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ORIGINAL ARTICLE

Prevalence of Self-Reported Halitosis and Associated Factors: A Cross-Sectional Study among Dental Patients

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ABSTRACT

Objective: To determine the prevalence of self-reported halitosis among patients attending the dental clinic of a university in southern Brazil and identify associated factors. **Material and Methods:** The sample of this cross-sectional study included 269 individuals over 18 who attended the clinic for six months. A questionnaire was used to collect data on self-reported halitosis, sociodemographic characteristics, oral hygiene habits, medication use, systemic diseases, smoking and drinking habits, and self-perception of oral health. The relative and absolute frequencies of the variables were analyzed, and multivariate binary logistic regression analysis was performed to obtain odds ratios (OR) and respective 95% confidence intervals (95%CI) at $p < 0.05$. **Results:** The mean age of the sample was 44.86 (±16.55), and 65% were female. The study found a self-reported prevalence of halitosis of 27.9%. Individuals who reported xerostomia were more likely to have self-reported halitosis (OR=2.15; 95% CI: 1.22-3.78). Furthermore, those who visited the dentist more than a year ago were more likely to have self-reported halitosis compared to those who visited no more than six months ago (OR=1.93; 95% CI: 1.09-3.41). **Conclusion:** The study showed a high prevalence of self-reported halitosis among patients and revealed an association with individuals who reported having xerostomia and who have been attending dental appointments for a longer time.

Keywords: Signs and Symptoms, Digestive; Halitosis; Oral Hygiene; Self-Report; Xerostomia.

Introduction

Halitosis is a term used to define an unpleasant odor condition through breath that emanates from the oral cavity, sinuses, nasal cavities, and pharynx and may originate from oral or non-oral sources. The word halitosis originates from Latin, where *halitus* means breathed air and *osis* means pathological change [1,2], also known as bad breath [2-4].

Halitosis can be classified as physiological, pathological, pseudo-halitosis, or halitophobia [1,5,6]. In most cases, it originates in the oral cavity and is caused by microbial putrefaction or bacterial metabolism of amino acids in tissue debris at the site [5-7]. Studies indicate that 80% to 90% of halitosis cases originate orally, mainly on the tongue (tongue coating), because of inadequate oral hygiene [4,6]. Some systemic diseases can also induce oral odors, such as kidney disorders, diabetes, liver diseases, and gastrointestinal diseases, along with oropharyngeal infections [7]. However, halitosis may also be associated with symptoms of depression and psychological disorders in certain individuals [5].

Halitosis affects the population regardless of the individual's environment, potentially compromising the quality of life, self-image, and interpersonal relationships [3-5,7]. It can diminish self-confidence and self-esteem, causing social and personal discomfort and an inability to express oneself, affecting social, professional, and familial aspects [3-5,7]. Statistically, one in four individuals experiences halitosis, characterizing it as a significant social problem [1]. Scientific evidence indicates that 50% of the global population is impacted by this condition, with personal discomfort and social embarrassment being the main reasons individuals seek professional help [6,7-13]. However, despite the relevance of these statistics, halitosis remains underexplored in the scientific literature [7].

This study aimed to determine the prevalence of self-reported halitosis among patients attending the dental clinic of a university in southern Brazil and to analyze its association with sociodemographic data, oral hygiene habits, medication use, systemic diseases, harmful substances, and self-perception of oral health.

Material and Methods

Ethical Clearance

The research was submitted and approved by the Research Ethics Committee, under opinion number 4.602.097, on March 19, 2021, and the article was written according to the requirements of the guide from STROBE [14]

Design and Sample

The present quantitative study has a cross-sectional design, whose convenience sample was composed of all patients who attended the Dental Clinic of a University in the city of Passo Fundo, located in the north of Rio Grande do Sul, Brazil, regardless of the area of specialty (Prosthesis, Dentistry, Periodontics, Endodontics, Implantology, and Surgery), from April to September 2021, totaling 269 patients.

Data Collection Procedure

Data were collected by filling out a questionnaire for patients. The questions were taken from a published study on self-reported halitosis [15]. Additionally, questions about sociodemographic characteristics, oral hygiene habits, medication use, systemic diseases, harmful habits like smoking and alcohol, and self-perception of oral health (oral health classification) were added. For the inclusion criteria, all patients aged 18 years or over, of both genders, who attended dental care, and patients with some special need, such as syndromes

and illiterate people who did not know how to read the research instrument, were included. Thus, of the 271 who attended the Clinic, three patients were excluded from the research and considered losses, totaling 269.

Variables

Variables on self-reported halitosis – 1. Place the palm of your hand in front of your mouth and blow. After this test, would you say you have bad breath? (yes, no); 2. Have you ever been diagnosed with bad breath by your dentist? (yes, no), Has a family member or friend ever mentioned that you have bad breath? (yes, no); 3. Does your breath interfere with your day-to-day activities? (in the family and social environment (relatives and friends), in the professional environment (work), and in your intimate relationship with your partner, do not interfere) [15].

• Sociodemographic variables: age (continuous variable), gender (male, female), profession, education (elementary school, incomplete high school, complete high school, higher education, graduate), family income (from one to two minimum wages, from three to five minimum wages, above six minimum wages).

• Habit variables: are you under medical treatment? (yes, no), use of one or more continuous medications? (yes, no), smoker? (yes, no), do you drink alcohol regularly? (yes, no).

• Variables related to dental service, oral problems, oral hygiene, and self-perception of oral health: last visit to the dentist for control or treatment (in the last 6 months, in the last year, from 1 to 2 years, more than 2 years), in the last six months have you received any dental treatment? (no, tooth extraction, cleaning/prophylaxis, restoration, prosthesis, implant, root canal, whitening, orthodontic treatment), how often do you brush your teeth per day (never brush, less than 1x a day, 1x a day, 2x a day, 3x or more)? During brushing, do you brush your tongue? (yes, no), flossing daily? (yes, no), use mouthwash regularly? (yes, no), do you have white or yellowish deposits on your tongue? (yes, no), does the gum bleed frequently, or is it painful or swollen? (yes, no), do you have gum problems or infections? (yes, no), did you have teeth that became loose without any trauma or injury? (yes, no), do you use any dental prostheses? (yes, no), feel that your mouth is dry (never, rarely, sometimes, always), rating the general health of your teeth and gums (excellent, very good, good, fair, poor).

Outcome and Exposure Variables

Outcome variable: the prevalence of halitosis was analyzed according to the answers to the following questionnaire question: "Put the palm of your hand in front of your mouth and blow, and after this test, would you say you have bad breath? (yes/no)". This question was used for the results of this study, which was confirmed by another question in the questionnaire: "Has a family member or friend ever mentioned that you have bad breath? (yes/no)".

Exposure variables: age group (18 to 45 years/46 to 80 years); dental visit (6 months to 1 year/over 1 year), dry mouth/ self-reported xerostomia (never and rarely = no/sometimes and always = yes), classification of the general health of teeth and gums (excellent, very good and good = 1/regular and bad = 0); and how often you brush your teeth per day (never/once or more times a day).

Data Analysis

The data from the questionnaire were recorded in a database of the program statistical program IBM SPSS software, version 20.0 (IBM Corp., Armonk, NY, USA). The data was analyzed for relative and absolute frequencies of variables, and a multivariate analysis of binary logistic regression was conducted to obtain odds

ratios (OR) and respective 95% confidence intervals (95% CI) at $p < 0.05$. All exploratory variables were included in the raw model with p-values < 0.15 for confounding adjustment, but only those with p-values < 0.05 remained in the adjusted model.

Results

The mean age of the participants was 44.86 years old (SD ± 16.55); most were female (65.1%), had completed high school (39%), and had a family income monthly salary of 1 to 2 minimum wages (Table 1).

Table 1. Frequency distribution of sociodemographic variables of patients.

Variables	N	%
Gender		
Female	175	65.1
Male	94	34.9
Age Group		
18-45 years	139	51.7
46-80 years	130	48.3
Schooling		
Elementary School	54	20.1
Incomplete high school	58	21.6
Complete high school	105	39.0
University education	45	16.7
Postgraduate studies	7	2.6
Income		
1 to 2 BMW	173	64.3
3 to 5 BMW	75	27.9
Above 5 BMW	21	7.8

BMW: Brazilian minimum wage; 1BMW=190.31 USD.

The prevalence of self-reported halitosis was 27.9%; 90.3% had not been diagnosed by a professional, and 25.7% reported that family and friends had already reported their bad breath. However, 78.1% said their breath does not interfere with their daily activities (Table 2).

Of the patients, 36.4% were undergoing medical treatment, and 53.5% were on continuous medication. Only 12.3% of the participants were smokers, and 31.6% drank alcohol frequently (more than 3 times a week). Also, 36.1% of the participants reported their last dental appointment more than 1 year ago. The results of the answers about oral hygiene, tooth brushing, tongue brushing, flossing, and mouthwash, in addition to signs of bleeding, gingival pain or swelling, mobile teeth, white or yellow deposits on your tongue, and self-reported xerostomia (dry mouth) are found in Table 2. Most participants use some dental prostheses (44.2%), and when asked about their self-assessment of oral health, 35.3% classified it as good.

Table 2. Frequency distribution of self-reported halitosis, oral hygiene habits, medication use, systemic diseases, smoking and alcohol habits, and self-perception of oral health.

Variables	N	%
Place the palm of your hand in front of your mouth and blow. After this test, would you say you have bad breath?		
Yes	75	27.9
No	194	72.1
Have you ever been diagnosed with bad breath by your dentist?		
Yes	26	9.7
No	243	90.3
Has a family member or friend ever mentioned that you have bad breath?		
Yes	69	25.7

No	200	74.3
Does your breath interfere with your day-to-day activities?		
In the family and social environment (relatives and friends)	31	11.5
In the professional environment (work)	15	5.6
In your intimate relationship with your partner	15	5.6
Do not interfere	210	78.1
Are you undergoing any medical treatment?		
Yes	98	36.4
No	171	63.6
Do you use one or more medications of continuous use?		
Yes	144	53.5
No	125	46.5
Do you smoke?		
Yes	33	12.3
No	236	87.7
Do you drink alcohol regularly?		
Yes	85	31.6
No	184	68.4
When was your last visit to the dentist for control or treatment?		
In the last 6 months	172	63.9
1 year	31	11.5
2 years	36	13.4
More than 2 years	30	11.2
In the last six months. have you received any dental treatment?		
No	93	34.6
Dental extraction	36	13.5
Cleaning/prophylaxis	71	26.5
Restoration	59	22.1
Prosthesis	28	10.7
Implant	22	8.4
Root canal treatment	41	15.4
Whitening	14	5.3
Orthodontic treatment	15	5.7
How often do you brush your teeth a day?		
Never	3	1.1
1 time a day	16	5.9
2 times a day	89	33.1
3 times or more	161	59.9
During brushing, do you brush your tongue?		
Yes	211	78.4
No	58	21.6
Do you floss daily?		
Yes	135	50.2
No	134	49.8
Do you use mouthwash regularly?		
Yes	100	37.2
No	169	62.8
Do you have white or yellowish deposits on your tongue?		
Yes	63	23.4
No	206	76.6
Do you notice that during daily activities, such as eating and doing oral hygiene, your gums often bleed, become painful or swollen?		
Yes	73	27.1
No	196	72.9
Has your dentist ever told you that you have gum problems or infections?		
Yes	45	16.7
No	224	83.3
Do you have or have you ever had teeth that became loose without any trauma or injury?		
Yes	71	26.4
No	198	73.6

Do you use or have any dentures on your teeth?		
Yes	119	44.2
No	150	55.8
Do you feel your mouth is dry?		
Never	90	33.5
Rarely	67	24.9
Sometimes	94	34.9
Ever	18	6.7
How do you rate the overall health of your teeth and gums (self-perception of oral health)?		
Great	15	5.6
Very good	35	13.0
Good	95	35.3
Regular	82	30.5
Bad	42	15.6

All variables were tested in the analysis with self-reported halitosis: age, schooling, use of dental prosthesis, frequent alcohol consumption and medication use, self-report xerostomia, and dental visit entered the crude model (<0.15). After adjusting for confounding in the regression analysis, the association between self-reported halitosis and the variables age, schooling, use of dental prostheses, frequent alcohol consumption, and use of continuous medication were excluded from the model (p>0.05). The final model maintained a higher probability of self-reported halitosis in individuals with self-reported xerostomia when compared to those without (OR=2.15; 95% CI: 1.22-3.78), as well as consulting the dentist for more than one year compared to those who attended at most 6 months ago (OR=1.93; 95% CI: 1.09-3.41). The results are reported in Table 3.

Table 3. Odds ratio (OR) and confidence intervals (95% CI) between independent variables and self-reported halitosis outcome.

Variables	Self-Reported Halitosis			
	Crude (95% CI)	p-value#	Adjusted (95% CI)	p-value#
Age (Years)				
18-45	1	0.009*	1	0.119
46-80	2.00 (1.20-3.58)		1.69 (0.87- 3.29)	
Dentist Appointment				
Six months to 1 year	1	0.025*	1	0.022*
More than 1 year	1.86 (1.08-3.21)		1.93 (1.09-3.41)	
Use of dental prosthesis				
No	1	0.016*	1	0.470
Yes	0.51 (0.30-0.88)		078 (0.39-1.53)	
Self-reported Xerostomia				
No	1	0.003*	1	0.007*
Yes	2.22 (1.31-3.87)		2.15 (1.22-3.78)	
Schooling				
Elementary school	1	0.112	1	0.306
High school and higher	0.64 (0.37-1.10)		0.74 (0.42-1.31)	
Continuous Medication Use				
No	1	0.060	1	0.844
Yes	1.68 (0.97-2.90)		1.06 (0.54-2.08)	
Frequent Alcohol Consumption				
No	1	0.052	1	0.101
Yes	1.841 (0.995-43.408)		2.15 (0.90-3.26)	

#Wald test; *Statistically significant.

Discussion

Our study showed a significant prevalence of self-reported halitosis by patients from the Dental Clinic of the university (27.9%), indicating that almost a third of the patients have self-reported halitosis. A systematic

review study reported a halitosis prevalence of 31.8% among the 13 articles included in the analysis [3]. Another study that evaluated the prevalence of self-reported halitosis highlighted that the values may vary according to the self-report measures; however, in general, the prevalence was between 14.6% and 33.2%, being considered moderate [15]. The prevalence of halitosis in older adults was 26.1% [8]. In students at a Dental School, the occurrence of halitosis was 21.8% [11]. In adolescent schoolchildren, the prevalence was 39.6%, highlighting that 88.58% were concerned about bad breath [16]. In contrast, in a survey that evaluated the emotional impact of halitosis on men serving in the military, only 12% reported concern about bad breath [13].

In the present study, patients with self-reported xerostomia were more likely to have self-reported halitosis when compared to patients without xerostomia. The survey by Milanesi et al. [11] corroborated a significant association between halitosis and dry mouth in dentistry students. A recent study evaluated the effects of face mask use on self-reported halitosis and dry mouth, reporting that self-reported dry mouth and halitosis were associated [17]. A systematic review of the research evaluated the factors associated with the onset of halitosis, and xerostomia showed a 13.6% association with the bad breath [18]. A survey carried out in a dental clinic with two groups of patients, one group of patients with Parkinson's disease (PD) and the other group with healthy patients, pointed out that patients with PD suffer from halitosis, xerostomia and worsening of their quality of life [19]. A clinical study verified a relationship between halitosis and hyposalivation, concluding that having xerostomia can worsen the intensity of halitosis in patients who already have this condition [20]. When evaluating mouth-breathing children in a Pediatric Dentistry Clinic, authors observed a relationship between halitosis and mouth breathing in children; however, they pointed out the need for investigations regarding the etiology of bad breath [21], which also seems necessary to us to investigate more about these relationships, and especially in the case of xerostomia, since it appears to be an important condition to be considered in evaluations and treatments of halitosis. In the present study, 41.6% of respondents reported having a dry mouth feeling sometimes or always.

Health professionals are of fundamental importance in understanding the risk factors and etiology that involve halitosis and informing, diagnosing, and treating the patient properly [1]. Pereira et al. [22] presented a proposal for a protocol of action and approach for halitosis, which involves primary health care through anamnesis, detailed physical examination, and secondary treatments, if necessary. A randomized clinical study reports that the treatment performed by professionals was well accepted by the participants, improved oral hygiene, reduced bad breath, and enhanced all parameters of patients' quality of life [23]. To evaluate a new technique for cleaning the tongue and its effects, in research, patients were divided into three groups, where each group was instructed to perform brushing differently; after performing a new collection of information, the results showed that patients who brushed more often had an improvement in the final assessment and a better perception of bad breath [2]. Another study found an association between bad breath, dental caries, and poor oral hygiene [7]. The treatment of halitosis can start with the orientation of adequate and regular oral hygiene, and other forms of therapy can be combined, namely, professional mechanical cleaning and antimicrobial products [5,9]. Thus, the dental surgeon plays a crucial role in helping identify the etiology of halitosis with a multidisciplinary team [12].

In the present study, patients who had their last dental appointment more than a year ago were almost twice as likely to have halitosis. The care and instructions provided by dental surgeons about oral cavity hygiene must be reaffirmed at each appointment and with a shorter time interval to be effective [9,23]. In our study, 36.1% of respondents reported not visiting the dentist last year.

Self-reported halitosis was not associated with age, education, oral hygiene habits, use of dental prostheses, frequent consumption of alcoholic beverages, and use of continuous medications in our study, as they lost power in the multivariate analysis. Some studies have reported an association of halitosis with the older age of individuals [4], with low income and education [13,15,16], with the use of medications and some systemic diseases [4], and with inadequate oral hygiene habits [4,8,15]. However, other studies found no association between halitosis and variables such as age, gender, oral hygiene, and behavioral habits [11,16].

It is important to note that the generalization and external validity of the results of this study cannot be extrapolated. The research participants were exclusively patients from a dental clinic, which may limit the applicability of the findings to a broader population. Future research should consider a more diverse sample to provide a more comprehensive and representative understanding of the phenomenon in question.

One of the limitations of the present study is that it is a cross-sectional study and cannot verify the influence of variables over time. Another point was that there is no validated scale regarding self-reported halitosis. However, in this study, we used a structured self-administered questionnaire with questions about specific self-report questions for halitosis based on published studies [11,15]. Another limitation was the absence of clinical oral examination in the patients investigated and the impossibility of analyzing dental records to verify their oral condition. However, the study followed an adequate methodology and presented important and worrying results on the self-report of halitosis by the patients.

Thus, these findings have significant clinical relevance and warn health professionals about halitosis and its association with dry mouth and dental appointments, as these associations are still little reported in the literature. In this way, it will be possible to implement specific care by dentists in diagnosing and treating halitosis.

Conclusion

The study results showed a high prevalence of self-reported halitosis among patients and revealed an association with individuals who reported having xerostomia and who have been attending dental appointments for a longer time. These findings underscore the importance of dentists communicating this information to patients during dental appointments. Additionally, dentists should educate patients about the potential link between xerostomia and halitosis, providing personalized recommendations to improve oral hygiene and hydration practices. This proactive approach can improve patient awareness and overall oral health outcomes.

Authors' Contributions

MA	https://orcid.org/0000-0003-3176-0152	Conceptualization, Methodology, Formal Analysis, Investigation and Writing - Original Draft.
SSF	https://orcid.org/0000-0002-7334-6972	Methodology and Investigation.
RCM	https://orcid.org/0009-0002-7221-3681	Methodology and Investigation.
LR	https://orcid.org/0000-0003-3725-3047	Conceptualization, Formal Analysis, Writing - Review and Editing, Supervision, and Project Administration.

All authors declare that they contributed to a critical review of intellectual content and approval of the final version to be published.

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Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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