



(RESEARCH ARTICLE)



## Halitosis occurrence due to systemic disease and medication

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### Abstract

**Background:** Halitosis, a term originating from "halitusus" and the Greek suffix "osis," refers to malodorous breath. It is a common problem impacting individuals globally, with prevalence estimates ranging from 24% to 65%. Dental issues, dry mouth, infections, medications, and systemic diseases can contribute to halitosis. Notably, systemic conditions like kidney and liver diseases, diabetes, respiratory infections, and gastritis can produce distinct odors in the mouth. The management of halitosis focuses on identifying and addressing underlying causes, with intraoral interventions like oral hygiene measures and extraoral treatments such as medical management based on the etiology.

**Objectives:** To review and clarify association between halitosis with systemic diseases and medication.

**Conclusion:** This study reveals a notable correlation between halitosis and systemic diseases or medication. Halitosis, a common occurrence influenced by various factors, appears to have a strong association with systemic ailments and medication usage.

**Keywords:** Halitosis; Systemic Disease; Medication; Public Health; Health Risk

### 1. Introduction

Halitosis refers to an unpleasant breath odor, characterized by a disagreeable and pungent smell. The term is derived from the Latin "halitusus," signifying breath, combined with the Greek suffix "osis," indicating an abnormal state [1]. Halitosis can cause significant discomfort to both the individual affected and those with whom they come into contact. Halitosis is commonly experienced by individuals of various age groups, genders, ethnicities, and can be caused by factors inside and outside the mouth [2].

Bad breath or halitosis is a common condition, found in 50-65% of the world's population [3]. Halitosis is frequently encountered by individuals seeking dental care. However, in other studies it is reported there are no accurate estimates of how often halitosis occurs. The prevalence of halitosis is estimated to be in the range of 24% - 39%. According to the American Dental Association, half of adults have encountered occasional halitosis, while quarter of the population have persistent halitosis [4]. Based on Nazir's research in 2017, the self-reported prevalence of halitosis was 75.1%, with about a quarter (24.9%) of participants. More female subjects (51.4%) than male subjects (23.7%) that have been to reported bad breath [5].

Halitosis is a prevalent issue that can significantly affect an individual's quality of life that is caused by various factors, both from inside of the mouth or from outside of the mouth [6]. Halitosis can be caused by dental problems, dry mouth, infections, medications, or diseases that affect other organs [3]. Some systemic diseases, such as kidney problems, liver disease, diabetes, respiratory infections, and gastritis, can also generate distinct odors in the mouth [7]. This occurs due

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to the presence of chemicals in the exhaled air, especially Volatile Sulfur Compounds (VSC) in oral problems, and volatile organic compounds (VOC) in most causes outside the mouth [8]. Volatile Sulfur Compounds (VSC) are produced by gram-negative anaerobic bacteria from the protein degradation process [9].

The cornerstone of halitosis management involves removing etiologic factors and improving oral health status, as halitosis can indicate an underlying systemic disease, making an accurate diagnosis of its origin (whether intraoral or extraoral) crucial for appropriate management [10]. The goal of managing halitosis is to reduce breath odor, thus enhancing the individual's social interactions, while minimizing any adverse effects. Treatment for halitosis that originates from inside the mouth can include brushing your teeth twice a day, regularly scaling, scraping the tongue, and gargling with chlorhexidine (CHX) mouthwash to reduce odor [11]. Meanwhile, treatment of halitosis extra oral or halitosis caused by other factors such as medication or related systemic diseases, may require further examination, disease management, and referral to a specialist [1].

The aim of this study was to investigate halitosis occurrences due to systemic disease and medication. This research is intended so that this relationship can be clarified based on findings from previous research, so that this information can be the basis for further research in the future.

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## 2. Material and methods

This research was carried out by systematically searching for several kinds of literatures relevant to the topic discussed as references. This type of research is Literature Review design. The research was done audaciously in April 2024.

### 2.1. Research Strategy

Search for literature and data from journals or articles using keywords and Boolean Operators (AND, OR, and AND NOT). Article searches are limited to the year the article was published, namely within the last 5 years from 2019-2024. The keywords used in this systematic review are "halitosis and medication" OR "halitosis and systemic disease" which aims to specify the search so as to make it easier to determine the literature used.

### 2.2. Inclusion and Exclusion Criteria

In this study, the inclusion criteria is literature that is available in full text and open access in English, has been published, and uses an original research design within the last 5 years.

The exclusion criteria used in this research is literature that uses languages other than English, literature reviews or systematic reviews, literature that is not available in full-text or open access and more than 5 years.

### 2.3. Synthetic Data

Literature collected through full-text understanding and extraction, including research title, author, year of publication, research objectives, methods, and conclusions. Subsequently, the data is analyzed to draw conclusions and recommendations that can answer research questions and objectives. Literature was selected through keyword searches and filtered based on title and abstract. The full text of each piece of literature was screened to determine its relevance to the inclusion and exclusion criteria established in this study.

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## 3. Results and discussion

The risk of experiencing halitosis rises with higher levels of HbA1c. In this study, approximately 88% of prediabetic and 97% of diabetic patients exhibited halitosis, consistent with findings from Choi and Al-Zahrani et al., which indicate a significant correlation between halitosis and elevated HbA1c levels [12]. Around 25% of diabetes mellitus patients are reported to suffer from halitosis, a condition that is susceptible to being experienced by them. The pathogenesis of this disorder may be related to the frequent presentation of xerostomia, dental caries, gingivitis, periodontitis, that prevent adequate self-cleaning of the oral mucosa. Additionally, in infected diabetic patients, some of the bacteria that are generally isolated are anaerobic bacteria which influence the production of volatile products, further exacerbating halitosis. Metformin, an oral antidiabetic drug belonging to the biguanide class, suppresses hepatic gluconeogenesis and enhances insulin sensitivity. It can be readily detected in saliva after oral or intravenous administration and may accumulate in various organs and tissues, including the salivary glands. Metformin enters the salivary glands through passive diffusion mediated by Organic Cation Transporter 3 (OCT3), increasing drug toxicity on the epithelial cells of the salivary glands. This accumulation can lead to salivary gland dysfunction, resulting in xerostomia (dry mouth) and halitosis in diabetic patients [13].

Anticonvulsants, such as phenytoin used to treat epilepsy, can cause gingival enlargement or a condition where the gum tissue becomes thicker and covers the upper teeth. This gingival enlargement can disrupt oral hygiene and lead to plaque buildup, which, in turn can cause gum inflammation and gum diseases like gingivitis. These gum health issues, along with other side effects like xerostomia (dry mouth) may increase the risk of halitosis or bad breath. Therefore, patients that are taking anticonvulsants, especially phenytoin, might need to pay attention to good oral hygiene and regular dental care to prevent these problems. Same as antidiabetic and anticonvulsant medication, antihypertensive, anticholinergic, and antipsychotic drugs have the potential to induce bad breath or halitosis in patients by causing reduced saliva production and dry mouth.

Gastroesophageal reflux disease is considered one of the frequently associated risk factors with halitosis. The association between GERD and halitosis has been established, albeit linked to disorders in other parts of the gastrointestinal tract. A study conducted by Struch et al. stated that GERD is associated with causing halitosis through three biological explanations. In cases of GERD, stomach acid can reach the nasopharynx and cause irritation to the nasopharyngeal wall, leading to the accumulation of postnasal drip, which, along with tongue coating, can mediate GERD with halitosis. Additionally, damage to the esophageal sphincter associated with the stomach can cause gases from the intestines and gastric juice to reflux into the esophagus, resulting in malodor or bad breath. Bad breath can also be caused by the presence of acid produced from injury or damage to supraesophageal tissues [7].

Chronic kidney disease (CKD) can lead to bad breath through several pathways, including decreased saliva production due to alterations in salivary glands and reduced fluid intake, promoting the development of halitosis. Poor tongue hygiene, exacerbated by decreased saliva flow, can cause tongue coating, a significant factor in CKD-related halitosis. Additionally, CKD patients may experience heightened levels of volatile sulfur compounds (VSCs) such as hydrogen sulfide, methyl mercaptan, and dimethyl sulfide, which are linked to bad breath. These compounds, combined with tongue coating and reduced saliva flow, contribute to oral halitosis in CKD individuals. Moreover, bad breath in CKD patients can adversely impact their quality of life, particularly in terms of psychological discomfort, disability, and psychological disability dimensions. Therefore, addressing oral health issues, including bad breath, is crucial for enhancing the well-being of CKD patients before kidney transplantation [15]. Additionally, respiratory diseases such as COVID-19 are also associated with halitosis. Halitosis in COVID-19 patients might result from systemic insults altering salivary characteristics and tongue dorsum susceptibility to anaerobic microorganisms, potentially due to the virus's impact on the respiratory system [16].

**Table 1** Summary of study results

No.	Author Name, Year	Objective	Research Result
1.	Shahbaz M. et al., 2023	The objective of this article is to detect undiagnosed cases of diabetes mellitus (UDM) within the Pakistani population by recognizing the signs and symptoms of DM and linking them to oral manifestations, such as halitosis.	The findings of the present investigation indicate that individuals with undiagnosed diabetes mellitus (UDM) and inadequate glycemic control exhibited a higher prevalence of fissured tongue, halitosis, generalized periodontitis, tongue coatings, thick ropy saliva, and xerostomia in comparison to those without diabetes..
2.	Lau P., et al., 2019	This study aim is to investigate the habits, expertise, and perspectives of Australian general dental practitioners (GDPs), general medical practitioners (GMPs), and community pharmacists (CPs) concerning halitosis and collaborative efforts in its management.	A majority of participants, comprising at least two-thirds (68%), indicated their awareness of additional factors contributing to halitosis, including specific medications, respiratory and gastrointestinal tract infections, as well as metabolic disorders. Notably, a higher proportion of general dental practitioners (GDPs) (53% for renal dysfunction and 44% for liver dysfunction) and general medical practitioners (GMPs) (70% for renal dysfunction and 67% for liver dysfunction) displayed awareness of the potential link between renal or liver dysfunction and halitosis compared to community pharmacists (CPs) (17% for renal dysfunction and 25% for liver dysfunction).

3.	Anbari F, et al., 2022	The aim of this study was to explore the correlation between oral conditions and halitosis in individuals experiencing gastroesophageal reflux disease (GERD).	Halitosis is one of the common symptoms of gastroesophageal reflux and can be considered as an extra-esophageal manifestation of gastroesophageal reflux. The risk of halitosis increases with the severity of gastroesophageal reflux symptoms.
4.	Santaella NG, et al., 2020	The aim of this study was to assess oral signs and volatile sulfur compounds (VSCs) linked to bad breath and its impact on the quality of life in individuals awaiting kidney transplantation.	Halitosis, a prevalent symptom of gastroesophageal reflux, is regarded as an additional manifestation of the condition beyond the esophagus. The likelihood of experiencing halitosis escalates with the severity of gastroesophageal reflux symptoms.
5.	Riad A, et al., 2021	The objective of this research is to document, in compliance with the CARE guidelines, the demographic, clinical, and laboratory profiles of eighteen individuals diagnosed with COVID-19, devoid of any pertinent medical background, who presented with newly-developed halitosis during their infection.	Halitosis, characterized by unpleasant breath odor, is indicative of various systemic disorders like respiratory, otolaryngologic, and gastrointestinal pathologies. These conditions can affect the characteristics of saliva and make the tongue dorsum more prone to hosting anaerobic microorganisms.

#### 4. Conclusion

This study can be inferred that there is an association between halitosis and systemic disease or medication. Halitosis is a prevalent occurrence attributed to a multitude of factors, with systemic diseases and medications notably intertwined with its manifestation. Each systemic ailment or medication presents distinct mechanisms underlying halitosis.

#### Compliance with ethical standards

##### *Disclosure of conflict of interest*

There is no conflict of interest declared by authors in this study.

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### Author's short biography

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#### Aqsa Sjuhada Oki

Dr Aqsa Sjuhada Oki is an Associate Professor, and the head of Oral Biology Department at Universitas Airlangga. He has been teaching Medical Physiology and Oral Biology for over 25 years. Aqsa has great interests to explore the relationship of systemic disease and oral health, as well as teaching innovations and telemedicine. In his philosophy, elearning and telemedicine should come to bring more value for the institution in the aspects of education, research, and community development.

