

Oral hygiene habits, dental conditions, and self-perceived halitosis across age groups: A cross-sectional survey

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Abstract

Background: Oral hygiene practices are central to the prevention of dental disease and oral malodor. Understanding how these behaviors vary across community respondents is important for designing targeted preventive programs, particularly in settings where population-level data remain limited. **Objective:** The aim of this study was to describe oral hygiene practices, dental conditions, and the frequency of self-perceived halitosis in a mixed-age sample and to explore how behavioral, dietary, medical, and lifestyle factors relate to reported oral-health outcomes. **Methods:** A cross-sectional survey of 301 participants was conducted using a structured, self-administered questionnaire. Data were collected on sociodemographic characteristics, oral hygiene behaviors, dental attendance, diet, self-reported medical and dental history, lifestyle factors, and halitosis-related variables. Statistical analysis was performed in SPSS version 26. Descriptive statistics were generated, and chi-square testing was used for exploratory comparisons among categorical variables at a significance level of ≤ 0.05 . **Results:** Most respondents reported tooth brushing (94.4%), and nearly half reported brushing twice daily (46.2%). Use of adjunctive measures was lower, including mouthwash (32.2%), floss (17.6%), and tongue cleaning (52.8%). Self-perceived halitosis was reported occasionally by 59.1% and frequently by 4.3% of respondents. Self-reported dental caries (62.1%), periodontal disease (32.2%), and malocclusion (35.9%) were common. Exploratory chi-square analyses also showed significant differences across several behavioral and clinical response categories, including smoking or vaping, breathing pattern, and sinus-related conditions ($p \leq 0.01$). Although only 8% reported overt social problems related to breath odor, 40.9% reported concern about how others responded to them. Treatment-seeking for halitosis was uncommon (9.6%). **Conclusion:** Self-perceived halitosis and several adverse oral-health indicators were common in this sample, while recommended daily hygiene practices and treatment-seeking remained suboptimal. These findings support the need for targeted oral-health education, early assessment, and preventive counseling to improve hygiene behaviors and reduce the psychosocial burden associated with oral malodor.

Keywords: oral hygiene, self-perceived halitosis, cross-sectional survey, dental caries, periodontal disease, oral health behaviors, bad breath, dental attendance, lifestyle factors, psychosocial impact

1 Introduction

Oral health is a core component of overall well-being across the life course. Daily practices such as tooth brushing, interdental cleaning, tongue cleaning, and routine dental attendance are central to preventing dental caries, periodontal disease, and halitosis, yet substantial unmet oral-health needs remain in many populations [1].

Halitosis, or oral malodor, is a common condition that affects individuals across age groups. It is commonly linked to microbial activity within the oral cavity, particularly the degradation of organic substrates by anaerobic bacteria with subsequent production of volatile sulfur compounds (VSCs) [2]. Major intra-oral contributors include tongue coating, plaque accumulation, dental caries, gingival inflammation, and reduced salivary flow [3, 4]. Although halitosis is not life-threatening, it can impair social interaction, self-confidence, and quality of life, especially among younger respondents who may be sensitive to peer evaluation [5, 6].

Poor oral hygiene and halitosis are shaped by multiple behavioral and lifestyle factors, including infrequent tooth brushing, limited interdental cleaning, inadequate tongue care, irregular dental attendance, high intake of carbohydrate-rich foods, smoking, and mouth breathing [7, 8]. Oral malodor may also be aggravated by systemic or upper-airway conditions such as respiratory disease, diabetes mellitus, and sinus disorders [9, 10].

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Because halitosis is multifactorial, its assessment and management require attention to both oral and non-oral contributors.

Self-perception of halitosis is often imperfect, and many affected individuals rely on subjective judgment rather than professional confirmation. Prior studies suggest that oral malodor may be underrecognized, underreported, or untreated because patients may not identify the problem clearly or may hesitate to seek care [6, 11]. In addition, family context and health literacy can influence the development of oral-hygiene routines and the timing of professional care [12].

In Iraq and comparable settings, population-level data on oral hygiene patterns, self-reported dental conditions, and halitosis remain limited. Clarifying the frequency of these findings and their relationship to behavioral, dietary, and health-related variables is useful for preventive planning. Accordingly, the present cross-sectional survey aimed to characterize oral hygiene practices, dental conditions, and self-perceived halitosis in a mixed-age sample and to describe how these measures varied across the recorded demographic, behavioral, and clinical variables. The findings are intended to support oral-health education and guide future analytical studies.

2 Materials and methods

2.1 Study design and setting

The present study used a cross-sectional survey design to characterize oral hygiene practices, self-reported dental status, and self-perceived halitosis. Data were collected from respondents recruited in dental clinics and educational or community settings during the study period. A cross-sectional approach was selected because it permits estimation of the distribution of oral-health behaviors and reported conditions within the study sample at a single time point.

2.2 Study population and sample size

A total of 301 participants of both sexes were included. Because the questionnaire captured a broad age range, the final sample represented respondents from adolescence through older adulthood rather than a narrowly pediatric cohort. Eligible participants were those who agreed to participate and were able to complete the questionnaire. Individuals unable to provide reliable responses or unwilling to participate were excluded. Participation was voluntary, and identifying information was kept confidential.

2.3 Data collection tool

Data were collected using a structured, self-administered questionnaire developed from prior studies of oral health and halitosis. The questionnaire was organized into the following sections:

- Sociodemographic characteristics (age, sex, and education level).
- Oral hygiene practices (frequency and timing of tooth brushing, brushing technique, use of dental floss, mouth rinses, mouthwash, and tongue cleaning).
- Dental attendance patterns.
- Dietary habits, with emphasis on carbohydrate intake.
- Lifestyle variables, including smoking or vaping, breathing pattern, and alcohol intake, together with self-reported medical and dental history (periodontal disease, dental caries, malocclusion, and sinus-related conditions).
- Halitosis-related variables, including self-perceived bad breath, frequency, source of awareness, prior treatment, social impact, and concern about others' reactions. Multiple-choice responses were used to promote consistency and facilitate analysis.

2.4 Clinical and dental variables

Dental variables such as dental caries, periodontal disease, and malocclusion were recorded from participant self-report and/or previously communicated dental diagnoses rather than direct clinical examination. Medical history variables included heart, respiratory, liver, kidney, intestinal, allergic, paranasal sinus, and diabetes-related conditions.

2.5 Ethical considerations

The study was conducted after approval by the relevant institutional review process. All participants were informed about the purpose of the study before data collection, and informed consent was obtained directly from participants or from parents/guardians when required. The study procedures were performed in accordance with the principles of the Declaration of Helsinki for research involving human participants.

2.6 Statistical analysis

Data were coded and analyzed using the Statistical Package for the Social Sciences (SPSS), version 26 (IBM Corp., Armonk, NY, USA). Categorical variables were summarized as frequencies and percentages. Chi-square testing was used for exploratory comparisons among categorical response distributions related to oral hygiene habits, dental conditions, halitosis, and other recorded variables. A p-value of ≤ 0.05 was considered statistically significant, whereas a p-value of ≤ 0.01 was considered highly significant. Results not meeting these thresholds were described as non-significant (NS).

3 Results

A total of 301 participants were included in the analysis. Table 1 summarizes the characteristics of the study population. Males comprised 72.4% of the sample and females 27.6%. The largest age group was 21–31 years (56.8%), followed by 10–20 years (20.9%) and 32–43 years (15.6%). Most respondents reported a high-school level of education (78.4%), whereas 18.3% reported junior high school and 3.3% primary school.

Table 1: Survey results

Questionnaire	Number of response	Percentage (%)	Chi-Square (P-value)
Gender			
Male	218	72.4%	60.548 ** (0.0001)
Female	83	27.6%	
Total	301	100%	
Age			
10-20	63	20.9%	117.66 ** (0.0001)
21-31	171	56.8%	
32-43	47	15.6%	
44-55	14	4.7%	
56-66	5	1.7%	
More than 66	1	0.3%	
Total	301	100%	

Questionnaire	Number of response	Percentage (%)	Chi-Square (P-value)
Education level			
Primary School	10	3.3 %	288.167 ** (0.0001)
Junior high school	55	18.3%	
High School	236	78.4%	
Total	301	100%	
Frequency of dental visit per year			
1	155	51.5%	114.827 ** (0.0001)
2	59	19.6%	
3	44	14.6%	
3 _i	43	14.3%	
Total	301	100%	
Do you brush your teeth?			
Yes	284	94.4%	236.840 ** (0.0001)
No	17	5.6%	
Total	301	100%	
Frequency of toothbrush per day			
1	116	38.5%	159.265 ** (0.0001)
2	139	46.2%	
3	43	14.3%	
3 _i	3	1%	
Total	301	100%	
Do you use mouthwash?			
Yes	97	32.2%	38.037 ** (0.0001)
No	204	67.8%	
Total	301	100%	
Tongue cleaning			
Yes	159	52.8%	0.9601 NS (0.3272)
No	142	47.2%	
Total	301	100%	
Suffering from halitosis			
Never/rarely	110	36.5%	138.484 ** (0.0001)
Sometimes	178	59.1%	
Frequently	13	4.3%	
Total	301	100%	
Frequency of tooth brushing			
After every meal	41	13.6%	107.677 ** (0.0001)
Twice/day	136	45.2%	
Once/day	100	33.2%	
Some times	24	8%	
Total	301	100%	
Timing of tooth brushing			
Before bed	55	18.3%	86.920 ** (0.0001)
Morning	46	15.2%	
Morning and before bed	145	48.2%	
No fixed time	55	18.3%	
Total	301	100%	

Questionnaire	Number of response	Percentage (%)	Chi-Square (P-value)
Way of tooth brushing			
Vertical stroke	63	20.9%	11.757 ** (0.0083)
Horizontal stroke	61	20.3%	
Semi-circular	79	26.2%	
Gum to incisal edge	98	32.6%	
Total	301	100%	
Carbohydrate foods			
Yes	240	79.7%	106.448 ** (0.0001)
No	61	20.3%	
Total	301	100%	
Breathing Pattern			
Through the mouth	29	9.6%	78.161 ** (0.0001)
Through the nose	144	47.8%	
Both	128	42.5%	
Total	301	100%	
Smoking history			
Yes	69	22.9%	88.269 ** (0.0001)
No	232	77.1%	
Total	301	100%	
Systemic disease			
No	266	88.4%	177.279 ** (0.0001)
Yes	35	11.6%	
Total	301	100%	
Periodontal disease			
Yes	97	32.2%	38.037 ** (0.0001)
No	204	67.8%	
Total	301	100%	
Dental caries			
Yes	187	62.1%	17.704 ** (0.0001)
No	114	37.9%	
Total	301	100%	
Malocclusion			
Yes	108	35.9%	24.003 ** (0.0001)
No	193	64.1%	
Total	301	100%	
Medical history regarding diseases of the blood, heart, respiratory system, intestines, liver, kidneys, and known allergies			
Heart diseases	21	7%	102.873 ** (0.0001)
Respiratory diseases	21	7%	
Liver diseases	12	4%	
Renal diseases	18	5.9%	
allergies	38	12.6%	
paranasal sinuses	84	27.9%	
Other than that	61	20.3%	
Don't have any diseases	46	15.3%	
Total	301	100%	

Questionnaire	Number of response	Percentage (%)	Chi-Square (P-value)
A history of diabetes was recorded			
Yes	13	4.3%	251.245 ** (0.0001)
No	288	95.7%	
Total	301	100%	
Do you use floss			
Yes	53	17.6%	37.267 ** (0.0001)
Sometimes	137	45.5%	
Never	111	36.9%	
Total	301	100%	
Do you use any mouth rinses			
Yes	58	19.3%	33.984 ** (0.0001)
Sometimes	103	34.2%	
Never	140	46.5%	
Total	301	100%	
Consumption of alcoholic beverages			
Never	272	90.4%	690.614 ** (0.0001)
Rarely	25	8.3%	
Daily	3	1%	
Several times per day	1	0.3%	
Total	301	100%	
Smoking: The exact number of cigarettes smoked daily			
1-20	28	9.3%	607.455 ** (0.0001)
20-40	4	1.3%	
40-60	2	0.7%	
Never	229	76.1%	
Vape	38	12.6%	
Total	301	100%	
How long have you been smoking?			
1 Year	9	3%	609.880 ** (0.0001)
2 Year	13	4.3%	
3 Year	18	6%	
More than 3 Year	30	10%	
Never	231	76.7%	
Total	301	100%	
Do you suffer from bad breath odor ?			
Yes	9	3%	369.633 ** (0.0001)
Sometimes	36	12%	
Never	256	85%	
Total	301	100%	
How did you know that you suffer from bad breath odor			
Someone told me	31	10.3%	172.053 ** (0.0001)
People act funny around me	0	0%	
I just know	259	86%	
My dentist	11	3.7%	
Total	301	100%	

Questionnaire	Number of response	Percentage (%)	Chi-Square (P-value)
Have you had any treatments for bad breath odor			
Yes	29	9.6%	196.176 ** (0.0001)
No	272	90.4%	
Total	301	100%	
If you got it treated, what measurement did you use			
Drugs	9	2.9%	326.657 ** (0.0001)
Don't Suffering from halitosis	10	3.3%	
Cleaning mouth	52	17.3%	
Don't use any things	180	59.9%	
Other than that	50	16.6%	
Total	301	100%	
Do you have any social problems because of your bad breath odor			
Yes	24	8%	212.654 ** (0.0001)
No	277	92%	
Total	301	100%	
Are you concerned about other people's behavior toward yourself on account of your breath odor			
Yes	123	40.9%	10.0498 ** (0.0015)
No	178	59.1%	
Total	301	100%	
** (P≤0.01), NS: Non-Significant.			

3.1 Oral hygiene practices

Most respondents reported brushing their teeth (94.4%), whereas 5.6% reported that they did not. Brushing frequency varied, with 46.2% reporting twice-daily brushing, 38.5% once-daily brushing, and 14.3% brushing three times daily. Regarding timing, 48.2% reported brushing in both the morning and evening, 18.3% in the evening, and 15.2% in the morning. Brushing technique also varied, with 32.6% using a gum-to-incisal method, 26.2% using a semi-circular method, and the remainder reporting vertical or horizontal strokes. Mouthwash use was reported by 32.2% of participants and non-use by 67.8%. Tongue cleaning was reported by 52.8% of participants and was not statistically significant in the corresponding categorical comparison ($p = 0.3272$).

3.2 Dental visits and dietary habits

A little over half of respondents (51.5%) reported visiting a dentist once per year, while 19.6% reported two visits and 14.6% reported three visits annually. Carbohydrate-rich food intake was reported by 79.7% of the sample, indicating that this dietary pattern was common in the study population.

3.3 Halitosis and related factors

Self-perceived halitosis was reported as occasional by 59.1% of respondents, absent or rare by 36.5%, and frequent by 4.3%. When participants were asked directly about noticeable bad breath odor, 85% reported no such experience, 12% reported occasional episodes, and 3% reported persistent halitosis. Awareness of halitosis was predominantly self-reported (86%), followed by comments from other people (10.3%) and notification by a dentist (3.7%). Only 9.6% of respondents reported prior treatment for halitosis, whereas

90.4% had never sought treatment. Among those reporting treatment, oral hygiene measures were the most commonly mentioned response, while 59.9% reported no specific intervention.

3.4 Medical, lifestyle, and dental conditions

Smoking or vaping was reported by 22.9% of participants, whereas 77.1% reported no smoking history. Nasal breathing alone was reported by 9.6%, oral breathing by 47.8%, and combined mouth-and-nose breathing by 42.5%. Systemic disease was reported by 11.6% of the sample, with respiratory and sinus-related conditions among the most frequent categories. Self-reported dental caries, periodontal disease, and malocclusion were reported by 62.1%, 32.2%, and 35.9% of participants, respectively. A history of diabetes mellitus was reported by 4.3%.

3.5 Psychosocial impact

Eight percent of respondents reported social difficulties related to halitosis, whereas 92% reported no overt social problems. Even so, 40.9% reported concern about how other people might react to their breath odor, indicating a broader psychosocial burden than that captured by explicit social interference alone.

4 Discussion

The present cross-sectional survey provides descriptive evidence on oral hygiene behaviors, self-reported dental conditions, and self-perceived halitosis in a mixed-age sample. Several findings merit attention. Self-perceived halitosis was common, tooth brushing was widely reported, yet adjunctive hygiene measures and treatment-seeking were less common. Self-reported dental caries and periodontal disease were also frequent, suggesting that oral malodor may occur within a broader pattern of unmet preventive oral-health needs. Because the sample was predominantly male and centered in the 21–31-year age group, the findings should be interpreted as reflecting this respondent profile rather than a narrowly pediatric population [11].

With regard to daily hygiene practices, the high prevalence of reported tooth brushing is encouraging, but only about half of the sample reported brushing twice daily, which is closer to recommended practice [13]. This pattern suggests that brushing alone does not guarantee optimal frequency or technique. The observed variation in brushing timing and method may help explain why substantial levels of self-reported dental disease remained present despite the high overall prevalence of brushing [12]. Effective plaque control depends not only on whether brushing occurs, but also on how consistently and correctly it is performed [8].

Adjunctive practices such as mouthwash use, flossing, and tongue cleaning were less frequently reported than tooth brushing. This pattern is important because tongue coating and interdental plaque are recognized contributors to oral malodor and gingival inflammation. The non-significant finding for tongue cleaning in the descriptive table should be interpreted cautiously; it may reflect heterogeneity in how the behavior was performed or reported rather than an absence of clinical relevance. Overall, the data suggest that routine oral-hygiene behavior in this sample was incomplete rather than uniformly absent [7].

The halitosis findings also illustrate the limits of self-assessment. More than half of respondents described halitosis as occasional, whereas a separate direct question yielded a higher proportion reporting no noticeable odor. This discrepancy is consistent with prior observations that self-perception of oral malodor may vary according to question framing, awareness, and social context [11, 6]. The low proportion of participants who sought treatment further suggests that halitosis may be normalized, minimized, or managed informally rather than presented for professional evaluation [9].

Self-reported dental caries, periodontal disease, and malocclusion were all common. These conditions can increase plaque retention, complicate self-cleaning, and contribute to oral malodor, making the coexistence of these findings clinically plausible [1, 13]. Because these variables were recorded from self-report rather

than direct examination, they should be interpreted as perceived or previously communicated conditions rather than definitive clinical diagnoses [4].

Lifestyle and medical variables add further context. Smoking or vaping, altered breathing patterns, and sinus-related complaints may plausibly worsen oral dryness, plaque accumulation, or malodor perception [10]. However, the present dataset does not establish independent effects, and these findings are best interpreted as descriptive co-occurrences rather than proof of causation. Future studies should pair questionnaire data with clinical examination and stronger analytical modeling [8].

The psychosocial findings are clinically meaningful. Although only a minority reported explicit social problems, a much larger proportion expressed concern about how others reacted to their breath. This pattern suggests that the burden of halitosis may be expressed more strongly through worry, self-consciousness, and anticipated stigma than through overt social exclusion [5, 6]. These concerns reinforce the value of patient education, early counseling, and practical hygiene instruction.

The study has several limitations. The questionnaire-based design may be affected by recall bias, reporting bias, and selection bias. Dental conditions and halitosis were not clinically verified, so the findings should not be interpreted as objective prevalence estimates. In addition, the cross-sectional design does not support temporal or causal inference, and the chi-square analyses remain exploratory. Even with these limitations, the study provides useful baseline descriptive data and highlights areas that warrant targeted prevention and more rigorous follow-up investigation.

5 Conclusion

This study demonstrates that self-perceived halitosis, self-reported dental disease, and suboptimal oral-hygiene behaviors were common in this mixed-age sample. Although most respondents reported tooth brushing, more comprehensive preventive behaviors – including twice-daily brushing, flossing, tongue cleaning, and treatment-seeking for halitosis – were less consistently practiced. The co-occurrence of oral, behavioral, and lifestyle factors underscores the multifactorial nature of oral malodor. These findings support targeted oral-health education, earlier assessment, and prevention-oriented programs, while also indicating the need for future studies that include clinical examination and stronger analytical designs.

References

- [1] Kassebaum, Nicholas J., et al. "Global, regional, and national prevalence, incidence, and disability-adjusted life years for oral conditions for 195 countries, 1990-2015: a systematic analysis for the global burden of diseases, injuries, and risk factors." *Journal of Dental Research* 96.4 (2017): 380-387.
- [2] Shi, Jun-Yu, et al. "Clinical, radiographic and economic evaluation of short-6-mm implants and longer implants combined with osteotome sinus floor elevation in moderately atrophic maxillae: A 3-year randomized clinical trial." *Journal of Clinical Periodontology* 48.5 (2021): 695-704.
- [3] Laleman, Isabelle, et al. "Instrumental assessment of halitosis for the general dental practitioner." *Journal of Breath Research* 8.1 (2014): 017103.
- [4] Yokoyama, Yoko, et al. "Evidence-practice gap for dental sealant application: results from a dental practice-based research network in Japan." *International Dental Journal* 66.6 (2016): 330-336.
- [5] Deolia, Shravani G., et al. "Psychosocial effects of halitosis among young adults." *Annals of Indian Psychiatry* 2.2 (2018): 120-124.

- [6] Brown, Louise F., Pauline J. Ford, and Anne L. Symons. "Periodontal disease and the special needs patient." *Periodontology* 2000 74.1 (2017): 182-193.
- [7] Alotaibi, Ohoud, and Dalal ALQahtani. "Measuring dental students' preference: A comparison of light microscopy and virtual microscopy as teaching tools in oral histology and pathology." *The Saudi dental journal* 28.4 (2016): 169-173.
- [8] Iacobucci, Gareth. "Covid-19: Shielding May Be Reintroduced for Vulnerable People in Highest Risk Areas." (2020).
- [9] Wong, Hai Ming, et al. "Longitudinal changes in developmental defects of enamel." *Community Dentistry and Oral Epidemiology* 44.3 (2016): 255-262.
- [10] Sun, Zhenjie. "A study on the educational use of statistical package for the social sciences." *International Journal of Frontiers in Engineering Technology* 1.1 (2019): 20-29.
- [11] Ashwath, Balachandran, Rajaram Vijayalakshmi, and Subramaniam Malini. "Self-perceived halitosis and oral hygiene habits among undergraduate dental students." *Journal of Indian Society of Periodontology* 18.3 (2014): 357-360.
- [12] Folayan, Morenike Oluwatoyin, et al. "Association between early childhood caries and poverty in low and middle income countries." *BMC Oral Health* 20.1 (2020): 8.
- [13] Peres, Marco A., et al. "Oral diseases: a global public health challenge." *The Lancet* 394.10194 (2019): 249-260.