

Relationship between subjective halitosis and psychological factors

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Objectives: Subjective halitosis is a growing concern in the fields of dentistry and psychology. This study was designed to determine the association between subjective halitosis and contributing psychological factors. **Methods:** Data for this cross-sectional study were gathered from 4,763 participants who had answered questions on subjective halitosis and psychological factors (depression, anxiety, stress and personality traits) in the study on the epidemiology of psychological, alimentary health and nutrition (SEPAHAN). Binary logistic regression was used for data analysis. **Result:** The mean age of all subjects was 36.58 years; and the majority of subjects were female (55.8%), married (81.2%) and graduates (57.2%). The prevalence of subjective halitosis was 52.8%. The majority of subjects with the complaint of subjective halitosis were married ($P < 0.001$) and young ($P = 0.07$). Participants with subjective halitosis were significantly more anxious [odds ratio (OR) = 1.76, 95% confidence interval (95% CI): 1.38–2.24], stressed (OR = 1.41, 95% CI: 1.17–1.71) and depressed (OR = 1.31, 95% CI: 1.09–1.57). Among personality traits, neuroticism was a risk factor (tertile 1 *vs.* tertile 2: OR = 1.29, 95% CI: 1.09–1.51; and tertile 1 *vs.* tertile 3: OR = 1.74, 95% CI: 1.43–2.13) and conscientiousness was revealed to be a protective factor (tertile 1 *vs.* tertile 2: OR = 0.82, 95% CI: 0.70–0.98; and tertile 1 *vs.* tertile 3: OR = 0.65, 95% CI: 0.53–0.80). **Conclusion:** It seems that psychological factors, such as anxiety, depression and stress, as well as some personality traits, can be considered as risk factors for subjective halitosis. Multidisciplinary efforts by dental and psychological professionals must be considered to address this problem.

Key words: Behavioural science, halitosis, oral hygiene

INTRODUCTION

Halitosis, oral malodour or bad breath are terms defining a common concern of individuals with bad odour originating from their mouth. Regardless of the cause, malodour motivates people to seek professional dental care and counsel¹. Halitosis is usually classified as genuine halitosis (pathological and physiological), pseudo halitosis or halitophobia². Halitosis can be categorised either subjectively (based on patients' or others' sense of odour) or objectively (using different clinical measurement methods). The four most common diagnostic methods of halitosis are: self-assessment; organoleptic measurements; monitoring of volatile sulphur compounds (VSC); and microbiologi-

cal tests³. Some causative factors are certain kinds of food, poor oral hygiene, decreased salivary flow rate (xerostomia)⁴, periodontal diseases, pericoronitis and ulcers⁵. According to the American Dental Association (ADA), over 50% of adults occasionally complain of bad breath, of whom 25% are actually suffering from severe chronic halitosis⁶.

Pathological halitosis is related to dental, otolaryngological, internal medicine and psychological factors. Approximately 85% of oral malodours originate from the oral cavity⁷. Other highly associated factors of halitosis are past smoking and a history of gastrointestinal disorders⁸. Although some studies mentioned female gender as a risk factor for halitosis⁸, information explaining the association between halitosis and

demographic factors, including gender, age and level of education, are limited⁹.

Also, it has been reported that both incidence and intensity of halitosis increases in stressful and anxious situations^{10,11}. Some research has indicated that pseudo halitosis is strongly associated with a patient's somatic and emotional status, depression and psychological disorders, whereas other studies have demonstrated no significant relationship¹²⁻¹⁴.

Halitosis has an important psychological impact, resulting in poor social communication, personal isolation⁹ and decrease in social activity of a person^{15,16}. Over 50% of the population claim to have halitosis, and half of these individuals mentioned personal discomfort and embarrassment because of this problem¹⁷. As odour is a subjective sense and can be affected by emotion, mood¹⁸ and cognitive variables, it has an important role in cognition and memory¹⁹. 'Olfactory reference syndrome' patients are those who claim to have a malodour but the malodour cannot be detected by a professional²⁰. Personality tendencies towards self-criticism, neuroticism, inferiority, shyness, self-observation, difficulty in expressing emotion and obsession were shown to be associated with subjective halitosis. Moreover, depression was mentioned as an associative factor²¹.

As there are limited studies, with low sample sizes, concerning this issue, the present study was designed to determine the association between subjective halitosis and contributing psychological factors, such as personality type, anxiety, depression and stress level.

MATERIAL AND METHOD

Study population

The current survey is part of the study on the epidemiology of psychological, alimentary health and nutrition (SEPAHAN) project²², which aims to investigate the association between halitosis and psychological factors. Detailed information regarding study design, sampling strategies, survey instruments, participants' characteristics and data-collection procedures have recently been published²².

The study population was selected among 4 million people in 20 counties across Isfahan province. Convenience sampling was performed according to geographical region to determine the number of participants needed in each region. The participants were selected from healthy people who live in Isfahan province. The questionnaires were given to the participants in their home and workplace and they answered the questionnaires during their spare time. The questionnaires were received as sealed envelopes. All data collected were anonymous and confidential. Participation in this study was completely optional. The

response rate was 86.16%. In order to increase the data-collection accuracy and response rate, two separate questionnaires were used. Initially, a self-administered questionnaire on demographic features and psychological factors was completed by all participants, and then another self-administered questionnaire was used to gather data on halitosis.

From the selected sample, 97% (4,652 individuals) answered both halitosis-related questions and questions about their psychology profiles.

After clarification for all the participants, written informed consent was obtained. Subjects agreed to fill in a questionnaire as a contribution to scientific research.

This study project was approved ethically and scientifically by the Regional Bioethics Committee of International Union of Microbiological Societies. The research was conducted in full accordance with the World Medical Association Declaration of Helsinki.

Measurements

Demographic factors

Demographic factors assessed in this study were age, sex, educational status (undergraduate or graduate) and marital status (unmarried, divorced or widowed).

Oral health

A questionnaire for evaluating oral health was administered. One of its questions was for assessing subjective halitosis, which is defined as a sensation of bad oral odour. Participants were asked 'How often have you suffered from bad breath in the last 3 months?'. The answers available in the questionnaire were 'never', 'sometimes', 'often' or 'always', which were later recoded 'no' for the 'never' answer and 'yes' for the three other answers.

Psychological variables

In order to study depression and anxiety among individuals, the validated Hospital Anxiety and Depression Scale (HADS) was used^{23,24}. The questionnaire had 14 different items, each group consists of seven questions, scored from 0 to 21 and results in two scales, anxiety ($\alpha = 0.82$) and depression ($\alpha = 0.84$). Higher scores demonstrate more depression and anxiety. A score of >11 was considered as a threshold point for anxiety and clinical depression.

The General Health Questionnaire (GHQ-12) was used for measuring stress levels in staff²⁵. The GHQ-12 is generally used in general population studies as a consistent and reliable tool²⁶. A four-point scale is used for each item of the GHQ-12 (less than usual,

no more than usual, fairly more than usual and much more than usual). The 0-0-1-1 method was applied for scoring the GHQ-12 questionnaires. By applying this method, each participant could score between 0 and 12 points; a score of 4 or more demonstrated that a participant had a high stress level.

Costa and McCrae²⁷ developed the Big Five Personality Inventory Short Form (NEO FFI) scale. This scale consists of 60 items divided into five subscales: extraversion; neuroticism; agreeableness; openness to experience; and conscientiousness. Twelve items were used to assess each of these five personality traits. Each item was rated on a scale of 1 (strongly disagree) to 5 (strongly agree). Certain items were reverse scored. Higher levels of a particular personality trait are shown by higher scores. Both the entire scale ($\alpha = 0.70$) and subscales ($\alpha > 0.68$) demonstrated adequate reliability²⁷.

Statistical analysis

Binary logistic regression analysis was applied to find the association between subjective halitosis and contributing psychological factors (stress level, anxiety, depression and personality traits). Odds ratios (ORs) were reported with the corresponding 95% confidence intervals (95% CIs). A dependent variable was considered as a dichotomous variable defined by the presence or absence of subjective halitosis. Independent variables included level of depression (yes/no), anxiety (yes/no), distress (high/low) and personality trait tertiles (extraversion, neuroticism, agreeableness, openness to experience and conscientiousness) as well as demographic factors such as age, sex, educational status (undergraduate or graduate) and marital status (unmarried, divorced or widowed).

RESULTS

A total of 4,763 individuals participated in this cross-sectional study. The mean age of all subjects was 36.58 [standard deviation (SD) = 8.09; range: 19–70] years. Female subjects comprised 55.8% of the sample, and 81.2% of the sample was married. There are two groups of married and unmarried (single, divorced and widow). More than half (57.2%) of the sample were college graduates. The prevalence of subjective halitosis was 52.8% (2,458 individuals). The demographic characteristics of this study are summarised in Table 1.

The majority of subjects with the complaint of subjective halitosis were married ($P < 0.001$) and young ($P = 0.07$). No significant differences in the prevalence of subjective halitosis were found for level of education or gender. Participants with subjective halitosis were significantly more anxious, stressed and depressed

Table 1 Demographic characteristics, personality traits and psychological variables of the study population ($n = 4652$)

| Variable | Halitosis | | P |
|------------------------------------|--------------|--------------|---------|
| | Yes | No | |
| Demographic characteristics | | | |
| Age (years) | 36.20 ± 7.68 | 36.89 ± 8.45 | 0.07 |
| Sex | | | |
| Male ($n = 2063$) | 1062 (51.5) | 1001 (48.5) | 0.097 |
| Female ($n = 2589$) | 1396 (53.9) | 1193 (46.1) | |
| Educational level | | | |
| Undergraduate ($n = 1939$) | 1016 (52.4) | 923 (47.6) | 0.637 |
| Graduate ($n = 2593$) | 1377 (53.1) | 1216 (46.9) | |
| Marital status | | | |
| Unmarried ($n = 858$) | 394 (45.9) | 464 (54.1) | <0.0001 |
| Married ($n = 3685$) | 2007 (54.5) | 1678 (45.5) | |
| Personality traits | | | |
| Neuroticism | | | |
| Tertile 1 ($n = 1650$) | 701 (42.5) | 949 (57.5) | <0.0001 |
| Tertile 2 ($n = 1544$) | 812 (52.6) | 732 (47.4) | |
| Tertile 3 ($n = 1458$) | 945 (64.8) | 513 (35.2) | |
| Extraversion | | | |
| Tertile 1 ($n = 1783$) | 1068 (59.9) | 715 (40.1) | <0.0001 |
| Tertile 2 ($n = 1362$) | 698 (51.2) | 664 (48.8) | |
| Tertile 3 ($n = 1507$) | 692 (45.9) | 815 (54.1) | |
| Openness | | | |
| Tertile 1 ($n = 1555$) | 845 (54.3) | 710 (45.7) | 0.075 |
| Tertile 2 ($n = 1668$) | 893 (53.5) | 775 (46.5) | |
| Tertile 3 ($n = 1429$) | 720 (50.4) | 709 (49.6) | |
| Agreeableness | | | |
| Tertile 1 ($n = 1644$) | 989 (60.2) | 655 (39.8) | <0.0001 |
| Tertile 2 ($n = 1646$) | 872 (53.0) | 774 (47.0) | |
| Tertile 3 ($n = 1353$) | 597 (44.1) | 756 (55.9) | |
| Conscientiousness | | | |
| Tertile 1 ($n = 1596$) | 980 (61.4) | 616 (38.6) | <0.0001 |
| Tertile 2 ($n = 1719$) | 908 (52.8) | 811 (47.2) | |
| Tertile 3 ($n = 1337$) | 570 (49.4) | 767 (50.6) | |
| Psychological variable | | | |
| Depression | | | |
| No ($n = 3250$) | 1579 (48.6) | 1671 (51.4) | <0.0001 |
| Yes ($n = 1302$) | 832 (63.9) | 470 (36.1) | |
| Anxiety | | | |
| No ($n = 3905$) | 1954 (50) | 1951 (50) | <0.0001 |
| Yes ($n = 637$) | 459 (72.1) | 178 (27.9) | |
| Stress level | | | |
| Low ($n = 3488$) | 1699 (48.7) | 1789 (51.3) | <0.0001 |
| High ($n = 1046$) | 692 (66.2) | 354 (33.8) | |

Values are given as mean ± standard deviation or n (%). Some participants have not answered all of the questions of each domain and therefore it's possible that the total sum of each domain is less than the total study population.

($P < 0.001$). The results for different personality traits are also shown in Table 1.

Table 2 presents the results of logistic regression analyses. Model 1 demonstrates that of all demographic variables examined, the most associated protective factor was age (OR = 0.98, 95% CI = 0.97–0.99) and the most associated risk factor was being married (OR = 1.67, 95% CI = 1.40–1.97). With demographic factors as a covariant in model 2, among personality traits neuroticism was a risk factor (tertile 1 vs. tertile 2: OR = 1.29, 95% CI: 1.09–1.51; and tertile 1 vs. tertile 3: OR = 1.74, 95% CI: 1.43–2.13) and conscien-

Table 2 Binary logistic regression analysis of subjective halitosis based on psychological variables and personality traits

| Variable | Model 1 OR (95% CI) | Model 2 OR (95% CI) | Model 3 OR (95% CI) |
|------------------------------|------------------------|------------------------|------------------------|
| Demographic factors | | | |
| Age | 0.98 (0.97–0.99) | 0.98 (0.97–0.99) | 0.98 (0.97–0.99) |
| Sex (female) | 1.12 (0.98–1.29) | 1.05 (0.91–1.21) | 1.00 (0.86–1.15) |
| Educational level (graduate) | 0.98 (0.85–1.12) | 1.06 (0.92–1.22) | 1.07 (0.93–1.23) |
| Marital status (married) | 1.67 (1.40–1.97) | 1.66 (1.42–2.01) | 0.58 (1.38–2.04) |
| Personality traits | | | |
| Neuroticism | | | |
| Tertile 1 | | Ref | |
| Tertile 2 | | 1.29 (1.09–1.51) | |
| Tertile 3 | | 1.74 (1.43–2.13) | |
| Extraversion | | | |
| Tertile 1 | | Ref | |
| Tertile 2 | | 0.92 (0.77–1.09) | |
| Tertile 3 | | 0.98 (0.86–1.27) | |
| Openness | | | |
| Tertile 1 | | Ref | |
| Tertile 2 | | 1.04 (0.88–1.22) | |
| Tertile 3 | | 1.01 (0.85–1.21) | |
| Agreeableness | | | |
| Tertile 1 | | Ref | |
| Tertile 2 | | 0.92 (0.78–1.08) | |
| Tertile 3 | | 0.75 (0.62–1.09) | |
| Conscientiousness | | | |
| Tertile 1 | | Ref | |
| Tertile 2 | | 0.82 (0.70–0.98) | |
| Tertile 3 | | 0.65 (0.53–0.80) | |
| Psychological variable | | | |
| Presence of depression | | | 1.31 (1.09–1.57) |
| Presence of anxiety | | | 1.76 (1.38–2.24) |
| High stress level | | | 1.41 (1.17–1.71) |

95% CI, 95% confidence interval; OR, odds ratio.

Model 1: Demographic factors.

Model 2: Personality traits adjusted by demographic factors.

Model 3: Other psychological variables adjusted by demographic factors.

tiousness was revealed to be a protective factor (tertile 1 *vs.* tertile 2: OR = 0.82, 95% CI: 0.70–0.98; and tertile 1 *vs.* tertile 3: OR = 0.65, 95% CI: 0.53–0.80). Also, all psychological factors, including the presence of depression (OR = 1.31; 95% CI: 1.09–1.57), anxiety (OR = 1.76; 95% CI: 1.38–2.24) and high stress level (OR = 1.41; 95% CI: 1.17–1.71) were risk factors for subjective halitosis.

DISCUSSION

The results of this cross-section community-based study showed that young and married subjects report to be suffering more from subjective halitosis. Participants with subjective halitosis were significantly more anxious, stressed and depressed. Among personality traits, neuroticism was a risk factor and conscientiousness was revealed to be a protective factor.

Halitosis has large social and economic impacts. The majority of patients with this problem complain about its negative impact on their social life and communication²⁸. Oral malodour seems to be a growing concern in a large percentage of the general population²⁹. The

prevalence of subjective halitosis in this cross-section community-based study was found to be high among the study population. Different studies have reported various prevalence rates of subjective halitosis around the world. In a systematic review conducted in the USA and Brazil, the prevalence rate of subjective halitosis varied from 17% to 70.7% in adults³. The prevalence of subjective halitosis in the Iranian population was higher than in some other populations, including France³⁰, Japan³¹ and the estimates of the general population of the USA⁶. In general, around 25% of the population seems to experience subjective halitosis on a regular basis⁸. Some demographic factors, such as age and being married, demonstrated a significant association with subjective halitosis (*Table 2*). The effect of demographic factors in self-perception and aetiology of subjective halitosis are yet to be established³². Controversy still remains regarding the effect of gender on subjective halitosis. In contrast to several studies which reported that the prevalence of subjective halitosis is higher in female subjects^{8,33}, in the present study and in some other studies³¹ no significant differences in gender were found. Although, in the present study, younger

people reported to be suffering more from subjective halitosis than older subjects, a positive association between halitosis and aging has been stated in several studies³⁴⁻³⁷. However, eating habits, the quality of one's oral hygiene, hormonal changes and perception of overall self-image related to age and marital status can indirectly affect the tendency to report subjective halitosis³⁸. These results regarding prevalence and demographic factors could be caused by cultural differences or the fact that the majority of people in our country are young and sensitive to their body odour. Also, as Iran is a developing country, lack of attention to dental care and oral hygiene may act as underlying factors that affect the prevalence of genuine, and therefore subjective, halitosis.

The high prevalence of subjective halitosis may demonstrate the magnitude of this oral health problem in the Iranian population and therefore more attention should be focused on this issue by care providers. These prevalence rates revealed personal awareness of an individual towards their own bad breath. However, it is possible that some subjects with halitosis did not expressly declare that they were suffering from it^{8,39,40}. This means that halitosis perception can be different in line with the subjectivity of perception⁴¹. This aspect was important because the association between psychological related factors and subjective halitosis was evaluated in our study.

Few studies have investigated the association between halitosis and psychological factors^{42,43}. In a review carried out in 2000, examination and classification of patients with halitosis was outlined to avoid mismanagement of psychosomatic halitosis. It was found that treatment of physiological or pathological halitosis is successful, but treatment of halitophobic patients is seldom successful. Therefore, they proposed that subjective halitosis can be associated with psychological variables and thus the psychological condition of patients with halitosis should be evaluated, which is in line with the findings of this study². It was indicated that anxiety regarding dentist-patient relationships (relational dental anxiety) and general anxiety are associated with subjective halitosis. Their study found anxiety to be one of the causes of self-reported halitosis. Takashi Zaitzu *et al.*⁴⁴ also reported a close relationship between social anxiety disorders and different classes of halitosis. The results of these studies were similar to the results found in the current study. All psychological conditions (depression, anxiety and stress) demonstrated a significant association with subjective halitosis. Anxiety seemed to be the greatest risk factor of all, which could be caused either by the effect of anxiety on nutritional behaviour, oral hygiene, gastrointestinal problems, etc., or increased sensitivity to one's body odour or another's reaction to it. Bad breath can have distressing effects, as a result of which

the affected person may avoid socialising⁴⁵. Different studies indicated that the sensation of malodour can be related to different personality traits of individuals⁴⁶. Conflicting results have been reported regarding the relationship between subjective halitosis and personality traits. The Guideline Committee, in their article 'A definition and classification of malodor syndrome'⁴⁷, propose neuroticism as a risk factor, which is similar to the results found in this study.

Halitosis has different aetiologic factors, including biological, dental and psychopathological factors. The biological aetiopathogenesis of halitosis can be linked to medical problems and several chronic diseases, such as urinary system disorders, anaemia, gastrointestinal tract disorders, skin problems, allergies and thyroid problems. Patients with these chronic conditions are usually depressed and this can cause subjective halitosis. Alcohol consumption, smoking and poor oral hygiene are usually higher in depressed, anxious and stressed people, and may also be related to the cause of subjective halitosis⁴⁸.

Rosenberg and Doyle have reported the oral cavity as the origin of the majority of halitosis cases⁴⁹. Gingivitis and periodontitis account for 60% of the oral factors. Stress is another factor known to be associated with gingivitis and periodontitis⁵⁰.

Most patients with subjective halitosis tend to falsely interpret other people's behaviour, for example stepping back, covering the nose or averting the face, as occurring because of their own bad breath^{49,50}. These gestures are misunderstood by patients with subjective halitosis because this psychological condition is caused by psychosomatic factors, such as social phobia⁴⁹⁻⁵² and patients' anxiety about other individuals' behaviour towards them².

Queiroz *et al.* reported that stressful situations might contribute to halitosis¹¹.

Use of a questionnaire for assessing oral malodour and no clinical examination can be considered as limitations of this study, although it should be noted that studies which evaluated both objective and subjective halitosis reported that subjective halitosis has been found to be positively correlated with objective assessments and being reliable in the general population^{53,54}. It should be mentioned that convenience sampling was chosen in this study based on its simplicity and cost-effectiveness and we suggest that more studies should be carried out using samples that are more representative of the population. One limitation of this study is that sampling from one province only may affect the generalisability of the results.

CONCLUSION

The results of this study showed that the prevalence of subjective halitosis is high. Our study found anxiety,

stress and depression to be associated with subjective halitosis, in addition to some patients' character traits (neuroticism was a risk factor and conscientiousness was revealed to be a protective factor). Therefore, patients with halitosis should be treated through a multidisciplinary effort, both by the professional care supplied by dentists and by psychological support, because halitosis restricts relationships with others. This study highlights the importance of the psychological aspects of this problem besides its medical aspects.

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Competing interest

There was no competing interest in this research.

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