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Review Article

Halitosis: The Science Behind Bad Breathe

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Abstract

Halitosis, commonly known as bad breath, is a prevalent oral health concern that can significantly affect an individual's social interactions, self-confidence, and overall quality of life. It is a multifactorial condition with oral and extraoral causes, although the majority of cases originate within the oral cavity. Common oral factors include tongue coating, poor oral hygiene, periodontal disease, dental caries, food impaction, and reduced salivary flow. Extraoral causes may include gastrointestinal disorders, upper respiratory tract infections, metabolic conditions, and certain medications. Because of its broad etiology, halitosis requires careful clinical evaluation to identify the underlying cause and provide appropriate management.

This review aims to summarize the current understanding of halitosis with emphasis on its etiology, pathogenesis, diagnosis, and treatment options. The condition is primarily associated with the production of volatile sulfur compounds by anaerobic bacteria acting on protein substrates in the oral cavity. Diagnosis is based on a detailed history, clinical examination, organoleptic assessment, and, when available, objective methods such as gas chromatography or portable sulfide monitors. Early recognition is important, as halitosis may sometimes indicate an underlying systemic or oral pathology that requires treatment

Although halitosis is often considered a minor complaint, its impact on psychological well-being and social functioning can be substantial. A clear understanding of its causes and management strategies is essential for dental and medical professionals. This review highlights the importance of a systematic approach to diagnosis and treatment, with the goal of improving oral health and patient quality of life.

Keywords: Halitosis; Bad Breath; Oral Malodor; Volatile Sulphur Compounds; Oral Hygiene; Periodontal Disease; Etiology

Introduction

Halitosis or oral malodor has represented a condition that has held age old interest and remedies. Ancient texts refer to the condition confirming a variety of social stigmas and disease thought to be associated with oral malodor. The term halitosis has been used to describe bad breathe, yet the true meaning of this term is abnormal odor, whereas fetor oris or fetox ex ore are terms that accurately describe what 80% to 90% of individuals with bad breathe experience: odor originating and emanating from the oral cavity. Halitosis is a term used to describe noticeably unpleasant odor exhaled in breathing. This common disease has been ignored for too long by periodontologists even though the most common cause is related to the micro biota of the subgingival areas and the related tongue coating [1-4,8].

The intensity of bad breathe differs during the day, (which may be due to stress or fasting),eating certain foods (such as garlic, onions, meat, fish, and cheese) smoking and alcohol consumption. Because the mouth is dry and inactive during the night the odor is usually worse upon awakening (morning breath).

Etiology

At least 90% of all malodor originates from the oral cavity whereas the remaining 10% has systemic or normal causes. Oral malodor is commonly the result of microbial putrefaction of food debris, cells, saliva and blood within the oral cavity. In particular proteolysis of proteins to peptides and amino acids takes place. The resultant substrate with free thiol group such as cysteine and reduced glutathione rise to volatile sulfur compounds (VSC) which are malodor substance. The most common physiological and pathological causes of halitosis are discussed below: [3,6,9,11].

Causes for physiologic halitosis Mouth breathing

- Medications
- Ageing and poor dental hygiene
- Fasting/starving

Foods (onion garlic) [6,11,25].

Classification of halitosis based on source of origin halistosis can be classified into :

- Genuine halitosis
- Physiologic halitosis
- Pathologic halitosis
  - Oral
  - Extraoral
- Pseudohalitosis
- Halitophobia

According to duration halitosis can be classified into :

- Transient halitosis
- Chronic halitosis [5,15,25].

Relationship between volatile sulfur compound and periodontitis [23,26-28]

Volatile sulfur compound are foul smelling gases primarily responsible for oral malodor.

Main types are:

- Hydrogen sulfide: Rotten egg smell
- Methyl mercaptan: Fecal smell
- Dimethyl sulfide: cabbage like odor

Sources of VSCs in periodontitis

- **Subgingival plaque biofilm:** Pathogenic anaerobes such as *Porphyromonas gingivalis*, *Treponema denticola*, *Tannerella forsythia* and *Prevotella intermedia* generate high levels of VSCs.
- **Deep periodontal pockets:** Provide a protein rich oxygen depleted environment favorable for putrefactive metabolism.
- **Inflammatory exudate**: Gingival crevicular fluid contributes peptides and sulfur containing substrates
- **Tongue dorsum**: Coated tongue harbors bacteria that produce VSCs, often in synergy with periodontal pathogens.

Pathophyisiological role of VSCs in periodontitis [23,26-28]

- **Tissue toxicity:** H2S and CH3SH damage epithelial cells, fibroblasts and periodontal ligament cells.
- **Immune modulations:** VSCs inhibit neutrophil function, reducing host defense.

- They promote apoptosis of epithelial cells, exacerbating tissue destruction
- **Bone resorption**: Methyl mercaptan stimulates production of pro-inflammatory cytokines (IL -1b, TNF-a) enhancing osteoclast activity and alveolar bone loss.
- **Biofilm enhancement:** VSCs contribute to an anaerobic environment, favoring growth of periodontopathogens.

Clinical correlation [13,21,22,28]

- Patient with chronic periodontitis typically exhibits higher VSC concentrations compared to healthy individuals.
- Elevated CH3SH/H2S ratio is considered a marker of periodontal disease activity
- Organoleptic scores and gas chromatography studies confirm that VSCs level directly correlate with pocket depth, bleeding on probing, and clinical attachment loss

Diagnostic and therapeutic implications [15,19,24]

- **Diagnostic role:** Measurement of VSCs can severe as a non-invasive adjunctive tool for monitoring periodontal disease progression and halitosis.
- **Therapeutic approaches:** Scaling and root planning significantly reduce VSC levels.
- Adjunctive use of antimicrobial mouth rinses (chlorhexidine, cetylpyridinium chloride, zinc salt) suppresses VSC - producing bacteria.
- Tongue cleaning reduces bacterial reservoirs that contribute to malodor and periodontal inflammation.

Causes for pathologic halitosis [4,6,11,25]

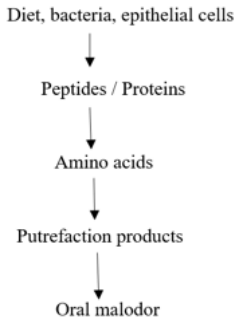
Oral and the other contributing factors such as :

- Periodontal infection : Odor from subgingival dental biofilm. Specific diseases like acute necrotizing gingivitis and periocorontis.
- Tongue coating harbors microorganisms
- Stomatitis, Xerostomia
- Faulty restoratons retaining food and bacteria

Systemic and extra oral factors include :

- Nasal infections like rhinitis, sinusitis, tumors and foreign bodies
- Disease of gastrointestinal tract (GIT) like Hiatus hernia, carcinomas, GERD
- Pulmonary infections like bronchitis, Pneumonia, Tuberculosis and carcinoma
- Certain hormonal changes that occur during ovulation, Menstruation, pregnancy and menopause.

Pathogenesis of halitosis [3,9,11]



Diagnosis [1,5,10,15]

Review of medical, dental and Personal history.

Clinical examination

- Intraoral examination
  - Tongue coating
  - Evidence of mouth breathing
  - Xerostomia : Dry mucosa
  - Other oral causes
- Complete Periodontal examination
  - General personal care, state of oral hygiene.
  - Probing for attachment levels, probing depth
  - Evidence of neglect, past history of dental hygiene care

Measurement of oral malodor

Patients should be instructed not to eat, chew, rinse or smoke for at least two hours before examination. Patients who are on antibiotics should be seen 2 weeks after discontinuation of medicines. The test used to detect halitosis as follow.

Self assessment tests

- **Whole mouth malodor (Cupped Breathe):** The subjects are instructed to small the odor emanating from their entire mouth by cupping hands over their mouth and breathing through the nose. The presence or absence of malodor can be evaluated by the patient themselves.
- **Wrist lick test:** Subjects are asked to extend their tongue and lick their wrist in a perpendicular fashion. The presence of odor is judged by smelling the wrist after 5 seconds at a distance of about 3 cm
- **Spoon test:** Plastic spoon is used to scrape and scoop material from the back region of the tongue. The odor is judged by smelling the spoon after 5 seconds at a distance of about 5cm organoleptically.
- **Dental floss test:** Unwaxed floss is passed through interproximal contacts.

Objective tests

Organoleptic measurements

Sniffing of expelled air of the patient by using the nose of the examiner, Organoleptic scoring is the usual technique for halitosis examination in daily practice.

Examination: For the organoleptic evaluation, participants are instructed to close their mouth for 1 minute, then to slowly exhale air out of the mouth at a distance of approximately 10 cm from the nose of the examiner. For evaluation of extraoral halitosis, patients are also asked to slowly exhale air out of the nose also at a distance of approximately 10 cm from the nose of the examiner. Full mouth and nose organoleptic odor assessments are used on a scale 0 to 5.

Organoleptic scoring scale: [1,15]

- 0 - No Odor
- 1 - Barely noticeable odor
- 2 - Slight but noticeable odor
- 3 - Moderate odor (clearly detectable)
- 4 - Strong odor
- 5 - Extremely foul odor

Gas chromatography

In order to assess oral malodor objectively, a portable industrial monitor has been developed. These machines are specifically designed to digitally to measure molecular levels of the three major volatile sulfur compounds (VSC) in a sample of mouth air (hydrogen sulfide, methyl mercaptan and dimethyl sulfide). It is accurate in measuring the sulfur components of the breath and produces visual results in graph form via computer interface

Hali meters

These machines measure the level of sulfide gas found in a persons breath. But it has certain drawbacks in clinical applications, some of the common sulfides such as mercaptan are not easily recorded and can be misrepresented in test results.

BANA Test (Benzoyl -d, L arginine - napthylamide)

Some of the bacteria like *P. gingivalis*, *T. denticola* and *B. forsythus* produce waste products that are quite odiferous and as a result contribute in causing bad breath. These bacteria 1in question have the characteristic of being able to produce an enzyme that degrades the compound they cause it to breakdown.

Phase contrast microscopy

It is used to identify bacterial composition and motility in tongue coating, saliva or periodontal pocket. This also detects anaerobic motile organisms (like Treponema denticola) which are key producers of volatile sulfur compounds.

Saliva incubation test

This to evaluate malodor causing bacteria bacterial activity by incubating a patients saliva and detecting the release of VSCs. Saliva contains anaerobic bacteria and organic substrate. When incubated at body temperature bacteria break down these substrate. This ananeaorbic metabolism produces VSCs responsible for bad breathe. Then this odor is assessed organoleptically.

Treatment [15,19,24]

Treatment needs for halitosis have been categorized into 5 classes in order to provide guidelines for clinicians in treating halitosis patients :

- TN 1: Evaluation of halitosis and instructions of oral hygiene
- TN 2: Oral prophylaxis ; professional cleaning and treatment for periodontal disease
- TN 3: Referral a physician in medical specialist
- TN 4: Explanation of examination data, further professional instructions, education

- TN 5: Referral to clinical psychologist, psychiatrist or psychological specialist

Mechanical reduction of intraoral nutrients and micro organisms

- Tongue cleaning
- Inter dental cleaning
- Professional periodontal therapy
- Chewing gum

Chemical reduction of oral microbial load

- Chlorhexidine
- Chlorine dioxide
- Two phase of oil water rinse
- Triclosan
- Hydrogen peroxide

Conversion of VSCs

- Metal salt solutions
- Tooth paste
- Chewing gum

Masking the malodor [8,24]

- Rinses
- Mouth sprays
- Lozenges containing volatiles

Conclusion [3,4,15,24]

A thorough understanding of its classification, pathogenesis, diagnostic methods (like organoleptic assessment, saliva incubation, and VSC detection), and underlying causes is essential for effective diagnosis and management. Proper oral hygiene, periodontal therapy, and in some cases, medical or psychological referral are key to successful treatment. Patient education and a multidisciplinary approach can significantly improve both oral health and quality of life [1,5,10,15].

Bibliography

1. Rosenberg M. "Clinical assessment of bad breath: Current methods and future prospects". *Journal of the American Dental Association* 127.4 (1996): 475-482.
2. Tonetic J. "Oral malodor: An indicator of health status and oral cleanliness". *International Dental Journal* 28.3 (1978): 309-319.
3. Loesche WJ and Kazor C. "Microbiology and treatment of halitosis". *Periodontology 2000* 28 (2002): 256-279.
4. Porter SR and Scully C. "Oral malodor (halitosis)". *BMJ* 333.7569 (2006): 632-635.
5. Murata T., *et al*. "Classification and examination of halitosis". *International Dental Journal* 52.S5P1 (2002): 181-186.
6. van den Broek AM., *et al*. "A review of the current literature on an etiology and measurement of halitosis". *Journal of Dentistry* 35.8 (2007): 627-635.
7. Cortell JR., *et al*. "Halitosis: A review of associated factors and therapeutic approach". *Brazilian Oral Research* 22 (2008): 44-54.
8. Bosy A. "Oral malodor: Philosophical and practical aspects". *Journal of the Canadian Dental Association* 63.3 (1997): 196-201.
9. Scully C and Greenman J. "Halitosis (breath odor)". *Periodontology 2000* 48 (2008): 66-75.
10. Quirine M., *et al*. "Characteristics of 2000 patients who visited a halitosis clinic". *Journal of Clinical Periodontology* 36.11 (2009): 970-975.
11. Tangerman A. "Halitosis in medicine: A review". *International Dental Journal* 52.S5P1 (2002): 201-206.
12. Delange G., *et al*. "Multidisciplinary breath-odor clinic". *Lancet* 350.9072 (1997): 187.
13. van den Velde S., *et al*. "Detection of volatile compounds as indicators of halitosis". *Journal of Dental Research* 88.10 (2009): 965-969.
14. Liu XN., *et al*. "Oral malodor-related parameters in the Chinese general population". *Journal of Clinical Periodontology* 33.1 (2006): 31-36.
15. Yaegaki K and Coil J. "Examination, classification, and treatment of halitosis; clinical perspectives". *Journal of the Canadian Dental Association* 66.5 (2000): 257-261.
16. Hughes FJ and McNab R. "Oral malodour—A review". *Archives of Oral Biology* 53.1 (2008): S1-S7.

17. Outhouse TL., *et al*. "Tongue scraping for treating halitosis". *Cochrane Database System Review* 2 (2006): CD005519.

18. Carneiro LG., *et al*. "Halitosis: A multidisciplinary approach". *Brazilian Journal of Otorhinolaryngology* 73.6 (2007): 835-842.

19. Slot DE., *et al*. "The efficacy of tongue scraping and brushing in reducing halitosis: A systematic review". *International Journal of Dental Hygiene* 13.1 (2015): 1-12.

20. Salako NO and Philip L. "Comparison of the use of a triclosan-containing mouthrinse and a tongue scraper in improving breath odor". *Odonto-Stomatologie Tropicale* 34.133 (2001): 31-35.

21. Oliveira-Neto JM., *et al*. "Halitosis and its relation to dental caries and periodontal disease – A literature review". *Revista de Odontologia da UNESP* 46 (2 (2017): 118-124.

22. Silva MF., *et al*. "Estimated prevalence of halitosis: A systematic review and meta-regression analysis". *Clinical Oral Investigation* 24.3 (2020): 889-900.

23. Haraszthy VI and Zambon J. "Microbiological aspects of oral malodor". *Periodontal Clinical Investigation* 26.2 (2004): 56-63.

24. Seemann R., *et al*. "Halitosis management by the general dental practitioner—Results of an international consensus workshop". *Journal of Breath Research* 8.1 (2014): 017101.

25. Tangerman A and Winkel EG. "Intra- and extra-oral halitosis: Review". *Journal of Breath Research* 4.1 (2010): 017003.

26. Krespi YP., *et al*. "The relationship between oral malodor and volatile sulfur compound–producing bacteria". *Otolaryngology–Head and Neck Surgery* 135.5 (2006): 671-676.

27. Persson S., *et al*. "The formation of hydrogen sulfide and methyl mercaptan by oral bacteria". *Oral Microbiology and Immunology* 4.4 (1989): 195-201.

28. Sanz M., *et al*. "Periodontitis and systemics: Consensus report". *Journal of Clinical Periodontology* 47.S22 (2020): S3-S22.

29. Kleinberg I and Westbay G. "Oral malodor". *Critical Reviews in Oral Biology and Medicine* 1.4 (1990): 247-259.

30. Filippi A. "Halitosis: A common problem". *La Revue Médicale Suisse* 4.171 (2008): 1161-1164.