Govaresh/ Vol. 20, No.1, Spring 2015; 49-56.

Review Article

A Review of the Etiology, Diagnosis and Management of Halitosis

Sanam Javid Anbardan[1], Zahra Azizi[2], Nasser Ebrahimi Daryani[3]

[1] Researcher, Tehran University of Medical Sciences, Tehran, Iran.
[2] Researcher, Iran University of Medical Sciences, Tehran, Iran.
[3] Professor, Department of internal medicine, Division of Gastroenterology, Imam Khomeini hospital, Tehran University of Medical Sciences, Tehran, Iran

ABSTRACT

Halitosis generally refers to the unpleasant odor of breath irrespective of its origin. Oral malodour could result in diverse problems in daily life such as social embarrassment and can adversely affect individuals' social interactions. Though many oral and non-oral sources could give rise to halitosis, it was mainly associated with oral cavity conditions and volatile sulfur compounds –produced by microbial activity- were the main elements of oral malodor.
Objective measurement was the first step in assessment to determine presence of malodour. Then, taken a complete history including diet and habit history and performing a comprehensive physical examination contribute to the primary two steps for evaluating a patient complaining.
The oral malodor management was mainly achieved by determining and eliminating the etiology of the condition. A major step in this regard was improving the oral health by means of establishing appropriate oral hygiene measures and controlling tongue flora by brushing or scraping and also, use of antiseptics as adjuvant therapy.
Current article was systematic reviews the literature on prevalence, classification, diagnosis and treatment of halitosis.

Keywords: Halitosis, Malodor, Bad breath, Etiology, Classification, Diagnosis

please cite this paper as:
Javid Anbardan S, Azizi Z, Ebrahimi Daryani N. A systematic Review of the Etiology, Diagnosis and Management on Halitosis. *Govaresh* 2015;20:49-56.

INTRODUCTION

Halitosis- derived from the Latin word halitus meaning breath – generally refers to the unpleasant odor of breath irrespective of its origin which was very common worldwide. Many other terms such as foul breath, breath malodor, and foetor oris have also been used to describe this condition. Halitosis must be differentiated from the transient oral malodours due to ingesting certain foods, drinks and medications(1-7).

Oral malodour could result in diverse problems in daily life such as social embarrassment and can adversely affect individuals' social interactions(8-12).

Although many oral and non-oral sources could give rise to halitosis, it was mainly associated with oral cavity conditions (3,13-15).

Volatile sulfur compounds (VSCs) including hydrogen sulfide (H2S) and methyl mercaptan (CH3SH) were the main elements of oral malodor and are produced by bacterial metabolism of leukocytes, amino acids and desquamated cells(16-23).

Corresponding author:
Nasser EbrahimiDaryani, MD
Floor 2, no.130, ShahidNaseri Street, Valiasr Ave, Tehran, Iran
Telefax: + 98 2188793896
E-mail: nebrahim@sina.tums.ac.ir
Received: 02 Feb 2015
Edited: 18 Mar. 2015
Accepted: 19 Mar. 2015

Prevalence

As few community-based studies have been performed to evaluate the prevalence of halitosis, the exact prevalence was unknown (9, 24, 25). However,

it was estimated that halitosis is present in more than 10% of the population in many countries, and can have higher prevalence up to 30%.(26-30). In a study performed among Jordanian people aged between 20-60 years, 25% were diagnosed with halitosis(1,31). In another study conducted among Chinese individuals, 27% were reported with oral malodor(1,27). In another study performed in Brazil, it was demonstrated that halitosis was more common in male and older individuals(32). Moreover, an investigation in Netherland revealed that oral malodor was among top 100 annoying issues people complain about (33).

Types of breath odor

Halitosis could be categorized into three classes of genuine halitosis, pseudo-halitosis and halitophobia(1,6, 9, 15, 34-38).

Obvious malodor stronger than publicly tolerable level was perceived as genuine halitosis(1). Pseudo-halitosis is referred to conditions that others has not perceive malodor but the patient inflexibly nags in its presence. If after treating genuine or pseudohalitosis despite absence of objectively obvious malodor, the patient insists on presence of halitosis, the diagnosis would be halitophobia(1,39).

The genuine halitosis was further categorized into physiologic and pathologic halitosis and the pathologic halitosis itself is then classified into intra-oral and extra-oral halitosis(13,40).

The Physiologic halitosis was a temporary and reversible condition that resolves by eating, oral hygiene practices and rinsing the mouth. Although hypo salivation and hypo activity of tongue and cheek muscles during the night could be responsible for morning (hunger) breath, lifestyle habits including tobacco smoking, alcohol ingestion and consuming odorous food and drinks (spices, garlic, onion) also contribute to malodorous breath. Overall, the oral and dental cares accompanied with hygiene instructions are the mainstays of treating physiologic halitosis(7, 9, 21, 28, 29, 40-43).

The pathologic malodor was stronger and is hardly reversible. The activity of bacteria (especially gram-negative anaerobes) in the oral cavity is the main origin of the odor in intra oral pathologic halitosis and most cases suffer periodontal diseases. Among the malodorous volatile compounds (VCs) produced due to interaction of bacteria with specific substrates, hydrogen sulphide (H2S) and methyl mercaptan (CH3SH) were the main contributors to the oral halitosis(13, 21, 28, 29, 36, 40, 44-47).

On the other hand, extra-oral halitosis mainly originates from systemic disorders including diabetic ketosis, gastritis, esophagitis, pyloric stenosis, or hepatitis and the main VSC contributing to this condition was Dimethyl sulphide (CH3SCH3)(48, 49).

Etiology

While multiple oral and systemic factors contribute to the formation of persistent genuine halitosis, intra-oral conditions account for about 80% of cases.(4,6,15, 21, 50, 51).

Diverse acute and chronic intra-oral disorders were considered to be responsible for oral malodour. Although conditions such as mucosal ulceration, herpetic gingivostomatitis and necrotizing ulcerative gingivitis acutely cause oral malodor (9, 52, 53), the chronic action of bacteria coating the tongue was responsible for most cases of oral malodor(8, 54-58). Thus tongue brushing was one of the main methods for managing oral malodor(59-61).

Moreover, other conditions including periodontal disease, Poor oral hygiene, dental caries, deep carious lesions, impacted food or debris, imperfect dental restorations, unclean dentures, intraoral neoplasia, factors causing decreased salivary flow rate and salivary PH changes have also been proposed to cause oral halitosis(5, 21, 27, 29, 39, 44,62-67).

Presence of high amounts of salivary volatile sulphur compounds (VSCs) and increased tongue coating has been consistent findings in studies evaluating the role of periodontitis in development of oral halitosis(68-70).

While volatile sulphur-containing compounds such as hydrogen sulphide, methyl mercaptan (CH3SH), and dimethyl sulphide ((CH3) 2S) -produced by microbial degradation of organic substrates especially sulfurous amino acids such as cysteine, methionine, tryptophan, arginine and lysine – were available in saliva, crevicular fluid, oral soft tissues and retained debris are known to be the major factors causing formation of oral malodor short-chain fatty acids , alcohols, ketones, and nitrogen-containing compounds have also been proposed to contribute to this condition. Furthermore, it has been demonstrated that the amount of biofilm affects the grade of the odor (3, 24, 47,71-77).

While diverse species have been recognized in samples taken for evaluating halitosis, it seems that obligate anaerobes –particularly the gram negatives- located in tongue coating and periodontal pockets are the main causative agents for producing VSCs(32,78-83).

Besides, detection of the Solobacterium moorei in

nearly all patients suffering from halitosis supports the idea that some specific bacterial species are more prevalent in tongue coating of some individuals(84,85).

Genuine halitosis was also rarely caused (about 10% of the cases) by systemic disorders. which was suspected when malodor was detected in breath exhaled nasally as well as orally exhaled air(4,49, 86).

Extra-oral etiologies of halitosis were disorders of the respiratory tract –including infections such as chronic (rhino) sinusitis, chronic tonsillitis and bronchitis, bronchiectasis, nasal obstruction, nasopharyngeal abscess, the gastrointestinal system - including inflammatory bowel disease, infection with Helicobacter pylori, pyloric stenosis and gastroesophageal reflux disorder-, neoplasms and tonsillithiasis(4,9, 21, 29, 40, 87-90).

Additionally, some systemic and metabolic diseases, carcinomas and some medications - including antidepressants, antipsychotics and narcotics- have also been suggested to cause oral malodour (8, 52, 91-93).

In several metabolic disorders including renal failure, cirrhosis of the liver and diabetes mellitus, odiferous agents mainly the volatile sulfur compound dimethyl sulfide circulating in the bloodstream, are exhaled into the breath and cause halitosis.

Similarly, systemic production of volatile malodours in some hereditary metabolic conditions such as tyrosinemy manifests themselves as halitosis(33, 94, 95).

Likewise, in some patients psychologic or psychosomatic factors may be responsible in some patients and high levels of stress are considered to increases the levels of volatile sulfur compounds.(1,9, 21, 36, 89, 96-98).

Diagnosis

Taking a complete history including diet and habit history and performing a comprehensive physical examination – especially the tongue, the periodontal tissues, and upper respiratory tract- contribute to the primary two steps for evaluating a patient complaining of bad breath. All possible systemic and local factors should be considered carefully and a complete medication history should be attained and questions assessing the psychosomatic source should be asked. Instrumental and sensory evaluation of patient's breath is the last step(1, 6, 25).

As self-assessments of halitosis were unreliable, organoleptic measurement, sulfide monitoring and gas chromatography are the three primary methods available for measuring halitosis(4, 11, 99, 100).

Generally, the patient and the examiner are told to abstain from smoking, consuming tea and coffee and using perfumed cosmetics. Then patients were advised not to eat odiferous nutrients forty-eight hours prior to evaluation(36).

The sensory organoleptic test which is scored on a scale from 0 to 5 based on the perception of a trained clinician is the gold standard for diagnosis of intraoral halitosis. In this method, direct smelling of the exhaled air from patient's mouth and nose is used for evaluation of the oral malodor .The trained examiners sniff and score the patient's exhaled air(1, 5, 10, 14, 24, 75, 81, 101).

In fact, the most reliable and practical method for clinical evaluation of oral malodor was believed to be the organoleptic measurement. The gas chromatography and portable sulfide-monitoring unit (Halimeter) were the instrumental measurements used for evaluating volatile sulfur compounds (VSC) (1, 6, 34, 81).

As sensitive photometric detectors installed in gas chromatography units make this method suitable for discriminating and calculating the VSCs, the gas chromatography is applied when accurate measurements of specific gases are needed. Moreover, it is possible to determine the origin of halitosis - oral and systemic - by means of gas chromatography as it was capable of measuring other compounds too(5, 25,102).

While the most precise method for evaluation of VSC in breath was known to be gas chromatography, it is considered to be the best method for researchers as its particular structure was not suitable for usual clinical application(5,9).

Sulfide monitoring is a practical method which measures total VSCs with an electrochemical instrument. As this method mainly identifies hydrogen sulfide and to smaller degree methylmercaptan -a major component of halitosis originating from periodontal disease- and has not detect other important factors, it is mostly used for monitoring malodor and treatment rather than detection(4, 6,103, 104).

If the initial assessment failed to detect any malodor, the evaluation should repeated on two or three different days. Then, if still no halitosis was detected, the pseudo-halitosis should considered as the diagnosis. Factors such as depression, obsessive behavior, anxiety, decreased social communications and paranoid ideation should raise the suspect of pseudo-halitosis. However, it should kept in mind that pseudo-halitosis was a diagnosis of exclusion(25, 28, 29, 36, 61,105).

To summarize, despite high reliability, halimetry and gas chromatography are not clinically applicable and so the organoleptic measurement is the recommended 'gold standard'. Other available measurements -such as BANA (benzoyl–arginine–naphthyl–amide) test, chemical sensors, salivary incubation test, quantifying beta-galactosidase activity, ammonia monitoring, ninhydrin method and polymerase chain reaction- are rarely used(1, 8, 25).

Management

The main step in management of malodour was determining and eliminating the etiology of the condition. However, abstaining smoking, drugs and foods that might be in charge was always beneficial(9, 25, 28, 106).

Different treatment strategies have been proposed for the management of intra-oral halitosis. Improving oral hygiene by applying appropriate and regular oral hygiene procedures such as regular tooth cleaning (brushing and interdental flossing) and the use of antimicrobial toothpastes and mouthwashes are of significant importance. Generally, it is recommended that mouthwashes should be used two or three times daily for at least 30 s(107, 108). Mouthwashes with active ingredients such as chlorhexidine gluconate (CHX), cetylpyridinium chloride (CPC) or triclosan , and two-phase oil: water chlorhexidine, cetylpyridinium chloride mouthwashes have been used since long ago to reduce malodour by decreasing the microbial load of tongue(5, 85, 109-114).

Also, a number of active ingredients of mouth washes including zinc and copper ions not only have antibacterial effects but also directly neutralize VSCs. However these agents mask the malodor and may have short term effects(59, 106, 115-117). Furthermore, chlorine dioxide and products containing chlorite anion have been shown to maintain VSC at lower levels(118, 119).

Likewise, as it is estimated that 60% of VSCs originates from the tongue surface, managing the bacterial load and tongue coating in persistent oral malodor was of significance; hence, gentle and regular tongue cleaning was indicated to decrease the concentration of volatile sulfur compounds by dislodging trapped food, cells and bacteria from between the filiform papillae. Gentle mechanical cleaning of the dorsal aspect of the tongue using a tongue scraper or a hard toothbrush and cold water should be carried out at night with no toothpaste(6, 8, 28, 55, 59).

Additionally, since periodontal diseases account for majority of oral pathologic halitosis, all patients should undergo a complete oral soft tissue examination and evaluation of the dentition and the periodontal tissues. In presence of active periodontal disease, reducing the accumulation of responsible bacteria by periodontal treatment and improving oral hygiene were the main therapeutic methods(4, 13, 39, 107, 120).

Specialists use an empirically 1-week course of metronidazole (200 mg three times daily) to eliminate unidentified anaerobic infections in retractable patients(4,121).

In patients with halitosis arising from systemic disorders, management of underlying disorder is the mainstay of treatment. For example, eradication of *H.pylori* infection in patients with functional dyspepsia results in resolution of the halitosis in the majority of patients. Thus, it was necessary to refer individuals with suspected systemic disorders to appropriate specialists(6, 8, 25, 122).

Patients with pseudohalitosis and halitophobia should be informed that the strength of their malodor is not beyond generally acceptable levels and should be referred for psychologic evaluation and treatment. However, involving a third party may be necessary as patients often deny their psychological conditions(6, 13, 76).

To summarize, management of oral malodour requires combining different methods including patient education on avoiding habits such as smoking and consuming audiferous foods, eating regular meals and finishing meals with fibrous fruits and vegetables, ensuring good oral hygiene and treating the underlying systemic disorders(40, 111, 113, 115, 123).

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