



## Self-perception prevalence of halitosis and oral hygiene habits in volunteers admitted to the school of dentistry in Kerman, Iran

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### Original Article

#### Abstract

**BACKGROUND AND AIM:** This study was conducted to investigate the self-perception of mouth odor and its correlation with different variables.

**METHODS:** This cross-sectional study was carried out on 260 individuals who were asked about their perception of personal mouth odor. Factors such as age, gender, oral hygiene, periodontal and dental status, tongue coating, and medical history were recorded on a checklist. Halitosis was evaluated using an etiquette checker. The variables were analyzed using the independent samples t-test and multiple logistic regressions.

**RESULTS:** Of 260 individuals, 101 persons claimed to have halitosis. The prevalence of pseudo-halitosis was 13.5%. Female gender, spontaneous bleeding and bleeding during dental brushing, periodontal index (PI), and tongue coating had a significant association with genuine halitosis according to logistic regression. The decayed, missing, and filled teeth (DMFT) index had a significant association with pseudo- and genuine halitosis.

**CONCLUSION:** Dental status, tongue coating, female gender, and periodontal disease were most significantly related to halitosis.

**KEYWORDS:** Halitosis; Oral Health; Prevalence

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Bad breath, which is also called oral malodor and halitosis, is a general term that refers to unpleasant smell of breath with an intraoral or extraoral origin,<sup>1</sup> which can cause social, emotional, and psychological problems. About 25% of people around the world suffer from halitosis, and most of them suffer from it occasionally.<sup>2</sup> In different studies, its prevalence rate was reported as being 50%<sup>3</sup> and 60%.<sup>4</sup>

The main factor behind halitosis is anaerobic gram-negative proteolytic microorganisms in the mouth. The activity of these microorganisms on proteins like

exfoliative epithelium cells from the mouth, blood cells, and food debris leads to the production of cysteine and methionine amino acids and finally leads to a volatile sulfur compound (VSC). VSC includes hydrogen sulfide (H<sub>2</sub>S), methyl mercaptan (CH<sub>3</sub>SH), and dimethyl sulfide [(CH<sub>3</sub>)<sub>2</sub>S].

If there is no halitosis but the patient believes that it exists, it is called halitophobia. Most of these people consider the behavior of others like covering the nose, turning the face, or moving away from them as an evidence of their halitosis. This type of social phobia intimidates a patient, and thus both patients

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with halitophobia and those with genuine halitosis may have psychological problems.<sup>6</sup> Different intraoral factors can cause halitosis including tooth decay, pericoronitis, exposing of a necrotic tooth, food debris, and unclean prosthodontics which can lead to a decrease of saliva. Mouth sores which are covered with pseudomembrane like herpetic ulcers, wounds caused by cancer, periodontal diseases, and some systemic factors are among the factors of halitosis.<sup>7</sup> Kakoei et al. showed that stress, menstrual cycle, and xerostomia could play a role in halitosis, but halitosis had no relationship with female hormones such as beta-estradiol.<sup>8</sup>

In general, halitophobia or genuine halitosis may affect the psychological health of the individuals and can negatively affect the quality of life to some degree. The purpose of this study was to assess the level of halitosis in the individuals who referred to the school of dentistry in Kerman City, Iran. After measurement of halitosis by a portable etiquette checker device, a questionnaire was completed by the patients. This questionnaire asked the patients opinions on halitosis. Hence, the level of halitophobia and genuine halitosis was studied in the above population; and with this information, it is possible to reduce the levels of anxiety in individuals regarding their halitosis. Furthermore, it is possible to give opportunities for further assessment and treatment.

## Methods

This was a cross-sectional study of simple randomly selected 260 volunteers (among all students and patients who referred to School of Dentistry of Kerman University of Medical Sciences. The inclusion criteria for individuals in the study included age of over 18 years and participant satisfaction. Furthermore, those who used the medication that could affect halitosis directly or indirectly (through the reduction of saliva) were excluded from the study. Written informed consents were obtained from all participants. The study conforms to the

Declaration of Helsinki regarding research involving human subjects and was approved by Ethic Committee of Kerman University of Medical Sciences (IR.KMU.K/90/41).

The demographic data were collected using a questionnaire including a number of demographic data as well as those on medical and lifestyle history such as smoking, patient's habits, history of systemic diseases, drug use, and a self-assessment about halitosis and oral hygiene status.

For the purpose of content validity, an expert panel consisting of seven oral medicine specialists reviewed and revised the questionnaire. The content validity index (CVI) was above 0.78 and was considered as valid. In order to evaluate the reliability of the questionnaire, 30 patients referred to dental school answered the questionnaire twice in between three weeks and intraclass correlation coefficient (ICC) was reported more than 0.74 that was considered reliable.

Afterwards, a text about the conditions and measurement of halitosis was given to them. These conditions were as follows: the individual must avoid eating garlic and onions two days before the experiment. They must also refrain from smoking and drinking coffee or alcohol for 12 hours before the examination. On the day of referral, they must avoid using gum, mint, perfume, or mouthwash. However, patients were free to eat breakfast and brush their teeth as usual. The time of examining halitosis was restricted to at least two hours after eating and drinking. The participants were examined from 8-12 a.m. The patients were examined in terms of oral status like teeth decay, oral hygiene status (accumulation of dental plaque and gingivitis), xerostomia, and tongue coating which were recorded in a checklist.

The tongue coating degree was recorded as follows: 0) without coating, 1) coating less than 1/3 of tongue dorsal surface, 2) coating between 1/3 and 2/3 of tongue dorsal surface, and 3) coating more than 2/3 of tongue dorsal surface.

To determine xerostomia, the Fox questionnaire was used. Determining the accuracy of the Fox questionnaire in evaluating oral problems in Persian language was performed as a thesis in 2009. According to this investigation, at least one positive item was considered as xerostomia.<sup>9</sup> Self-perception of individuals was investigated by the questionnaire. There were questions about feelings toward halitosis and how they felt it affected their lives, whether they were worried about it, and whether the severity of their halitosis was low, average, or high. The obtained results were compared to the results obtained from etiquette device. Then, the level of genuine halitosis and halitophobia of individuals was assessed.

To determine the level of genuine halitosis a portable etiquette checker device (Etiquette Topland Co., Japan) was used. Portable etiquette checker is a small device that can be carried easily. The validation of this device checking for mouth odor detection has been studied previously.<sup>5</sup> Halitosis was considered according to rank of 1 to 6 (1 = no halitosis, 2 = very low, 3 = mild, 4 = average, 5 = high, and 6 = very high). Genuine halitosis referred to the cases in which the subject's response to the question was positive, and the value shown by etiquette checker device was 3 or higher. Halitophobia referred to those who gave a positive answer to the question and where the etiquette value was equal to 2 or less.

Categorical variables were presented as numbers (percentages). The variables were compared between two groups by chi-square/Fisher's exact test. The t-test was used to compare the quantitative variables between

groups. Multiple logistic regression was also used. The statistical analyses were performed using the SPSS software (version 19, SPSS Inc., Chicago, IL, USA). P-values less than 0.0500 were considered statistically significant.

## Results

In this study, 260 subjects participated whose demographic information is shown in table 1. Of total subjects, 101 (38.8%) ones suffered from halitosis, and 66 subjects (25.4%) reported genuine halitosis while 35 (13.5%) ones reported halitophobia.

**Table 1.** Demographic information of the studied subjects

Variables	n (%)
Gender	
Men	106 (40.8)
Women	154 (59.2)
Marital status	
Single	208 (80.0)
Married	48 (18.5)
Level of education	
Under diploma	5 (1.9)
Diploma	57 (21.9)
Associate degree	36 (13.8)
Bachelor and higher	159 (61.2)
History of smoking	
Yes	21 (8.1)
No	239 (91.9)
History of drinking alcohol	
Yes	30 (11.5)
No	226 (86.9)

Missing caused the percent of sum of some columns be less than 100%.

Feeling of oral mouth odor had significant relationship with daily brushing and frequency of tooth brushing, history of gum bleeding, and toothache ( $P < 0.0500$ ) (Table 2).

**Table 2.** The relationship of self-perceived halitosis with oral hygiene habits in the participants

Variables		Self-perceived halitosis		P
		Yes [n (%)]	No [n (%)]	
Do you brush during 24 hours of day?	Yes	90 (89.1)	154 (96.8)	0.0110
	No	11 (10.9)	5 (3.2)	
Time number of brushing teeth per day	0	12 (12.0)	4 (2.5)	0.0100
	1	58 (58.0)	78 (49.6)	
	More than 1	30 (30.0)	75 (47.7)	
Do you use dental floss?	Yes	43 (42.5)	83 (52.3)	0.0800
	No	58 (57.4)	76 (47.7)	
Do you have gingival bleeding while brushing your teeth?	Yes	42 (41.5)	36 (22.7)	0.0010
	No	59 (58.4)	123 (77.3)	
Do you have toothache?	Yes	39 (39.0)	37 (23.9)	0.0100
	No	61 (61.0)	118 (76.1)	

**Table 3.** The relationship of halitosis and halitophobia with oral hygiene in the participants

Variables	Genuine halitosis [n (%)]	Halitophobia [n (%)]
Do you brush during 24 hours of day?		
Yes	56 (84.5)	34 (97.1)
No	10 (15.5)	1 (2.9)
P	< 0.0001*	0.3800**
Time number of brushing teeth per day		
0	11 (16.9)	1 (2.9)
1	38 (58.5)	20 (57.1)
More than once	16 (24.6)	14 (40.0)
P	< 0.0001*	0.2500**
Do you use dental floss?		
Yes	21 (31.8)	22 (62.8)
No	45 (68.2)	13 (37.2)
P	0.0020*	0.0600**
Do you have gingival bleeding while brushing your teeth?		
Yes	30 (45.4)	12 (34.3)
No	36 (54.6)	23 (65.7)
P	0.0020*	0.5000**
Do you have toothache?		
Yes	28 (43.1)	11 (31.4)
No	37 (56.9)	24 (68.6)
P	0.0070*	0.8000**

\*P-value in genuine halitosis compared with all subjects, \*\*P-value in halitophobia compared with all subjects

Univariate analysis of questions on oral hygiene in those who had positive response to feeling oral mouth odor and those who had genuine halitosis showed a significant relationship with poor dental hygiene. In the subjects who did not brush their teeth or had a less frequent number of brushing per day and also had toothache, halitosis was more severe ( $P < 0.0500$ ). However, there was not such a relationship in those with halitophobia (Table 3).

The study of the periodontal index (PI) showed that 36 subjects (13.8%) had no plaque in their gums ( $PI = 0$ ). 94 subjects (36.2%) had low level of plaque stuck to the free edge of their gums ( $PI = 1$ ), 93 subjects (35.8%) had average plaque in periodontal pocket and gingival margin ( $PI = 2$ ), and 37 subjects (14.2%) had high plaque in periodontal pocket and adjacent surface of tooth ( $PI = 3$ ). The mean score of PI was  $1.50 \pm 0.90$ . Furthermore, the mean of number of decayed, missing, and filled teeth (DMFT) was  $7.60 \pm 5.30$ . Tongue coating investigations showed that 55 subjects (21.2%) had tongues without coating, 90 subjects (30.8%) had coating less than 1/3

of the tongue's dorsal surface, 69 subjects (26.5%) had coating between 1/3 and 2/3 of the tongue's dorsal surface, and 55 subjects (21.2%) had coating more than 2/3 of the tongue's dorsal surface (data are not shown).

The features of variables according to genuine halitosis and halitophobia are shown in table 4.

The univariate relationship regarding halitophobia and genuine halitosis showed the lack of a significant relationship between the variables except for DMFT. The results showed that DMFT was significantly ( $P = 0.0001$ ) higher both in individuals with genuine halitosis (mean =  $9.88 \pm 5.30$ ) and those with halitophobia (mean =  $5.43 \pm 3.80$ ) in all subjects. Moreover, the t-test conducted in relation to DMFT showed that both in terms of genuine halitosis and halitophobia, those who had genuine halitosis were more numerous than those who did not have halitosis (results are not shown).

Multivariate analysis was used to determine the effect of all variables in relation to halitophobia and genuine halitosis. Accordingly, those with higher education [odds ratio (OR) = 1.60,  $P = 0.0230$ ]

**Table 4.** Frequency of the variables according to halitophobia and genuine halitosis in the participants

Variables	Genuine halitosis [n (%)]	Halitophobia [n (%)]
Gender		
Men	28 (42.4)	11 (31.4)
Women	38 (57.6)	24 (68.6)
Marital status		
Single	52 (81.2)	26 (76.5)
Married	12 (18.8)	8 (12.5)
Level of education		
Under diploma	2 (3.0)	0
Diploma and associate degree	22 (33.3)	13 (37.1)
Bachelor and higher	42 (63.7)	22 (62.9)
Xerostomia		
Yes	53 (80.3)	26 (74.3)
No	13 (19.7)	9 (25.7)
Smoking		
Yes	10 (15.5)	1 (2.9)
No	56 (84.5)	34 (97.1)
Drinking alcohol		
Yes	13 (20.0)	1 (2.9)
No	52 (80.0)	34 (97.1)
Using medicine		
Yes	11 (16.7)	5 (14.3)
No	55 (83.3)	30 (85.7)
History of systemic disease		
Respiratory disease	18 (27.3)	5 (1.9)
Diabetes mellitus	2 (3.0)	1 (0.4)
Gastrointestinal disease	6 (9.0)	4 (1.5)
Kidney disease	0 (0)	1 (0.4)
Liver disease	1 (1.5)	0 (0)
Haematic disease	0 (0)	1 (0.4)
Other diseases	3 (4.6)	9 (3.5)
More than one disease	12 (18.2)	25 (9.6)
No history	24 (36.4)	17 (6.5)

and a higher PI (OR = 1.93, P = 0.0800) had a higher degree of genuine halitosis than those with lower level of education and no PI (this problem is confirmed through the significance of questions on gingival bleeding). The relationship of other variables with halitophobia was not significant (Table 5).

## Discussion

It is clear that if people feel they have halitosis, they will more likely be guided to the diagnosis and treatment of oral and non-oral health problems. In the present study, 260 volunteers were asked to assess whether or not they had halitosis.

**Table 5.** Regression analysis in genuine halitosis

Variables	B	P	OR Exp (B)
Gender	0.71	0.0600	2.04
Average plaque compared to the lack of plaque	8.40	0.0080	8.40
High plaque compared to the lack of plaque	16.57	0.0010	16.57
Tongue coating	1.39	0.0730	1.39
Education	1.60	0.0230	1.60
Bleeding during dental brushing	1.93	0.0800	1.93
Spontaneous bleeding	5.11	0.0530	5.11

OR: Odds ratio

Of 101 subjects (38.8%) who felt they had halitosis according to the questionnaires, 35 ones (13.5%) did not actually have halitosis according to the etiquette checker (EC) device. It can be said that they experienced pseudo-halitosis.

Different values for this trait have been reported in previous studies. Oho et al.<sup>10</sup> and Iwanicka-Grzegorek et al.<sup>11</sup> reported that the rate of pseudo-halitosis was 25% to 50%. However, Romano et al. reported this percentage to be 6.1.<sup>12</sup> Quirynen et al. reported a value of 16%.<sup>17</sup> The large differences in self-assessment of halitosis can relate to the population studied in these reports. Populations can vary either culturally or mentally in terms of degree of sensitivity to such problems. Another possibility is that there could have been differences in the estimation of halitosis by the devices used. In the present study, 66 subjects (68.3%) diagnosed themselves as having halitosis or of being aware of it. Romano et al. found that 25.0% of subjects complained about having halitosis and 35.6% were made aware of halitosis by others.<sup>12</sup> Al-Ansari et al. found that most subjects (57.3%) detected their halitosis themselves,<sup>13</sup> and these results were more similar to those of the present study.

A comparison of the current questionnaire results with the results of EC showed that of the total research population, 25.4% of individuals had genuine halitosis and 13.5% had pseudo-halitosis. Similar to the present study, Romano et al. reported that a majority of subjects had genuine halitosis rather than pseudo-halitosis (93.9% to 6.1%).<sup>12</sup> This difference can relate to the expectations and views of individuals on the definition of halitosis and also the results of the halitosis measurement devices. For example, in Romano et al. study, the assessment of halitosis was done using the organoleptic method.<sup>12</sup>

In the present study, none of the study variables showed a significant relationship with pseudo-halitosis. In terms of gender, female participants showed a relatively

significant relationship with genuine halitosis. Al-Ansari et al.<sup>13</sup> and Romano et al.<sup>12</sup> both reported that women reported a higher percentage of halitosis. This was related to the stress of most women about the possibility of having halitosis. This problem may show the role of hormones in detecting halitosis or increased sensitivity to halitosis. Kakoei et al. reported that women experiencing their menstrual cycles were more likely to report halitosis.<sup>8</sup> This is another factor in the significantly higher prevalence of halitosis in women.

Individual perception of halitosis is a subjective feeling. The result of other studies indicates that it is not always an accurate feeling. To address this issue, the psychological status of individuals should be analyzed, which was not possible in the current study.

The results of univariate analysis indicated that those who used toothbrush and toothpaste daily had less genuine halitosis, which is similar to the results of previous studies. Nalcaci and Baran measured factors related to self-perception of halitosis in healthy people. They showed that those who less brushed their teeth, more often had halitosis.<sup>14</sup> Oral hygiene can be effective in prevention of tooth decay and periodontal disease and thus the control of halitosis.<sup>15</sup>

Lopes et al. investigated self-assessment of halitosis in teenagers in Brazil and showed that the frequency of teeth brushing and oral hygiene was related to the presence of halitosis as reported by others. Self-perception of halitosis was found to be more dependent on the social and economic status of individuals.<sup>16</sup>

In the present study, a history of systemic disease had no significant relationship with pseudo-halitosis or genuine halitosis, which may be due to the low prevalence of these diseases in the individuals studied. However, individuals with respiratory diseases (such as sinusitis) suffered more from genuine halitosis than the other participants. These findings are consistent with those of

Al-Ansari et al.,<sup>13</sup> who found that the two participants suffering from gastrointestinal disease and sinusitis showed a direct relationship with halitosis. In addition, similar to the findings of the present study, their study showed no significant relationship between diseases such as diabetes, kidney disease, or the use of medicine and self-perception of individuals as having halitosis.

In the present study, those who had coated tongues had a significantly higher prevalence of genuine halitosis. This is consistent with previous studies.<sup>12,17</sup> Tongue coating consists of dental epithelial cells, food debris with microorganisms, and an accumulation of leukocytes in the gingival sulcus.<sup>18</sup> It is a suitable place for the growth of bacteria, especially anaerobic bacteria that leads to halitosis.<sup>15,19</sup>

Although smoking increases halitosis from an external source,<sup>20</sup> the current study showed no significant relationship between smoking and genuine halitosis or pseudo-halitosis. Al-Ansari et al. reported that a subject's self-perception of halitosis indicated that those who smoked had a greater tendency to feel halitosis.<sup>13</sup> In the current study, the researchers showed that halitosis caused by smoking related more to the smell of cigarette and probably had no direct relationship with halitosis with a sulfur source.<sup>13</sup> It is plausible that smoking in the long term has an indirect relationship with periodontal diseases. The current study had a low number of smokers. It can be said that assessment of halitosis using a device by VSCs may account for the insignificance.

In the present study, those with periodontal disease had higher genuine halitosis than the other participants. Periodontal disease can be considered a cause of halitosis. This issue has been studied widely.<sup>21,22</sup> Liu et al. investigated a number of periodontal indices and found that halitosis had a direct relationship with an increase in gingival indices.<sup>23</sup> Gingival disease increases the liquid in the gingival sulcus and causes

bleeding.<sup>24</sup> The hemoglobin provided by such bleeding is necessary for the growth of porphyromonas gingivalis bacteria and can increase halitosis. In addition, blood sedimentation can produce peptides containing sulfur and cause halitosis.<sup>23</sup>

In the present study, individuals with higher levels of DMFT had genuine halitosis or pseudo-halitosis, which was in agreement with previous study.<sup>25</sup> Nevertheless, the assessment of tooth decay has been less considered in previous studies and this index has been less frequently investigated. A lack of oral hygiene can lead to decay and loss of teeth.<sup>26-28</sup> Cavities caused by dental decay are good sites for the accumulation of microorganisms and can lead to halitosis.<sup>29,30</sup> However, the number of filled or pulled teeth as assessed in this index can have no direct relation with halitosis.<sup>25</sup>

In the current study, most of the measured variables had no relationship with genuine halitosis and the individuals' self-perception of the level of their halitosis was similar to their actual level of halitosis. Nalcaci and Baran in a review showed that the estimations of individuals regarding their halitosis were highly unreliable and objective evaluation was not consistent with self-perception.<sup>14</sup>

## Conclusion

The current study found a significant relationship between all research variables including periodontal disease, spontaneous bleeding during dental brushing, tongue coating, and genuine halitosis. It also showed that the individuals' self-perception of halitosis was not reliable.

## Conflict of Interests

Authors have no conflict of interest.

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