Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Awareness of Halitosis Among Final-Year Dental Students and Specialty Residents in Isfahan, Iran: A Cross-Sectional Study

Zahra Saberi
Isfahan University of Medical Sciences
Mohammad Mahdi Vatankhah
MohammadMahdyVatankhah@gmail.com
Isfahan University of Medical Sciences
Adel Tabesh
Isfahan University of Medical Sciences

Research Article

Keywords: Halitosis, Awareness, Dental students, Questionnaire

Posted Date: November 12th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11434025/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background

Halitosis (bad breath) is a prevalent condition affecting 20–50% of the global population, with significant social and psychological consequences. Dentists play a primary role in its diagnosis and management; however, inadequate training may compromise their clinical competence. This study aimed to assess the level of awareness regarding halitosis among final-year dental students and specialty residents in Isfahan, Iran.

Methods

This analytical cross-sectional study was conducted on 206 participants (132 general dental students and 74 specialty residents) from two dental schools in Isfahan during the 2025–2026 academic year. Data were collected using a validated researcher-developed questionnaire consisting of 28 items across four domains: demographic characteristics, educational experience, awareness of etiology (8 items), assessment and diagnosis (4 items), and management and treatment (6 items). Content validity was confirmed (S-CVI = 0.9375), and reliability was acceptable (Cronbach's α = 0.71). Data were analyzed using independent t-tests, ANOVA, Spearman and Pearson correlation coefficients (SPSS 26, $p < 0.05$).

Results

The mean total awareness score was 8.2 ± 2.7 out of a maximum of 18. Based on the classification, 30.6% had poor awareness, 63.1% had moderate awareness, and only 6.3% had good awareness. Females had significantly higher total awareness scores than males (8.9 ± 2.5 vs. 7.8 ± 2.7, P = 0.005). Perceived adequacy of education was positively correlated with awareness scores (r = 0.167, P = 0.02). The lowest scores were observed in the management and treatment domain (33.1 ± 16.5 out of 100), which was significantly lower than the etiology (48.7 ± 22.1) and assessment and diagnosis (57.5 ± 28.0) domains (P < 0.001). Residents demonstrated significantly more active clinical approaches than general students (P < 0.001). Familiarity with halitosis classification was associated with higher awareness scores (9.1 ± 2.6 vs. 7.5 ± 2.5, P < 0.001).

Conclusion

The awareness level of halitosis among dental students and residents is moderate, with notable deficiencies in practical management and treatment protocols. Current educational curricula appear insufficient to meet clinical needs. Curriculum revision emphasizing practical training, evidence-based protocols, and skill-based workshops is essential to enhance clinical preparedness in managing patients with halitosis.

Introduction

Halitosis is defined as an unpleasant and offensive odor emanating from the oral cavity or breath that is objectionable to others [1]. It affects approximately 20–50% of the global population, with over 50% of individuals reporting experiencing this condition at some point [2]. Beyond its physical manifestation, halitosis imposes substantial economic burdens, with over $2 billion spent annually on products such as chewing gums, mints, and mouthwashes intended to mask the odor [3]. Individuals suffering from halitosis often experience anxiety, diminished self-confidence, and social withdrawal [4].

Approximately 85–90% of halitosis cases originate from intraoral sources, including tongue coating, deep carious lesions, food impaction, poor oral hygiene, oral infections, mucosal ulcerations, periodontitis, and pericoronitis [5]. Consequently, dentists bear the primary responsibility for managing this condition; however, this role can only be fulfilled effectively when adequate knowledge and training are in place [6]. The main etiological agents are Volatile Sulfur Compounds (VSCs), particularly hydrogen sulfide (H_2S), methyl mercaptan (CH_3SH), and dimethyl sulfide [$(CH_3)_2S$], which result from microbial degradation of proteins in the oral cavity [7, 8].

Extraoral causes include respiratory diseases, gastrointestinal disorders, metabolic abnormalities, systemic medications, and aerodigestive tract carcinomas [9]. Based on the International Classification of Halitosis, the condition is categorized into genuine halitosis, pseudo-halitosis, and halitophobia [7]. Genuine halitosis involves objectively detectable malodor, while pseudo-halitosis and halitophobia are characterized by subjective complaints without clinical evidence of bad breath [10].

Given the profound social and psychological consequences of halitosis, oral health professionals must be adequately prepared to identify, diagnose, and manage this condition sensitively and effectively [11]. Unfortunately, studies have indicated that physicians and dentists generally possess poor knowledge regarding the causes and treatment of halitosis [12], which may lead to misdiagnosis, unnecessary interventions, and prolonged patient suffering [13]. Similarly, patients themselves often hold contradictory beliefs about the etiology and prevention of halitosis [14].

Dental students, as future providers of oral health care, must develop robust knowledge and clinical competence in halitosis management. However, research suggests that education on this topic remains insufficient in many dental curricula. A study from Austria revealed that only 5.2% of students had attended lectures or courses on halitosis, and awareness did not significantly differ between dental and medical students—a finding contrary to expectations given the periodontal and oral medicine training received by dental students [15].

In Iran, few studies have evaluated the awareness of dental professionals regarding halitosis. Ebrahimi et al. reported that dentists in Shiraz had good overall awareness (82.9%), with a reverse correlation between awareness and age and years of experience [16]. Similarly, Vaziri et al. found that 54.8% of general dentists in Yazd had good awareness, with lower scores among older practitioners [17]. Shooriabi et al. reported that 98.9% of dentists recognized intraoral causes as the primary etiology, but

93.3% lacked appropriate diagnostic equipment [18]. Malekzadeh et al. reported moderate awareness among dental students in Guilan, with senior students demonstrating better knowledge [19].

Given the limited and sometimes conflicting evidence, and the absence of studies specifically targeting dental students and residents in Isfahan, this study was designed to assess the level of awareness regarding halitosis among final-year dental students and specialty residents in Isfahan dental schools. The findings aim to identify educational gaps and inform curriculum development to improve clinical preparedness in halitosis management.

Materials and Methods

Study Design and Participants

This analytical cross-sectional study was conducted at the dental schools of Isfahan University of Medical Sciences and Islamic Azad University, Isfahan (Khorasgan) Branch, during the 2025–2026 academic year. The study population comprised final-year (fifth and sixth years) dental students and specialty residents enrolled in these institutions.

Inclusion and Exclusion Criteria

Inclusion criteria were: (1) enrollment in the fifth or sixth year of the general dentistry program or a specialty residency program; (2) willingness to participate and complete the questionnaire. Exclusion criteria included: (1) refusal to participate; and (2) failure to complete more than 10% of the questionnaire items.

Sample Size Calculation

The minimum required sample size was calculated using the formula $n = Z^2S^2/d^2$ with a 95% confidence level ($Z = 1.96$), estimated standard deviation based on similar studies, and a margin of error of 0.15S. Accounting for a 10% attrition rate, the calculated sample size was 200 participants. Ultimately, 206 participants were enrolled.

Sampling Method

A quota sampling method was employed based on two stratification variables: educational level (final-year general students vs. specialty residents) and dental school (public vs. private). The number of participants from each stratum was proportional to the total population size. Within each stratum, convenience sampling was used until the quota was reached. Table 1 presents the distribution of participants across strata.

Table 1
Sampling Distribution Across Dental Schools

Dental School	Group	Total Population	Sample Size
Isfahan University of Medical Sciences	Final-year	80	31
	Pre-final year	71	27
	Residents	104	40
	Total	**255**	**98**
Islamic Azad University (Khorasgan)	Final-year	102	39
	Pre-final year	74	29
	Residents	88	34
	Total	**264**	**102**
Overall Total		**519**	**200**

A total of 206 completed questionnaires were ultimately included in the final analysis.

Data Collection Instrument

A researcher-developed questionnaire was designed based on a comprehensive review of the literature and validated through a systematic process (Additional file 1). The questionnaire comprised 28 items divided into six sections: (1) informed consent and demographic characteristics; (2) educational experience (10 items); (3) awareness of etiology and causative factors (8 items); (4) assessment and diagnosis (4 items); and (5) management and treatment (6 items).

The demographic section collected information on age, gender, educational level, dental school, specialty (for residents), and academic semester.

The educational experience section assessed variables including receipt of adequate training, estimated hours of instruction on halitosis, perceived adequacy of education, sources of knowledge, familiarity with halitosis classification, perceived importance of the topic, self-reported clinical preparedness, willingness to attend workshops, attitudes toward treatment effectiveness, and self-reported clinical approach when encountering patients with halitosis.

The awareness section consisted of 18 multiple-choice questions, with each correct answer scoring 1 point and incorrect answers scoring 0. The maximum possible score was 18. Based on total scores, awareness levels were categorized as: poor (0–6), moderate (7–12), and good (13–18).

Validity and Reliability

The initial questionnaire contained 34 items. Content validity was assessed using the opinions of 8 experts (3 oral medicine specialists, 3 periodontists, 1 oral health specialist, and 1 oral pathologist). The Content Validity Ratio (CVR) was calculated based on Lawshe's table, resulting in the retention of 29 items with CVR ≥ 0.75 and the removal of 5 items. The Content Validity Index (CVI) for the remaining items was ≥ 0.875 for 28 items, leading to the removal of one additional item. The final 28-item questionnaire demonstrated a Scale-level Content Validity Index (S-CVI) of 0.9375.

Reliability was assessed by administering the questionnaire to 18 students with characteristics similar to the target population. Cronbach's alpha coefficient was 0.71 for the awareness section. Split-half reliability yielded Spearman-Brown and Guttman coefficients of 0.79 and 0.76, respectively, indicating acceptable internal consistency.

Data Collection Procedure

The researcher visited the dental schools and approached potential participants before or after scheduled academic sessions. After providing a detailed explanation of the study objectives and procedures, written informed consent was obtained. Participants completed the questionnaire in approximately 15–20 minutes. Following completion, all participants received an educational pamphlet on halitosis, covering its etiology, prevention, and treatment strategies.

Statistical Analysis

Data were analyzed using SPSS version 26. Descriptive statistics, including means, standard deviations, frequencies, and percentages, were calculated for all variables. The association between awareness scores and categorical variables was assessed using independent t-tests (two-level variables) and one-way ANOVA (multi-level variables). Pearson correlation coefficients were used to examine relationships between awareness scores and continuous variables (age), while Spearman correlation coefficients were employed for ordinal variables (perceived adequacy of education, clinical preparedness, attitudes, etc.). The level of statistical significance was set at $P < 0.05$.

Ethical Considerations

This study was approved by the Ethics Committee of Isfahan University of Medical Sciences (Ethics Code: IR.MUI.DHMT.REC.1404.244). All participants provided written informed consent, and confidentiality of responses was assured. Participation was entirely voluntary, and participants were free to withdraw at any time without consequences.

Results

Participant Characteristics

A total of 206 participants were enrolled in this study. The mean age was 26.1 ± 2.9 years (range: 21–36 years). The majority were male (132, 64.1%), with 71 females (34.5%) and 3 participants not specifying gender. Participants were equally distributed between the two dental schools (103 from each). Regarding educational level, 132 participants (64.1%) were general dental students, and 74 (35.9%) were specialty residents.

Among specialty residents, the largest groups were pediatric dentistry (12, 5.8%), orthodontics (10, 4.9%), and prosthodontics (8, 3.9%), while oral pathology had the smallest representation (3, 1.5%) (Table 2).

Table 2
Demographic Characteristics of Participants

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	132	64.1
	Female	71	34.5
	Not specified	3	1.5
Academic Year	Pre-final year	60	29.1
	Final year	72	35.0
	Residency	74	35.9
Dental School	Isfahan University of Medical Sciences	103	50.0
	Islamic Azad University (Khorasgan)	103	50.0
Educational Level	General dentistry	132	64.1
	Specialty residency	74	35.9

Educational Experience

Of the participants, 117 (56.8%) reported receiving adequate training on halitosis during their dental education, while 45 (21.8%) were unsure, and 44 (21.4%) reported no such training. The mean number of formal education hours on halitosis was 3.1 ± 2.0 (range: 0–20 hours). Only 101 participants (49.0%) considered the education and training provided by their university to be adequate, while 85 (41.3%) rated it as inadequate, and 14 (6.8%) reported receiving no effective education.

Familiarity with a specific classification system for halitosis was reported by 91 participants (44.2%), while 115 (55.8%) lacked such familiarity.

The majority of participants considered education in this field useful and followed it. However, the greatest willingness to attend an educational workshop on halitosis (94 participants, 45.6%) was conditional upon it being free or offering educational credits. More than half of the participants (51%),

despite expressing readiness to treat such patients, lacked a specific treatment protocol. Less than one-quarter of the students (20.4%) considered their provided treatments to be effective and satisfactory. More than one-third of the participants (74, 35.9%) had taken no action when encountering such patients, and nearly another one-third (32%) merely informed the patient about the issue and referred them.

Awareness Scores

The mean total awareness score was 8.2 ± 2.7 out of a maximum of 18. Based on the classification, 63 participants (30.6%) had poor awareness, 130 (63.1%) had moderate awareness, and only 13 (6.3%) had good awareness.

To compare the awareness domain scores, the raw scores were standardized to percentages (out of 100). Repeated-measures ANOVA revealed that the mean scores of the awareness domains differed significantly (P < 0.001). Post-hoc LSD analysis showed that the mean awareness score in the assessment and diagnosis domain (57.5%) was significantly higher than in the etiology domain (48.7%), and the score in the etiology domain was significantly higher than in the management and treatment domain (33.1%) (P < 0.001) (Table 3).

Table 3
Comparison of Standardized Awareness Domain Scores (Out of 100)

Domain	Mean (%)	Standard Deviation	P-value*
Etiology and Factors	48.7	22.1	
Assessment and Diagnosis	57.5	28.0	
Management and Treatment	33.1	16.5	
			< 0.001

*P-value for overall repeated-measures ANOVA; pairwise comparisons were significant between all domains (LSD post-hoc test, P < 0.001).

Factors Associated with Awareness Scores

Gender

Female participants had significantly higher total awareness scores than males (8.9 ± 2.5 vs. 7.8 ± 2.7, P = 0.005). In the assessment and diagnosis domain, females also scored significantly higher (2.7 ± 1.1 vs. 2.1 ± 1.1, P < 0.001). No significant gender differences were observed in the etiology or management domains.

Educational Level

No significant differences in total awareness scores were observed between general dental students and residents (7.9 ± 2.8 vs. 8.6 ± 2.5, P = 0.09). Similarly, no significant differences were found between dental schools (public vs. private, P = 0.15).

Age and Semester

Pearson correlation analysis revealed a significant positive correlation between age and the management and treatment domain (r = 0.140, P = 0.047). However, age was not significantly correlated with total awareness (r=-0.030, P = 0.67) or other domains. Academic semester was not significantly correlated with awareness scores in either general students or residents.

Specialty

One-way ANOVA revealed significant differences in total awareness scores across specialties (P = 0.02). Post-hoc analysis using Tukey's test showed that radiology residents had significantly higher awareness scores (11.6 ± 1.7) than prosthodontics residents (7.0 ± 1.4). No other significant pairwise differences were identified.

Familiarity with Classification

Participants familiar with a classification system for halitosis had significantly higher total awareness scores than those who were not (9.1 ± 2.6 vs. 7.5 ± 2.5, P < 0.001).

Perceived Adequacy of Education

Spearman correlation analysis revealed a significant positive correlation between perceived adequacy of education and total awareness scores (r = 0.167, P = 0.02). Similarly, attitudes toward treatment effectiveness were positively correlated with awareness scores (r = 0.168, P = 0.02). However, neither hours of education received nor self-reported clinical preparedness were significantly correlated with awareness scores (Table 4).

Clinical Approach

Residents demonstrated significantly more active clinical approaches than general students when encountering patients with halitosis (P < 0.001). Among residents, 35.1% reported providing treatment, compared to only 10.6% of general students. Conversely, 45.5% of general students reported taking no action, compared to 18.9% of residents.

Table 4
Correlation of Total Awareness Score with Educational Variables

Variable	Correlation Coefficient (r)	P-value
Hours of education received	-0.074	0.30
Perceived adequacy of education	0.167	0.02
Perceived importance of education	0.008	0.91
Clinical preparedness	0.033	0.64
Willingness to attend workshops	-0.061	0.39
Attitudes toward treatment effectiveness	0.168	0.02
Clinical approach	-0.010	0.89

Item-Level Analysis

The highest rate of correct responses was for the question regarding the primary source of halitosis, while the lowest rates were observed for three questions related to the management and treatment domain (the effect of scaling, mouthwash, and the least effective option for sustained improvement).

Discussion

This study provides a comprehensive assessment of halitosis awareness among final-year dental students and specialty residents in Isfahan, Iran. The mean total awareness score of 8.2 out of 18, with only 6.3% of participants demonstrating good awareness, indicates a moderate but suboptimal level of knowledge. These findings align with other studies, including Malekzadeh et al. in Iran (53.6% moderate knowledge) [19] and Rizkianto et al. in Indonesia (43% poor knowledge) [20]. However, they contrast with studies conducted on practicing dentists, such as Ebrahimi et al. (82.9% good knowledge) [16] and Vaziri et al. (54.8% good knowledge) [17], suggesting that clinical experience may contribute to knowledge acquisition.

The significant weakness observed in the management and treatment domain (mean score 33.1%) is particularly concerning given the clinical responsibilities that students and residents will assume. This finding mirrors the results of Ebrahimi et al., who reported that dentists had relatively weaker knowledge of treatment methods compared to etiology and diagnosis [16]. The poor performance on questions related to commercially available products and evidence-based treatment protocols highlights a critical gap between theoretical education and practical clinical application. For instance, many participants incorrectly identified non-therapeutic agents as effective treatments, suggesting that education on evidence-based halitosis management is insufficient.

The gender difference observed, with females scoring significantly higher than males, is consistent with the findings of Rizkianto et al. [20] and may reflect greater health awareness and attention to personal

appearance among women, as previously reported in the literature [21, 22]. However, this finding contrasts with studies by Malekzadeh et al. [19] and Khalil et al. [1], who reported no significant gender differences. These discrepancies may be attributed to differences in questionnaire content or cultural factors.

The lack of significant differences between general students and residents was unexpected, as residents possess greater clinical experience. Similar findings have been reported by Kahraman et al. in Turkey, where fifth-year students showed no significant knowledge improvement over fourth-year students [23]. This suggests that clinical exposure alone does not guarantee knowledge acquisition and that formal education on halitosis may be inadequate throughout the training period.

The significant correlation between perceived adequacy of education and actual awareness scores underscores the importance of quality over quantity in educational delivery. Participants who rated their education as adequate demonstrated higher objective awareness scores, while hours of education did not correlate with awareness. This finding emphasizes the need for effective, outcome-oriented educational strategies rather than simply increasing instructional time.

The more active clinical approach observed among residents compared to general students is encouraging, as it suggests that clinical experience promotes a proactive attitude. However, the finding that 35.9% of all participants reported taking no action when encountering patients with halitosis is alarming and consistent with previous studies [24, 25]. This passivity likely stems from both a lack of knowledge regarding appropriate treatment protocols and discomfort in addressing the sensitive topic with patients.

The overestimation of gastrointestinal causes of halitosis observed in this study (as indicated by responses to related questions) mirrors findings from previous research [26–28]. This misconception suggests that dental curricula need to reinforce the predominant role of oral factors in halitosis etiology.

The higher awareness scores observed among radiology residents compared to prosthodontics residents may reflect differences in educational priorities or clinical exposure across specialties, though the small sample sizes in individual specialties limit definitive conclusions.

Study Limitations

Several limitations should be acknowledged. The cross-sectional design precludes causal inferences. Self-reported data may introduce recall and social desirability biases. The use of a convenience sample within quota strata may limit generalizability, although the sample was representative of the target population. Furthermore, the study did not assess participants' actual clinical performance; it relied on self-reported knowledge and approaches. The limited sample size in some specialty subgroups prevented detailed subgroup analyses.

Implications for Education

Based on the findings, curriculum revision is recommended, with emphasis on practical management protocols, evidence-based treatment algorithms, and skill-based workshops. Educational programs should also include clear referral pathways and communication strategies for addressing halitosis with patients. Regular updates to educational content based on current evidence, along with objective assessment of halitosis knowledge in examinations, are essential to ensure clinical competency.

Conclusion

The awareness level of halitosis among final-year dental students and residents in Isfahan is moderate, with significant deficiencies in the practical management domain. Current educational curricula appear insufficient to prepare future dentists for competent clinical management of halitosis. While perceived adequacy of education is associated with higher awareness scores, formal instructional hours do not correlate with knowledge acquisition. Revision of the dental curriculum, with emphasis on evidence-based treatment protocols, practical workshops, and systematic assessment of clinical preparedness, is essential to enhance the quality of care provided to patients with halitosis.

Abbreviations

VSCs
Volatile Sulfur Compounds
H2S
Hydrogen sulfide
CH2SH
Methyl mercaptan
(CH3)2S
Dimethyl sulfide
CVR
Content Validity Ratio
CVI
Content Validity Index
S-CVI
Scale-level Content Validity Index
SPSS
Statistical Package for the Social Sciences
ANOVA
Analysis of Variance.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the principles of the Declaration of Helsinki. The study was approved by the Ethics Committee of Isfahan University of Medical Sciences (Ethics Code: IR.MUI.DHMT.REC.1404.244). Written informed consent to participate was obtained from all participants prior to their involvement in the study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Funding

This study was supported by the Dental Research Center, Isfahan University of Medical Sciences.

Author Contribution

Z.S. and A.T. conceptualized and designed the study. M.M.V. collected the data and performed the statistical analysis. M.M.V. drafted the initial manuscript. Z.S. and A.T. critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

Acknowledgements

The authors would like to thank all the dental students and specialty residents who participated in this study, as well as the faculty and staff of the dental schools of Isfahan University of Medical Sciences and Islamic Azad University (Khorasgan) Branch for facilitating data collection.

Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

References

1. Khalil I, Hassan K, Kheir EA. Assessment of the knowledge of dentists about halitosis at two dental teaching hospitals in Khartoum city. Int Arab J Dent. 2015;6(2):77–86.

2. Nachnani S. Oral malodor: causes, assessment, and treatment. Compend Contin Educ Dent. 2011;32(1):22–4. 6–8, 30 – 1.
3. Lenton P, Majerus G, Bakdash B. Counseling and treating bad breath patients: a step-by-step approach. J Contemp Dent Pract. 2001;2(2):46–61.
4. Donaldson AC, Riggio MP, Rolph HJ, Bagg J, Hodge PJ. Clinical examination of subjects with halitosis. Oral Dis. 2007;13(1):63–70.
5. Cortelli JR, Barbosa MDS, Westphal MA. Halitosis: a review of associated factors and therapeutic approach. Braz Oral Res. 2008;22(suppl 1):44–54.
6. Aylıkcı BU, Colak H. Halitosis: From diagnosis to management. J Nat Sci Biol Med. 2013;4(1):14–23.
7. Yaegaki K, Coil JM. Examination, classification, and treatment of halitosis; clinical perspectives. J Can Dent Assoc. 2000;66(5):257–61.
8. Ratcliff PA, Johnson PW. The relationship between oral malodor, gingivitis, and periodontitis: a review. J Periodontol. 1999;70(5):485–9.
9. Dadamio J, Van Tournout M, Teughels W, Dekeyser C, Coucke W, Quirynen M. Efficacy of different mouthrinse formulations in reducing oral malodour: a randomized clinical trial. J Clin Periodontol. 2013;40(5):505–13.
10. Quirynen M, Dadamio J, Van den Velde S, De Smit M, Dekeyser C, Van Tornout M, et al. Characteristics of 2000 patients who visited a halitosis clinic. J Clin Periodontol. 2009;36(11):970–5.
11. de Jongh A, de Baat C, Horstman M. Psychosocial aspects of halitosis. Ned Tijdschr Tandheelkd. 2012;119(9):436–40.
12. Rayman S, Almas K. Halitosis among racially diverse populations: an update. Int J Dent Hyg. 2008;6(1):2–7.
13. Quirynen M, Dadamio J, Van den Velde S, De Smit M, Dekeyser C, Van Tornout M, et al. Characteristics of 2000 patients who visited a halitosis clinic. J Clin Periodontol. 2009;36(11):970–5.
14. Soares L, Tinoco E. Prevalence and related parameters of halitosis in general population and periodontal patients. OA Dent. 2014;2(1):4.
15. El Din AA. Awareness and attitude towards bad breath malodor among dental and medical students in Vienna, Austria: an online survey [dissertation]. Vienna: Medical University of Vienna; 2016.
16. Ebrahimi R, Lavaee F, Darvishi Tafvizi M, Rahmani F. Evaluation of Shiraz Dentists' Knowledge of Causes and Treatments Methods of Halitosis in 2015. J Mashad Dent Sch. 2016;40(3):193–202.
17. Vaziri F, Raei F, Herandi V. Investigation of the level of general dentists' awareness about the causes of halitosis and its treatment in Yazd in 2018. J Shahid Sadoughi Univ Med Sci. 2020;28(2):2363–72.
18. Shooriabi M, Hojjat SM, Satvati SAR, Sharifı R. Evaluating the Knowledge and Performance of Dentists about Halitosis in Ahvaz, Tehran and Gorgan during 2014–2015. Int J Med Res Health Sci.

2016;5(9):167–73.
19. Malekzadeh M, Ezoji M, Maleki D. Knowledge and practice of dental students in Guilan University about halitosis: A randomized questionnaire-based cross-sectional study. J Dentomaxillofac Radiol Pathol Surg. 2018;7(4):137–44.
20. Rizkianto MA, Novita CS, Anargia G, Titani FM, Nurrahman TF, Iskandar RPD. Level of knowledge and awareness of Halitosis in the Dental Medicine Students. Prof Dr RK Sharma. 2020;20(4):388.
21. Khami MR, Ghadimi S, Zare H, Rabbani M. Attitudes towards oral health behavior among students of dental schools in Tehran. J Islam Dent Assoc Iran. 2010;22(4):223–32.
22. Al-Omari QD, Hamasha AA. Gender-specific oral health attitudes and behavior among dental students in Jordan. J Contemp Dent Pract. 2005;6(1):107–14.
23. Kahraman EN, Erensoy Ş, Dikilitaş A, Gülşahı A, Aydın EÖ, Özalp Ateş FS. Awareness and knowledge of halitosis among students at two different dental universities in Turkey: a cross-sectional survey. BMC Oral Health. 2025;25(1):194.
24. Buunk-Werkhoven YAB, Buls JG, Osinga E, Bruers JJM. Diagnosis and treatment of patients with halitosis by dental hygienists and dentists in the Netherlands. Int Dent J. 2015;65(2):65–70.
25. Nunes JC, Martínez-Sahuquillo Á, Cameira MJ, Marques HD, Halitosis. Are dentists being prepared for this challenge?—A questionnaire survey in a dental school. Rev Port Estomatol Med Dent Cir Maxilofac. 2011;52(3):142–6.
26. Harmouche L, Reingewirtz Y, Tuzin N, Lefebvre F, Davideau J-L, Huck O. Knowledge and management of halitosis in France and Lebanon: A questionnaire-based study. J Clin Med. 2021;10(3):502.
27. Al-Atrooshi B, Al-Rawi A. Oral halitosis and oral hygiene practices among dental students. J Bagh Coll Dent. 2007;19(1):72–6.
28. Oppliger N, Roth B, Filippi A. Knowledge of halitosis among dentists and dental hygienists: A comparison between Switzerland, Germany, and France. Swiss Dent J. 2014;124(2):133–8.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Additionalfile101.08.05.docx