

**Abdul Azeem Rasouli<sup>1,\*</sup>** , **Sadaqat Momand<sup>1</sup>** ,  
**Mohammad Taqi Anwari<sup>2</sup>** , **Joya Shafiq Ahmad<sup>3</sup>** 

<sup>1</sup>Nangarhar University, Jalalabad, Afghanistan

<sup>2</sup>Kabul Medical University, Kabul, Afghanistan

<sup>3</sup> Herat Uinvesity, Herat, Afghanistan

\*e-mail: azeem284@gmail.com

## RHINOLARYNGOLOGICAL AND SYSTEMIC CAUSES OF HALITOSIS: A MINI-REVIEW

Halitosis, commonly known as bad breath, is a common condition that affects a significant portion of the population. Volatile molecules resulting from pathological and non-pathological causes from oral or extra-oral sources are known to be responsible for halitosis. While poor oral hygiene is often the primary cause of halitosis, several other factors can contribute to this condition, and most of these causes are ignored. such as problems in the nose and throat and the presence of systemic diseases that affect different parts of the body. These problems can lead to the production of foul-smelling gases that are released through the mouth, resulting in bad breath. Some examples Halitosis producing conditions include sinusitis, tonsillitis, and systemic diseases. In addition to these conditions, certain medications and lifestyle habits, such as smoking and alcohol consumption, can also contribute to halitosis. Halitosis negatively impacts a person's everyday life; the majority of those who complain about it seek treatment at a clinic, however, some halitosis sufferers have no detectable halitosis. Halitosis can be determined using a variety of techniques. Understanding the various causes of halitosis is essential for effective treatment and management of this condition.

**Key words:** ENT, etiology, extra-oral, halitosis, pseudohalitosis, systemic.

### Introduction

Human breath is made up of highly complex chemicals with numerous and varied smells that can cause unpleasant conditions such as halitosis. Halitosis is a Latin term derived from the words halitus “breathed air” and osis “pathologic changes” [1]. It can also refer to any unpleasant odor originating from the mouth, air, or breath. Other names used to define and characterize halitosis include foetor oris, oral malodor, mouth odor, bad breath, and awful mouth odor [2]. The Listerine Company first used the term “halitosis” in 1921 to describe bad breath independent of its source [3]. Few researchers have studied the prevalence of oral malodor in the general population [2]. According to several articles, the prevalence ranges from 2.4% to 78% [4–6]. According to the American Dental Association, approximately 50% of American adults have a bad breath at some point in their lives. Half of this population may have persistent, intermittent, or chronic breath odor problems [7, 8]. Additionally, while waking up in the morning, almost half of the adults and elderly

people have socially undesirable breath that is caused by physiological factors [2].

This broad range in prevalence is due to the halitosis evaluation methodologies, whether the results are based on self-reporting or objective measures of oral malodor, geographic area, and year of study. Furthermore, neither objective nor subjective standard criteria for identifying patients with halitosis have been widely accepted [2]. Owing to its high prevalence, research into its origin and patient-reported outcomes is on the rise. Halitosis has an adverse impact on patient's quality of life. Patients who feel humiliated by their behavior, especially in interpersonal interactions, are more likely to seek professional assistance [9, 10]. It is a common problem that can have an impact on personal relationships because it interferes with communication between individuals [11]. According to Al-Ansari et al findings, some factors were significantly linked to self-perceived halitosis: current or past smoking, female gender, age 30 or older, having only completed high school, history of chronic sinusitis or gastrointestinal disorders, never using Miswak (a natural toothbrush made from

the twigs of the *Salvadora persica* tree), and never using dental floss [12]. To compare epidemiological data, halitosis study need a standardized evaluation process. Therefore, the gold standard for studies on bad breath should be a mechanical detection method [13]. Understanding its origin is essential for health-care professionals, particularly general practitioners and, dentists [14].

**Aim:** The objectives of this review were to explore Nose, Throat and systemic causes of halitosis as well as to provide a snapshot of the impact of halitosis on social life.

### Causes of Halitosis

Volatile sulfur compounds (VSCs), which are odoriferous substances present in the exhaled air as a result of the action of anaerobic oral Gram-negative bacteria (*Bacteroides loescheii*, *Centipeda periodontii*, *Eikenella corrodens*, *Treponema denticola*, *Prevotella intermedia*, *Porphyromonas gingivalis*, *Fusobacterium nucleatum*, *Selenomonas*) [6]. 90% of the VSCs in bad breath are hydrogen sulfide, methyl mercaptan, and, to a lesser amount, dimethyl sulfide [9]. A temporary change in breath odor can be brought on by eating foods like garlic or some spicy dishes, drinking alcohol, or using tobacco products [15].

#### 1 extra-oral causes

Halitosis is thought to have extra-oral origins in 10–20% of cases [16, 17]. The extra-oral conditions that can cause halitosis include chronic sinusitis, post-nasal drip, nasal foreign bodies, respiratory tract infections and cancer, gastrointestinal illness, inflammatory bowel disease, endocrine, hematologic system abnormalities, and helicobacter pylori infection [16, 18]. Dimethyl sulphoxide is the primary VSC linked to extra-oral halitosis, whereas methyl mercaptan and hydrogen sulfide are the primary VSCs contributing to intra-oral halitosis [16, 17].

#### 1.1 ENT region

Up to 10% of cases of oral malodor come from the ENT (ears, nose, and throat) area, with the tonsils contributing to 3% of those cases [19].

##### 1.1.1 Paranasal Sinuses causes

Nasal bad breath may be mostly brought on by chronic sinusitis [20]. 50% to 70% of people who have chronic sinusitis complain of bad breath. Ten percent of sinusitis may be linked to problems of one or more teeth. Upper respiratory tract infections, persistent mucosal diseases, and

abnormal intranasal structures are some of the potential causes of chronic sinusitis. *Streptococcus pneumoniae* and *Haemophilus influenzae* are the two main bacteria involved in the development of bacterial sinusitis [21]. These bacteria have a clear link with halitosis since they can produce VSCs. The most typical signs include postnasal drip, coughing, coated tongues, and hawking [22]. It is believed that the purulent material, which already contains microbiota, falls on the base of the tongue, predisposing to the production of VSC [23, 24]. Antibiotics are frequently used to treat acute sinusitis, which lowers the incidence of anaerobic microorganisms and malodor problems. A characteristic odor comes about when purulent mucus becomes apparent [21]. Referrals to an ear, nose, and throat specialist for causative treatment of patients with halitosis and chronic nasal/paranasal sinus conditions are recommended [23].

##### 1.1.2 Atrophic rhinitis

Atrophic rhinitis is a long-term condition that affects the nasal mucosa. Dryness, crusting, atrophy, halitosis, and a paradoxical perception of nasal congestion are the disease's primary symptoms, and it is characterized by excessively broad nasal cavities [25]. The primary atrophic rhinitis cause is unknown [26]. Primary atrophic rhinitis typically affects both nostrils and is six times as prevalent in women. The main symptom of the condition is that the nose gives off an unpleasant odor as a result of crusting and secondary infections. Keeping friends and family away, this factor alone causes social issues for the sufferer [27]. The patient is frequently anosmic for the following reasons: there is an inadequate and non-uniform air blast that may not reach the olfactory areas; there may be a genuine obstruction with large crusts blocking the air flow to the olfactory area in the roof of the nose; and there may be an atrophic process involving the olfactory epithelium and the bipolar nerve cells and nerve fibers. Nasal obstruction is a common primary complaint that can be caused by a variety of things, including congestion of the nasal mucosa (the "blunting effect"), large crusts that obstruct airflow, and disruptions to the normal laminar and eddy current pattern of the inspiratory and expiratory air flows. Patients may also express headache complaints. Anaerobic bacteria frequently cause thick, purulent discharge with an unpleasant odor. Periodically, crusts with dark greenish color with a bad smell are expelled from the nostrils. Rarely, crusts may dislodge into the pharynx and induce choking and the feeling of a foreign body.

With the dislodging of crusts, minor nosebleeds may be seen. Occasionally, patients may experience pharyngitis sicca, which causes the nose and throat to become dry [26–28].

### 1.1.3 Foreign Bodies and cleft palate

Foreign objects in the nasal cavity can also produce a bad odor. Additionally, a cleft palate might cause poor breath [29].

### 1.1.4 Chronic Tonsillitis and Tonsilloliths

Chronic caseous tonsillitis (CCT) is frequently correlated to halitosis and is also a common disease [30]. Chronic caseous or follicular tonsillitis is caused by recurrent infections of the tonsils [31]. The tonsils contain deep crypts that, as a result of their anatomy, favor the collection of food, saliva, and necrotic debris. When exfoliated epithelial cells, keratin debris, and foreign objects are retained in the crypts of the palatine tonsils, a tonsillolith develops [32]. Tonsilloliths form if these materials are not naturally removed, and they raise the probability of abnormal VSC levels by ten times [30]. The palatine tonsils are the best locations in the upper airway system for anaerobic bacterial activity [30]. Upon observation, the tonsils are normally not hyperemic and may or may not be hypertrophied. The bacteria most usually involved are streptococci, while viral infections (such as infectious mononucleosis) are a further possibility. Tonsilloliths have been shown to include several anaerobic bacterial species, including those from the genera *Eubacterium*, *Fusobacterium*, *Porphyromonas*, *Prevotella*, *Selenomonas*, and *Tanarella* [33]. The typical CCT symptoms include retention of a tonsillolith, throat irritation, feeling of foreign substances, and halitosis, all of which can be extremely debilitating for the patient. In over 77% of CCT patients, halitosis is present. CCT can happen to men or women at any age. When medical treatment with oral antibiotics and topical antiseptics fails to provide relief, tonsil removal surgery is advised [34]. Tonsillary cryptolysis using a CO<sub>2</sub> laser has recently been presented as a less invasive treatment option. Utilizing CO<sub>2</sub> laser ablation can minimize tonsillolith retention and crypt depth, maintaining the tonsils' immunological activity. This procedure can be carried out in an office work setting while the patient is under local anesthesia, is basically painless, and is able to return normal activities as soon as possible [35]. As a result, the tonsils' size, shape, coating, hyperaemia, and presence of tonsilloliths should be the first thing examined during a clinical investigation [36].

### 1.1.5 larynx

The larynx is rarely involved [36].

## 1.2 Systemic

### 1.2.1 Respiratory disorders

Differentiating the expired air is necessary to determine whether the malodor is nasal or oral in origin. The patient is instructed to close the lips and exhale through the nostrils. If the examiner detects an unpleasant odor originating from the nose, he/she will note it. The patients are next directed to squeeze their noses and exhale through their mouths [16]. By doing so, we can estimate whether the nasopharynx, paranasal sinuses or nasal cavity are the source of the halitosis [16].

Even if symptoms result in significant quantities of sputum such as, pneumonia and bronchitis caused by aerobes, mycoplasma, or viruses rarely end in halitosis. Halitosis is mentioned as a relevant symptom in a variety of clinical respiratory conditions. Included in those are anaerobic lung abscesses, debris lodged in the respiratory system, necrotizing pneumonia, emphysema, lung cancer, bronchiectasis, and tuberculosis [37]. The lungs serve as a source for smells produced by metabolism. Alcohol, high-fat diets, ketosis (also known as diabetic ketoacidosis or DKA), nitrates, chloral hydrate, and iodine-containing medications are some examples of substances that enter the bloodstream and exit the lungs through expired air [8].

### 1.2.2 Gastrointestinal disorders

Although the majority of halitosis cases are thought to originate from the gastrointestinal system, only 0.5% of cases are, contrary to what the medical profession and many patients believe. Esophageal reflux, achalasia, pyloric stenosis, and hiatal hernia are a few gastrointestinal disorders that can result in bad breath. These disorders result in weakened or inhibited esophageal closure, insufficient emptying into the stomach, and retention of food, drink, and saliva, which results in malodor [38]. On the other hand, gastroesophageal reflux, an extremely common condition, infrequently results in halitosis. Heartburn is the most common symptom, and the related odor is similar to a simple belch and smells like the most recent meal [8]. Halitosis has been linked to bezoars, malabsorption syndromes, stomach carcinomas, and a few enteric diseases [39]. Whittle et al., describe metabolic disorders in the intestines as a cause of halitosis [13]. Regardless of dental or otolaryngological findings, gastrointestinal pathology is quite common in individuals with

halitosis, and the majority of patients got better after therapy [40]. Feller and Blignaut described pancreatic insufficiency as a cause of extra-oral halitosis as well [41]. Fetor hepaticus, an unpleasant, excremental smell (the breath of death), is caused when liver function becomes impaired as waste products are released through the lungs [42]. Failure of the liver prevents the body's ability to detoxify itself, leading to the unpleasant odors known as Fetor hepaticus [43].

### 1.2.3 Endocrine disorders

Patients who have type 2 diabetes (T2DM) typically smell sweet and fruity. Different extra-oral causes of halitosis, such as DM, can be diagnosed using gas chromatography-mass spectrometry [8]. Diabetic ketoacidosis leads to a typical breath odor [13]. Additionally, a few congenital diseases might affect breathing; the most known example is tyrosinemia, which causes a strong cabbage odor. In addition to the hormone cycle, several other intestinal disorders also appear to have an impact on mouth odor [44, 45]. 4.6% of women reported having halitosis throughout their menstrual cycle, indicating a connection between the hormones and halitosis. According to Alzoman et al., findings, women's self-perceived halitosis and the frequency of oral health symptoms can be affected by the regularity of the menstrual cycle and hormonal changes [46].

### 1.2.4 Kidney disorders

Phenylketonuria, trimethylaminuria are known to be causes of oral mal odor [8]. Patients with chronic renal failure have high blood urea nitrogen levels and reduced salivary flow. The odor is typically uremic associated with dry mouth [41].

### 1.2.5 Drugs

The use of bisphosphonates has recently been associated with oral malodor in addition to medications that cause a dry mouth and indirectly contribute to halitosis, such as anticholinergics, antihistaminics, antipsychotics, anxiolytics, antidepressants, antihypertensives, diuretics, and opioids. Malignant bone tumors and their metastases are treated with bisphosphonates, which are powerful medicines that block bone resorption [47]. In a recent systematic review, medications that can cause extra-oral halitosis were identified as follows: Aminothiols, antacids, Anticholinergics, steroids, Anti-spasmodics, Chemotherapeutic agents, dietary supplements (fish oil, vitamin E), and Diclofenac. To identify the involvement of different drugs in leading to extra-oral halitosis, more research is required [48].

## 1.3 Miscellaneous

### 1.3.1 Fish Odor Syndrome

Trimethylaminuria's breath odor, often known as "fish odor syndrome," can induce severe halitosis [49]. The inability of the organism to metabolize trimethylamine is the hallmark of the hereditary illness called trimethylaminuria. This volatile chemical builds up in the body and is eventually excreted in the urine, but it is also present in sweating and breath, giving it a fishy smell. The authors claim that this hereditary condition is the main reason for undetected body odor and that its social impacts can include frustration and social isolation. [50]. By adjusting dietary changes to avoid precursors, particularly trimethylamine N-oxide, which is present in high concentrations in marine fish, the symptoms of trimethylaminuria can be alleviated. Antibiotic therapy to manage gut flora or activated charcoal therapy to sequester trimethylamine may both be helpful [51].

### 2.1 Oral causes

Poor oral hygiene, periodontal disease, a coated tongue, food impaction in the interdental spaces, unhygienic dentures, and unsuitable prostheses are the main causes of bad breath in the oral cavity [52]. In 85–90% of patients with halitosis, the oral cavity is the main cause of bad breath [8].

## Classifications

Halitosis can often be divided into three categories: Genuine (true) halitosis, pseudo-halitosis (false halitosis), and halitophobia. Genuine halitosis can be further categorized as physiologic or pathologic. About 27% of patients who complain of halitosis are found to have non-genuine halitosis [11]. Pseudo-halitosis can be defined as a condition in which the patient is the only one to notice an obvious odor problem, Halitosis is not perceived by others. Halitophobia is a condition in which a patient complains about halitosis after receiving therapy for either real or fake halitosis (generally after the adequate treatment of genuine or pseudo-halitosis), even though no obvious signs may be found during a physical examination. Halitophobic patients may need to undergo neurological and mental testing [19].

## Impact of Halitosis on Social Life

Odor is a tool that society employs to engage and characterize the outside environment. The olfactory, or smelling, experience is personal, very emotional, and it links us to the outside world. This means that a person's breath odor might either make them

feel more connected to their social environment or less connected to their close relationships. When someone believes they have a persistent bad breath problem, they may employ defense mechanisms and even avoid social interactions. This has an impact on a person's health [53]. Teenagers and young adults with poor breath reported feeling anxious and depressed [54]. Smell perception is subjective and influenced by emotional and cognitive factors, just like other human senses. Those who are unaware of their bad breath may experience unfair romantic, social, and professional rejection. Few people are willing to confront those who have a problem due to the sensitive nature of bad breath and other internal odors. The apparent inability to tell whether or how much one has bad breath is a very intriguing issue with it [55].

### Investigations for Underlying Causes

Despite the subjective character of halitosis, various objective tests have been applied in clinical evaluation. It's critical to evaluate the patient's perception of oral malodor as their primary social problem. It is not, however, very reliable[56]. A plastic tube is put into the patient's mouth to prevent the mouth from getting diluted with room air when undergoing an organoleptic assessment of oral malodor by trained and calibrated professionals. In most cases, a screen with a straw or tube hole separates the patient and examiner. Despite being fairly simple to use, this approach is very subjective and prone to nutritional influences on patients. It's also fairly simple to use the "spoon test," an organoleptic assessment technique. On the tongue's dorsum, a spoon or similar object is used, and the scraped material is smell [57]. The objective evaluation of oral malodor makes use of additional objective techniques like VSC measurements with electrochemical reactions like halimeters, gas chromatography, or salivary study for bacterial load and other chemicals. Due to its simplicity of use, the Halimeter portable VSC detector is in high demand. However, additional substances that may also contribute to oral malodor include volatile short-chain fatty acids, polyamines, alcohols, phenyl compounds, alkanes, ketones, and substances containing nitrogen, this test only identifies VSC products[56, 58]. To perform a salivary incubation test, saliva is collected in a glass and placed in an aerobic chamber at 37 °C. The examiner can measure odor after some time has passed. In contrast to other diagnostic procedures, the salivary incubation test is associated with other tests and far less affected by patients' dietary habits.

By washing the mouth with urea solution for at least 30 seconds and then closing it for around five minutes, an ammonia test could be carried out. The amount of ammonia produced by bacteria can be measured from a scale using a detector. Ammonia levels typically correspond with VSC levels [59]. To find low-molecular-weight amines in breath, the ninhydrin method is used. This quick and simple test has a good test-to-test correlation[20]. The TaqMan system's real-time polymerase chain reaction (PCR) can also be used to find microorganisms that produce VSC. Oral bacterial DNA may be quickly detected and identified using this amplification technique [60].

### Management of the causative factors

Treating the identified causes should be the first line of therapy[61]. The effects of toothpaste can vary, but they are often minimal. Mouthwash is also frequently recommended. It is normally advised to use it twice or three times every day for at least 30 seconds on each occasion. In addition to vitamin A and vitamin B12, zinc, and copper are essential minerals for the olfactory and gustatory systems. Their inefficiency may exacerbate or contribute to symptoms of halitosis. The treatment also includes the use of zinc and copper ions. Along with other positive properties including antibacterial action, they immediately neutralize VSCs. VSCs can also be reduced by mouthwashes and toothpastes, particularly those containing zinc ions. Mouthwashes that contain alcohol, phenol, and chlorhexidine may also cover up the odor of the breath [62]. Frequently used antibiotics may reduce the bacterial load and minimize mouth odor. However, using antibiotics additionally kills all bacteria that are part of the normal flora [63]. Probiotics are thus useful and appropriate therapy options for a variety of microorganisms that contribute to the development of halitosis. Before that connects non-genuine halitosis to a psychiatric issue, organic causes must be ruled out. A patient's level of depression and psychogenic diseases needs to be assessed, particularly in cases of non-genuine halitosis [64]. The primary causes of the disease must be treated for long-term effects. The patient must receive a thorough explanation of the causes and treatment options for halitosis. Always keep systemic issues in mind, and if there are any suspicions, further testing should be done to rule out any of these possible causes. It is important to avoid bad habits like smoking and eating foods like onion, garlic, and others. It is also necessary to advise the patient to eat regular meals and to end each meal with some fruit or vegetables, such as carrots or pineapples [23].

## Conclusion

In conclusion, halitosis or bad breath can be caused by various factors such as poor oral hygiene, infections in the nose and throat, and systemic diseases. In cases where halitosis is caused by infections in the nose and throat, seeking medical attention and treating the underlying condition can help alleviate bad breath. Additionally, managing systemic diseases can also help reduce halitosis. Overall, understanding the causes of halitosis and taking appropriate measures to address them can help individuals maintain fresh breath and improve their overall oral health. Even Though oral pathologies

are the primary culprits, nose, throat and systemic causes can also be the source and need to be properly addressed. Halitosis may be a sign of significant health issues like cancer, thus this must be considered. Planned observations by ENT doctors, dentists, or internal medicine specialties are required to find other causal factors. Patients exhibiting depressive symptoms in either group—true halitosis or non-true halitosis—are typically referred for a psychiatric assessment. halitosis is a common condition that can be caused by a variety of factors. While it can be a source of embarrassment, by addressing these underlying issues, individuals can improve their overall oral health and quality of life.

## References

1. Hine MK. Halitosis. *J Am Dent Assoc* 1957; 55: 37–46.
2. Roberto J. Halitosis : a review of associated factors and therapeutic approach. *Braz Oral Res* 2008; 22: 44–54.
3. Rayman S, Almas K. Halitosis among racially diverse populations : an update. *Int J Dent Hyg* 2008; 2–7.
4. Liu XN, Shinada K, Chen XC, et al. Oral malodor-related parameters in the Chinese general population. *J Clin Periodontol* 2006; 33: 31–36.
5. Loesche WJ. Microbiology and treatment of halitosis. *Curr Infect Dis Rep* 2003; 5: 220–226.
6. Lopes RG, de Godoy CHL, Deana AM, et al. Photodynamic therapy as a novel treatment for halitosis in adolescents: Study protocol for a randomized controlled trial. *Trials* 2014; 15: 1–7.
7. Lee SS, Zhang W, Li Y. Halitosis update: a review of causes, diagnoses, and treatments. *J Calif Dent Assoc* 2007; 35: 258-260,262,264-268.
8. Izidoro C, Botelho J, Machado V, et al. Revisiting Standard and Novel Therapeutic Approaches in Halitosis: A Review. *Int J Environ Res Public Health*; 19. Epub ahead of print 2022. DOI: 10.3390/ijerph191811303.
9. Miyazaki H, Sakao S, Katoh Y, et al. Correlation Between Volatile Sulphur Compounds and Certain Oral Health Measurements in the General Population. *J Periodontol* 1995; 66: 679–684.
10. Kizhner V, Xu D, Krespi YP. A new tool measuring oral malodor quality of life. *Eur Arch Oto-Rhino-Laryngology* 2011; 268: 1227–1232.
11. Seemann R, Bizhang M, Djamchidi C, et al. The proportion of pseudo-halitosis patients in a multidisciplinary breath malodour consultation. *Int Dent J* 2006; 56: 77–81.
12. Al-Ansari JM, Boodai H, Al-Sumait N, et al. Factors associated with self-reported halitosis in Kuwaiti patients. *J Dent* 2006; 34: 444–449.
13. Bollen CM, Rompen EH, Demanez JP. Halitosis: a multidisciplinary problem. *Int J Oral Sci* 2012; 4: 55–63.
14. Wu J, Cannon RD, Ji P, et al. Halitosis: prevalence, risk factors, sources, measurement and treatment – a review of the literature. *Aust Dent J* 2020; 65: 4–11.
15. Hughes F j., McNab R. Oral malodour – a review. *Arch Oral Biol* 2008; 53: 1–7.
16. Aylikci B, Çolak H. Halitosis: From diagnosis to management. *J Nat Sci Biol Med* 2013; 4: 14–23.
17. Tangerman A, Winkel EG. Intra- and extra-oral halitosis: Finding of a new form of extra-oral blood-borne halitosis caused by dimethyl sulphide. *J Clin Periodontol* 2007; 34: 748–755.
18. Adler I, Denninghoff VC, Álvarez MI, et al. Helicobacter pylori associated with glossitis and halitosis. *Helicobacter* 2005; 10: 312–317.
19. van den Broek AMWT, Feenstra L, de Baat C. A review of the current literature on aetiology and measurement methods of halitosis. *J Dent* 2007; 35: 627–635.
20. Iwanicka-Grzegorek K, Lipkowska E, Kepa J, et al. Comparison of ninhydrin method of detecting amine compounds with other methods of halitosis detection. *Oral Dis* 2005; 11: 37–39.
21. Schlosser RJ, Harvey RJ. Diagnosis of chronic rhinosinusitis. *Rhinosinusitis A Guid Diagnosis Manag* 2008; 4: 41–64.
22. Kleinberg I, Westbay G. Oral malodor. *Crit Rev Oral Biol Med* 1990; 1: 247–259.
23. Gokdogan O, Catli T, Ileri F. Halitosis in Otorhinolaryngology Practice. *Iran J Otorhinolaryngol* 2015; 27: 145–153.
24. Amir E, Shimonov R, Rosenberg M. Halitosis in children. *Pediatr* 1999; 134: 338–343.
25. Ly TH, deShazo RD, Olivier J, et al. Diagnostic Criteria for Atrophic Rhinosinusitis. *Am J Med* 2009; 122: 747–753.
26. Dutt SN, Kameswaran M. The aetiology and management of atrophic rhinitis. *J Laryngol Otol* 2005; 119: 843–852.
27. Weir N G-WD. Infective rhinitis and sinusitis. In: Mackay IS, Bull TR E (ed) *Scott-Brown's Otolaryngology*. Oxford: Butterworth-Heinemann, 1997, pp. 4,8,26–8.

28. Magyar T, King VL, Kovács F. Evaluation of vaccines for atrophic rhinitis – A comparison of three challenge models. *Vaccine* 2002; 20: 1797–1802.
29. Montenegro E, Rezende R De, Lu M, et al. Evaluation of oral and nasal halitosis parameters in patients with repaired cleft lip and / or palate. 2005; 682–687.
30. Dal Rio AC, Franchi-Teixeira AR, Nicola EMD. Relationship between the presence of tonsilloliths and halitosis in patients with chronic caseous tonsillitis. *Br Dent J* 2008; 204: 8–11.
31. Pruet CW, Duplan DA. Tonsil concretions and tonsilloliths. *Otolaryngol Clin North Am* 1987; 20: 305–309.
32. Abbey K, Kawabata I. Computerized Three-dimensional Reconstruction of the Crypt System of the Palatine Tonsil. *Acta Otolaryngol* 1988; 454: 39–42.
33. Mulwafu W, Fagan JJ, Isaacs S. Adult tonsillectomy--are long waiting lists putting patients at risk? *South African J Surg* 2006; 44: 66–68.
34. Ginström R, Silvola J, Saarnivaara L. Local bupivacaine-epinephrine infiltration combined with general anesthesia for adult tonsillectomy. *Acta Otolaryngol* 2005; 125: 972–975.
35. Finkelstein Y, Talmi YP, Ophir D, et al. Laser cryptolysis for the treatment of halitosis. *Otolaryngol – Head Neck Surg* 2004; 131: 372–377.
36. Ansai T, Takehara T. Tonsillolith as a halitosis-inducing factor. *Br Dent J* 2005; 198: 263–264.
37. Scully C, Greenman J. Halitosis (breath odor). *Periodontol 2000* 2008; 48: 66–75.
38. Durham TM, Malloy T, Hodges ED. Halitosis: knowing when ‘bad breath’ signals systemic disease. *Geriatrics* 1993; 48: 55–59.
39. Lu DP. Halitosis : An etiologic classification , a treatment approach , and prevention. *Oral Surg Oral Med Oral Pathol* 1982; 54: 521–526.
40. Kinberg S, Stein M, Zion N, et al. The gastrointestinal aspects of halitosis. *Can J Gastroenterol* 2010; 24: 552–556.
41. Feller L, Blihnaut E. Halitosis: a review. *J South African Dent Assoc* 2005; 60: 17–19.
42. Albert Tangerman, Maria T Meuwese-Arends JBMJJ. Preimplantation diagnosis Foetor hepaticus. *Lancet* 1994; 05: 1569.
43. Van den Velde S, Nevens F, Van hee P, et al. GC-MS analysis of breath odor compounds in liver patients. *J Chromatogr B Anal Technol Biomed Life Sci* 2008; 875: 344–348.
44. Kawamoto A, Sugano N, Motohashi M, et al. Relationship between oral malodor and the menstrual cycle. *J Periodont Res* 2010; 681–687.
45. Calil CM, Lima PO, Bernardes CF, et al. Influence of gender and menstrual cycle on volatile sulphur compounds production. *ar ch i v e s o r a l b i o l o g y* 2008; 53: 1107–1112.
46. Alzoman H, Alssum L, Helmi M, et al. Relationship between Hormonal Changes and Self-Perceived Halitosis in Females: A Cross-Sectional Study. *Healthc* 2023; 11: 1–15.
47. Marx P. Letters to the editor. *J Oral Maxillofac Surg* 2003; 61: 1115–1118.
48. Mortazavi H, Rahbani Nobar B, Shafiei S. Drug-related Halitosis: A Systematic Review. *Oral Health Prev Dent* 2020; 18: 399–407.
49. Porter SR SC. Preface. *Ecol Biochem Environ Interspecies Interact* 2015; 333: xxiii–xxiv.
50. Whittle CL, Fakhrazadeh S, Eades J. Human Breath Odors and Their Use in Diagnosis. *Ann N Y Acad Sci* 2007; 266: 252–266.
51. Mackay RJ, Mcentyre CJ, Henderson C, et al. Trimethylaminuria : Causes and Diagnosis of a Socially Distressing Condition. *Clin Biochem Rev* 2011; 31: 33–43.
52. Han HS, Yum H, Cho YD, et al. Improvement of halitosis by probiotic bacterium *Weissella cibaria* CMU: A randomized controlled trial. *Front Microbiol* 2023; 14: 1–9.
53. Donaldson AC, McKenzie D, Riggio MP, et al. Microbiological culture analysis of the tongue anaerobic microflora in subjects with and without halitosis. *Oral Dis* 2005; 11: 61–63.
54. Briceag R, Caraiane A, Raftu G, et al. Emotional and Social Impact of Halitosis on Adolescents and Young Adults: A Systematic Review. *Medicina (B Aires)* 2023; 59: 564.
55. Tatli MM, San I, Karaoglanoglu M. Paranasal sinus computed tomographic findings of children with chronic cough. *Int J Pediatr Otorhinolaryngol* 2001; 60: 213–217.
56. Eli I, Baht R, Koriat H, et al. Self-perception of breath odor. *J Am Dent Assoc* 2001; 132: 621–626.
57. Rosenberg M. Clinical assessment of bad breath: Current concepts. *J Am Dent Assoc* 1996; 127: 475–482.
58. Quirynen M, Zhao H, Avontroodt P, et al. A Salivary Incubation Test for Evaluation of Oral Malodor: A Pilot Study. *J Periodontol* 2003; 74: 937–944.
59. Amano A, Yoshida Y, Oho T, et al. Monitoring ammonia to assess halitosis. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2002; 94: 692–696.
60. Suzuki N, Yoshida A, Nakano Y. Quantitative analysis of multi-species oral biofilms by TaqMan Real-Time PCR. *Clin Med Res* 2005; 3: 176–185.
61. Winkel EG, Roldán S, Van Winkelhoff AJ, et al. Clinical effects of a new mouthrinse containing chlorhexidine, cetylpyridinium chloride and zinc-lactate on oral halitosis: A dual-center, double-blind placebo-controlled study. *J Clin Periodontol* 2003; 30: 300–306.
62. Farrell S, Baker RA, Somogyi-Mann M, et al. Oral malodor reduction by a combination of chemotherapeutic and mechanical treatments. *Clin Oral Investig* 2006; 10: 157–163.
63. Levine MJ, Reddy MS, Tabak LA, et al. Structural Aspects of Salivary Glycoproteins. *J Dent Res* 1987; 66: 436–441.
64. Feusner JD, Phillips KA, Stein DJ. Olfactory reference syndrome: Issues for DSM-V. *Depress Anxiety* 2010; 27: 592–599.

**Information about authors:**

*Abdul Azeem Rasouli – Nangarhar University, Jalalabad, Afghanistan, e-mail: azeem284@gmail.com*

*Sadaqat Momand – Nangarhar University, Jalalabad, Afghanistan*

*Mohammad Taqi Anwari – Kabul Medical University, Kabul, Afghanistan*

*Joya Shafiq Ahmad – Herat University, Herat, Afghanistan*

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