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Relationship between Dental anxiety and Halitosis among University students in Saudi Arabia

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Abstract

Objective: The purpose of this study is to determine the relationship between dental anxiety, social outcomes, and halitosis.

Materials and Methods: This study comprised a total of 538 voluntary participants who were otherwise healthy and had no tobacco habits. A self-administered validated questionnaire was used to collect data. Dental anxiety was assessed using a sum of five-item Modified Dental Anxiety Scale (MDAS), with each item scored on a scale of 1 - 5. Expected social outcomes (ESOs) of having healthy teeth were assessed by the sum of six items; with each item having a score ranging from 1 to 5.Halitosis was evaluated by asking the participants to exhale on the back of the palm to smell for any perceived malodor, duration and specific time frame of the day.

Results: The presence of halitosis was statistically significant for females, younger aged individuals, participants with low social outcomes, and higher dental anxiety scores. Factors such as tooth brushing and gingival bleeding were also found to be significant predictors of halitosis and dental anxiety.

Conclusion: Halitosis significantly interfered with social outcomes and dental anxiety was found to be a reason in delaying treatment and aggravating halitosis.

Keywords: *Dental Anxiety; Social Outcomes; Halitosis; Tooth Brushing; Gingival Bleeding*

Abbreviations

VSCs: Volatile Sulfur Compounds; ESOs: Expected Social Outcomes; MDAS: Modified Dental Anxiety Scale; DA: Dental Anxiety

Introduction

Dental anxiety is a term used to describe anticipatory reactions such as fear or stress in a dental setting [1]. The prevalence of dental anxiety ranges from 5 to 61% in children and from 1 to 52% in adults [2,3]. Dental patients are reported to have experienced a varying degree of anxiety during treatment with significant implications to the individual's oral health and quality of life. Studies have consistently shown that dental anxiety is associated with poor oral health outcomes either due to reduced or complete avoidance of optimal dental care needed to maintain oral health, leading to further deterioration of oral health status. Deteriorating oral health, coupled with dental

anxiety, can impair several dimensions in the physical, psychological, and social domains such as sleep, work, social behavior, personal relationships, significantly affecting both oral health and general health-related quality of life [4,5].

The resulting poor oral status can lead to many symptoms, including halitosis, an offensive odor emanating from the mouth. Halitosis is a relatively common oral symptom of multifactorial etiology with poor oral hygiene, lifestyle habits, and an underlying medical condition as common causes of halitosis. Other risk factors implicated in dental anxiety-induced subjective halitosis include conditions such as generalized anxiety disorder, depression, post-traumatic stress disorder, bipolar disorder or schizophrenia, or a previous history of head and neck trauma [6]. In effect, anxiety is believed to cause halitosis, and this halitosis can further add to anxiety due to a sense of guilt and embarrassment. This vicious cycle of anxiety-halitosis-anxiety can be influenced by various behavioral traits, beliefs, and psychological factors.

The prevalence of halitosis has been reported to be in the range of 6% to 50% [7,8]. Regardless of the aetiology, the presence of volatile sulfur compounds (VSCs) particularly hydrogen sulfide, methyl mercaptan, dimethyl-sulfide, and organic acids emanating from the mouth or exhaled air is reported to be the underlying chemistry of halitosis and various studies have reported the relationship between that anxiety-induced increase in VSC concentration and halitosis [9,10]. Halitosis can be quantitatively analyzed by organoleptic measurement, gas chromatography, and sulfide monitors [11,12]. However, the psychologic or anxiety component can only be qualitatively analyzed by a detailed questionnaire about various psychologic determinants such as anxiety, depression [13]. This study was designed to determine the relationship between dental anxiety, social outcomes, and halitosis among undergraduate students of King Khalid University.

Materials and Methods

This study was conducted among a total of 538 undergraduate students consisting of 215 males and 323 females studying at the King Khalid University, Saudi Arabia, who volunteered to take part in the study after duly providing their informed consent. Participants with any medical condition and tobacco consumption were excluded from this study to rule out commonly occurring causative factors of halitosis and restrict our study to cases of halitosis affected by dental anxiety.

A self-administered validated questionnaire was provided to all the participants to obtain information on demographic characteristics such as age, gender, and study stream. Oral hygiene practices such as tooth brushing and frequency of brushing, oral health concerns such as gingival bleeding on tooth brushing, and dental anxiety were obtained. Expected social outcomes of having healthy teeth, importance attached to their body and mouth, self-reported perception of halitosis, level of awareness, timing and treatment of oral malodor were obtained and used for data collection and analysis.

Evaluation of halitosis was done using a three-item tool. The participants were asked to exhale on the back of the palm to smell for any perceived malodor, and the findings were duly noted. If positive, the duration of the halitosis and the specific time frame of the day during which halitosis was perceived the most was also assessed.

Expected social outcomes (ESOs) of having healthy teeth were assessed with a scale of six items [14]. The items are 'People judge each other in part on the basis of appearance and condition of their teeth'; 'In social contacts and communications well-maintained teeth are important'; 'It is embarrassing when someone has badly appearing or maintained teeth'; 'Someone's teeth are important for the first impression he or she makes'; 'I appreciate it when people with whom I socialize have well maintained clean teeth; 'In social contacts fresh breath is important'. Each item was given a score ranging from 1 to 5 and a sum score ranging from 6 to 30 was noted on all six items of ESOs. A higher sum score of 24 - 30 indicated higher expected social outcomes while a lower sum score of 6 - 23 indicated a lower expected social outcome and was grouped accordingly.

The importance attached to their body was assessed using a single-item on a scale of 0 - 10, where 0 meant not important and 10 very important. Based on the scores, they were categorized into low, moderate, and high importance based on score 0 - 3, 4 - 7, and 8 - 10, respectively. The importance attached to their mouth was assessed using a single-item on a scale of 0 - 10, where 0 meant not important and 10 very important. Based on the scores, they were categorized into low, moderate and high importance based on score 0 - 3, 4 - 7 and 8 - 10 respectively.

Dental anxiety was assessed using a five-item Modified Dental Anxiety Scale (MDAS) [3]. The five items included DA1: 'If you have an appointment with your dentist for treatment tomorrow, how would you feel?' DA2: 'While sitting in the waiting room, how you would feel?'; DA3: 'If you were about to have a tooth filled, how would you feel?' DA4: 'If you were about to have scaling and polishing of teeth, how would you feel? DA5: 'If you were about to have a local anesthetic injection in your gums, how would you feel?'. Each item was scored on a scale of 1 - 5 and a sum score ranging from 5 to 25 was noted on all five items of the MDAS. The level of dental anxiety was then grouped into low and high dental anxiety based on the sum score of 5 - 18 and 19 - 25, respectively.

The obtained data were subjected to descriptive statistics and binary logistic regression statistics using IBM SPSS version 21.0. The statistical significance was set at $P < 0.05$.

Results

The mean age group of the participants was 22.5 ± 4.1 years, with 69.3% of the participants in the age group of 21 to 30 years. Females comprised 60.04% of the participants, and 39.96% of the participants were males. Participants studying science-related courses comprised 76%, and 24% of them belonged to non-science related courses. A total of 65.80% and 63.57% of the participants showed moderate importance to their body and mouth, respectively. A total of 71.38% of the participants reported high social outcome, 58.92% of the participants reported brushing their teeth more than once daily and 79.37% of the participants consumed aerated drinks/tea coffee regularly. Some degree of dental anxiety (MDAS score ≥ 11) was noted in 41.82% of the participants, and the prevalence of gingival bleeding and halitosis among the participants was 54.65% and 31.97%, respectively (Table 1).

Characteristics	n	%
Gender		
Male	215	39.96
Female	323	60.04
Age groups		
≤ 20 yrs	145	26.95
21- 30 yrs	373	69.33
≥ 31 yrs	20	3.72
Course of study		
Science	410	76.21
Non-science	128	23.79
Importance do you attach to own body		
Low	98	18.22
Moderate	354	65.80
High	86	15.99
Importance do you attach to own mouth		
Low	82	15.24

Moderate	342	63.57
High	114	21.19
Tooth cleaning frequency		
Not everyday	52	9.67
Once-daily	317	58.92
More than Once-daily	169	31.41
Drink soft drinks and tea/coffee frequently?		
No	111	20.63
Yes	427	79.37
Bleeding while brushing your teeth?		
No	244	45.35
Yes	294	54.65
Halitosis		
No	366	68.03
Yes	172	31.97
Social outcomes		
Low (< mean)	154	28.62
High (> mean)	384	71.38
Anxiety		
No (< mean)	313	58.17
Yes (> mean)	225	41.82
Total	538	100

Table 1: *Sample characteristics.*

The mean dental anxiety was 11.04 ± 4.25. The mean dental anxiety score for DA1 was 2.11 ± 1.05; DA2 was 2.23 ± 1.17; DA3 was 1.91 ± 1.08; DA4 was 1.75 ± 1.02, and DA5 was 2.89 ± 1.35. The mean dental anxiety scores were higher among participants lesser than 30 years (11.05 ± 4.22), for females (11.35 ± 4.53), for participants studying non-science related courses (11.15 ± 3.98), for participants that did not clean their teeth daily (11.87 ± 4.05), for frequent consumers of aerated drinks/coffee/tea (11.06 ± 4.24), participants with gingival bleeding (11.45 ± 4.23) and halitosis (11.45 ± 4.23) The mean dental anxiety was 11.25 ± 4.43 and 10.95 ± 4.20 for participants with low and high social outcomes respectively (Table 2).

A total of 31.97% of participants reported for halitosis. The majority of the halitosis sufferers had experienced it for an unspecified duration (50.56%), which was usually worse after waking up (57.43%) followed by occurrence in the morning (13.01%) (Table 3). The presence of halitosis was statistically significant for Gender (p value 0.0001*), Age (p value 0.003*), importance to own mouth (p value 0.002*), tooth cleaning frequency (p value 0.0001*), bleeding on brushing (p value 0.0001*), low social outcome (p value 0.0210*) and high total dental anxiety (p value 0.05*) (Table 4).

Regression statistical analysis revealed that factors such as gender, age, gingival bleeding on brushing, social outcomes, and total dental anxiety emerged as the significant predictor of halitosis. The anxious participants have 1.04 odds of having halitosis at a 95% confidence interval (1.0 - 1.09) than non-anxious participants (Table 5).

Factors	DA1 Treatment tomorrow		DA2 Waiting room		DA3 Tooth drill		DA4 Scale & Polish		DA5 Anaesthetic injection		Total dental anxiety	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Gender												
Male	2.00	0.99	2.08	0.91	2.00	1.02	1.74	0.89	2.74	1.20	10.56	3.80
Female	2.33	1.18	2.32	1.19	2.13	1.18	1.70	1.06	2.88	1.39	11.35	4.53
Age groups												
<=20yrs	2.15	1.09	2.20	1.06	2.00	0.98	1.79	1.03	2.90	1.27	11.04	4.10
21-30yrs	2.23	1.13	2.23	1.10	2.13	1.16	1.69	0.98	2.78	1.33	11.06	4.34
>=31yrs	1.95	0.94	2.25	1.33	1.60	1.10	1.75	1.07	3.00	1.45	10.55	4.22
Course of study												
Science	2.20	1.15	2.22	1.12	2.07	1.13	1.68	0.99	2.82	1.31	11.00	4.36
Non-science	2.19	1.01	2.23	1.04	2.09	1.07	1.84	1.03	2.81	1.36	11.15	3.98
Importance attached to own body												
Low	2.20	1.17	2.28	1.16	1.90	1.07	1.71	0.98	2.95	1.35	11.04	4.34
Moderate	2.17	1.09	2.18	1.02	2.08	1.09	1.71	0.96	2.79	1.30	10.94	4.05
High	2.29	1.17	2.34	1.29	2.27	1.26	1.74	1.17	2.79	1.36	11.43	5.02
Importance attached to own mouth												
Low	2.28	1.18	2.28	1.15	2.06	1.14	1.77	0.99	3.07	1.37	11.46	4.31
Moderate	2.23	1.13	2.24	1.10	2.09	1.12	1.78	1.04	2.80	1.28	11.14	4.34
High	2.04	1.00	2.13	1.05	2.05	1.11	1.48	0.84	2.70	1.39	10.41	3.97
Tooth cleaning frequency												
Not everyday	2.35	1.27	2.31	1.02	2.04	1.10	1.85	0.83	3.33	1.34	11.87	4.05
Once-daily	2.20	1.12	2.23	1.10	2.09	1.15	1.77	1.08	2.81	1.33	11.09	4.47
More than Once-daily	2.14	1.06	2.19	1.11	2.07	1.07	1.59	0.86	2.68	1.26	10.67	3.91
Drink soft drinks and tea/ coffee frequently?												
No	2.22	1.14	2.20	1.08	2.04	1.17	1.72	1.09	2.78	1.36	10.95	4.39
Yes	2.19	1.11	2.23	1.10	2.09	1.10	1.72	0.97	2.83	1.31	11.06	4.24
Gingival bleeding												
No	2.16	1.13	2.10	1.08	2.07	1.16	1.59	0.90	2.62	1.29	10.54	4.27
Yes	2.23	1.10	2.32	1.10	2.09	1.08	1.82	1.06	2.99	1.32	11.45	4.23
Halitosis												
No	2.18	1.14	2.17	1.13	1.95	1.10	1.65	1.00	2.67	1.34	10.62	4.27
Yes	2.21	1.09	2.27	1.06	2.20	1.12	1.78	0.99	2.98	1.28	11.45	4.23
Expected Social outcomes												
Low (< mean)	2.21	1.16	2.35	1.16	2.06	1.11	1.78	1.07	2.85	1.39	11.25	4.43
High (>mean)	2.19	1.10	2.17	1.07	2.08	1.12	1.69	0.97	2.81	1.29	10.95	4.20
Total	2.18	1.11	2.23	1.10	2.05	1.11	1.72	0.99	2.84	1.32	11.04	4.25

***Table 2**: Dental anxiety among the participants.*

Variable	n	%
How long have you been aware about your halitosis?		
Unspecified	272	50.56
<1 month	43	7.99
1-6months	20	3.72
7-11months	21	3.90
1-2years	58	10.78
>2years	124	23.05
What time of the day do you find your breath the worst?		
After waking up	309	57.43
Afternoon	4	0.74
During work	5	0.93
In the morning	70	13.01
Throughout the day	32	5.95
When hungry	76	14.13
When thirsty	13	2.42
When tired	9	1.67
While talking to people	20	3.72

Table 3: *Awareness duration and timing of worst halitosis among the participants.*

Characteristics	Yes	%	No	%	Total	Chi-square	p-value
Gender							
Male	135	62.79	80	37.21	215	25.5260	0.0001*
Female	131	40.56	192	59.44	323		
Age groups							
<=20yrs	81	55.86	64	44.14	145	11.9450	0.0030*
21-30 yrs	182	48.79	191	51.21	373		
>=31yrs	3	15.00	17	85.00	20		
Course of study							
Science	202	49.27	208	50.73	410	0.0210	0.8850
Non-science	64	50.00	64	50.00	128		
Importance do you attach to your own body							
Low	56	57.14	42	42.86	98	4.9560	0.0840
Moderate	175	49.44	179	50.56	354		
High	35	40.70	51	59.30	86		

Importance do you attach to your mouth							
Low	53	64.63	29	35.37	82	12.1170	0.0020*
Moderate	168	49.12	174	50.88	342		
High	45	39.47	69	60.53	114		
Tooth cleaning frequency							
Not everyday	37	71.15	15	28.85	52	24.8420	0.0001*
Once-daily	169	53.31	148	46.69	317		
More than Once-daily	60	35.50	109	64.50	169		
Drink soft drinks and tea/coffee frequently?							
No	47	42.34	64	57.66	111	2.8200	0.0930
Yes	219	51.29	208	48.71	427		
Bleeding while brushing your teeth?							
No	91	37.30	153	62.70	244	26.3570	0.0001*
Yes	175	59.52	119	40.48	294		
Social outcomes							
Low (< mean)	64	41.56	90	58.44	154	5.3650	0.0210*
High (> mean)	202	52.60	182	47.40	384		
Anxiety							
No (< mean)	145	46.33	168	53.67	313	2.9080	0.0880
Yes (>mean)	121	53.78	104	46.22	225		
Total	266	49.44	272	50.56	538		

Table 4: *Association between sample characteristics and halitosis among the participants.*

$p < 0.05$ indicates significant association.

Characteristics	B	S.E.	Wald	df	Odds Ratio	95% CI for OR		P-value
						Lower	Upper	
Gender	-0.77	0.20	14.76	1.00	0.47	0.32	0.69	0.0001*
Age in yrs	-0.07	0.02	14.34	1.00	0.93	0.90	0.97	0.0001*
Course of study	-0.07	0.23	0.11	1.00	0.93	0.60	1.44	0.7440
Importance do you attach to your own body								
Low	0.15	0.34	0.18	1.00	1.16	0.59	2.27	0.6700
Moderate	0.10	0.27	0.14	1.00	1.11	0.65	1.89	0.7130
High								
Importance do you attach to your mouth								
Low	0.24	0.37	0.40	1.00	1.27	0.61	2.63	0.5250
Moderate	-0.08	0.26	0.10	1.00	0.92	0.55	1.53	0.7530
High								
Tooth cleaning frequency								
Not everyday	0.63	0.42	2.29	1.00	1.88	0.83	4.26	0.1300
Once-daily	0.30	0.22	1.94	1.00	1.36	0.88	2.08	0.1640
More than Once-daily								
Drink soft drinks and tea/coffee frequently?	-0.08	0.23	0.12	1.00	0.92	0.59	1.45	0.7270
Bleeding while brushing your teeth?	0.64	0.19	10.87	1.00	1.90	1.30	2.78	0.0010*
Social outcomes	0.18	0.07	5.73	1.00	1.19	1.03	1.38	0.0170*
Total dental anxiety cat	0.04	0.02	3.79	1.00	1.04	1.00	1.09	0.0500*

Table 5: *Logistic regression of halitosis by other characteristics.*

**$p < 0.05$.*

Discussion

The present study was done to assess the association between dental anxiety, halitosis, and expected social outcomes. In this study, 41.82% of the participants had some degree of dental anxiety (MDAS score ≥ 11). These findings are similar to studies by Malvania and Ajithkrishnan [15] and Marya CM., *et al.* [16] that showed a prevalence of 46% to 50% and significantly higher than studies with a reported prevalence of 19.2% to 26% [17-19]. However, our findings are significantly lower in comparison to reported prevalence of 81.2% by Bhatt S., *et al* [20]. This disparity in reported prevalence could be due to subjectivity of the diagnostic criteria, sampling techniques such as race, assessment methods, and standard of living.

The mean dental anxiety was relatively more in younger participants and is similar to studies that showed increased dental anxiety among participants in the age group of 25 years [19,21-22]. These findings are in agreement with the reasoning by Liddell and Locker [30] that dental anxiety decreases with age proportional to a decrease in general anxiety with progressing age and adaptive conditioning to dental settings.

The mean dental anxiety was more among females than males. This finding is similar to studies that have reported higher prevalence among females [15,19,23]. The reasons for higher levels of dental anxiety among females can be attributed to the findings that females, in general, are more likely than men to be affected by anxiety disorders [29] and are more likely to self-report symptoms that affects their social outcomes and also lesser threshold to potentially painful stimuli such as dental procedures [21].

This demographic disparity in reported prevalence could be due to subjectivity of the diagnostic criteria and sampling techniques such as ethnic or racial differences and standard of living that influences health of an individual. It is also possible that not all the participants report halitosis due to subjectivity in perception levels of acceptable malodor.

The study participant's subjective reaction to questions related to drilling of a tooth (DA3) and use of local anesthetic injections (DA5) elicited higher anxiety levels than other items in the MDAS scale, possibly due to fearful stimulus of potential drilling of tooth and injection by syringe that could have increased anxiety levels. Although the values are higher in comparison to other items on the MDAS scale, our values were lesser than the values reported in studies by Al-Omari [23] and Azodo and Umoh [17]. In our study, a total of 31.97% of participants reported for halitosis, with most of the participants experiencing halitosis for an unspecified duration and usually worse after waking up in the morning. These findings are similar in comparison to studies with a reported prevalence range of 30 - 40% [19,24,25] but significantly higher than values reported in Nigerian dental clinics [26-28].

All participants practiced brushing of teeth with varying frequencies and regularity. Lower frequency of tooth brushing was related to a higher occurrence of halitosis. Halitosis was significantly higher for those participants who did not brush regularly for at least once a day and the presence of halitosis even for those participants who brushed their teeth regularly can be attributed to improper brushing technique, reduced effectiveness of cleaning with the aging of toothbrush and/or excessive consumption of beverages [31].

Halitosis was found to be more after waking up in the morning, especially for participants who did not brush their teeth before sleeping, suggesting that overnight plaque build-up and reduced salivary secretion at night resulted in more production of VSCs and halitosis [32]. Halitosis was significant in participants with reported bleeding of gums on tooth brushing. Various studies have suggested putrefaction of the blood in the gingival sulcus or periodontal pocket as a possible explanation [32,33].

In this study, almost all subjects that had halitosis admitted that it interfered with their social life and behavior ranging from personal discomfort to embarrassment in social gatherings.

The participants considered having healthy teeth, pleasant smile, and fresh breath to influence positive social outcomes among social gatherings. The mean dental anxiety was high for 72% of participants with low social outcomes in comparison to participants with high social outcomes who demonstrated relatively lower levels of dental anxiety. It is essential to consider these psychological determinants that can contribute to dental anxiety to address them effectively and provide relief to individuals in potentially anxious settings. It also helps in the early detection of individuals with undetected or underlying psychiatric issues because individuals with a tendency for psychiatric issues tend to be affected more by anxiety influenced by oral health [34,35].

In this study, participants with high dental anxiety reported more halitosis than their counterparts but were statistically insignificant. Participants with halitosis reported higher mean dental anxiety scores. Regression statistical analysis revealed that gender, age, gingival bleeding on brushing, social outcomes, and total dental anxiety emerged as the significant predictor of halitosis. The anxious participants have 1.04 odds of having halitosis at 95% confidence interval (1.0 - 1.09) than non-anxious participants (Table 5).

This interesting observation by Facco and Zanette [36] explains findings reported in studies on psychological halitosis and the unwilling attitude of affected individuals in seeking treatment probably due to dental fear as the main factor with more than 25% of patients avoiding visits and procrastinating treatments, and approximately 10% of participants demonstrating phobic levels of anxiety.

The findings of our study should be interpreted after due consideration of inherent limitations such as subjectivity of data that is based on self-reported information and voluntary exclusion of cases due to the nature of participation that could have made halitosis affected individuals from opting out influencing data collection. Our methodology excluded cases of known medical conditions and did not investigate undetected medical diseases, including psychiatric illness and its influence on oral health and dental anxiety owing to the nature of questionnaire-based study. Although this method is not standardized and considered to be unreliable, it is the best possible method to detect halitosis in everyday situation [37].

Conclusion

The presence of halitosis in association with social outcomes and dental anxiety was significant and influenced by factors such as gender, age, an individual's importance given towards their oral health, low social outcome, and total dental anxiety. All subjects with halitosis had admitted that it interfered with their social life and behavior, ranging from personal discomfort to embarrassment in social gatherings and reported dental fear as the main reason for delay in seeking professional help. Dental professionals need to emphasize on addressing underlying dental fear and phobia for individuals with low social outcomes for successful management of halitosis and overall oral health.

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Conflict of Interest

There are no conflicts of interest.

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