

Non-Oral Factors Associated with Self-Reported Halitosis among Adults Living in Riyadh, Saudi Arabia

Alsadhan Salwa¹, Darwish Amel²

¹Department of Periodontics and Community Dentistry, College of Dentistry, King Saud University, Kingdom of Saudi Arabia, Saudi Arabia. ²Department of Pediatric and Community Dentistry, Faculty of Dentistry, Alexandria University, Egypt.

Abstract

Halitosis is a general term used to describe an unpleasant or offensive odor emanating from the oral cavity. It may be caused by oral as well as non-oral factors.

Aim: to assess the relation of non-oral factors and self-reported halitosis among adults living in Riyadh, Saudi Arabia.

Materials and methods: A cross-sectional descriptive study was performed in Riyadh, Saudi Arabia in 2012. Structured questionnaire was distributed to 3000 subjects who were randomly selected from high schools, colleges and governmental offices; 1000 from each (500 male and 500 female subjects). A total of 2343 out of 3000 questionnaires were collected from the sample. Data was collected and statistical analyses were performed using Chi square test at 95% confidence ($p < 0.05$).

Results: Self-reported halitosis was significantly related to heart problems, gastrointestinal diseases, sinusitis and anxiety ($P = 0.009, 0.009, 0.013$ and 0.01 , respectively). Whereas, there were no statistically significant relations between self-reported halitosis and high blood pressure, blood disorders, Diabetes Mellitus, renal, liver, and respiratory tract problems ($p = 0.066, 0.274, 0.37, 0.355, 0.263$ and 435 , respectively).

Conclusion: Some non-oral factors, such as heart problems, gastrointestinal diseases, sinusitis and anxiety, may be associated with self-reported halitosis among adults living in Riyadh.

Key Words: Self-reported halitosis, Non-oral factors, Riyadh

Introduction

Halitosis is a Latin word which means halitus (breathed air) and osis (pathologic alteration) [1]. Halitosis or bad breath occurs when noticeably unpleasant odour is exhaled in breathing regardless of whether the odorous substances in the breath originate from oral or non-oral sources. It is common and can affect people of all ages. When it is severe or longstanding, it may decrease self-confidence and social interactions [2]. It is estimated to be the third most frequent reason for seeking dental aid following tooth decay and periodontal diseases [3].

Oral etiologies such as periodontal diseases, oral candidiasis, inadequate oral hygiene and poorly fitting restorations are considered to be the main causes of halitosis [4]. However, If oral factors cannot be attributed, non-oral etiologies should be considered [4-7].

Recent research suggested that halitosis could have a gastrointestinal origin [8-10]. In cases of intestinal obstruction, a faecal mouth odour may be detectable, as found in two siblings with extrinsic duodenal obstruction caused by congenital peritoneal bands [11]. There is no 100% clear correlation found between peptic ulcers and halitosis [12,13]. Several metabolic disorders in the bowels, like trimethylaminuria cause a specific fishy odour. According to Whittle et al. 2007, this genetic disease may be the largest cause of undiagnosed body odour including breath odour [14].

Chronic mouth breathing, dehydration and autoimmune diseases (as Sjogren's) can also diminish salivation, as can systemic illness such as diabetes mellitus, nephritis and thyroid dysfunction. Research groups of Kleinberg et al. 2002 and Koshimune et al. 2003 described properly the correlation between the dry mouth and the increase of halitosis [15,16]. It

was also stated in literature that anxiety might be associated with halitosis [17,19].

Accordingly, the relation between halitosis and non-oral factors still needs to be supported by more evidence. The aim of this study is to assess the relation of non-oral factors and self-reported halitosis among adults living in Riyadh, Saudi Arabia.

Materials and Methods

This was a cross-sectional descriptive study conducted in Riyadh, Saudi Arabia in 2012. The study was ethically approved by the College of Dentistry Research Center, King Saud University, Riyadh, Saudi Arabia.

Sample size estimation

Multi stage stratified sampling technique was used in this study. There were three stages; three levels of occupation (school students, college students and employees, represented equally) and within each occupation, there were two genders (male and female, represented equally) and within each, there were five locations (east, west, north, south and center, represented equally). The sample was selected at a level of significance of 0.05, with an estimated standard deviation of 1.2 and a power of 0.9. The sample size for each level of location within gender's level and level of occupation should be at least 100. So, the total sample size is around 3000 ($3 \times 2 \times 5 \times 100$).

Questionnaire designing

A specially designed self-administered questionnaire was developed in English then translated to Arabic [20]. To ensure the validity of the questionnaire, a senior expert faculty reviewed it then it was modified according to her comments.

A pilot study was performed to ensure the practicability and the feasibility of the questionnaire.

The questionnaire began with a brief explanation of "Halitosis" then a statement indicating to the participants that their answers would be stored and transmitted securely for protecting confidentiality [21]. The questionnaire was made up of 3 parts; the first part inquired about the socio-demographic factors including gender, age, educational level and occupation. The second part concerned the participant's perception of any malodour (halitosis), its history and its social effects. The last part inquired about the general health and if the subject suffers from cardiac, blood pressure, circulatory, gastro-intestinal, renal, hepatic, respiratory tract, nasal sinuses, Diabetes Mellitus or anxiety problems. The questions called for "yes/ no" answers and a tick box layout was used for the provision of the appropriate answer.

Questionnaire distribution

The questionnaire was distributed to 3000 subjects who were randomly selected from high schools, colleges and governmental offices; 1000 from each (500 male and 500 female subjects). High schools and governmental offices were selected using systematic random sampling from each of the main five regions of Riyadh (East, West, North, South, and Central). In each region, 100 male and 100 female subjects were randomly selected. The college students were selected from the major universities in Riyadh (King Saud, AlEmam, Prince Sultan, AlYammamah Universities and Prince Norah University for female students or AlFaisal University for male students). From each university 100 male and 100 female students were randomly selected.

Statistical analysis

After collecting the questionnaire, data was transferred to a computer for analysis using Statistical Package for Social Sciences program for Windows (version 16 SPSS Inc., Chicago, IL, USA). Simple descriptive statistics as means and frequency distributions were calculated for the study variables. Relations of the variables with self-reported halitosis were also evaluated using Chi square test at 95% confidence ($p < 0.05$).

Results

A total of 2343 out of 3000 questionnaires were collected from the sample giving a response rate of 78.1%.

The socio-demographic characteristics of the study subjects are summarized in *Table 1*. The age range of the participants was (17-65 years). Females and males accounted for 53.4% and 46.6% of the sample, respectively. Regarding the education level, 55% of the sample had graduated from high schools and still undergraduate, 39% were in levels less than high school and the postgraduates represented 4.7% of the sample. Halitosis was reported by 22.8% of the study subjects.

A statistically significant relation was found between self-reported halitosis and the general health condition of the subjects ($P < 0.0001$). There was greater percentage of self-reported halitosis among subjects with poor general health (41.9%) in comparison to subjects with good general health (20.2%). *Figure 1* presents percentages of self-reported halitosis in relation to general health condition of adults living in Riyadh.

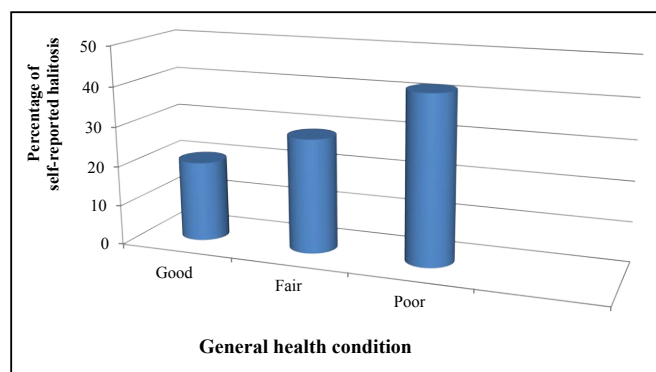


Figure 1. Percentage of self-reported halitosis in relation to general health condition of adults living in Riyadh, Saudi-Arabia.

Table 1. Socio-demographic characteristics of the study sample (n= 2343).

Variable	Frequency; n (%)
Age	
17-24 years	1559 (66.7)
25-34 years	436 (18.6)
35-44 years	190 (8.1)
45-54 years	113 (4.8)
>54 years	40 (1.7)
Gender	
Male	1093 (46.6)
Female	1250 (53.4)
Education level	
Illiterate	8 (0.3)
<High school	915 (39.1)
High school-<Bachelor degree	1292 (55.1)
Post graduate	111 (4.7)
Occupation	
High school students	907(38.7)
College students	638 (27.2)
Employee	798 (34.1)
Self-reported halitosis	
Yes	534 (22.8)
No	1809 (77.2)

Table 2 presents the relation of self-reported halitosis and non-oral (medical) factors among adults living in Riyadh. Self-reported halitosis was significantly related to heart problems, gastrointestinal diseases, sinusitis and anxiety ($P=0.009$, 0.009 , 0.013 and 0.01 , respectively). Whereas, there were no statistically significant relations between self-reported halitosis and high blood pressure, blood disorders, Diabetes Mellitus, renal, liver and respiratory tract problems ($P=0.066$, 0.274 , 0.370 , 0.355 , 0.263 and 0.435 , respectively).

Discussion

Halitosis is a common complaint among adults of both genders all over the world. It has a multifactorial etiology, but its main cause is the decomposition of the organic materials by microorganisms in the oral cavity [22].

Through this study, it was observed that about 27% of subjects suffered from sinusitis complained from halitosis. This was explained by Tarzia, 2003 and van Steenberghe, 2004 who reported that halitosis related to the oronasal cavity, such as chronic/purulent sinusitis, post-nasal drip and foreign body in nasal or sinus cavity, was mainly due to bacterial action which lead to putrefaction of the tissues and production of Volatile Sulphur Compounds (VSC) [6,7].

Table 2. Relation of self-reported halitosis and non-oral factors among adults living in Riyadh, Saudi Arabia.

Variable	Subjects with halitosis, n (%)	X ² (P value)
Heart problems Yes	19 (38.8)	7.10 (0.009) †
High blood pressure Yes	47 (28.0)	2.63 (0.066)
Blood disorders Yes	40 (25.2)	0.48 (0.274)
Diabetes mellitus Yes	20 (25.0)	0.20 (0.370)
Gastrointestinal diseases Yes	80 (28.8)	6.19 (0.009) †
Sinusitis Yes	113 (27.3)	5.41 (0.013) †
Renal diseases Yes	12 (26.1)	0.27 (0.355)
Liver problems Yes	10 (28.6)	0.66 (0.263)
Respiratory tract problems Yes	67 (23.8)	0.05 (0.435)
Anxiety Yes	258 (25.0)	5.59 (0.010) †

*X²: chi square test

†: Statistically significant (P≤0.05)

There was a significant statistical relation between self-reported halitosis and gastrointestinal problems. This agrees with other authors who stated that many gastrointestinal diseases, such as reflux esophagitis, hiatal hernia, Zencker diverticulum, achalasia, steatorrhea or other malabsorption syndromes, caused excessive flatulence which made them be traditionally associated with halitosis [6,7]. In Gastroesophageal reflux disease, an improper function of the gastroesophageal inferior sphincter allows acid and non-acid stomach contents to flow back into the esophagus. This alteration could result in esophageal mucosal break down. These areas can be inhabited by bacteria, causing the production of volatile sulphur compounds. In some cases, esophagus sphincter pathologies may cause halitosis due to putrefaction of the trapped food debris and food stasis [7,23,24]. In-vitro studies showed significant VSCs production by the bacteria that causes peptic ulcers; *Helicobacter pylori* (*H. pylori*) [23].

This study showed that there was a statistically significant relation between heart problems and self-reported halitosis. As a self-explanation, this may be due to the possibility that the oral pathogenic microorganisms, in the case of neglected oral hygiene, may circulate in the blood stream attacking the heart or attaching to blood vessels increasing the probability of clot formation that may decrease the blood flow to the heart causing some cardiac problems.

References

- Hine KH. Halitosis. *Journal of American Dental Association*. 1957; **55**: 37-46.
- Porter SR, Scully C. Oral malodour (halitosis). *British Journal of Medicine*. 2006; **333**: 632-635.
- Loesche WJ, Kazor C. Microbiology and treatment of halitosis. *Periodontology*. 2000; **28**: 256-279.
- Rosenberg M. Clinical assessment of bad breath: Current

Regarding anxiety, this study's results agree with those of Settineri et al. 2010 [18], who found that poor oral health and self-reported halitosis was associated with dental anxiety factors and concluded that anxiety was one of the causes of halitosis. Zaitzu et al. 2011 found that about one-third of halitosis patients suffered from social anxiety disorders [19]. In particular, pseudo-halitosis patients had a higher risk of social anxiety disorders compared to real halitosis patients. This also agrees with Calil and Marcondes, 2006 who concluded that the anxiogenic condition induces elevation in the VSC concentration, which might contribute to halitosis [17].

No statistically significant relation was found between self-reported halitosis and respiratory tract problems. This disagrees with Rosemberg, 1996 and Tonzetich, 1977 who concluded that there were some pathologies such as chronic bronchitis, bronchial carcinoma, bronchiectasis that caused tissue necrosis and ulcerations, producing malodorous gases, which were expired causing halitosis [4,25].

There were no statistically significant relations of halitosis with diabetes mellitus, renal and liver problems. This disagrees with other researchers who found that there were statistically significant relations between halitosis and these medical problems [23,25-27]. This may be explained by the probability of unawareness of some study subjects whether they were having these problems or not.

Self-reported halitosis had no statistically significant relations to high blood pressure or to blood disorders. There was no data in the literature assessing relations between halitosis and the latter two conditions.

The limitation of this study is that it was a cross-sectional study including a wide age range which does not allow the examination of cause-and-effect relations. Self-reported halitosis may be an indication to genuine halitosis, however, further analytical studies are recommended to be conducted targeting subjects with narrower age range to assess the association of genuine halitosis and non-oral factors.

Conclusion

It can be concluded that some non-oral factors, including heart problems, gastrointestinal diseases, sinusitis and anxiety, may be associated with self-reported halitosis among adults living in Riyadh.

For helping patients get rid of halitosis, not only dental professional care is required but also medical consultations are necessary to assess and treat the underlying non-oral conditions, if found.

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- concepts. *Journal of American Dental Association*. 1996; **127**: 475-482.
- Page R. Causes of halitosis. *Oral Care Report*. 1997; **7**: 7-8.
 - Tárzia O. Halitose (Editors). Um desafio que tem cura (1st edn.) Rio de Janeiro: Ed. de Publicações Biomédicas Ltda; 2003.
 - Van Steenberghe D (Editors). Breath Malodor a step-by-step approach. Quintessence Books (1st edn.) Copenhagen; 2004.
 - Lee H, Kho HS, Chung JW, Chung SC, Kim YK. Volatile sulphur compounds produced by *Helicobacter pylori*. *Journal of Clinical Gastroenterology*. 2006; **40**: 421-426.

9. Kinberg S, Stein M, Zion N. The gastrointestinal aspects of halitosis. *Canadian Journal of Gastroenterology*. 2010; **24**: 552-556.
10. Yilmaz AE, Bilici M, Tonbul A, Karabel M, Dogan G, Tas T. Paediatric halitosis and Helicobacter pylori infection. *Journal of the College of Physicians and Surgeons Pakistan*. 2012; **22**: 27-30.
11. Stephenson BM, Rees BI. Extrinsic duodenal obstruction and halitosis. *Postgraduate Medical Journal*. 1990; **66**: 568-570.
12. Werdmuller BF, van der Putten TB, Balk TG, Lamers CB, Loffeld RJ. Clinical presentation of Helicobacter pylori-positive and -negative functional dyspepsia. *Journal of Gastroenterology and Hepatology*. 2000; **15**: 498-502.
13. Moshkowitz M, Horowitz N, Leshno M, Halpern Z. Halitosis and gastroesophageal reflux disease: a possible association. *Oral Diseases*. 2007; **13**: 581-585.
14. Whittle CL, Fakharzadeh S, Eades J, Preti G. Human breath doors and their use in diagnosis. *Annals of the New York Academy of Sciences*. 2007; **1098**: 252-266.
15. Kleinberg I, Wolff MS, Codipilly DM. Role of saliva in oral dryness, oral feel and oral malodour. *International Dental Journal*. 2002; **52**: 236-240.
16. Koshimune S, Awano S, Gohara K, Kurihara E, Ansai T, Takehara T. Low salivary flow and volatile sulphur compounds in mouth air. *Oral Surgery Oral Medicine Oral Pathology Oral Radiology Endodontics*. 2003; **9**: 38-41.
17. Calil CM, Marcondes FK. Influence of anxiety on the production of oral volatile sulfur compounds. *Life Sciences*. 2006; **79**: 660-664.
18. Settineri S, Mento C, Gugliotta SC, Saitta A, Terranova A, Trimarchi G. Self-reported halitosis and emotional state: Impact on oral conditions and treatments. *Health and Quality of Life Outcomes*. 2010; **8**: 34.
19. Zaitso T, Ueno M, Shinada K, Wright FAC, Kawaguchi Y. Relationship between Social Anxiety Disorder and Halitosis. *International Journal of Clinical Dentistry*. 2011; **6**: 63-71.
20. Al-Ansari JM, Boodai H, Al-Sumait N, Al-Khabbaz AK, Al-Shammari KF, Salako N. Factors associated with self-reported halitosis in Kuwaiti patients. *Journal of Dentistry*. 2006; **34**: 444-449.
21. World Health Federation. FDI Dental Ethics Manual. 2007.
22. Uliana RMB, Briques W, Conti R. Microbiota oral e suas repercussões no hálito. *Odontologia*. 2002: 297-308.
23. Hoshi K, Yamano Y, Mitsunaga A, Shimizu S, Kagawa J, Ogiuchi H. Gastrointestinal diseases and halitosis: Association of gastric Helicobacter pylori infection. *International Dental Journal*. 2002; **52**: 207-211.
24. Costa IM. Patologia das halitoses. *Odontólogo Moderno*. 1987; **14**: 7-16.
25. Tonzetich J. Production and origin of oral malodor: A review of mechanisms and methods of analysis. *Journal of Periodontology*. 1977; **48**: 13-20.
26. Rocha EM, Carvalho CR, Saad MJ, Velloso LA. The influence of ageing on the insulin signaling system in rat lacrimal and salivary glands. *Acta Ophthalmologica Scandinavica*. 2003; **81**: 639-645.
27. Han DH, Lee SM, Lee JG, Kim YJ, Kim JB. Association between viral hepatitis B infection and halitosis. *Acta Ophthalmologica Scandinavica*. 2014; **72**: 274-282.