

Original Article



Assessment of halitosis-related factors in Turkish population, a cross-sectional study

Murat Aydın^{1*}, Şakir Özgür Keşkek²¹Halitorium- Halitosis Clinic, Reşatbey Mah Gazipaşa bulv Emre apt n:6 k:2 d:5 Adana-Türkiye²Department of Internal Medicine, School of Medicine Alaaddin Keykubat University Alanya/Antalya-Türkiye

*Corresponding Author: Murat aydin, Email: draydinmurat@gmail.com

Abstract

Background: Halitosis is a prevalent issue globally, causing economic burdens and diminishing quality of life, and often remains confidential due to social stigma. This survey aimed to determine the prevalence, characteristics, and early signs of the condition among the Turkish population and dentists while also exploring hygiene habits, knowledge levels, and associated psychological aspects.

Methods: A total of 1,181 participants (aged 19–78 [median 22], 681 female, 655 married, 601 dentists, 886 complained of halitosis) completed a self-administered, structured questionnaire with 91 questions on halitosis, along with the Beck Anxiety and Depression Inventories. Results were compared with existing literature findings.

Results: Seventy-five percent of the participants and 21.5% of dentists experienced halitosis at level 2 on a 5-point scale. Moreover, 40.3% of them experienced a bad taste. Halitosis was correlated with various factors, including tongue brushing ($P=0.019$), constipation ($P=0.044$), and lactose malabsorption ($P=0.033$). Gingival bleeding emerged as a significant symptom ($P=0.003$), correlating with soft brush use ($P<0.05$). In addition, 40.49% of dentists reported feeling insufficiently trained in halitosis, with 83.19% expressing inadequacy in examination or treatment. Furthermore, 29.4% of 286 individuals asserted unrealistic claims, likely indicative of subjective halitosis. Halitosis can cause anxiety or depression, with males being more affected by anxiety; both dentists ($P=0.0184$) and non-dentists ($P=0.0092$) who experienced halitosis reported higher anxiety levels compared to those who did not.

Conclusion: This survey offers insights into the prevalence of halitosis and its associated factors, highlighting the need for comprehensive management that includes psychological support and professional education on diagnosis and treatment.

Keywords: Halitosis, Bad breath, Survey, Questionnaire, Malodor, Diganose

Citation: Aydın M, Keşkek ŞÖ. Assessment of halitosis-related factors in Turkish population, a cross-sectional study. *J Oral Health Oral Epidemiol.* 2025;14:2404.1645. doi:10.34172/johoe.2404.1645

Received: April 27, 2024, **Revised:** May 6, 2025, **Accepted:** May 18, 2025, **ePublished:** November 4, 2025

Introduction

Halitosis is a chronic, endogenous malodor. Typically, everyone experiences halitosis at some time.¹ Approximately \$10 billion is spent annually worldwide on halitosis. During an annual ADA meeting, 92% of dentists reported seeing patients with halitosis, with 50% noting six or more cases per week. Patient visits for halitosis treatment surpass those for blood transfusions.² Previous statistics²⁻⁷ reflect old data. Its prevalence may vary according to the country or the methodology used for assessment.²

Halitosis is an intimate and embarrassing issue, leading fewer patients to seek help from healthcare professionals. They continue to live with their problem and tend to conceal it socially.^{3,4} However, psychological problems may arise if halitosis is left untreated.^{5,6} An anonymous survey is the best way to determine the true rate of halitosis complaints.

Halitosis constitutes a significant social issue, often leading to psychological distress and impaired social interactions. Due to the stigma surrounding oral malodor, individuals may experience embarrassment and reluctance to acknowledge or discuss their condition, even with healthcare professionals. As a result, the social impact of halitosis frequently remains underreported and, in many cases, surpasses its biological consequences.^{3,4} Accurately assessing the true prevalence of halitosis-related social burden in the general population poses a methodological challenge.^{5,6} To address this, data collection in the present study was conducted using an anonymous survey, ensuring that no personal identifying information was obtained from participants.

This survey aimed to determine the prevalence, characteristics, and early signs of halitosis in the Turkish population. It also aimed to assess hygiene habits,



knowledge levels, and psychological status among individuals and dentists with or without halitosis. Additionally, the survey aimed to determine the psychological, social, spiritual, and mental impressions of contributors with halitosis, as well as the competency and training of dentists regarding halitosis and treatment protocols. Therefore, this study also intended to identify supplementary signs and potential indicators—apart from the individual's subjective awareness of odor—that may assist in predicting the presence of halitosis. This is the first statistical analysis of halitosis distribution among the general public and dental professionals in Turkey.

Methods

Study design

Invitations were posted to open public Internet forums and dental groups. Individuals with or without halitosis complaints were invited to complete the “Distribution of Halitosis” questionnaire via the Google Documents website.

Every participant provided consent for the use of their answers for statistical analysis. Approval was obtained from the Ethical Committee of City Hospital (24.07.2022/496).

Sample size estimation

As no official statistics have been published regarding the prevalence of halitosis in the Turkish population, a maximum participation strategy was adopted to estimate the sample size. The study aimed to reach as many individuals as possible, with a minimum target of 1,000 participants.

Data collecting

The survey link was announced online via social media platforms, inviting participation from both men and women with or without halitosis. Dentists were specifically encouraged to take part in the study. This approach allowed for reaching diverse segments of the population. Participation was voluntary, and no identifying information was collected to protect respondent anonymity and encourage honest responses. Over 17 weeks (from July 27, 2022, to March 14, 2023), a total of 1,193 individuals participated in the survey.

Inclusion and Exclusion Criteria

Individuals under the age of 18 or those not residing in Türkiye were excluded from the study. After applying the exclusion criteria, 1,181 respondents were included in the final analysis (see Figure 1).

Outcome definition

Sex was dichotomized into male or female. Marital status was dichotomized as married or unmarried. Singles, divorcees, and widowers comprised the unmarried group.

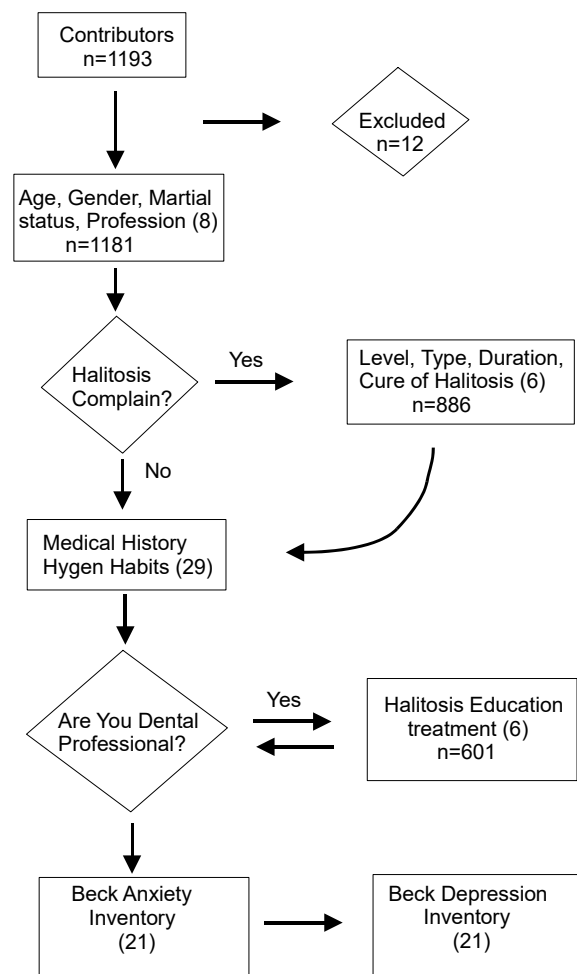


Figure 1. Flow chart of study design. Ninety-one questions were asked to 1,181 contributors (601 dentists). The number of questions is shown in parentheses

Smoking was dichotomized as either “yes” or “no.” Former smokers were categorized as “no.” Individuals who answered “never” or “rarely” were classified as “no,” while those who answered “sometimes,” “repeatedly,” or “always” were classified as “yes.” Medication use was dichotomized as either “yes” or “no,” regardless of the specific type of medication used. Systemic disease status was dichotomized as either “yes” or “no.” Participants were considered to have a systemic disease if they reported a chronic condition requiring medical treatment, showing no tendency to resolve spontaneously, and involving metabolic processes—such as diabetes, nephritis, chronic hepatitis, immunologic, neurological, or psychiatric disorders, gout, or cardiovascular diseases.

Questionnaire Design and Organization

The structured questionnaire (Table 1), consisting of five sections and 197 questions, was administered anonymously. Questions in Sections 1 and 2 were taken from previous similar studies^{3,4,6,8}, with some modified to reflect Turkish cultural traditions—for example,

Table 1. The Structured Questionnaire

Section 1: Questions for All Participants
Age, Sex, Marital status, Country of residence, use of dental prosthesis, smoking, drinking alcohol. Do you have halitosis complaints? __
Please mark any of the following conditions you have:
• Asthma, COPD, pneumonia • Sinusitis, post-nasal drip, allergy • Reflux, heartburn • Bloating, gas, diarrhea, celiac disease, lactose intolerance • Diabetes, neurologic, and psychiatric disorders • Obesity, immunologic diseases • Gout, goiter, thyroid disorders • Kidney failure, nephritis • Liver disease, including cirrhosis • Depression, obsession, anxiety • Crohn's or irritable bowel syndrome
Rate your halitosis level on a 5-point scale: 0 (no malodor) to 5 (extremely foul odor) __
How long have you been suffering from halitosis? __
How many particular malodors do you distinguish in your mouth? __
Do you receive social reactions because of your halitosis? (Y/N)
How do you know that your mouth smells?
• I can detect my halitosis. • I can tell from the taste on my tongue. • Someone explicitly told me that I have halitosis. • Some people imply it. • I suspect that my mouth smells. • Dentist diagnosed
Have you tried any of the following to eliminate your halitosis?
• Oil pulling • Leech therapy, wet cupping (hijama), or dry cupping • Candida diet, probiotics, colloidal silver, alkaline diet • Bioenergy, bioresonance, diaphragmatic breathing • Various herbs, Himalayan salt • Spells or talismans • Liver detox, fasting • Homeopathy, phytotherapy
How many people have told you directly, using words, that you have halitosis? __
What might be the cause of your halitosis?
• Decayed tooth • Tongue coating • Gum problem • Pharyngitis or tonsillitis • Digestive tract • Other __
Does milk cause abdominal pain for you (Do you have lactose intolerance)? (Y/N)
When you have halitosis, do you also experience a bad taste in your mouth? (Y/N)
Is there any food item you consume regularly and consistently every day? __
How often do you defecate? Do you suffer from constipation? __
Do you notice the halitosis while inhaling or exhaling? __
What is the longest amount of time your halitosis disappears without any treatment? __
If you regularly take any medication(s) daily, please write its/their name: __
If there is anything that improves your halitosis, please write it: __
If you have body odor, that is, if any part of your body has a noticeable smell, please indicate which area: __
How often do you brush your teeth? 3x1, 2x1, 1x1, 1x2, 1x3
How long do you brush your teeth? <1 minute, 1-3 min, >3 min
How often do you brush your tongue? __
Do your gums bleed when brushing your teeth? (Y/N)
What kind of toothbrush do you use? Soft/Medium/Hard/Automatic

Table 1. Continued.

Section 2: Questions for Dentists Only
As a dentist:
• How do you manage your halitosis? • Have you received any training on halitosis during your dental education? • Do you recall any specific topics or lessons on halitosis in dental school? • Do you take any precautions regarding your halitosis while examining patients?
Did you already know that any of the following could cause halitosis?
• Dental bridge restorations with closed undersides • Plaque coating the tongue surface • Lips that cannot fully cover the teeth • Consumption of alcohol • Use of alcohol-based mouthwash • Dry mouth
Do you consider yourself competent in managing patients with halitosis? (Y/N)
Sections 3,4,5: Questions for All Participants
Beck Anxiety Inventory, Symptom Checklist-90, and Beck Depression Inventory consist of clinically validated standardized psychometric tests that are well-known and worldwide used to detect potential psychiatric conditions.

commonly consumed foods, milk consumption, systemic diseases, and the use of alternative medicine. The questions in the remaining three sections were universally accepted and widely used clinically validated psychometric instruments.⁴

The first section covers age, gender, marital status, knowledge of halitosis, smoking and alcohol habits, toothbrush type, oral hygiene practices, demographic data, profession, education, country of residence, use of dental prostheses, general and oral health behaviors, medical and dental histories, and systemic diseases. The subjects were asked if they believed they had halitosis and how they identified it (self-perception, dentist diagnosis, or others' feedback). Additionally, the participants rated their halitosis severity on a 5-point scale, ranging from 0 (no malodor) to 5 (extremely foul odor). The second section focused on diagnostic and therapeutic protocols exclusive to dentists, as well as training, self-treatment, and medical knowledge (Table 1).

The remaining three sections, including the Beck Anxiety Inventory (BAI), the Symptom Checklist-90 (SCL-90), and the Beck Depression Inventory, consist of standardized diagnostic tests. They are widely used multiple-choice self-report inventories for assessing the severity of anxiety or depression.⁴ The Beck Anxiety Inventory and the Beck Depression Inventory each comprise 21 clinically validated questions, rated on a scale from 0 (never) to 3 (severely). The SCL-90 evaluates a broad range of psychiatric conditions across 90 standardized and clinically validated questions, covering both somatic and emotional states. Prior to administering the main survey, the survey questions were piloted with a cohort of 10 individuals.

In total, the participants were presented with 65 general questions about halitosis and an additional 132 items for psychometric tests. Due to the comprehensive or

exhaustive nature of the questionnaire, some respondents opted not to answer certain items. Consequently, SCL-90 queries and 16 general questions (totaling 106 items) were excluded from the survey analysis. Ultimately, each participant's responses to the 91 questions were evaluated (Figure 1).

Statistical analyses

Statistical analysis was conducted using MedCalc v19.8 software (MedCalc, Belgium). Categorical measurements were reported as numbers and percentages, while quantitative measurements were reported as mean $\pm$ standard deviation. The *Kolmogorov-Smirnov* test confirmed the normal distribution of quantitative measurements. The Chi-square test compared categorical measures, and the T-test or *Mann-Whitney U* tests compared quantitative measurements between the groups. The correlation coefficient (*Pearson* correlation coefficient, *r*), along with its *p*-value and 95% confidence interval for *r*, were used to analyze the association between the variables.

Results

Of the population (*n* = 1,181), 886 (75.02%) complained of halitosis at level 2 on a 0–5 scale. The participants ranged in age from 19 to 78 years (median = 22); 681 were female, 655 were married, and 601 were dentists. One hundred twenty-nine of 601 individuals (21.5%) experienced halitosis despite being dentists.

Of 587 halitosis patients, 424 perceived halitosis only during exhalation, 52 did not perceive it, and 111 perceived it during both inhalation and exhalation. A significant relationship (*P* = 0.025) is observed, indicating that halitosis self-perception is exclusive to exhalation.

In this patient series, 113 patients with halitosis (40.35%) experienced a bad taste problem that was synchronized with the sense of oral malodor (*n* = 280).

No significant association was found between complaints of halitosis and regular medication use (*n* = 13), the presence of systemic diseases (*n* = 8), or smoking (*n* = 6). Two participants reported alcohol use. Twelve participants reported using an oral prosthesis.

Eighty out of 285 halitosis patients experienced signs of lactose malabsorption. There was a potential relationship between halitosis and lactose malabsorption (*P* = 0.033).

The defecation frequency of halitosis patients was noted as follows: once daily (*n* = 196), every 2 days (*n* = 69), and every 3 days or less frequently (*n* = 23).

The patients were asked about the causes of halitosis to assess their awareness of halitosis. Tongue coating was known by 117 patients, dry mouth by 115, poor restorations by 112, drinking alcohol by 81, keeping lips open by 75, and alcoholic mouthwashes by 52 (*n* = 801). Although 21.19% of 552 halitosis patients (including 123 dentists) were aware of the importance of tongue coating,

only 4% of them brushed their tongues.

Halitosis patients (*n* = 273, including 126 dentists) utilized diverse treatment methods: tooth brushing (*n* = 34), consuming snacks (*n* = 22), mouth rinsing (*n* = 21), chewing gum (*n* = 16), using herbal products (*n* = 13), taking some medications (*n* = 13), and other interventions (*n* = 143). Remarkably, only 11 out of 273 individuals implemented the recommended treatment (tongue brushing); four of these 11 were dentists.

Only 13.2% of patients with halitosis brushed their teeth for ≥ 3 minutes. Tooth brushing frequency showed a weak correlation with halitosis complaints (*P* = 0.059). Individuals with halitosis brushed their tongues less frequently than those without complaints (*P* = 0.019), confirming the relationship between tongue brushing and halitosis. Non-dentists brushed their tongues more often than dentists (*P* = 0.039). The hygiene habits of patients with halitosis are outlined in Table 2.

Five hundred seventy-four of 886 individuals with halitosis showed gingival bleeding (*P* = 0.003). It was significantly associated with using a soft brush (*P* < 0.05). Participants using manual or medium brushes experienced less gingival bleeding and halitosis compared to those using automatic or soft brushes (*P* = 0.041).

A total of 40.49% of the dentists reported inadequate training on halitosis. Nearly half (49.6%) of the dentists could not recall any content related to halitosis in their dental education materials. Furthermore, 83.19% of the dentists felt inadequate in conducting halitosis examinations or treatments (Table 3). Due to insufficient training, the dentists frequently struggled to effectively diagnose and manage halitosis, both in the patients and themselves. Merely 12.75% of the dentists employed appropriate actions, such as tongue brushing, for self-treatment. Additionally, 15.95% of the dentists resorted to poor scientific practices (e.g., bioresonance, diet, cupping, and hijama), as indicated in Table 3.

Psychometric data showed that, among 286 individuals with halitosis, 29.4% made such claims, suggesting subjective halitosis, with 28 reporting more than three bad odors (Table 4).

Non-dentists

Individuals with halitosis showed higher anxiety than those without halitosis (*P* = 0.0092) (Table 4). BAS was found higher for males (mean 14.34, median 6, *n* = 79) than for females (mean 7.51, median 6, *n* = 52) (*P* = 0.0001). Individuals with halitosis were found to be more depressive than those without halitosis (*P* = 0.042) (Table 4). Females were much more affected than males (*P* = 0.033). The results showed that halitosis can cause depression, especially in non-dentist females. No difference was found between dentists and non-dentists without halitosis regarding anxiety (*P* = 0.188) or depression (*P* = 0.84) parameters.

Table 2. Oral Hygiene Habits Of Halitosis Patients

	Dentist	Non-dentist
How often do you brush your teeth?		
3 times per day (n = 17)	9	8
2 times per day (n = 144)	70	74
1 time per day (n = 103)	42	61
1 time per 2 days (n = 9)	0	9
1 time per 3 days (n = 15)	5	10
Total (n = 288)	126	162
How long do you brush your teeth?		
< 1 minute (n = 57)	9	48
1-3 minutes (n = 290)	89	201
> 3 minutes (n = 62)	24	38
Total (n = 288)	122	166
How often do you brush your tongue?		
2 times or more per day (n = 8)	5	3
After every tooth brushing (n = 122)	62	60
When I remember (n = 93)	38	55
Never (n = 64)	20	44
Total (n = 287)	125	162
Do your gums bleed when brushing your teeth?		
Sometimes (n = 339)	96	243
Always (n = 59)	17	42
Never (n = 176)	63	113
Total (n = 574)	176	398
What kind of toothbrush do you use?		
Soft brush (n = 67)	16	51
Medium (n = 285)	90	195
Automatic (n = 64)	22	42
Total (n = 416)	128	288

Dentists

Dentists with halitosis exhibited higher BAS scores compared to non-dentists with halitosis ($P=0.00184$), indicating that halitosis may contribute to anxiety among dentists. Dentists with halitosis exhibited higher anxiety than those without halitosis ($P=0.0001$) (Table 4). Male dentists were more affected (mean 15.9, $n=70$) than female dentists (mean 11.04, median 11, $n=42$) ($P=0.0097$). This suggests that halitosis induces greater anxiety among male dentists. Dentists with halitosis showed more depression than those without halitosis ($P=0.0389$). No gender difference was observed in depression scores among the dentists ($P=0.086$).

Discussion

Anonymous survey methodologies provide valuable insights into sensitive health issues like halitosis, where patients may hesitate to disclose concerns in clinical

Table 3. Actions by Dentists Who Complain of Halitosis

Question	Answer
Have you been trained on halitosis in dentistry faculty? (n = 121)	Yes (n = 72) No (n = 49)
Do you recall a section on halitosis in your dental education? (n = 123)	Yes (n = 62) No (n = 61)
As a dentist, How do you treat your halitosis? (n = 188)	Brushing teeth (n = 47) Rinsing mouthwash (n = 26) Brushing tongue (n = 24) Dental floss (n = 12) Snacking (n = 11) Removal of dental plaque and calculus myself (n = 10) I can not (n = 9) Herbals, ocean salt, rock salt (n = 9) Oil pulling (n = 8) Candida diet, alkaline diet, Pro(e)biotic, silver water (n = 5) <i>H. pylori</i> treatment (n = 4) Liver detox, fasting (n = 4) Removal tonsils (n = 3) Dental filling (n = 2) Homeopathy, phytotherapy (n = 1) Magic, amulet (n = 1) Bioenergy, bioresonance, diaphragm breathing (n = 1) Stick leech, hajamat, cupping (n = 1)
How do you hide your halitosis when examining patients? (n = 156)	Face mask (n = 90) Brushing teeth (n = 23) Gum, clove (n = 14) Rinse mouthwash (n = 11) Keeping far from the patient (n = 9) Stay away from smelly foods (n = 6) Cleaning tongue (n = 3)
Do you think that you are inadequate in the face of halitosis patients?	Yes (n = 99) No (n = 20)

Table 4. Results of Psychometric Tests

Test	With Halitosis		Without Halitosis	
	Dentist	Non-dentist	Dentist	Non-dentist
Beck Anxiety Score (BAS) (mean value)	14 $p=0.0038$ (n = 112)	11.53 $p=0.0092$ (n = 131)	10.45 $p=0.0001$ (n = 418)	9.57 $p=0.0092$ (n = 357)
Beck Depression Score (BDS) (mean value)	14.65 $p=0.0389$ (n = 88)	14 $p=0.042$ (n = 104)	13.2 $p=0.042$ (n = 310)	13.07 $p=0.051$ (n = 285)

Anxiety and depression scores range from 0 to 63, where elevated scores indicate heightened levels of anxiety or depression symptoms

settings.⁷ The current study, by leveraging the anonymity and breadth of an online survey, offers a multifactorial assessment of halitosis across both dental professionals and the general population. The study presents a multifaceted analysis of halitosis, encompassing epidemiological, behavioral, clinical, and psychological dimensions in both dental professionals and the general population.

The findings, analyzed within thematic subcategories, are consistent with and build upon existing literature.

The results reinforce the evolving understanding of halitosis as not merely an oral health issue but a condition with complex psychosocial and systemic implications, consistent with recent paradigm shifts in its definition and classification.¹ Each subheading in this section presents findings refined through the survey instrument, contextualized against relevant scholarly work. The clinical implications of the findings are also emphasized.

The distribution of halitosis differs from one population to another. Many statistical reports on halitosis prevalence across different populations indicate rates ranging from 15% to over 90%, depending on geographic and demographic variables.^{2,7,8} In this study, 75% of the participants reported experiencing halitosis, a figure consistent with prior findings from countries such as Italy (90.7%), Germany (90%), Taiwan (60%), and France (50–60%).⁸

Self-evaluation is valuable for estimating halitosis prevalence in epidemiological studies where quantitative measurements are impractical.⁷ Consequently, in the present study, individuals who reported halitosis were considered halitosis patients. Given their complaint of halitosis, it is evident that they have an objective or subjective manifestation of halitosis that necessitates treatment.

A substantial portion of the participants (40.3%) reported a concurrent bad taste, a symptom supported in prior studies as indicative of elevated intraoral hydrogen sulfide (H_2S) concentrations.^{5,9–11} Bad taste can be a clinical sign of halitosis.⁵ A study linked self-reported halitosis with taste distortions in 21 out of 72 complaints.⁹ Hydrogen sulfide (H_2S) is the primary halitotic gas, soluble at 1 g/242 ml H_2O . When the oral H_2S concentration exceeds the gustatory threshold (0.05–0.1 mg H_2S /L), patients with halitosis perceive the bad taste.^{10,11} Indole, another halitotic gas soluble at 0.19 g/100 ml, may have a different bad taste. The sense of bad taste plays a crucial role in referring patients with halitosis to healthcare professionals because taste distortions contribute to considering the presence of halitosis.¹² In this series, 40.3% had complaints of bad taste, confirming literature findings. Assessment of bad taste may provide additional clinical insight and can be incorporated into routine examinations.

Patients with halitosis who have a good understanding of prevention methods and hygiene habits tend to experience less severe complaints. In this study, both dentists and non-dentists exhibited suboptimal oral hygiene behaviors. While tooth brushing duration and frequency showed limited association with halitosis, tongue brushing emerged as the most significant variable ($p=0.019$). This aligns with existing evidence that the tongue dorsum is a primary source of volatile sulfur compounds,² and its neglect may perpetuate malodor even in otherwise healthy individuals. The most effective

treatment is tongue brushing.¹³ Moreover, the inverse relationship between soft/automatic toothbrush use and gingival health ($p=0.041$) supports previous findings,^{14,15} emphasizing the mechanical efficacy of tongue brushing. Patients with halitosis are advised to use a medium-bristled toothbrush.

Although brushing frequency and duration are traditionally emphasized, their relationship with halitosis was found to be less pronounced. Using a toothbrush less than once daily was strongly associated with self-perceived halitosis ($P<0.001$).¹⁶ Although tooth brushing twice daily for two minutes has been recommended,^{14,15} longer duration (180 seconds) is even better.¹⁵ In the literature, patients with halitosis reported brushing their teeth once (66.1%), twice (32.1%), and three times daily (1.8%). Average brushing time was noted as <1 min (21.8%), 1–2 min (13.9%), >2 min (64.3%) ($n=280$).³ Tongue brushing was found more effective than both periodontal therapy ($n=28$, $P<0.01$)¹⁷ and tooth brushing alone.⁸ In this survey, the participants brushed their teeth less frequently compared to the literature, but the relationship between tongue brushing and halitosis was consistent with previous findings. Critically, tongue coating remains the primary etiological factor in oral halitosis; yet, in our study, only 4% of affected individuals reported regular tongue brushing, despite 21.19% acknowledging its importance. This highlights a clear knowledge-behavior gap, consistent with previous literature—a phenomenon previously described as “knowing-doing dissociation.”^{2,3} Interestingly, many contributors knew effective halitosis treatments, but even the dentists did not report brushing their tongues.

Despite their clinical training, 21.5% of the dentists reported experiencing halitosis, and 83.19% expressed inadequacy in diagnosis or treatment. This paradox is supported by others,⁷ who reported insufficient curricular emphasis on halitosis in dental education. Similar concerns were echoed in this study, where 83.19% of the dentists felt unprepared to manage halitosis clinically, and less than 13% engaged in appropriate tongue brushing—an intervention consistently shown to reduce oral malodor.¹⁷ Tongue brushing should be recommended for patients with halitosis, as it represents the first step in managing all clinical forms of the condition.

The study identified a potential link between halitosis and constipation or lactose malabsorption, aligning with gastrointestinal associations previously discussed in breath analysis studies.^{16,18} Exhaled hydrogen and methane¹⁶ in lactose malabsorption and dimethyl sulfide¹⁸ in constipation cases are documented as extra-oral malodor sources. The present study found statistically moderate associations between halitosis and both constipation ($P=0.044$) and lactose malabsorption ($P=0.033$). More clinical evidence is needed to support this topic.

The patients' limited awareness of halitosis-related

etiologies, particularly tongue coating and dry mouth, mirrors findings from others,^{3,19,20} suggesting persistent educational gaps in both lay and professional populations. Despite the widespread prevalence of halitosis worldwide, education on halitosis in dental schools is insufficient, with 72% of dental students feeling unprepared to handle such cases.^{21–23} The survey results were consistent with previous reports^{7,23} regarding the insufficient training of dentists on halitosis. Given its high prevalence and psychosocial burden, halitosis should receive greater emphasis in dental training programs.

Alcohol, smoking, certain regularly used medications, dental prostheses, and systemic diseases have been reported to contribute to halitosis.^{12,13} However, the number of participants with these characteristics was low in the present study. The median age of the participants was relatively young, at 22 years. A total of 112 participants were over the age of 40 (data not shown), and only 12 of them reported using prostheses. This sample size was insufficient to perform a preliminary statistical analysis. Therefore, it was not possible to establish a statistically significant association between halitosis and smoking, prostheses, systemic diseases, alcohol, or regular medication use.

An intriguing 72.23% of the respondents reported perceiving halitosis exclusively during exhalation. Those who perceived malodor during inhalation or both phases exhibited higher anxiety and depression scores (data not shown), suggesting that perception modality may hold diagnostic value in cases of subjective halitosis.

Gingival bleeding, observed in 37.9% of halitosis sufferers,³ was significantly associated with the use of soft or automatic toothbrushes—tools previously linked to poorer periodontal outcomes.^{20–22} In contrast, manual or medium-bristled brushes were associated with less gingival bleeding, consistent with literature emphasizing the mechanical effectiveness of brushing.^{17,21}

The increasing use of scientifically unsupported methods—such as bioresonance, oil pulling, alkaline diets, homeopathy, magic, amulets, and phytotherapy—is concerning. These approaches not only possibly cause harm but may delay or prevent effective treatment. These observations echo earlier critiques of pseudoscientific interventions in oral health, particularly when formal training is lacking.^{2, 23} It raises the question of whether halitosis should be more explicitly addressed in continuing dental education and clinical guidelines.

The psychological burden of halitosis was notable. Subjective halitosis is not uncommon, with rates ranging from 27% to 38.5%,⁵ and it remains a challenging diagnostic entity, often coexisting with psychiatric symptoms such as anxiety, depression, or olfactory reference syndrome.^{5, 24–27} Clinic attendees often feel self-conscious, yet only 24% have objective or measurable halitosis. Additionally, 55% perceive no or slight odor. Complaints often involve

multiple malodors, with unrealistic claims like covering their mouth, touching their nose, and opening windows.²⁷ In this survey, 29.4% of the individuals exhibited unrealistic or exaggerated complaints, a figure consistent with reports of 27–38.5% for subjective halitosis.⁵ This survey's results echo previous reports, revealing 286 individuals with unrealistic complaints. Of these, 61.5% were unmarried (data not shown).

Significant correlations were observed between self-rated oral malodor and obsession-compulsion ($r=0.27$, $P<0.05$), depression ($r=0.38$, $P<0.01$), anxiety ($r=0.34$, $P<0.05$), phobic anxiety ($r=0.32$, $P<0.03$), paranoid ideation ($r=0.27$, $P<0.05$), psychoticism ($r=0.27$, $P<0.05$), general symptom index ($r=0.34$, $P<0.03$), and positive distress index ($r=0.28$, $P<0.05$).^{25, 26} Over 20% of halitosis patients ($n=262$) showed high social anxiety (>60 score).²⁷

In this study, the results showed highly similar values to the literature (Table 4). Anxiety levels were significantly higher among those with halitosis, affecting both dentists ($P=0.0184$) and non-dentists ($P=0.0092$), particularly males. These results suggest that halitosis may be a hidden contributor to psychological morbidity and should be considered in cases of unexplained mental distress. Psychological factors are more influential in complaints than previously thought.

Policy & Recommendations

Teaching tongue brushing and promoting it as a public health habit would enhance the overall health capacity of the population. Tongue cleaning, a simple practice that can be easily performed at home, should be taught across all segments of the population. Healthcare professionals, especially dentists, should encourage the public to use medium-bristled toothbrushes instead of soft ones and help establish regular tongue-cleaning habits. This approach would contribute positively to both economic and socio-cultural well-being.

Limitations

The study's anonymous design enhanced candidness and breadth but also introduced inherent limitations. As a cross-sectional study, it could not establish causality. This study was not a face-to-face survey; not all participants answered every question, and some psychometric tools (e.g., SCL-90) were not completed. The findings require confirmation through additional clinical trials. Additionally, the scarcity of comparable multidimensional halitosis surveys in the literature also restricts in-depth comparative analysis.

Conclusion

This study confirms the multifaceted nature of halitosis, encompassing behavioral, psychological, and educational factors. The results underscore the urgent need for

comprehensive, evidence-based education for dental professionals, as well as interdisciplinary collaboration and public health strategies that address both the physiological and psychosocial dimensions of halitosis. Future research should continue to explore the bidirectional relationship between halitosis and mental health, as well as the efficacy of systemic screening protocols in patients with persistent or subjective oral malodor.

Authors' Contribution

Conceptualization: Murat Aydin.

Data Curation: Şakir Özgür Keşkek.

Investigation: Murat Aydin.

Formal analysis: Şakir Özgür Keşkek, Murat Aydin.

Methodology: Şakir Özgür Keşkek.

Project administration: Murat Aydin.

Supervision: Murat Aydin.

Software: Şakir Özgür Keşkek.

Resources: Şakir Özgür Keşkek, Murat Aydin.

Validation: Murat Aydin.

Visualization: Murat Aydin.

Writing – original draft : Murat Aydin.

Writing – review & editing: Murat Aydin, Şakir Özgür Keşkek.

Competing Interests

There is not competing interest

Data Availability Statement

Raw data can be shared upon request if it is ethically permissible.

Ethical Approval

Every participant provided consent for the use of their answers for statistical analysis. Approval obtained from the Ethical Committee of City Hospital (24.07.2022/496)

Funding

This reserch did not receive any financial support.

References

- Aydin M, Harvey-Woodworth CN. Halitosis: a new definition and classification. *Br Dent J*. 2014;217(1):E1. doi: [10.1038/sj.bdj.2014.552](https://doi.org/10.1038/sj.bdj.2014.552).
- Bollen CM, Beikler T. Halitosis: the multidisciplinary approach. *Int J Oral Sci*. 2012;4(2):55-63. doi: [10.1038/ijos.2012.39](https://doi.org/10.1038/ijos.2012.39).
- Balami S, Shrestha E, Dhungana A, Chhatkuli A, Shrestha M, Chaulagain R. Self-perception, knowledge and awareness of halitosis among students of higher learning institutions of Chitwan. *MedS Alliance Journal of Medicine and Medical Sciences*. 2022;2(3):33-8. doi: [10.3126/mjmm.v2i3.47659](https://doi.org/10.3126/mjmm.v2i3.47659).
- Suzuki N, Yoneda M, Naito T, Inamitsu T, Yamada K, Okada I, et al. Association between oral malodour and psychological characteristics in subjects with neurotic tendencies complaining of halitosis. *Int Dent J*. 2011;61(2):57-62. doi: [10.1111/j.1875-595X.2011.00014.x](https://doi.org/10.1111/j.1875-595X.2011.00014.x).
- Özen ME, Aydin M. Subjective halitosis: definition and classification. *J N J Dent Assoc*. 2015;86(4):20-4.
- Aydin M, Derici M, Yeler DY, Eren M. Distinguishing subjective halitosis. *Compend Contin Educ Dent*. 2017;38(9):e5-8.
- Silva MF, Leite FR, Ferreira LB, Pola NM, Scannapieco FA, Demarco FF, et al. Estimated prevalence of halitosis: a systematic review and meta-regression analysis. *Clin Oral Investig*. 2018;22(1):47-55. doi: [10.1007/s00784-017-2164-5](https://doi.org/10.1007/s00784-017-2164-5).
- Nalcaci R, Baran I. Factors associated with self-reported halitosis (SRH) and perceived taste disturbance (PTD) in elderly. *Arch Gerontol Geriatr*. 2008;46(3):307-16. doi: [10.1016/j.archger.2007.05.004](https://doi.org/10.1016/j.archger.2007.05.004).
- Moreno LB, Colussi PR, Marostega MG, Rosalen NP, Rösing CK, Muniz F. Self-reported halitosis and associated factors among older adults: a cross-sectional study. *J Oral Biol Craniofac Res*. 2022;12(4):431-6. doi: [10.1016/j.jobcr.2022.05.009](https://doi.org/10.1016/j.jobcr.2022.05.009).
- Falcão DP, Vieira CN, Batista de Amorim RF. Breaking paradigms: a new definition for halitosis in the context of pseudo-halitosis and halitophobia. *J Breath Res*. 2012;6(1):017105. doi: [10.1088/1752-7155/6/1/017105](https://doi.org/10.1088/1752-7155/6/1/017105).
- Lutsenko LA, Egorova AM. Characteristics of the effect of hydrogen sulfide on the human body and measures of assistance to the victim. *Biomed J Sci Tech Res*. 2022;47(4):38835-8. doi: [10.26717/bjstr.2022.47.007547](https://doi.org/10.26717/bjstr.2022.47.007547).
- Rosenberg M. Clinical assessment of bad breath: current concepts. *J Am Dent Assoc*. 1996;127(4):475-82. doi: [10.14219/jada.archive.1996.0239](https://doi.org/10.14219/jada.archive.1996.0239).
- Ben-Aryeh H, Horowitz G, Nir D, Laufer D. Halitosis: an interdisciplinary approach. *Am J Otolaryngol*. 1998;19(1):8-11. doi: [10.1016/s0196-0709\(98\)90058-8](https://doi.org/10.1016/s0196-0709(98)90058-8).
- Van Leeuwen MP, Van der Weijden FA, Slot DE, Rosema MA. Toothbrush wear in relation to toothbrushing effectiveness. *Int J Dent Hyg*. 2019;17(1):77-84. doi: [10.1111/dh.12370](https://doi.org/10.1111/dh.12370).
- Creeth JE, Gallagher A, Sowinski J, Bowman J, Barrett K, Lowe S, et al. The effect of brushing time and dentifrice on dental plaque removal in vivo. *J Dent Hyg*. 2009;83(3):111-6.
- Ruzsanyi V, Heinz-Erian P, Entenmann A, Karall D, Müller T, Schimkowitsch A, et al. Diagnosing lactose malabsorption in children: difficulties in interpreting hydrogen breath test results. *J Breath Res*. 2016;10(1):016015. doi: [10.1088/1752-7155/10/1/016015](https://doi.org/10.1088/1752-7155/10/1/016015).
- Çiçek Y, Orbak R, Tezel A, Orbak Z, Erciyas K. Effect of tongue brushing on oral malodor in adolescents. *Pediatr Int*. 2003;45(6):719-23. doi: [10.1111/j.1442-200X.2003.01804.x](https://doi.org/10.1111/j.1442-200X.2003.01804.x).
- Qian XX. Characteristics of extra-oral halitosis induced by functional constipation: a prospective cohort study. *J Breath Res*. 2024;18(2):026006. doi: [10.1088/1752-7163/ad2213](https://doi.org/10.1088/1752-7163/ad2213).
- Al-Ansari JM, Boodai H, Al-Sumait N, Al-Khabbaz AK, Al-Shammari KF, Salako N. Factors associated with self-reported halitosis in Kuwaiti patients. *J Dent*. 2006;34(7):444-9. doi: [10.1016/j.jdent.2005.10.002](https://doi.org/10.1016/j.jdent.2005.10.002).
- Grover HS, Blaggana A, Jain Y, Saini N. Detection and measurement of oral malodor in chronic periodontitis patients and its correlation with levels of select oral anaerobes in subgingival plaque. *Contemp Clin Dent*. 2015;6(Suppl 1):S181-7. doi: [10.4103/0976-237X.166825](https://doi.org/10.4103/0976-237X.166825).
- Liu XN, Shinada K, Chen XC, Zhang BX, Yaegaki K, Kawaguchi Y. Oral malodor-related parameters in the Chinese general population. *J Clin Periodontol*. 2006;33(1):31-6. doi: [10.1111/j.1600-051X.2005.00862.x](https://doi.org/10.1111/j.1600-051X.2005.00862.x).
- Veeray JM, Gupta KK, Soni S, Kothari D. Comparison of clinical indices with halitosis grading in chronic periodontitis: a randomized control trial. *J Indian Soc Periodontol*. 2023;27(4):422-7. doi: [10.4103/jisp.jisp_197_22](https://doi.org/10.4103/jisp.jisp_197_22).
- Cameira Nunes J, Martínez-Sahuquillo Á, Cameira MJ, Dias Marques H. 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. doi: [10.1016/j.rpemd.2011.05.003](https://doi.org/10.1016/j.rpemd.2011.05.003).

-
24. Pham TA. Comparison between self-estimated and clinical oral malodor. *Acta Odontol Scand*. 2013;71(1):263-70. doi: [10.3109/00016357.2012.671363](https://doi.org/10.3109/00016357.2012.671363).
 25. Özen ME, Aydin M. Unremitting halitosis: a case of olfactory reference syndrome. *J Clin Psychiatry*. 2016;19(3):149-51. doi: [10.5505/kpd.2016.36844](https://doi.org/10.5505/kpd.2016.36844).
 26. Eli I, Baht R, Kozlovsky A, Rosenberg M. The complaint of oral malodor: possible psychopathological aspects. *Psychosom Med*. 1996;58(2):156-9. doi: [10.1097/00006842-199603000-00010](https://doi.org/10.1097/00006842-199603000-00010).
 27. Zaitsu T, Ueno M, Shinada K, Wright FA, Kawaguchi Y. Social anxiety disorder in genuine halitosis patients. *Health Qual Life Outcomes*. 2011;9:94. doi: [10.1186/1477-7525-9-94](https://doi.org/10.1186/1477-7525-9-94).