RESEARCH ARTICLE

Investigating the prevalence of halitosis and its associated factors amongst the general population of Karachi, Pakistan

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Abstract

Objective: To assess the prevalence of halitosis among the general population of Karachi, and to identify factors contributing to its occurrence.

Method: The cross-sectional study was conducted from March to July 2022 in Karachi after approval from the ethics review board of Dow University of Health Sciences, Karachi, and comprised the adult population of Karachi. Data was collected online using a questionnaire that was piloted before its link was distributed through social media platforms. The questionnaire evaluated the association of demographic features with self-perceived halitosis on the basis of which factors predictive of halitosis were determined. Data was analysed using SPSS 26.

Results: Of a total of 342 subjects, 182(53%) were females and 160(47%) were males. There were 141(41$) subjects aged 18-25 years, and 166(48%) were graduates. Overall, 240(70%) subjects reported to have self-perceived halitosis. Age, monthly household income, niswar and tea consumption, irregular use of dental floss and tongue cleaning were associated with higher incidence of halitosis ($p<0.05$). Carrying water bottle while outside was associated with decreased halitosis ($p=0.007$). Symptoms of gastroesophageal reflux disease, sinusitis, asthma, diabetes, hypertension and mental stress were associated with halitosis ($p<0.05$). Higher monthly household income and daily use of dental floss predicted lower odds of halitosis ($p<0.05$).

Conclusion: Maintaining good oral hygiene and hydration reduced, while comorbid conditions increased the probability of halitosis.

Key Words: Halitosis, Sinusitis, Gastroesophageal, Tongue, Hypertension, Asthma, Tea

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Introduction

Halitosis or unpleasant odour from the breath is a common disorder that affects 20-50% of the world population [1]. While halitosis is not a life-threatening illness, it does cause unpleasant situations[2]. Owing to its negative impact on social life, the market of pharmaceutical products against bad breath has massively grown.

Research suggests that most common sources of halitosis originate from the oral cavity. Poor oral hygiene, including irregular brushing or flossing, tongue coating, gingivitis and periodontitis, are the commonest causes[3, 4]. Xerostomia also results in decreased antimicrobial action of saliva, and contributes to halitosis[5]. Some extraoral factors that further bad breath are smoking, alcohol consumption, certain food items and dehydration[6]. Systemic diseases, like respiratory tract infections (RTIs), gastric disorders, hypertension (HTN), and diabetes mellitus (DM), have also been reported to be associated with halitosis [4].

Since halitosis is a socially disturbing condition which lowers self-esteem, it is important to understand the factors leading to this condition for proper diagnostic and preventive measures. Quite a few studies have been conducted in different parts of the world that assessed the prevalence and causative factors of halitosis. Dental students and practitioners from Lahore reported a very high prevalence of 75%[7].

To the best of our knowledge, very few studies have been published from Pakistan on the subjects at the community level. The current study was planned to fill the gap by finding out the prevalence of halitosis and its associated factors in the general population of Karachi.

Subjects and Methods

The cross-sectional study was conducted from March to July 2022 in Karachi. After approval from the ethics review board of Dow University of Health Sciences (DUHS), Karachi, and comprised the adult population of Karachi. Data was collected online using a questionnaire that was

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generated in the light of literature to assess subjective halitosis [5, 8, 9]. Subjective halitosis was divided into the categories of self-reported and informed halitosis, based on the choice of answer to a specific question: How did you realise that you have bad breath? (I feel it myself / Others have told me).

The questionnaire comprised 23 questions grouped into 6 domains: demographic details of the participant, perception of halitosis, medical history, oral hygiene, hydration status, and eating habits. The questions included yes/no and multiple-choice options.

The questionnaire was developed in the English language. The questionnaire was reviewed by two consultant dentists at the Dow International Dental College, DUHS, and their suggestions were incorporated. The questionnaire was then translated into Urdu language by a professional translator.

The sample size was calculated using OpenEpi version 3 calculator taking population size of Karachi as 17 million, anticipated frequency of halitosis as 23%, absolute precision 5% and design effect 1.25[8,10,11].

Survey was developed on Google Form, which also contained an informed consent form. Data was collected anonymously without names or contact details of the participants.

A pilot study was conducted to check the questionnaire's ease of use prior to making its link public. The pilot study comprised 30 participants from different socioeconomic and educational backgrounds who were selected using purposive sampling technique, and the link was shared on their private computer sysems. No post-pilot study modifications were needed in the questionnaire.

The sample for the main study was raised using convenience sampling technique. The link to the questionnaire was disseminated and advertised through different WhatsApp messages and social media platforms, including Facebook, Instagram and Twitter. A message in both English and Urdu languages was attached to the link to gain attention of the masses and encourage them to circulate it further. Regular reminders to fill the questionnaire were posted on the above platforms.

Data was analysed using SPSS 26. Cross-tabulation with Pearson's chi-square test was applied to evaluate the association of demographic features with subjective halitosis. Univariate analysis was first run to evaluate the relationship of each predictor variable with occurrence of both self-perceived and informed halitosis. Variables showing significance at p<0.05 were analysed through multivariable logistic regression to determine factors associated with halitosis. Odds ratio (OR) were calculated with 95% confidence interval (CI) for each variable assessed. P<0.05 was considered significant in all cases.

Results

Of a total of 342 subjects, 182(53%) were females and 160(47%) were males. There were 141(41$) subjects aged 18-25 years, and 166(48%) were graduates. Overall, 240(70%) subjects reported to have self-perceived halitosis. Age, monthly household income, niswar and tea consumption, irregular use of dental floss and tongue cleaning were associated with higher incidence of halitosis (p<0.05). Carrying water bottle while outside was associated with decreased halitosis (p=0.007). Symptoms of gastro-oesophageal reflux disease (GERD), sinusitis, asthma, DM, HTN and mental stress were associated with halitosis (p<0.05) (Table 1).

Table-1: Halitosis incidence in relation to demographic variables.

Demographic features	Total	Halitosis n (%) Yes	No	Sometimes	P value
Gender n (%)					**0.117**
Male	160	44 (27.5)	45 (28.12)	71 (44.37)	
Female	182	33 (18.13)	57 (31.31)	92 (50.54)	
18-25	141	16 (11.34)	51 (36.17)	74 (52.48)	
26-40	88	22 (25)	26 (29.54)	40 (45.45)	
41-60	90	27 (30)	22 (24.4)	41 (45.55)	
Age (years)					**< 0.001***
18-25	141	16 (11.34)	51 (36.17)	74 (52.48)	
26-40	88	22 (25)	26 (29.54)	40 (45.45)	
41-60	90	27 (30)	22 (24.4)	41 (45.55)	
> 60	23	12 (52.17)	3 (13.04)	8 (34.78)	
Education					**0.136**
No formal	11	2 (18.18)	4 (36.36)	5 (45.45)	
Primary	38	14 (36.84)	10 (26.31)	14 (36.84)	
Secondary	127	29 (22.83)	30 (23.62)	68 (53.54)	
Graduation	166	32 (19.27)	58 (34.93)	76 (45.78)	
Monthly household income (Rupees)					**< 0.001***
< 25,000	95	33 (34.73)	22 (23.15)	40 (42.10)	
25,000-50,000	108	18 (16.66)	27 (25)	63 (58.33)	
50,000-2 lacs	107	22 (20.56)	34 (31.77)	51 (47.66)	
> 2 lacs	32	4 (12.5)	19 (59.37)	9 (28.12)	
Oral Hygiene practices					
Brushing/Miswak					**0.339**
Not regularly	22	4 (18.18)	6 (27.27)	12 (54.54)	
Once daily	170	40 (23.52)	45 (26.47)	85 (50)	
Twice daily	150	31 (20.66)	53 (35.33)	66 (44)	
Use of dental floss					**0.001***
Not regularly	285	73 (25.61)	73 (25.61)	139 (48.77)	
Once daily	37	2 (0.54)	18 (48.64)	17 (45.94)	
Twice daily	20	2 (10)	11 (55)	7 (35)	

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Tongue cleaning					**0.001***
Not regularly	165	53 (32.12)	38 (23.03)	74 (44.84)	
Once daily	108	20 (18.51)	34 (31.48)	54 (50)	
Twice daily	69	4 (0.5)	30 (43.47)	35 (50.72)	
Mouth rinsing					**0.003***
Not regularly	15	0 (0)	10 (66.67)	5 (33.33)	
Once daily	49	6 (12.24)	18 (36.73)	25 (51.02)	
Twice daily	278	71 (25.53)	74 (26.61)	133 (47.84)	
Tongue cleaning					**0.001***
No	182	54 (29.67)	44 (24.17)		
Yes	160	23 (14.37)	58 (36.25)		
Frequency of changing toothbrush					**0.152**
After 15 days	15	2 (13.33)	6 (40)	7 (46)	
After a month	83	19 (22.89)	29 (34.93)	35 (42.16)	
After few months	202	48 (23.76)	61 (30.19)	93 (46.03)	
Once a year	42	8 (19.04)	6 (14.28)	28 (66.67)	
Use of addictive substances					
Cigarette consumption					**0.040***
Never	288	56 (19.44)	89 (30.90)	143 (49.65)	
Occasionally	27	11 (40.74)	6 (22.22)	10 (37.03)	
Regularly	27	10 (37.03)	7 (25.92)	10 (37.03)	
Paan consumption					**0.127**
Never	262	56 (21.37)	86 (32.82)	120 (45.80)	
Occasionally	62	14 (22.58)	14 (22.58)	34 (54.83)	
Regularly	18	7 (38.88)	2 (11.11)	9 (50)	
Chaliya (betel) consumption					**0.11**
Never	264	53 (20.07)	83 (31.43)	128 (48.48)	
Occasionally	48	12 (25)	11 (22.91)	25 (52.08)	
Regularly	30	12 (40)	8 (26.66)	10 (33.33)	
Gutka consumption					**0.273**
Never	330	74 (22.42)	97 (29.39)	159 (48.18)	
Occasionally	4	0 (0)	3 (75)	1 (25)	
Regularly	8	3 (37.5)	2 (25)	3 (37.5)	
Niswar consumption					**0.006***
Never	322	66 (20.5)	98 (30.4)	158 (49.1)	
Occasionally	11	5 (45.5)	3 (27.3)	3 (27.3)	
Regularly	9	6 (66.7)	1 (11.1)	2 (22.2)	
Alcohol consumption					**0.781**
Never	334	76 (22.8)	99 (29.6)	159 (47.6)	
Occasionally	7	1 (14.3)	3 (42.9)	3 (42.9)	
Regularly	1	0 (0)	0 (0)	1 (100)	
Water consumption					
Glasses of water consumed per day					**0.141**
10 glasses	90	19 (21.1)	31 (34.4)	40 (44.4)	
8 glasses	93	18 (19.4)	43 (46.2)	32 (34.4)	
6 glasses	99	19 (19.2)	27 (27.3)	53 (53.5)	
4 glasses	60	21 (35)	12 (20)	27 (45)	
Carry water bottle when outside					**0.007***
No	158	38 (24.1)	34 (21.5)	86 (54.4)	
Yes	184	39 (21.2)	68 (37)	77 (41.8)	
Drink water between meals					**0.742**
No	91	23 (25.3)	27 (29.7)	41 (45.1)	
Yes	251	54 (21.5)	75 (29.9)	122 (48.6)	
Drink water before feeling thirsty					**0.304**
No	134	34 (25.4)	34 (25.4)	66 (49.3)	

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Yes	208	43 (20.7)	68 (32.7)	97 (46.6)	
Dietary habits					
Frequency of eating fried items					**0.542**
Daily	50	16 (32)	14 (28)	20 (40)	
1-3 times a week	162	36 (22.2)	44 (27.2)	82 (50.6)	
< once a week	113	21 (18.6)	38 (33.6)	54 (47.8)	
Never	17	4 (23.5)	6 (35.3)	7 (41.2)	
Frequency of eating spicy food					**0.823**
Daily	70	19 (27.1)	21 (30)	30 (42.9)	
1-3 times a week	137	26 (19)	40 (29.2)	71 (51.8)	
< once a week	92	21 (22.8)	27 (29.3)	44 (47.8)	
Never	43	11 (25.6)	14 (32.6)	18 (41.9)	
Frequency with a lot of onion and garlic					**0.379**
Daily	111	32 (28.8)	32 (28.8)	47 (42.3)	
1-3 times a week	94	14 (14.9)	29 (30.9)	51 (54.3)	
< once a week	86	21 (24.4)	25 (29.1)	40 (46.5)	
Never	51	10 (19.6)	16 (31.4)	25 (49)	
Number of cups of tea/coffee consumed/day					**0.018***
None	51	10 (19.6)	17 (33.3)	24 (47.1)	
1 cup	87	9 (10.3)	30 (34.5)	48 (55.2)	
2 cups	130	32 (24.6)	35 (26.9)	63 (48.5)	
> 2 cups	74	26 (35.1)	20 (27)	28 (37.8)	
Gastro-oesophageal reflux					
Heart burn/Acidity					**0.039***
No	166	32 (19.3)	60 (36.1)	74 (44.6)	
Yes	176	45 (25.6)	42 (23.9)	89 (50.6)	
Acid regurgitation					**0.028***
No	238	48 (20.2)	81 (34)	109 (45.8)	
Yes	104	29 (27.9)	21 (20.2)	54 (51.9)	
Epigastric pain					**0.104**
No	216	47 (21.8)	73 (33.8)	96 (44.4)	
Yes	126	30 (23.8)	29 (23)	67 (53.2)	
Feeling of lump in throat					**0.008***
No	278	61 (21.9)	93 (33.5)	124 (44.6)	
Yes	64	16 (25)	9 (14.1)	39 (60.9)	
Peptic ulcer					**0.748**
No	331	74 (22.4)	98 (29.6)	159 (48)	
Yes	11	3 (27.3)	4 (36.4)	4 (36.4)	
Use of medication to relieve gastric symptoms					**0.526**
No	269	57 (21.2)	82 (30.5)	130 (48.3)	
Yes	73	20 (27.4)	20 (27.4)	33 (45.2)	
Comorbidities					
Sinusitis					**0.018***
Yes	87	29 (33.3)	14 (16.1)	44 (50.6)	
No	255	48 (18.8)	56 (22)	151 (59.2)	
Asthma					**0.039***
Yes	23	10 (43.5)	6 (26.1)	7 (30.4)	
No	319	67 (21)	96 (30.1)	156 (48.9)	
Cardiac disorder					**0.401**
Yes	4	2 (50)	1 (25)	1 (25)	
No	338	75 (22.2)	101 (29.9)	162 (47.9)	
Diabetes					**0.025***
Yes	54	19 (35.2)	10 (18.5)	25 (46.3)	
No	288	58 (20.1)	92 (31.9)	138 (47.9)	
Hypertension					**< 0.001***

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Yes	62	28 (45.2)	7 (11.3)	27 (43.5)	
No	280	49 (17.5)	95 (33.9)	136 (48.6)	
Kidney disease					**0.14**
Yes	9	3 (33.3)	0 (0)	6 (66.7)	
No	333	74 (22.2)	102 (30.6)	157 (47.1)	
Liver disease					**0.715**
Yes	2	0 (0)	0 (0)	2 (100)	
No	340	77 (22.6)	102 (30)	161 (47.4)	
Mental stress					**0.018***
Yes	89	28 (31.5)	18 (20.2)	43 (48.3)	
No	253	57 (22.5)	93 (36.7)	103 (40.7)	

*P-value significant at 0.05
P-value calculated through chi-squared test

Table-2: Multivariable predictors of self-perceived halitosis.

Demographic features	Multivariable logistic regression		
	Yes/Sometimes vs No. Adjusted OR	95% CI	*P* value
Age (years)			
18-25	Ref		
26-40	0.75	0.36-1.55	0.438
41-60	0.67	0.67-1.56	0.355
> 60	1.11	0.23-5.16	0.895
Monthly household income			
25,000-50,000	Ref		
< 25,000	0.86	0.40-1.85	0.707
50,000-2 lac	0.72	0.355-1.44	0.353
> 2 lac	0.24	0.08-0.66	0.006*
Oral Hygiene practices			
Use of dental floss			
Not regularly	Ref		
Once daily	0.71	0.31-1.64	0.427
Twice daily	0.31	0.09-0.980	0.046*
Tongue cleaning			
Not regularly	Ref		
Once daily	0.94	0.33-2.58	0.9
Twice daily	0.71	0.22-2.28	0.563
Mouth rinsing			
Not regularly	0.15	0.44-0.54	0.004*
Once daily	0.59	0.27-1.26	1.72
Twice daily	Ref		
Cleaning back of tongue			
No	Ref		
Yes	0.78	0.29-2.06	0.619
Use of addictive substances			
Cigarette consumption			
Never	Ref		
Occasionally	1.55	0.47-5.062	0.469
Regularly	0.91	0.29-2.75	0.863
Niswar consumption			
Never	Ref		
Occasionally	0.51	0.09-2.73	0.429
Regularly	1.98	0.12-31.19	0.629
Water consumption			
Carry water bottle when outside			
No	Ref		
Yes	0.50	0.28-0.89	0.019*
Dietary habits			
Number of cups of tea/coffee consumed/day			
None	Ref		
1 cup	1.09	0.46-2.58	0.843
2 cups	1.06	0.45-2.46	0.894
> 2 cups	1.09	0.40-2.98	0.861
Gastro-oesophageal reflux			
Heart burn/Acidity			
No	Ref		
Yes	1.39	0.77-2.50	0.273
Acid regurgitation			
No	Ref		
Yes	1.78	0.90-3.51	0.094
Feeling of lump in throat			
No	Ref		
Yes	2.18	0.94-5.05	0.068
Comorbidities			
Sinusitis			
No	Ref		
Yes	2.04	0.98-4.20	0.054
Asthma			
No	Ref		
Yes	0.86	0.28-2.63	0.796
Hypertension			
No	Ref		
Yes	3.22	1.16-8.85	0.024*
Diabetes			
No	Ref		
Yes	1.16	0.44-3.00	0.759
Mental stress			
No	Ref		
Yes	1.79	0.89-3.56	0.098

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*P-value significant at 0.05
OR: Odds ratio, CI: Confidence interval.

Higher monthly household income, daily use of dental floss, and carrying water bottle outside predicted lower odds of halitosis ($p<0.05$). HTN was a significant predictor of halitosis Table 2).

Discussion

The current study Found that 70% respondents had self-perceived halitosis, which was slightly lower than the previously reported prevalence of 75% in dental undergraduates and interns in Lahore, Pakistan [7], but higher than the globally reported prevalence of 22-50% in the adult population [12].

Unlike earlier studies, the current study did not find a significant association between gender and oral malodour [13], but it did support the finding of a strong association between age and subjective reporting of

halitosis[12]. A possible explanation for this association could be the increase in thickness of tongue coating due to greater physical inability to cope with oral hygiene, increased intake of soft food and reduction of natural cleansing of tongue with saliva. Lower immunity in the elderly could lead to increased oral bacterial growth. Multiple comorbid conditions could also contribute to development of bad breath in this age group [5, 14].

The current study found higher monthly household income a significant predictor of lower chances of halitosis, probably owing to more education, better hygiene practices, and affordability of good oral hygiene products in this group. Literature reports 85% causes of halitosis to be originating from the oral cavity[5]. the current study supported the assertion as it found that people who used dental floss twice daily had 70% lower odds of developing halitosis. Tongue cleaning and mouth rinsing were also associated with halitosis ($p<0.05$).

Surprisingly, the current study did not find an association between smoking and halitosis, which is in conflict with previous findings [13,15]. A possible explanation could be that we were assessing self-perceived halitosis and smokers are less likely to report it owing to reduced olfactory sensitivity [16]. In the present study, 22% population reported consuming >2 cups of tea/coffee in a day, and this population had a higher frequency of self-perceived halitosis ($p=0.018$) although an in vitro study and a crossover randomised controlled trial (RCT) reported to have reduced volatile sulphur compounds (VSCs) with coffee [17, 18].

Lack of salivatory flow diminishes the antimicrobial activity of saliva and facilitates conversion of gram-positive bacteria to gram-negative species which influences the production of VSCs[5]. The current study also found lower odds of halitosis in people who carried water bottles with them when outside. These people were likely to have good hydration status.

GERD symptoms were related to self-perceived halitosis in the current study, which was also previously reported[19]. Impaired lower oesophageal sphincter allows intestinal gas and stomach content to reflux in the oesophagus, producing oral malodour. Halitosis may also be produced by direct acid-peptic injury to susceptible supra-oesophageal tissue in these patients.

A significant positive predictor of halitosis in the current study was HTN ($p=0.003$). It was hypothesised that since HTN is reported to increase salivary viscosity, it affects quality and quantity of saliva, and leads to xerostomia, which itself is a contributory factor for halitosis [20].

The current study has limitations as the presence of halitosis was self-perceived and self-reported which is not the standard measure. The more accurate diagnostic measures, such as the use of halimeter or oralchroma, were not available for the study. Intraoral factors are most frequently associated with halitosis, but since this was an online survey, an objective examination of intraoral conditions, such as tongue coating and presence of periodontal diseases, could not be done. Also, since this was an online survey, limitations of the design meant the uneducated class was represented less because of their lack of access to internet and their inability to read.

Conclusion

The elevated prevalence of halitosis among Karachi's population highlighted the urgency of comprehending its underlying determinants for targetted intervention. Through prioritising optimal hydration, embracing regular dental flossing practices, and vigilantly addressing concurrent health conditions, the incidence and impact of halitosis can be curtailed.

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