $Z_{1-\alpha/2} = 1.96$  (95 % confidence level),
- ii.  $p = 0.5916$ , representing the prevalence of dental caries reported by Boukeng et al., (2024), in a comparable rural population in Benin ;
- iii.  $d = 0.05$ , acceptable margin of error.

In the absence of recent local data, this prevalence was retained as a reference. An increase of 10 % was applied to anticipate refusals, dropouts, or missing data, resulting in a final sample size of 410 participants. No finite population correction was applied.

### Sampling Method

Systematic sampling was applied in the selected villages. A door-to-door approach was used, starting from the residence of the neighborhood chief (Messiah et al., 2014), following WHO-recommended community-based protocols. If a household was unavailable or declined participation, the next eligible household was approached. The overall response rate was estimated at 90%.

### Data Collection Tools and Pretest

Data collection relied on a validated structured questionnaire, pretested on 20 elderly individuals from the village of Vallé. The pretest assessed the clarity and consistency of questions and led to minor adjustments. This number was considered sufficient according to methodological guidelines (Fréreau, 2023).

The questionnaire covered demographic characteristics, dietary habits, and oral health status. A clinical oral examination was performed by a qualified dentist with over ten years of community experience, using the method described by Bert & Bodineau-Mobarak, (2010) to identify dental caries, gingivitis, and tooth loss.

A 24-hour dietary recall was also conducted following FAO recommendations to calculate the Food Diversity Score (FDS). According to Diarra (2023), the FDS was categorized as:

- i. Low:  $\leq 3$  food groups
- ii. Medium: 4–5 food groups
- iii. High:  $\geq 6$  food groups

### Data Analysis

Data were entered into Excel 2016 and analyzed using SPSS version 20. Descriptive statistics summarized the variables. Chi-square tests were used to assess associations between qualitative variables, with significance set at  $p < 0.05$ . No multivariate analysis was conducted.

### Ethical Considerations

Ethical clearance was obtained from the Institutional Ethics Committee for Research on Human Health of the University of Douala (approval number 1668CEI-UDo/02/2020/T, dated February 2, 2020). Written informed consent was obtained from all participants. For illiterate individuals, verbal consent was given in the presence of a witness. Anonymity and confidentiality were ensured. Participants received oral health feedback following the examination.

## RESULTS

### Demographic Characteristics of Study Participants

The socio-demographic characteristics analyzed included age, sex, and level of education. Table 1 summarizes the associations between these demographic factors and oral pathological conditions (gingivitis, dental caries, and edentulism) among the study participants. Age was highly significantly associated with oral health status ( $p = 0.001$ ). Gingivitis was most frequent among individuals aged 66–70 years (19.51%), followed by those aged 60–65 (18.55%) and 76–80 (12.94%), while it was absent in older age brackets. Edentulism increased sharply after the age of 70, reaching 5.37% in the 71–75 age group and 15.85% among participants aged 81 and older. Dental caries followed an irregular pattern, peaking in the 71–75 (9.27%) and 81+ (15.85%) groups. These patterns indicate that aging is strongly linked to deteriorating oral health, particularly in the form of edentulism.

Sex was also significantly associated with oral health ( $p = 0.001$ ). Women showed a higher prevalence of gingivitis (36.59%) and dental caries (16.10%) compared to men (14.38% and 4.88%, respectively). In contrast, men were more affected by edentulism (17.56%) than women (10.49%). These differences may reflect sex-specific behaviors, hormonal variations, or disparities in access to oral care.

Educational level had a strong association with oral pathologies ( $p = 0.001$ ). Participants without formal education experienced the highest rates of gingivitis (39.50%) and dental caries (13.68%), while those with primary or secondary education had substantially lower levels of oral diseases. Individuals with higher education showed the lowest prevalence of gingivitis (8.30%) and dental caries (3.21%), although their edentulism rate remained moderate (8.28%). These findings highlight the protective influence of education, likely through improved health literacy and healthcare access.

**Table 1:**

*Associations Between Demographic Characteristics and Oral Pathological Conditions*

Variables / Modalities		Gingivitis (%)	Dental caries (%)	Edentulism (%)	Total (n)	P-values
Ages (years)	[60-65]	18.55%	8.78%	3.16%	125	
	] 66-70]	19.51%	0.00%	2.44%	90	



	] 71-75]	0.00%	9.27%	5.37%	60	0,001
	] 76-80]	12.94%	0.00%	4.09%	70	
	81 and older	0.00%	15.85%	0.06%	65	
	<b>Total</b>	<b>50.98%</b>	<b>33.90%</b>	<b>15.12%</b>	<b>410</b>	
<b>Sex</b>	Female	36.59%	16.10%	10.49%	260	0,001
	Male	14.38%	4.88%	17.56%	150	
	<b>Total</b>	<b>50.97%</b>	<b>20.98%</b>	<b>28.05%</b>	<b>410</b>	
<b>Level of education</b>	No education	39.50%	13.68%	8.56%	253	0,001
	Primary	5.76%	5.38%	1.54%	52	
	Secondary	3.86%	1.53%	0.40%	24	
	Higher	8.30%	3.21%	8.28%	81	
	<b>Total</b>	<b>57.42%</b>	<b>23.80%</b>	<b>18.78%</b>	<b>410</b>	

Source: Field survey, Batouri, 2020.

### Eating habits

The variables analyzed in Table 2 include the Food Diversity Score (FDS) and the frequency of sweetened product consumption per week. Both variables showed statistically significant associations with oral pathological conditions ( $p\text{-value} = 0.001 < 0.05$ ). Gingivitis appeared more frequently in individuals with low FDS (40.00%) and high FDS (38.53%), suggesting that both dietary insufficiency and excessive dietary variety, possibly linked to the consumption of processed foods, may be associated with poor oral hygiene. Dental caries were relatively rare across all Food Diversity Score (FDS) groups, ranging from 2.00% to 3.09%.

However, caries prevalence sharply increased with frequent sweet product consumption, reaching 45.85% among individuals consuming sweets three times per week. Edentulism was also highest (48.05%) in this group, suggesting a strong association between high sweet intake and poor oral health. Similarly, edentulism was higher in individuals with medium and high FDS (5.00%) and was particularly elevated in those with high sweet intake. These findings highlight the dual impact of diet quality and sugar consumption on oral health, emphasizing the role of nutritional education and hygiene interventions.

**Table 2:**

*Associations Between Food Diversity Score, Sweet Product Consumption, and Oral Pathological Conditions*

Variables / Modalities		Gingivitis (%)	Dental caries (%)	Edentulism (%)	Total (n)	P-values
<b>FDS</b>	Low FDS	40.00%	2.00%	0.00%	173	0,001
	Medium FDS	3.38%	3.00 %	5.00%	46	
	High FDS	38.53%	3.09 %	5.00%	191	
	<b>Total</b>	<b>81.91%</b>	<b>8.09 %</b>	<b>10.00%</b>	<b>410</b>	
<b>Frequency of consumption of sweet products</b>	1 time (F)/week (S)	0.00%	0.00%	1.46%	6	0,001
	2 times/week (S)	0.00%	0.00%	0.00%	0	
	3 times/week (S)	0.00%	45.85%	48.00%	385	
	More than 3 times/week (S)	1.46%	1.23%	1.95%	19	
	<b>Total</b>	<b>1.46%</b>	<b>47.08%</b>	<b>51.46%</b>	<b>410</b>	

Source: Field survey, Batouri, 2020.

## DISCUSSION

Our results show that age, sex, education level, and dietary habits significantly influence oral health in the elderly population studied. These findings largely align with existing literature, while also revealing local specificities that warrant further analysis.

The age-stratified analysis reveals a progressive decrease in gingivitis prevalence with increasing age: 18.55% among 60-65 years, 19.51% among 66-70 years, then dropping to 0% among 71-75 years and those 81 and older ( $p = 0.001$ ). This trend is consistent with Petersen & Yamamoto, (2005), who explain the decrease by progressive tooth loss in older individuals, making gingivitis less observable. Additionally, edentulism prevalence increases after age 70, peaking at 5.37% among 71-75 years and remaining high in the 76-80 years group (4.09%) ( $p = 0.001$ ). These figures confirm the cumulative impact of periodontal diseases and untreated caries on tooth loss with advancing age.

A noteworthy point is the distribution of dental caries: while literature (Thomson & Locker, 2000) generally reports a decline in caries among older adults due to tooth loss, our data indicate an increase in caries among 71-75-year-olds (9.27%) and especially in those 81 and older (15.85%). This discrepancy may be explained by limited access to dental care or cariogenic dietary habits in our population. This contrast highlights the importance of studying local contexts to better understand disease dynamics.

Regarding sex differences, gingivitis prevalence is significantly higher in women (36.59%) than men (14.38%) ( $p = 0.001$ ), as is caries prevalence (16.10% vs. 4.88%). These results align with Thomson & Locker, (2000), attributing the female predominance to hormonal factors (pregnancy, menopause) and certain dietary behaviors favoring caries formation. Conversely, unlike Eke et al., (2012), who found higher edentulism prevalence among women, our study observes higher edentulism in men (17.56%) compared to women (10.49%) with significant difference ( $p = 0.001$ ). This discrepancy might be due to sociocultural specifics and differential access to dental care in our setting, highlighting the role of social and behavioral determinants.

Our results clearly show education level as a protective factor. Individuals without formal education exhibit the highest rates of gingivitis (39.50%) and caries (13.68%), whereas those with secondary education show the lowest rates (3.86% gingivitis and 1.53% caries) ( $p = 0.001$ ). These findings concur with Peres et al., (2019) and Sanders & Spencer, (2004),

(demonstrating that higher education promotes better oral hygiene and greater dental care utilization. Interestingly, individuals with primary education have a low prevalence of gingivitis (5.76%) but moderate caries prevalence (5.38%), which may reflect partial access to dental care, allowing treatment of some but not all conditions.

Oral health also appears linked to dietary diversity. Gingivitis prevalence is high in both low Food Diversity Score (FDS) groups (40%) and high FDS groups (38.53%), while very low in medium FDS individuals (3.38%) ( $p = 0.001$ ). This pattern suggests that both limited and excessive dietary variety may be associated with gingivitis risk through different mechanisms: micronutrient deficiencies on one side and high intake of cariogenic foods on the other (Diarra, 2023 ; Henricsson et al., 2024). Edentulism is more frequent in medium (5%) and high (5%) FDS groups, aligning with Peres et al., (2019) who emphasize the role of an unbalanced diet in tooth loss. Caries prevalence, however, does not significantly vary by FDS, consistent with Moynihan & Petersen, (2004), who indicate that sugar exposure frequency and quantity are more critical in caries risk.

Indeed, frequent consumption of sugary products is strongly associated with increased caries, with 45.85% caries prevalence among those consuming sweets three times per week ( $p = 0.001$ ). This association is well documented (Bernabé et al., 2014 ; Sheiham & James, 2015) and highlights the importance of dietary habits in prevention. Regarding gingivitis, the effect of sugar consumption is less clear: it is almost absent among consumers of sweets three times per week (0%) but slightly present among those consuming once or more than three times weekly (1.46%). This aligns with Eke et al., (2012) and Henricsson et al., (2024), who show gingivitis is more related to oral hygiene and plaque formation than sugar intake per se.

Finally, a slight increase in edentulism is observed in heavy sugar consumers (>3 times/week: 1.95%), supporting Peres et al., (2019) and Hujoel & Lingström, (2017) conclusions on the link between excessive free sugar consumption, irreversible dental lesions, and extraction risk.

This study highlights the impact of age, sex, education, and diet on oral health, revealing local patterns such as unusual caries distribution in the elderly and gender differences in edentulism. These may stem from factors like diet quality, fluoride exposure, and limited dental care. The findings call for targeted prevention strategies focused on hygiene education, reduced sugar intake, and better access to care for vulnerable groups.

## Conclusion

The results show that age, gender, and level of education significantly influence oral health. Edentulism increases with age, while gingivitis is more frequent among women. Less educated individuals are the most affected, highlighting the impact of access to care and awareness of oral hygiene.

## Recommendations

Based on the findings, we propose the following actions:

### Policy-level (Short to Medium Term)

- Integrate oral health into local public health policies targeting older adults, with specific focus on high-risk groups such as women and individuals with low educational attainment.
- Develop and implement targeted awareness campaigns on oral hygiene and nutrition among elderly populations.
- Promote intersectoral collaboration among local authorities, health professionals, and community leaders to support healthy aging.

### Clinical-level (Medium Term)

- Train community health workers to screen for early signs of oral diseases and deliver basic nutritional counseling.
- Ensure access to biannual oral health check-ups for the elderly, particularly in underserved areas.

### Research-level (Long Term)

- Conduct longitudinal studies to examine causal relationships between dietary habits and oral health outcomes in older populations.
- Investigate the impact of preventive interventions on the incidence of gingivitis, dental caries, and edentulism over time.

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## Author Contributions

Study design (Claude Eugène EBEH and Gustave MABIAMA); Data collection (Chantal BAYA NGONDONG); Data analysis (Claude Eugène EBEH); Draft writing (All); and Manuscript approval (All).

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## Conflict of Interest

Authors declare no conflict of interest.

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