



## RESEARCH ARTICLE

### OPEN ACCESS

#### ARTICLE INFO

Date Received:

September 30, 2020

Date Revised:

December 03, 2020

Date Published Online

December 24, 2020

#### \*CORRESPONDENCE

Muhammad Naeem

Email:

[m.naeembanth@gmail.com](mailto:m.naeembanth@gmail.com)

Phone:

+923455036763

## Frequency of halitosis among patients aged between 18 to 40 years reporting to Saidu group of teaching hospital, KPK, Pakistan

<sup>a</sup>Muhammad Dawood Saleem, <sup>a</sup>Muhammad Naeem, <sup>a</sup>Mian Imam Shah, <sup>a</sup>Hammad Ahmed, <sup>a,b</sup>Aamir Naveed, <sup>c</sup>Bashir Ahmad

<sup>a</sup>Department of Allied Health Sciences, Bashir Institute of Health Sciences, Islamabad, Pakistan.

<sup>b</sup>Department of Psychiatry, Pakistan Institute of Medical Sciences, Islamabad, Pakistan.

<sup>c</sup>Jinnah Medical College, Peshawar, kpk, Pakistan.

#### ABSTRACT

**Background:** Oral health is associated with first-class teeth as it is essential for the general health and wellness of human beings. Poor oral hygiene leads to major issues including halitosis. Halitosis refers to an unpleasant breath odor that affects self-confidence and people's professional and social life.

**Objective:** The main of the current study was to uncover the frequency of halitosis among 18 to 40 years aged patients reporting to Saidu groups of teaching hospitals, swat KPK. **Materials and Methods:** A hospital-based descriptive cross-sectional study was conducted to determine the Frequency of halitosis among the patients in 6 months. Data was collected using a questionnaire and convenience sampling technique. **Results:** Out of 288 patients, 156 (54.2%) patients were affected while the rest 132 (45.8%) patients were not affected by halitosis. It was found more among males than females. The highly associated risk factors were smoking, patients having no knowledge of tooth cleansing protocol, interdental brush, not brushing their tongue, no use of mouthwash, and lack of monthly dentist visits. **Conclusion:** More than half of the population are suffering from halitosis where males are highly affected as compared to females. Patients having poor knowledge of teeth cleaning protocol and infrequent dental visits were among the more common causes of halitosis among the said age population.

**Keywords:** oral health, halitosis, risk factor, oral hygiene, teeth, dentists

#### INTRODUCTION

Halitosis or oral unpleasant and an offensive breath odor that hinders self-confidence and affects people's capabilities and social life. It simply represents the existence of unpleasant breath produced consistently from a person's mouth. The word halitosis or bad breath is commonly defined as any noticeable unpleasant odor of expired air irrespective of its origin [3].

Halitosis can be due to local factors of obsessive source such as reduced oral cleanliness, widespread caries, gingivitis, prolonged periodontal problem, and open interactions permitting for food impaction, fissured tongue, Vincent's disease, bushy or covered patois, curing removal wounds, extreme smoking. Extended sinusitis with a postnasal leak, tonsillitis, rhinitis, syphilitic sores, pharyngitis, and polyps of the trachea and bronchi, and diseased malicious neoplasm of the oral and pharyngeal cracks are other situations associated, producing halitosis [4].

The chief regulating factor in the creation of bad breath is pH [5]. Two main foundations of volatile sulfur compounds in the mouth in both well and unhealthy residents are the gingival sulcus and patois. Unproductivity of the spittle extreme smoking and dentures are indigenous influences of healthy origin that can yield bad breath [6]. Oral malodor can be the outcome of a complete cause of pathologic source.

Many non-oral situations have been reported, which might give rise to “bad breath.” Such as systemic illnesses including renal failure [7], diabetes, and cirrhosis of the liver [8, 9]. Various mouth odor also recommends critical illness such as rheumatic fever, and a vulgar putrefactive smell is symptomatic of lungs bronchiectasis [10, 11]. In acute and persistent scurvy, patients usually have the emblematic foul smell with fusospirochetal stomatitis [12]. Systematic disorders such as aplastic anemia, and thrombocytopenia, hemophilia, agranulocytosis, polycythemia can also give rise to bad breath due to infective necrosis, and decomposed blood from accidental hemorrhage in the mouth [13].

Bad breath can also be due to the overuse of medications for the management of certain diseases. It includes antihistamines, tranquilizers, diuretics isosorbide (antianginal drug), etc. Some antineoplastic agents, atropine and amphetamines-like drugs decrease saliva production which reduces the self-cleaning capacity of the orifice [6]. Xerostomia is caused by dense smoking, established salivary gland aplasia, Mikulicz’s disease, Sjogren’s syndrome, macroglobulinemia, diabetes, radiation therapy, metabolic diseases, and menopause which causes instabilities and declines of oral cleanness thus encouraging bad breath [14]. Halitosis may also result from unstable particles that are produced by an obsessive or nonpathological source or a non-oral source. Like, the combination of unstable aromatic compounds, amines, nitrogen-containing compounds, sulfur compounds, aliphatic compounds short-chain fatty acids, phenyl compounds, alcohols and ketones may lead to halitosis [15]. Sulfur compounds are most reported and highly blamable for intra-oral bad breath. These compounds are chiefly methyl mercaptan and hydrogen sulfide. They yield enzymatic responses by microorganisms that comprise sulfur-containing amino acids such as L-methionine and L-cysteine [16].

Besides, certain microorganisms yield methyl mercaptan and hydrogen sulfide from serum. The other sulfur compound is dimethyl sulfide which chiefly answerable for outer or blood-borne oral malodor but it can be a donor. Ketones such as benzophenone, acetone, and acetophenone have existed equally in the mouth, and in the lung and dimethyl selenide are present in alveolar air. These compounds are responsible for bad breath and are and are responsible for three categories: non-oral causes, oral causes, and the other origins halitosis [17].

The origin of halitosis is up to 90% of populations, is orally and merely a slight proportion belongs due to non-oral sources [16]. Oral microbes are an utmost source of oral malodor predominantly classes of Gram-negative bacteria including *Bacteroides loescheii*, *Treponema denticola*, *Enterobacteriaceae*, *Porphyromonas gingivalis*, *Prevotella intermedia*, *Porphyromonas endodontalis*, *Centipeda periodontii*, *Tannerella forsythensis*, *Fusobacterium nucleatum* and *Eikenella corrodens* [4].

Though, no clear relation between bad breath and any exact bacterial toxins, signifying that bad breath. Mediators that increase halitosis contain particularly the (VSCs), and short-chain fatty acids. The chief constituents of halitosis are (VSC), especially methyl mercaptan (CH<sub>3</sub>SH), and hydrogen sulfide (H<sub>2</sub>S), dimethylsulfide [(CH<sub>3</sub>)<sub>2</sub>S], or combinations of putrescine, propionic acid, butyric acid, and cadaverine [18]. These complexes result from the proteolytic degradation of sulfur-containing substrates in food debris, saliva, epithelial cells, and blood by Gram-negative oral microorganisms. Sulfur-containing amino acids such as cysteine, cystine, and methionine present in saliva or gingival fluid are Substrates for volatile sulfide compounds creation [19].

The oral malodor is not confined to the occurrence of unidentifiable Gram-negative but also Gram-positive rods Gram-negative rods, and coccobacilli can lead to halitosis. This establishes the relationship between bad breath and multifaceted exchanges in numerous microbial classes [20].

Taking into consideration the above clinical facts, the current study aims to find out the associated risk factors and the frequency of halitosis among patients aged between 18 to 40 years reporting to Saidu Group of Teaching Hospitals Swat, KPK.

## MATERIAL AND METHODS

A total of 288 adult patients both male and female and aged 18 to 40 years who visited dental departments of the above-mentioned hospital were selected for the current study. Mentally handicap patients were excluded from the study. The duration of the study was 4 months (Dec 2019 to March 2020). A convenience sampling technique was used. The study was approved by the research and ethical committee of BIHS for conducting this research. The patients were given the written consent form

before recruitment for this study. Also, prior approval and legal permission were taken from Saidu Group of Teaching Hospitals KPK Swat administration before the start of the project.

Sample size: The calculated sample size of this study was 288.

$$: n = z^2 p (1 - p) / d^2$$

Where  $Z = 95\% = 1.96$

$$P = 75\% = 0.75 \quad (75\%)(29).$$

$$D = \pm 5$$

Putting the values:  $n = (1.96)^2 (0.75) (1 - 0.75) / 0.0025 = 288$

### Statistical analysis

For continuous data, mean and standard deviation were calculated. While categorical variables like gender and education level were presented in terms of frequencies and percentage. A Chi-square test was applied. Results are calculated through appropriate statistical analysis. The data is analyzed by using SPSS version 22.

## RESULTS

### Frequency of halitosis

In the current study, 288 participants were examined to find the exact frequency of halitosis. Among them, 156 (54.17%) were affected with oral malodor. And the rest 132(45.83%) were having no sign of halitosis. The data is shown in Fig.1.

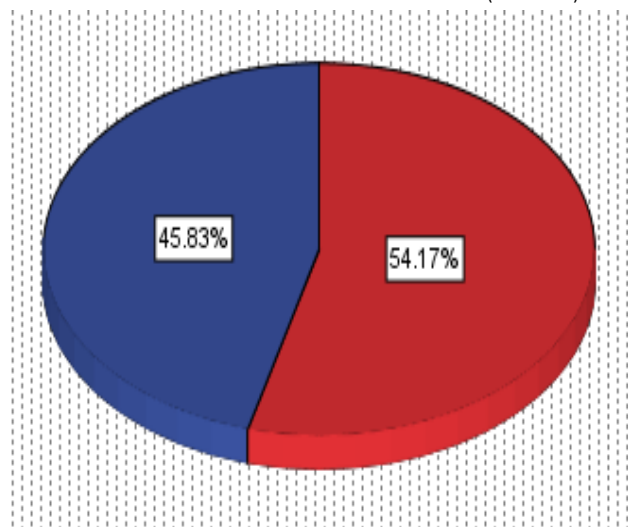


Figure 1. Frequency of halitosis.

### Gender

In the current study the male participated were  $n = 214$  (74.3%) while the female participated were  $n = 74$  (25.7%). In which 128(59.81%) males were having halitosis and 86(40.19%) males were safe. female participants 28(37%) were having halitosis and 46(63%) females were safe. The results are presented in table.1.

Table 1. Halitosis associated with patient gender.

	Halitosis		Total
	Yes	No	
Male	128	86	214
Female	28	46	74
Total	156	132	288

### Age of patients

There were three age groups participated in the study i.e. first group from 18 to 25 years n = 113 (39.2%) followed by the second age group 26 to 33 years was n = 102 (35.4%) third group 34 to 40 years was n = 73 (25.3%). In the first group, 62(54%) were having halitosis and 51(46%) were safe. In the second group, 54(53%) were having halitosis while the rest 48(47%) were with no sign of halitosis. In the third group, 40(54%) were having halitosis and 33(46%) were on the safe side. Data is presented Fig.2.

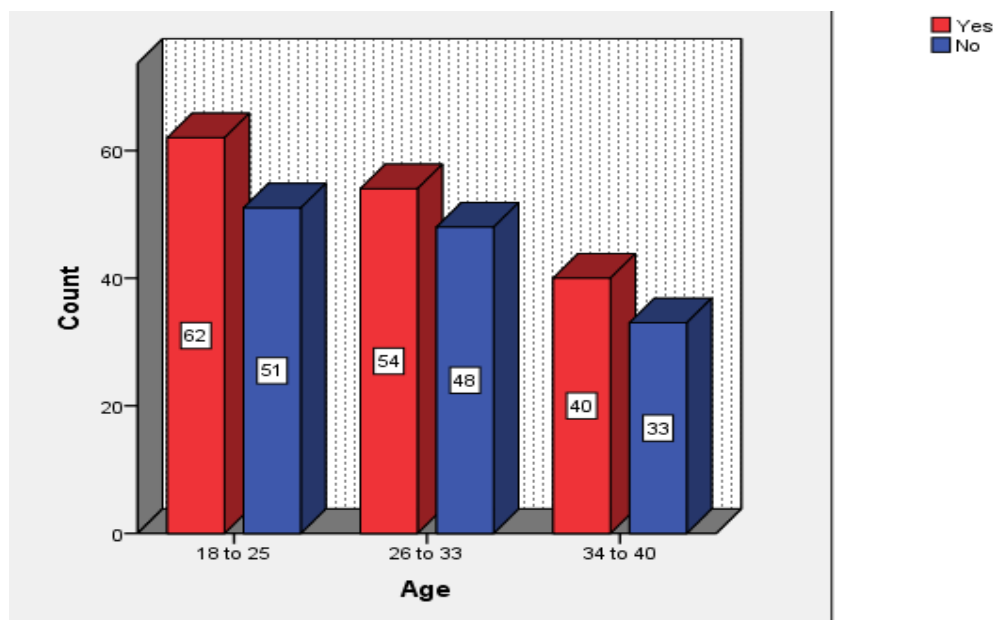


Figure 1. Halitosis Associated with the age of patient.

### Education

In the current study, the literacy rate was distributed in two categories. Literate n = 215 (74.7%) and illiterate n = 73 (24.3%). In literate 110(51.16%) were having halitosis and 105(48.84%) were having no sign of halitosis. On the other hand 46(63%) illiterate were having halitosis and 27 (37%) were on the safe side (Table.2).

Table 2. Halitosis Associated with Literacy.

	Halitosis		Total
	Yes	No	
Literate	110	105	215
Illiterate	46	27	73
Total	156	132	288

### Occupation of patients

In the current study the occupation was distributed in several categories' housewife n = 51 (17.7%) businessman n = 76 (26.4%) office worker n = 17 (5.9%) teacher n = 26 (9%) student n = 57 (19.8%) and labor 61 (21.2%). in housewives, 24(47%) were affected by halitosis and 27(53%) were on the safe side. on the other hand, businessman, 48(63.15%) were targeted by halitosis and 28(36.85%) have no sign of halitosis. The office workers 5(29%) were having halitosis and 12(71%) were on the safe side. In teacher 9(34%) were affected by halitosis and the remaining 17(66%) were having no sign of halitosis. In student 26(45.61%) were targeted by halitosis and 31(54.39%) were on the safe side. The labour 44(72.13%) were having the sign of halitosis and 17(27.87%) were targeted by the halitosis. Figure. 3 represents occupation of patients.

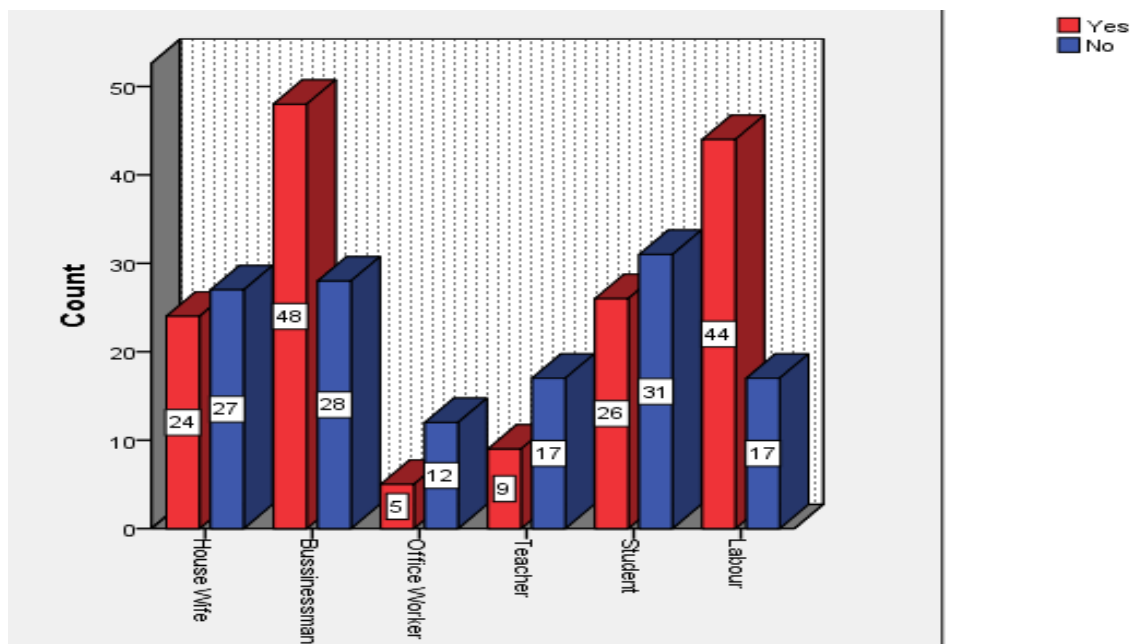


Figure 3. Halitosis associated with occupation.

### Teeth cleaning

The answer to cleaning status of patient's teeth through questionnaire was surprisingly amazing; there were 280(97%) patients with the answer YES to cleaning status of teeth 148(52.85%) patients were reported with halitosis while 132 (47.15%) were on the safe side. There were 8(100%) patients with the answer NO to cleaning status of teeth all of them were having halitosis. Results are shown in the table.3

Table 3. Halitosis associated with a teeth cleansing.

Teeth Cleansing	Halitosis		
	Halitosis		
	Yes	No	Total
Yes	148	132	280
No	008	000	008

### Instrument type

The cleaning aid which the patient employ was as; patients using toothbrush and toothpaste were 160(55.56%), among them 76(47.5%) patients were having halitosis and 84(52.5%) patients were not affected with halitosis. Patients using toothbrushes and powder were 16(5.56%), among them 11(68.75%) patients were affected while 5(31.25%) patients were safe. Patients cleaning their teeth with fingers were 50(17.36%), among them 22(44%) patients were having halitosis and 28(56%) were safe. Patients using Miswak and dandasa were 62(21.52%) among them 47(75.80%) patients were reported with halitosis and 15(24.20%) were having no sign of halitosis. Data are shown in figure 4.

### How often cleansing of teeth

Patients using a toothbrush once a day, were 89(30.90%), among them 53(59.55%) patients were affected with dental halitosis while 36(40.45%) patients were not affected. Patients using toothbrush twice a day were 69(23.95%), among them 24(34.78%) patients were having halitosis and 45(65.22%) patients were not affected. Patients using toothbrush more than twice were 3(1.04%), among them 2(66.67%) patients were involved in halitosis while 1(33.33%) were not affected. Patients using toothbrush sometimes were 17(5.90%) among them 11(64.70%) patients were involved in halitosis while 6(35.30%) were not affected. Table. 4 represents the data.

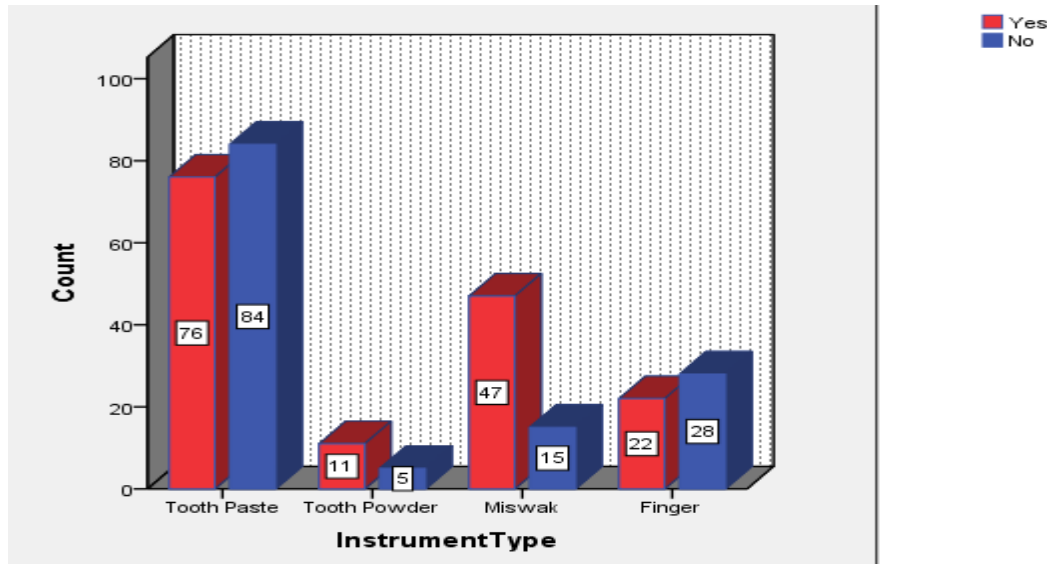


Figure 2. Halitosis associated with instrument type

Table 4. Halitosis associated with how often cleansing.

Frequency	Halitosis		
	Yes	No	Total
Once a day	53	36	89
Twice a day	24	45	69
More than two times	01	02	03
Sometimes	07	06	17
Not Applicable	67	43	110
Total	156	132	288

**Tongue Brushing**

Patients brushing the tongue were 53(18.40%) among them 23(43.39%) were affected by halitosis and 30(56.61%) were on the safe side, patients whose answer was in NO were 125(41.67%) among them 66(52.8%) were targeted by halitosis and 59(47.2%) were safe. Data is represented in Figure.5.

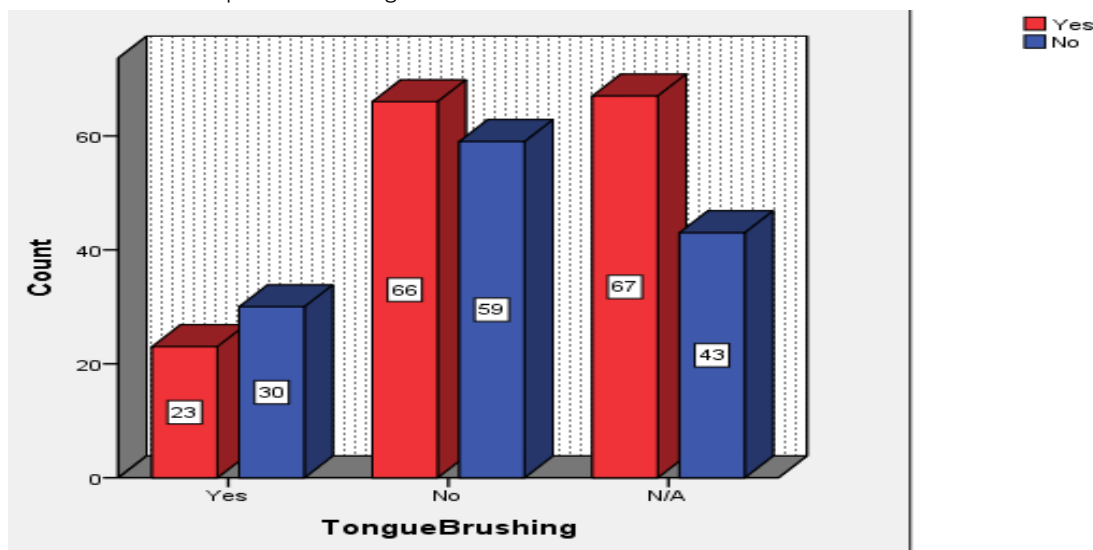


Figure 3. Halitosis associated with tongue brushing.

**Brush Changing**

Total 67 (23.26%) were those patients who used to change their toothbrush after three months. There were 34 (50.74%) patients reported with halitosis and 33 (49.26%) were on the safe side. There were 40 (13.89%) patients who used to change their brush after six months. In these 40 patients, there were 13(32.5%) which were reported with halitosis and 27 (67.5%) having no halitosis. Those patients changing their brush after one year they were 5 (1.73%) with 2 (40%) of them having halitosis and 3 (60%) were safe. While 71 (24.65%) patients are those who change their brush when brush gets worn out among them 42 (59.15%) patients were affected by halitosis and 29 (32.39%) were safe. And 105 (36.45%) patients were not applicable. There was a total of 288 patients associated with frequency of changing their brush in which 156 (54.16%) were reported with halitosis and 66 were on the safe side. Results are shown in the table. 5.

Table 5. Halitosis associated with brushing changing.

Brush Changing	Halitosis		
	Yes	No	Total
After three months	34	33	67
After six months	13	27	40
After twelve months	02	03	05
After worn out	42	29	71
N/A	65	40	105
Total	156	132	288

#### Plaque Control

Patients using dental floss as a secondary method for plaque control were 65 (22.56%), among them 26 (40%) patients were affected with halitosis while 39 (60%) patients were not affected. Patients using an interdental brush as a secondary method for plaque control were 13 (4.51%), among them 8(61.53%) patients were having halitosis while 5(38.47%) patients were not affected. Patients using toothpick were 76 (26.39%), among them 37 (48.68%) patients were affected with halitosis while 39 (51.31%) patients were not affected. 134 (46.52%) patients were not using any secondary method for plaque control. Figure. Shows halitosis associated with a secondary method for plaque control. Results are represented in figure.6.

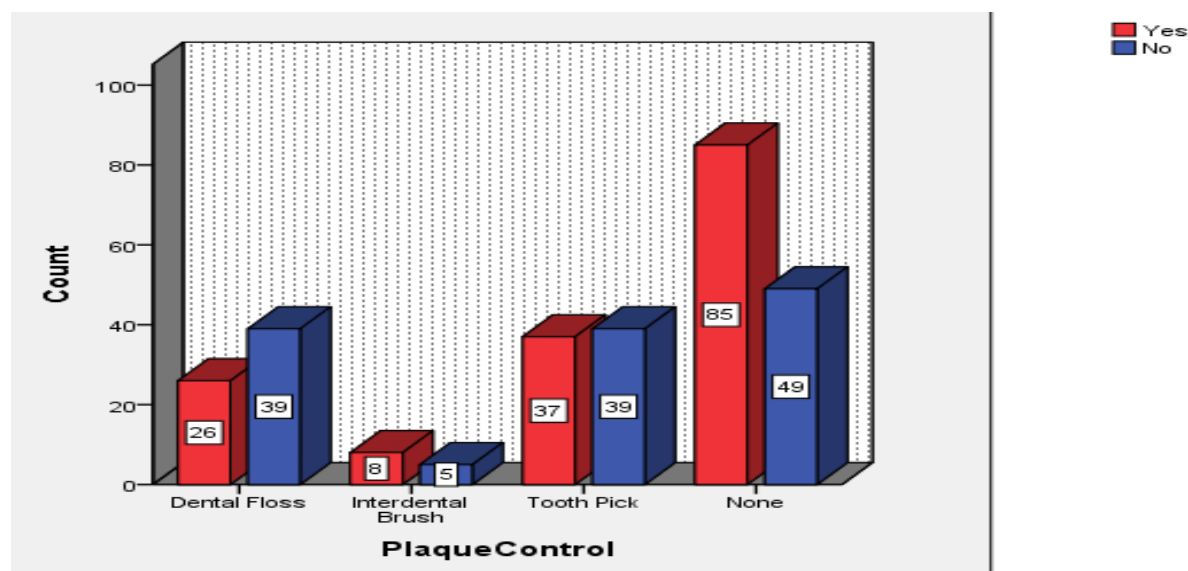


Figure 4. Halitosis associated with plaque control.

#### Dentist visit by the patients

Duration of visits to the dentist was as, 249 (86.45%) patients were visiting dentists only in problems, among them, 140 (56.22%) patients were having halitosis while 109 (43.77%) patients were safe. Patients visiting once in three months were 27 (9.37%),

among them 13 (48.14%) patients were affected while 14(51.86%) were having no halitosis. Patients visiting a dentist once in six months were 12 (4.17%) among them 3 (25%) were affected by halitosis and 9 (75%) were on the safe side (table 6).

Table 6. Halitosis associated with a dentist visit.

Dentist visit	Halitosis		
	Yes	No	Total
With problem	140	109	249
Once in three months	13	14	27
Once in six months	03	09	12
Total	156	132	288

### Mouthwash use by the patients

Patients using mouthwash were 47 (16.31%), among them 16 (34%) patients were having halitosis while 31(66%) patients were not affected. Patients not using mouth wash were 210(72.91%), among them 119 (56.67%) were having halitosis while 91 (43.33%) patients were not affected. The patient whose answer was —don't know were 31 (10.76%) among them 21 (67.74%) were affected by halitosis and 10 (32.26%) were not affected with halitosis. Reports are presented in figure.7.

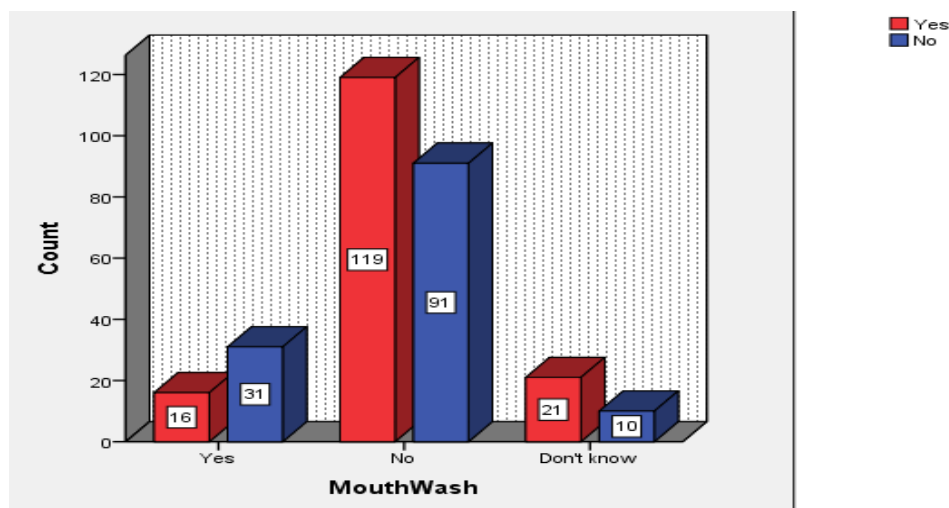


Figure 5. Halitosis associated with mouthwash use.

### Smoking

Talking about the smoking status of patients, 38 (13.19%) patients were smoking, among them, 25(65.78%) patients were having halitosis while 13 (34.21%) patients were not affected. Patients not smoking were 248(86.11%), among them 129 (52.01%) patients were affected while 119 (47.99%) patients were not affected with halitosis. Former smokers were 2 both of them were having halitosis. Table. 7 shows the association between halitosis and smoking.

Table 7. Halitosis associated with smoking

Smoking	Halitosis		Total
	Yes	No	
Yes	25	13	38
No	129	119	248
Quite	2	00	02
Total	156	132	288

### Diabetic status



The diabetic status of patients was as follows; 12 (4.16%) patients were diabetic, among them 8 (66.67%) were affected while 4 (33.33%) Patients were not affected with halitosis. 276 (95.84%) patients were nondiabetic, among them 148 (53.63%) patients were affected while 128 (46.37%) patients were having no Halitosis. Figure. Shows association between halitosis and diabetes. Results are shown in figure.8.

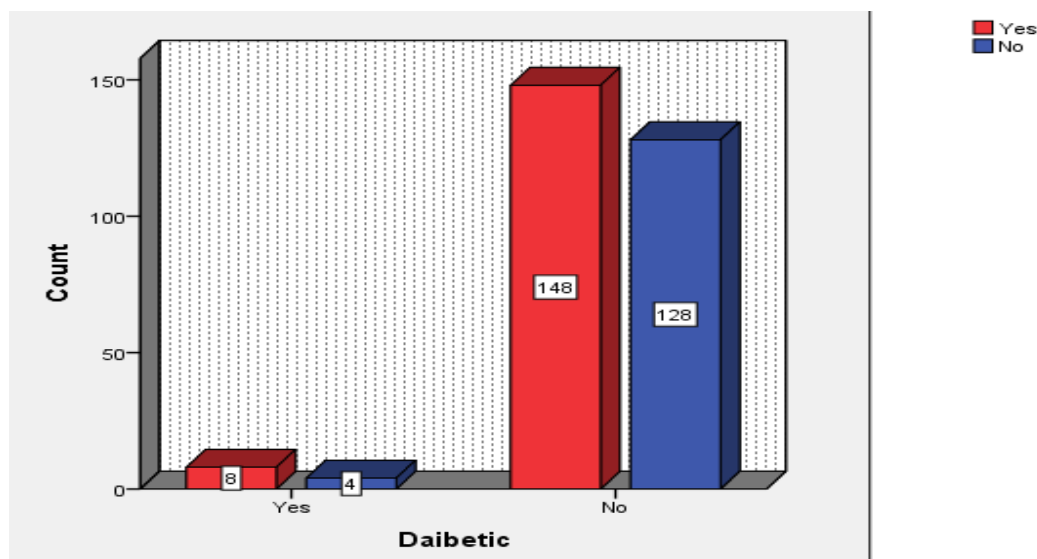


Figure 8. Halitosis associated with diabetes.

#### Someone Smelled Your Mouth

Patients who get complaints about their halitosis answer YES was 85 (29.51%) among them 59 (69.41%) were reported by halitosis and 26 (30.59%) were safe. Those whose answer was in NO were 203 (70.48%) among them 97(47.78%) were having halitosis and 106 (52.21%) were on the safe side. Table.8 represents the patient's data.

Table 8. Halitosis associated with someone smelled.

Someone Smelled	Halitosis		Total
	Yes	No	
Yes	59	26	85
No	97	106	203
Total	156	132	288

#### DISCUSSION

The term "halitosis" refers to displeasing or offensive odor coming from the mouth irrespective of its origin i.e., oral or non-oral. In the current study, we tried to found the relevant factors associated with halitosis. Our results revealed that halitosis is statistically significant among the patients, revealing that 54.17% of participants are affected with halitosis, while 45.83% of participants were asymptomatic for halitosis. Our results are consistent with the previous study which reported that 50%, 54%, and 60% of medical, pharmacy, and engineering students, respectively showed halitosis [21]. Another report revealed that Halitosis has a worldwide existence with a prevalence range of 22% to 50% which strongly supports our conducted study [22, 23].

A study conducted in Korea revealed that 33.2% of adolescent patients who visited dental hospital has reported halitosis [22]. This study is not in line with our current study, the high prevalence in the current study may be due to unawareness of oral health and poor hygiene in society.

In the current study, we observed that halitosis varies gender-wise, which is higher in males (74.3%) as compared to females (25.7%). A similar study is published from Iran reporting that male dental student participants were mostly targeted by halitosis as compared to female participants [24]. In contrast, research published in India reported that female participants are highly affected by halitosis than male participants [25].

In the current study, we reported that the risk factor of smoking in male participants is one of the reasons for the higher prevalence of halitosis than females. A study conducted in India Punjab by Saniya Setia et al in 2014 also revealed that tongue coating presented a higher prevalence of halitosis, which is in favor of the current study because we found that leaving the tongue during brushing is also a risk factor for halitosis [26].

It is also reported that chlorhexidine with an important oil mouth wash decreases VSCs and is extremely important. This strongly supported the current study, because we also found that not using mouthwash is a risk factor for halitosis [27]. Hence, it is one of the important studies reporting the risk factors for the occurrence and prevalence of halitosis.

A study conducted in Iran by Mahin Bakhshi et al in 2018 revealed that people who fluff their teeth once a day were more likely to develop halitosis than those who brushed more than twice a day [24]. In the current study, we also found that people who fluff their teeth more than twice a day are less likely affected than those who fluff their teeth once a day.

In the current study, we found that people who did not use dental floss are highly affected by halitosis than those who used dental floss. A study conducted in Iran by Mahin Bakhshi et al in 2018 showed that the people who used dental floss as a secondary plaque control are less likely affected by the halitosis [24, 28].

### LIMITATIONS

The study represents an attempt to quantify halitosis and to determine the associated risk factors in the population of the society. Here are some of the limitations of the study given below:

This is an analytical cross-sectional study that only finds out prevalence and risk factors. For more complete information, longitudinal studies are needed which is the best study designs as compare to a cross-sectional study.

The study was only conducted on those patients who visited hospitals for other dental problems the reason is there as might be some cases which may be missing.

### CONFLICT OF INTEREST

The authors declare no conflict of interest.

### AUTHOR CONTRIBUTION

MDS collected and analyzed the data and revised the final version of the manuscript, HA helped in data analysis and drafting of the manuscript, MN helped in study design. BA and AN helped in the critical revision of the manuscript, MIS helped in the study design and data analysis.

### FUNDING SOURCE

This study did not receive any funding for proceeding with this study.

### REFERENCES

- [1] B. O. Olatunji and C. N. Sawchuk, "Disgust: Characteristic features, social manifestations, and clinical implications," *Journal of Social and Clinical Psychology*, vol. 24, pp. 932-962, 2005.
- [2] I. Eli, *Oral psychophysiology: stress, pain, and behavior in dental care*: CRC press, 1992.
- [3] E. Attia and K. Marshall, "Halitosis," *Canadian Medical Association Journal*, vol. 126, p. 1281, 1982.
- [4] S. Porter and C. Scully, "Oral malodour (halitosis)," *Bmj*, vol. 333, pp. 632-635, 2006.
- [5] E. d. S. Tolentino, L. E. M. Chinellato, and O. Tarzia, "Saliva and tongue coating pH before and after use of mouthwashes and relationship with parameters of halitosis," *Journal of Applied Oral Science*, vol. 19, pp. 90-94, 2011.
- [6] M. Rad, S. Kakoie, F. N. Brojeni, and N. Pourdanghan, "Effect of long-term smoking on whole-mouth salivary flow rate and oral health," *Journal of dental research, dental clinics, dental prospects*, vol. 4, p. 110, 2010.
- [7] E.-S. Cho, "Effect of self awareness of halitosis on the quality of life related to oral health in patients with chronic renal failure," *Journal of Digital Convergence*, vol. 11, pp. 607-614, 2013.
- [8] S.-J. Choi, B.-H. Jang, S.-J. Lee, B. K. Min, A. Rothschild, and I.-D. Kim, "Selective detection of acetone and hydrogen sulfide for the diagnosis of diabetes and halitosis using SnO<sub>2</sub> nanofibers functionalized with reduced graphene oxide nanosheets," *ACS applied materials & interfaces*, vol. 6, pp. 2588-2597, 2014.

- [9] A. Tangerman, "Halitosis in medicine: a review," *International dental journal*, vol. 52, pp. 201-206, 2002.
- [10] K. Veerasha, M. Bansal, and V. Bansal, "Halitosis: A frequently ignored social condition," *Journal of International Society of Preventive & Community Dentistry*, vol. 1, p. 9, 2011.
- [11] D. P. Lu, "Halitosis: an etiologic classification, a treatment approach, and prevention," *Oral Surgery, Oral Medicine, Oral Pathology*, vol. 54, pp. 521-526, 1982.
- [12] S. Chaudhary, A. Singh, R. Jaiswal, F. M. Samadi, and S. Nisha, "Halitosis: A review," *Indian Journal of Public Health Research & Development*, vol. 2, 2011.
- [13] A. SHEWALE and S. DUBEY, "HALITOSIS RAISING A STINK: A Review," *Life*, vol. 50, p. 1.
- [14] J. A. Ship, S. R. Pillemer, and B. J. Baum, "Xerostomia and the geriatric patient," *Journal of the American Geriatrics Society*, vol. 50, pp. 535-543, 2002.
- [15] Z. Çoban and I. Sönmez, "Halitosis: a review of current literature," *Meandros Medical and Dental Journal*, vol. 18, p. 164, 2017.
- [16] B. U. Aylıkçı and H. Çolak, "Halitosis: From diagnosis to management," *Journal of natural science, biology, and medicine*, vol. 4, p. 14, 2013.
- [17] J. H. Kang, Y. J. Jang, D. J. Kim, and J. W. Park, "Antimicrobial Effectiveness of Cetylpyridinium Chloride and Zinc Chloride--Containing Mouthrinses on Bacteria of Halitosis and Peri-implant Disease," *International Journal of Oral & Maxillofacial Implants*, vol. 30, 2015.
- [18] M. Nakhleh, M. Quatredeniens, and H. Haick, "Detection of halitosis in breath: Between the past, present, and future," *Oral diseases*, vol. 24, pp. 685-695, 2018.
- [19] S. M. Wåler, "On the transformation of sulfur-containing amino acids and peptides to volatile sulfur compounds (VSC) in the human mouth," *European journal of oral sciences*, vol. 105, pp. 534-537, 1997.
- [20] A. Donaldson, D. McKenzie, M. Riggio, P. Hodge, H. Rolph, A. Flanagan, *et al.*, "Microbiological culture analysis of the tongue anaerobic microflora in subjects with and without halitosis," *Oral diseases*, vol. 11, pp. 61-63, 2005.
- [21] G. S. Penmetsa, S. Singh, P. Gadde, R. G. Teja, and U. R. Bhaskar, "Periodontal health awareness and self-perceived halitosis among various professional students of West Godavari District of Andhra Pradesh," *Journal of Indian Association of Public Health Dentistry*, vol. 15, p. 378, 2017.
- [22] S. Y. Kim, S. Sim, S.-G. Kim, B. Park, and H. G. Choi, "Prevalence and associated factors of subjective halitosis in Korean adolescents," *PloS one*, vol. 10, p. e0140214, 2015.
- [23] H. A. Eid, "Non surgical management of periodontitis related halitosis among adults," *Saudi Journal for Health Sciences*, vol. 3, p. 80, 2014.
- [24] M. Bakhshi, M. Tofangchiha, and S. Bakhtiari, "Prevalence of self-perceived halitosis, demographic factors and oral health care among defined groups of dental students in Iran," *Journal of International Oral Health*, vol. 10, p. 187, 2018.
- [25] S. G. Deolia, K. S. Kela, I. M. Sawhney, P. A. Sonavane, G. Nimbalkar, and A. Reche, "Evaluation of oral health care seeking behavior in rural population of central India," *Journal of Family Medicine and Primary Care*, vol. 9, p. 886, 2020.
- [26] S. Setia, P. Pannu, R. S. Gambhir, V. Galhotra, P. Ahluwalia, and A. Sofat, "Correlation of oral hygiene practices, smoking and oral health conditions with self perceived halitosis amongst undergraduate dental students," *Journal of natural science, biology, and medicine*, vol. 5, p. 67, 2014.
- [27] G. Jain, A. Kawadkar, T. Moidin, V. Singhal, and A. Chouksey, "Assessment of oral hygiene habits among the dental students of bhopal, madhya pradesh: a questionnaire survey," *Journal of Orofacial Research*, pp. 249-252, 2013.
- [28] S. Bakhtiari, M. Sehatpour, H. Mortazavi, and M. Bakhshi, "Orofacial manifestations of adverse drug reactions: A review study," *Clujul medical*, vol. 91, p. 27, 2018.

---

**Publisher's note:** Bashir Institute of Health Sciences remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.



**Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made. The images or other third-party material in this article are included in the article's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>.

© The Author(s) 2019.