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The Prevalence of Oral Malodor and Associated Factors Among Dental Students from Twin Cities, Pakistan

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Author`s Contribution

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ABSTRACT

Objective: To assess the prevalence of halitosis and the factors associated with it among dental students in Rawalpindi and Islamabad, Pakistan.

Methodology: A cross-sectional study conducted, and a sample of dental students was collected from four dental colleges in twin cities of Pakistan. The survey was conducted between December 2023 and April 2024, using a non-probability convenience sampling technique. A total of 450 participants were approached through shared link of the Google form. A self-reported questionnaire was administered and informed consent was obtained. The associations between oral malodor and different variables of the study were evaluated using Chi-square test and logistic regression analysis. Statistical significance was determined using a 95% confidence interval (CI).

Results: Three hundred and one participants (aged 18–24 years) completed the survey with a response rate of 66.8%. The study found that 75.4% of participants suffered from bad breath, or halitosis, with a notable difference in how bothered they were by it - 78.7% were concerned, while 25.9% considered it normal. The majority (63.1%) experienced bad breath in the morning. Despite the 75.4% prevalence, only 14.7% had a dental check-up for oral malodor, and 31.2% attempted self-medication. Tongue deposits/coating were more common among participants with severe halitosis (25.6%) than those with mild halitosis (9.5%). However, there was no significant difference in oral hygiene practices between those with minimal and profound halitosis, suggesting that factors beyond oral hygiene contribute to the severity of bad breath.

Conclusions: The study identified high prevalence of halitosis among dental students. They should be appropriately diagnosed and managed by a dentist. The regular toothbrushing, use of dental floss, mouthwash and removal of tongue coating can significantly reduce halitosis and improve the quality of life.

Keywords: Oral hygiene habits, smoking, halitosis, dental students, oral malodor.

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Introduction

Halitosis is a term used to describe oral malodor. It is an unpleasant or foul smell present in the mouth of an individual and is noticed by others.[1] It is classified into two main groups, Genuine halitosis (Physiological and Pathological halitosis) and Delusional halitosis (Pseudohalitosis and Halitophobia).[2] Approximately 80-85% of all halitosis cases have an intra-oral origin due to conditions such as gingival/periodontal disease, caries, coated tongue, tonsilloliths, food retention/impaction, ill-fitting prosthesis/appliances, malocclusion, xerostomia,

oral cancers and candidiasis.[3] Extraoral causes include respiratory infections, gastrointestinal disorders, certain systemic conditions such as carcinomas, dietary factors (consumption of volatile foods and spices, alcohol and the use of tobacco/betelnut) as well as certain drugs.[3,8] Halitosis is believed to have a significant detrimental effect on social interactions and quality of life.[2]

Halitosis is most commonly associated with inadequate oral hygiene. Poor hygiene leads to a buildup of bacterial biofilm in combination with increased food retention[3]. Common sites are the dorsal surface of the tongue and the interdental areas as well as untreated carious lesions, faulty restorations and ill-fitting prosthesis.[2] Halitosis has been correlated with the concentration of volatile sulfur compounds (VSC) produced in the oral cavity by metabolic activity of bacteria colonizing the periodontal area and the dorsum of the tongue" as reported by Figueredo et al.[4] Management includes oral health education combined with regular mechanical debridement, regular brushing and flossing, use of a tongue scraper, oral mouth rinses and dietary changes.[2]

Smoking and tobacco use have long been associated with bad breath and studies show a significant increase in cases of halitosis in smokers when compared to nonsmokers.[5,6] Current literature suggests that smoking causes a decrease in the normal flora of the oral cavity with a concurrent increase in pathogenic bacteria, increases the chances of developing severe gingival/periodontal disease, negatively impacts immune response to these bacteria and causes hyposalivation, all of which contribute to halitosis.[6] Other studies on subgingival plaque have also demonstrated that smoking is related with increased levels of periodontal pathogens.[7]

Halitosis is a stomatological as well as a psychological issue, as discussed by Nardi et al.[9] There are many patients who think they have bad breath problem whereas in reality it is not present (pseudo-halitosis) and more often, there are patients who are not aware they have a foul breath problem and are not willing to accept it (denied halitosis).[9] It is a dentist's professional duty to communicate to the unaware patient about the existence of the problem and ways to manage it effectively. It is even more important for the dentists to practice high standards of self oral care and have a pleasant breath while dealing with patients and colleagues.[1] As dental students are future health care providers, they should be aware about their breath odour, get proper diagnosis and treatment from dentist in case of halitosis.

The aim of this study is to identify the relationship between oral hygiene practices, tobacco smoking and halitosis in a cohort of dental students residing in the twin cities of Islamabad and Rawalpindi in Pakistan.

Methodology

A cross-sectional study design was employed to investigate a sample population of dental students and interns from four dental colleges in the twin cities of Islamabad and Rawalpindi, Pakistan. A Google form of the questionnaire was prepared for this purpose. Following obtaining consent from the parent institution, a link for this Google form was generated and shared across WhatsApp groups of dental students from first to final year of the selected four dental colleges through a designated person at each dental institute.

To ensure a sufficient sample size, all available and willing students in each college were approached and invited to participate through their class WhatsApp group.

A total of 450 participants were approached through shared link of the Google form, and those who agreed to participate were provided with details of the study, including its objective and purpose, and gave informed consent. The survey was conducted between December 2023 and April 2024, using a non-probability convenience sampling technique.

This study adapted a questionnaire from a previous investigation conducted in a similar context and demographics.[1] The survey gathered demographic data, including respondents' age and gender. It also assessed participants' experiences with bad breath, asking them to rate its severity on a scale from 0 (no bad breath) to 10 (extremely bad breath). Additionally, the questionnaire explored respondents' dental care habits, including oral hygiene practices, consulting a dentist or physician, self-treatment and medication use and smoking habits. In addition, they were also inquired about their history of tooth decay, gum bleeding, any dry mouth symptoms and consumption of mint tea. This questionnaire aimed to understand respondents' perceptions and behaviours related to bad breath and oral health.

Statistical analysis was performed using IBM SPSS Statistics for Windows, version 22.0. The study participants' characteristics and responses were summarized using descriptive statistics. The association between oral malodor and various factors was examined using Chi-square tests and logistic regression analysis.

The results were considered statistically significant if the 95% confidence interval was met (p value 0.05).

Results

There were 301 dental students who participated in this study. There were 187 (62.1%) females while 114 (37.9%) males in the study group. The mean age was 20.76±1.4 years (age range 18 – 24 years). The prevalence of self-reported halitosis was 75.4%, where participants scored breath smell from 2 to 10 in order of increasing bad smell. There were 74 (24.6%) participants who scored 1 which meant none to minimal bad breath. Figure 1 illustrates participants responses to halitosis scoring of 1 to 10 on a VAS scale.

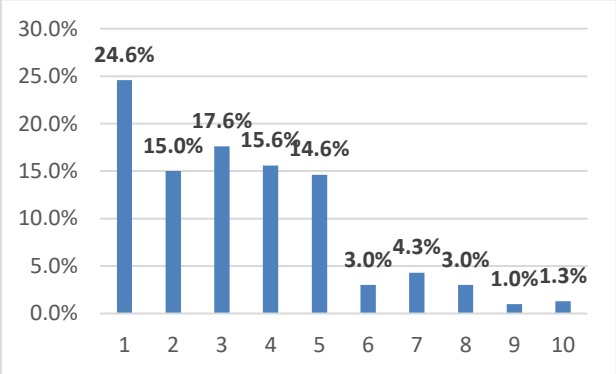

Figure 1. Frequency distribution of participants responses to halitosis scoring on 1-10 VAS scale.

There were 237 (78.7%) participants who were bothered by the bad breath, while 78 (25.9%) participants thought that its normal to have bad breath. Majority of the participants, 190 (63.1%) reported to have worst bad breath immediately after waking up, followed by 33 (11.0%) who reported that they have worst bad breath when they are thirsty, 32 (10.6%) said when they are hungry while 29 (9.6%) reported to have worst breath during morning time. Majority of the participants, 187 (62.1%) reported that their relatives also have issue of bad breath as shown in table 1. A significantly greater number of participants with profound halitosis thought that it was normal to have bad breath as compared to those with minimal halitosis (29.5% vs 14.9%, p=0.012). Similarly, a greater number of participants with profound halitosis had relatives with bad breath problem as compared to those with minimal halitosis (69.2% vs 40.5%, p<0.001). A significantly higher participants belonging to profound halitosis group reported that bad breath interferes with their social life as compared to those belonging to minimal halitosis group (12.3% vs 4.1%, p=0.042).

Of the participants, 10.0% consulted dentists and 4.7% consulted general physicians for bad breath. Treatment was received from dentists by 8.0% and from general physicians by 3.0%. Additionally, 31.2% opted for self-medication, and 14.6% used traditional remedies. Participants with profound halitosis were significantly more likely to use self-medication (35.2% vs. 18.9%, p=0.009) and traditional remedies (17.2% vs. 6.8%, p=0.028) compared to those with minimal halitosis (Figure 2)

Table I: Summary and comparison of baseline characteristics among study participants (n=301)

114+187=301	Overall (n=301)	Minimal halitosis (n=74)	Profound halitosis (n=227)	P value
Mean age in years	20.76±1.4	20.74±1.5	20.77±1.4	0.879
Age range in years				
Minimum age	18	18	18	0.100
Maximum age	24	24	24	
Gender	N(%)	N(%)	N(%)	
Male	114 (37.9)	16 (21.6)	51 (22.5)	0.897
Female	187 (62.1)	58 (78.4)	176 (77.5)	
Is it normal to have bad breath?				
Yes	78 (25.9)	11 (14.9)	67 (29.5)	0.012
No	223 (74.1)	63 (85.1)	160 (70.5)	
Does the bad breath bother you?				
Yes	237 (78.7)	55 (74.3)	182 (80.2)	0.285
No	64 (21.3)	19 (25.7)	45 (19.8)	
Do any of your relatives have a bad breath?				
Yes	187 (62.1)	30 (40.5)	157 (69.2)	<0.001
No	114 (37.9)	44 (59.5)	70 (30.8)	
In the last month, did your breath interfere with your social life?				
Yes	31 (10.3)	3 (4.1)	28 (12.3)	0.042
No	270 (89.7)	71 (95.9)	199 (87.7)	
What time during the day you find your breath the worst?				
After waking up	190 (63.1)	48 (64.9)	142 (62.6)	0.568
When hungry	32 (10.6)	5 (6.8)	24 (10.6)	
When thirsty	33 (11.0)	1 (1.4)	8 (3.5)	
While talking	4 (1.3)	9 (12.2)	23 (10.1)	
with other people	29 (9.6)	0 (0)	4 (1.8)	
Morning	9 (3.0)	9 (12.2)	24 (10.6)	
Afternoon	4 (1.3)	2 (2.7)	2 (0.9)	
All day				

Regarding hygiene practices, almost all the participants, 291 (96.7%) reported brushing teeth regularly. When asked about changing the toothbrush, 59 (19.6%) reported to change brush monthly, 169 (56.1%) reported after 3 months, 61 (20.3%) reported 6 months while 12 (4.0%) reported that they change brush after 12 months. There were 46 (15.3%) participants who used dental floss on daily basis, while 29 (9.6%) reported to used miswak on daily basis where majority of the participants 143 (47.5%) reported to change miswak after every month. About 86 (28.6%) participants used mouthwash regularly, while toothpick was used by 55 (18.3%) participants. There were 44 (14.6%) who never scraped their tongue while brushing teeth, while 132 (43.9%) and 125 (41.5%)

reported that they sometimes and regularly scrape tongue using brush/tongue scraper, respectively. Table II shows that there was no significant difference in the hygiene practices of participants who had minimal halitosis and those who had profound halitosis.

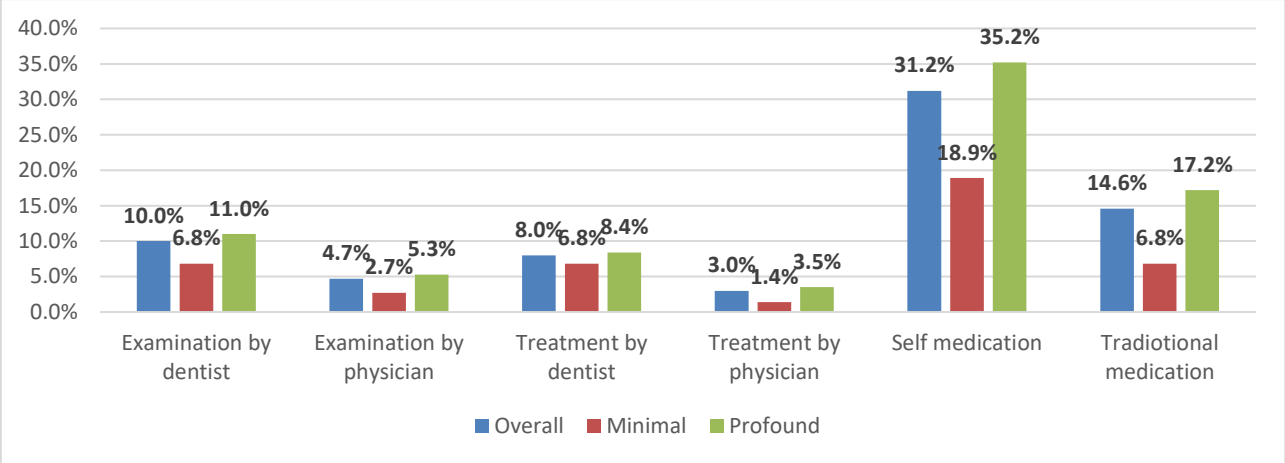

Figure 2. Comparison of seeking medical care and treatment for bad breath among participants with minimal and profound halitosis.

bleeding gums, 50 (16.6%) had dry mouth, while 65 (21.6%) reported to have white/yellow deposits/coating on tongue. There was significantly a higher number of participants who had problem of bleeding gums in profound halitosis group as compared to minimal halitosis group (19.8% vs 8.1%, p=0.020). Similarly, a greater number of participants with profound halitosis reported to have white/yellowish deposits/coating on their tongue as compared to those with minimal halitosis (25.6% vs 9.5%, p=0.003). There were 20 (6.6%) participants with prothesis, where 6/20 (30.0%) had braces, 4/20 (1.3%) had crowns, 8/20 (40.0%) had

Table II: Comparison of hygiene practices among participants with minimal halitosis and profound halitosis

	Overall (n=301)	Minimal halitosis (n=74)	Profound halitosis (n=227)	p
How often do you brush your teeth?	N(%)	N(%)	N(%)	
Regularly	291 (96.7)	72 (97.3)	219 (96.5)	0.732
Sometimes	10 (3.3)	2 (2.7)	8 (3.5)	
How often do you change your toothbrush?				
After 1 month	59 (19.6)	17 (23.0)	42 (18.5)	
After 3 months	169 (56.1)	43 (58.1)	126 (55.5)	0.127
After 6 months	61 (20.3)	9 (12.2)	52 (22.9)	
After 12 months	12 (4.0)	5 (6.8)	7 (3.1)	
Do you floss every day?				
Yes	46 (15.3)	10 (13.5)	36 (15.9)	0.626
No	255 (84.7)	64 (86.5)	191 (84.1)	
Do you use miswak every day?				
Yes	29 (9.6)	6 (8.1)	23 (10.1)	0.608
No	272 (90.4)	68 (91.6)	204 (89.9)	
How often do you change the miswak?				
After 1 month	143 (47.5)	39 (52.7)	104 (45.8)	
After 3 months	63 (20.9)	18 (24.3)	45 (19.8)	0.325
After 6 months	31 (10.3)	5 (6.8)	26 (11.5)	
After 12 months	64 (21.3)	12 (16.2)	52 (22.9)	
Do you use mouthwash regularly?				
Yes	86 (28.6)	20 (27.0)	66 (29.1)	0.735
No	215 (71.4)	54 (73.0)	161 (70.9)	
Do you use toothpick regularly?				
Yes	80 (26.6)	17 (23.0)	38 (16.7)	0.228
No	221 (73.4)	57 (77.0)	189 (83.8)	
Do you clean your tongue?				
Regularly	44 (14.6)	33 (44.6)	92 (40.5)	0.790
Sometimes	132 (43.9)	30 (40.5)	102 (44.9)	
Never	125 (41.5)	11 (14.9)	33 (14.5)	

Regarding dental issues, there were 80 (26.6%) who reported to have tooth decay, 51 (16.9%) reported to have

retainers and 2/20 (10.0%) had bridges. There were 14 (4.7%) participants who smoked, out of which 9 (64.3%) were regular smokers, 2 (14.3%) smoked sometimes while 3 (21.4%) rarely smoked. Among smokers, participants with profound halitosis reported to smoke more regularly as compared to those with minimal halitosis (75.0% vs 0.0%), p=0.001). About 50 (16.6%) reported t drinking green tea with mint, out of which 5 (10.0%) reported that it improves breath, while 35 (70.0%) used it because of its taste and 10 (20.0%) reported other reasons as given in table III.

Table III: Comparison of dental problems faced by participant with minimal halitosis and profound halitosis.

	Overall (n=301)	Minimal halitosis (n=74)	Profound halitosis (n=227)	P value
Do you have tooth decay?	N(%)	N(%)	N(%)	0.419
Yes	80 (26.2)	17 (23.0)	63 (27.8)	
No	221 (73.4)	57 (77.0)	164 (72.2)	
Do you have bleeding gums?				0.020
Yes	51 (16.9)	6 (8.1)	45 (19.8)	
No	250 (83.1)	68 (91.9)	182 (80.2)	
Do you have dryness of mouth?				0.123
- Yes	50 (16.6)	8 (10.8)	42 (18.5)	
- No	251 (83.4)	66 (89.2)	185 (81.5)	
Is your tongue coated with deposits?				0.003
Yes	65 (21.6)	7 (9.5)	58 (25.6)	
No	236 (78.4)	67 (90.5)	169 (74.4)	
Do you have a removable or fixed prosthesis?				0.117
Yes	20 (6.6)	2 (2.7)	18 (7.9)	
No	281 (93.4)	72 (97.3)	209 (92.1)	
If yes type?				
Braces	6 (30.0)	1 (50.0)	5 (27.8)	0.797
Crown	4 (20.0)	0 (0)	4 (22.2)	
Retainers	8 (40.0)	1 (50.0)	7 (38.9)	
Bridge	2 (10.0)	0 (0)	2 (11.1)	
Do you smoke?				0.359
Yes	14 (4.7)	2 (2.7)	12 (5.3)	
No	287 (95.3)	72 (97.3)	215 (94.7)	
If yes, how often				
regularly	9 (64.3)	0 (0)	9 (75.0)	0.001
sometimes	2 (14.3)	2 (100)	0 (0)	
rarely	3 (21.4)	0 (0)	3 (25.0)	
Do you drink tea with mint regularly?				0.539
Yes	50 (16.6)	14 (18.9)	36 (15.9)	
No	251 (83.4)	60 (81.1)	191 (84.1)	
If yes, why do you add mint?				
because of its taste	5 (10.0)	9 (64.3)	26 (72.2)	0.618
because it improves breath	35 (70.0)	1 (7.1)	4 (11.1)	
other reasons	10 (20.0)	4 (28.6)	6 (16.7)	

Discussion

This study explored the relationship of oral malodor with associated factors like oral hygiene, smoking, self oral hygiene practices and conditions like xerostomia, caries, bleeding gums, and tongue coating. The findings of this study showed that the prevalence of halitosis was high among the participants and students reporting minimal bad breath were few. Majority of the students were bothered by the malodor and considered it to interfere with their social life whereas only 26% students thought it was normal to have bad breath. A greater number of participants having profound halitosis had relatives with bad breath as compared to those with minimal halitosis. Majority of the participants (63%) reported to have halitosis after waking up, whereas 11% reported to have it when they are thirsty and 10% when they are hungry, with remaining students reporting halitosis during morning time. This could be due to reduced saliva production at night or negligence in brushing teeth before going to bed[10]. Reduced saliva flow promotes anaerobic bacterial putrefaction responsible for morning halitosis, a temporary condition that vanishes after a meal.[15]

A similar study done in India by Setia et al. indicated that dental students who were regular in brushing their teeth, cleaning their tongue, using mouth wash and changing their toothbrushes within three months had lesser prevalence of halitosis than the students who were not practicing these oral health care routines.[10] It further showed that female students had better oral hygiene practices as compared to males, and they had lesser

prevalence of self-perceived malodor. These findings match the results of other similar studies.[11,12] In contrast, our study shows that more females reported to have minimal as well as profound halitosis as compared to male participants.

There were few participants who smoked, out of which 64.3% were regular smokers, 14.3% smoked sometimes while 21.4% rarely smoked. Among smokers, participants with profound halitosis were found smoking more regularly as compared to those with minimal halitosis. Another similar study stated that there was a considerable association between halitosis and smoking and dryness of mouth among dental students.[10] Many individuals try to subdue their halitosis by smoking as it is concealed in strong smokers' breath.[12] Patients with oral malodor are recommended to stop smoking.[13]

Our study showed that very few dental students consulted dentists or physicians for their halitosis and got treatment from them. More students either opted for self-medication for their problem or tried traditional medicine. This was noted especially in students with profound halitosis compared to those with minimal halitosis.

Regarding dental issues, there were 26.6% who reported to have tooth decay, 16.9% reported to have bleeding gums, 16.6% had dry mouth, while 65 21.6% reported to have white/yellow deposits/coating on tongue. There was a significantly higher number of participants who had problem of bleeding gums in the profound halitosis group as compared to minimal halitosis group (19.8% vs 8.1%, p=0.020). The findings from another study suggested that halitosis is significantly associated with oral hygiene and periodontal disease.[15] Another study conducted by Yaegaki and Sanada showed a significant association between bleeding gums and oral VSC levels[16] and between periodontal disease and the extent of tongue coating.[17]

Our study highlighted that a greater number of participants with profound halitosis reported to have white/yellowish deposits on their tongue as compared to those with minimal halitosis (25.6% vs 9.5%, p=0.003). Morita and Wang suggested a significant relationship between levels of VSC on the dorsal surface of tongue and halitosis.[18] Another study supported these findings by suggesting halitosis in younger age groups could be due to tongue coat deposits.[19] A previous study indicated that morning bad breath was reduced after removal of tongue coating.[20] It was noted that in healthy participants, tongue coating proved to be the most significant cause of malodour, and the most preferred sites for the growth of the anaerobic bacteria responsible for the oral malodor. were the crypts present on posterior part of the dorsum of tongue.[14,16, 21, 22]

Halitosis is significantly related with dry mouth and smoking among dental students according to a previous similar study.[10] A study done in the United States concluded that 10 to 30% of the population suffered from dryness of mouth that resulted in persistent halitosis throughout the whole day.[23] On the contrary, our study findings indicated no significant association between halitosis and dryness of mouth, smoking, wearing of prosthesis, dental caries or bleeding gums. More female students participated in the study and they are generally more conscious about their oral hygiene and oral malodor as compared to boys.

Regarding oral hygiene practices, almost all the participants, 97% approximately reported brushing teeth regularly. When asked about changing the toothbrush, about 20% changed brush monthly or after six months, but majority changed after three months. Few students used dental floss daily or used miswak. About 29 % used mouthwash daily and few used toothpicks regularly. Table 2 shows that there was no significant difference in the hygiene practices of participants who had minimal halitosis and those who had profound halitosis. Few students had mint tea regularly and they consumed it mostly because of its flavor and not because it improved breath.

The study identified many important causes of halitosis among dental students from four different dental colleges in Rawalpindi and Islamabad. However, there are large number of dental colleges in Pakistan and due to limitations of time and resources, it was not possible to collect data from most dental institutions in the country. A similar study has previously been done by Nazir et al with quite similar results.[1]

Conclusion

There is high prevalence of halitosis among dental students. Halitosis is quite common and can be treated effectively if diagnosed and managed by a dentist. Efficient oral hygiene practices including use of dental floss, mouthwash and removal of tongue coating can reduce the oral malodor. It is highly recommended for dental students to improve upon their oral health behaviour because they are the future role models for

their patients and community at large and responsible for the sound oral health of the entire nation.

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