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THE UNPLEASANT TRUTH: EXPLORING THE COMPLEXITIES OF HALITOSIS

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ABSTRAK

Halitosis, atau bau mulut, adalah kondisi umum yang dapat memengaruhi kualitas hidup dan interaksi sosial seseorang secara signifikan. Hal ini disebabkan oleh interaksi kompleks berbagai faktor etiologi, yang sebagian besar berasal dari rongga mulut seperti aktivitas mikroba anaerobik yang menghasilkan senyawa sulfur volatil (VSC), tetapi juga sangat dipengaruhi oleh status kesehatan sistemik, pola makan, dan pilihan gaya hidup. Oleh karena itu, penanganan yang efektif memerlukan pendekatan diagnostik yang komprehensif dan cermat, tidak hanya untuk mengidentifikasi faktor etiologi tertentu seperti tingkat kebersihan mulut, kesehatan periodontal, dan ada atau tidaknya xerostomia, tetapi juga untuk mengungkap potensi kontribusi dari kondisi medis sistemik yang mendasarinya dan asupan makanan. artikel ini bertujuan untuk menyajikan tinjauan komprehensif tentang konsep terkini dalam diagnosis dan penanganan halitosis. Strategi penanganan halitosis yang berhasil sangat bergantung pada pilar-pilar edukasi pasien yang berkelanjutan, pengembangan rencana perawatan yang dipersonalisasi berdasarkan penyebab yang mendasarinya termasuk intervensi mekanis dan kimia dan pemantauan dan tindak lanjut klinis yang teratur. Lebih jauh lagi, kolaborasi interdisipliner, yang menggabungkan keahlian dari kedokteran gigi, mikrobiologi oral, penyakit dalam, dan psikologi, sangat penting untuk memajukan pendekatan diagnostik yang lebih akurat dan pilihan terapi yang lebih efektif. Dengan demikian, pentingnya menerapkan pendekatan holistik, interdisipliner, dan berpusat pada pasien untuk meningkatkan kesehatan mulut secara keseluruhan dan meningkatkan kesejahteraan pasien secara keseluruhan ditekankan.

Kata kunci: *halitosis, bau mulut, kebersihan mulut*

ABSTRACT

Halitosis, or bad breath, is a common condition that can significantly affect an individual's quality of life and social interactions. It results from a complex interaction of multiple etiological factors, predominantly originating within the oral cavity such as the activity of anaerobic microbes producing volatile sulfur compounds (VSCs), but also greatly influenced by systemic health status, diet, and lifestyle choices. Effective management therefore requires a comprehensive and careful diagnostic approach, not only to identify specific etiological factors such as the level of oral hygiene, periodontal health, and the presence or absence of xerostomia, but also to uncover potential contributions from underlying systemic medical conditions and dietary intake. This paper aims to present a comprehensive review of current concepts in the diagnosis and management of halitosis. Successful halitosis management strategies rely heavily on the pillars of ongoing patient education, the development of a personalized treatment plan based on the underlying cause—including mechanical and chemical interventions—and regular clinical monitoring and follow-up. Furthermore, interdisciplinary collaboration, combining expertise from dentistry, oral microbiology, internal medicine, and psychology, is crucial to advance more accurate diagnostic approaches and more effective therapeutic options. Thus, the importance of implementing a holistic, interdisciplinary,

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patient-centered approach to improve overall oral health and enhance overall patient well-being is emphasized.

Keywords: *halitosis, bad breath, oral hygiene*

INTRODUCTION

Halitosis, commonly known as bad breath, represents a prevalent and often distressing condition that affects a significant portion of the global population (Spielman & Forrai, 2023). Its impact extends beyond mere social discomfort, potentially indicating underlying systemic or oral health issues. Understanding halitosis necessitates a multifaceted approach, encompassing its etiology, diagnosis, and management strategies (Barranca-Enríquez & Romo-González, 2022). The perception of halitosis is subjective, and what one individual considers offensive may not be perceived as such by another, further complicating its assessment and treatment.

The oral cavity, a complex ecosystem teeming with diverse microbial communities, plays a pivotal role in the genesis of halitosis (Wijesinghe et al., 2023). Understanding the dynamics of these microbial interactions and their metabolic byproducts is crucial for developing targeted therapeutic interventions (Li et al., 2022). Moreover, the psychological impact of halitosis should not be underestimated, as it can lead to social isolation, anxiety, and diminished self-esteem. (Alkalash et al., 2023; Barranca-Enríquez & Romo-González, 2022). A comprehensive understanding of halitosis requires delving into the intricate interplay of microbial activity, volatile organic compounds, and individual perceptions, paving the way for effective and personalized management strategies. Addressing this pervasive issue requires a comprehensive understanding of its origins, diagnostic approaches, and therapeutic interventions.

The origins of halitosis are diverse, with the majority of cases stemming from oral sources, while a smaller proportion arises from systemic conditions or other factors. Oral malodor primarily originates from the microbial degradation of organic substrates, such as amino acids and peptides, within the oral cavity (Nobbs & Kreth, 2019). This intricate process yields volatile sulfur compounds, including hydrogen sulfide, methyl mercaptan, and dimethyl sulfide, which are major contributors to the characteristic unpleasant odor associated with halitosis (Milanowski et al., 2016). These compounds, produced by anaerobic bacteria residing on the tongue's dorsal surface, in periodontal pockets, and other retentive areas, possess a low odor threshold, making them readily detectable even at low concentrations. Factors such as poor oral hygiene, xerostomia (dry mouth), periodontal disease, and tongue coating contribute to the accumulation of these odor-producing compounds. The intricate interplay between oral hygiene practices, salivary flow, and microbial composition dictates the severity and persistence of halitosis. Beyond volatile sulfur compounds, other metabolites like cadaverine, putrescine, and skatole also contribute to the complex odor profile of halitosis. In addition, the interactions between fungi and bacteria play a crucial role in either establishing or maintaining a healthy oral ecology (Krom et al., 2014). Hyposalivation, or reduced salivary flow, significantly alters the oral environment, fostering conditions that favor the proliferation of odor-producing microorganisms (Almståhl & Wikström, 1999).

Xerostomia diminishes the natural cleansing action of saliva, leading to the accumulation of food debris and bacterial substrates, thereby exacerbating halitosis (Anil et al., 2014). Furthermore, xerostomia can significantly alter the oral environment, leading to increased caries activity, salivary gland enlargement, and heightened susceptibility to infections (Alhejoury et al., 2021). Systemic diseases, such as diabetes, renal failure, and liver disease, can also manifest as halitosis due to the production and release of specific metabolites into the bloodstream that are subsequently exhaled through the lungs. Additionally, respiratory tract

infections, such as sinusitis and bronchitis, can contribute to halitosis due to the presence of bacteria and inflammatory products in the nasal and respiratory passages. Understanding the relative contributions of oral and non-oral factors is crucial for tailoring effective treatment strategies for individuals affected by halitosis. Moreover, certain medications, such as antihistamines and antidepressants, can induce xerostomia as a side effect, indirectly contributing to halitosis (Stack & Papas, 2001).

RESEARCH METHODS

This study used a systematic literature review method to collect, analyze, and synthesize the latest scientific information on halitosis. The main objective of this review is to present a comprehensive overview of the latest concepts in the etiology, diagnosis, and management strategies of halitosis. Focus is given on a careful diagnostic approach and the importance of holistic and interdisciplinary management to improve oral health and overall patient well-being.

The literature search process was carried out through searches of leading electronic scientific databases, such as PubMed, Scopus, Google Scholar, and other relevant sources. Keywords used in the search included a combination of terms such as "halitosis", "bad breath", "diagnosis halitosis", "penagain halitosis", "etiology halitosis", "volatile sulfur compounds", "VSC", "oral health", and "interdisciplinary approach". The main inclusion criteria were scientific articles published in peer-reviewed journals in the last decade (around 2015-2025), which discussed aspects of the etiology, diagnosis, or management of halitosis in humans, and were available in English or Indonesian.

The identified articles were then screened through several stages, starting with reviewing the title and abstract to assess their relevance to the research topic. Furthermore, articles that passed the initial screening were reviewed in full (full-text) to ensure their suitability to the inclusion criteria and research objectives. Relevant data and information from the selected articles were extracted, categorized based on key themes (such as etiological factors, diagnostic methods, mechanical and chemical interventions, the role of patient education, and interdisciplinary collaboration), and then narratively synthesized to present a coherent and comprehensive review of current concepts in the field of halitosis.

RESULTS AND DISCUSSION

A. Diagnostic Approaches For Halitosis

The diagnosis of halitosis involves a combination of subjective assessments, objective measurements, and a thorough evaluation of the patient's medical and dental history. Subjective assessment typically involves organoleptic testing, where a trained examiner evaluates the odor intensity and characteristics of the patient's breath at various locations, such as the mouth and nose. While subjective, organoleptic measurements are considered the gold standard for halitosis diagnosis due to their direct relevance to human perception (Gaines, 2010). However, the subjective nature of organoleptic testing introduces potential biases, highlighting the need for standardized procedures and calibrated examiners to enhance reliability. Objective measurements, such as gas chromatography and sulfide monitoring, provide quantitative assessments of specific volatile compounds present in the oral cavity. Gas chromatography separates and quantifies individual volatile compounds, offering a detailed profile of the odor-producing substances. Sulfide monitors, also known as halimeters, measure the total concentration of volatile sulfur compounds in the breath, providing a convenient and rapid assessment of halitosis severity. However, the clinical interpretation of these findings remains difficult because definite marker substances for certain diseases could not yet be identified, substance concentrations in the exhaled air change under various conditions, and results vary in a wide range (Schubert & Geiger, 1999).

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The comprehensive evaluation of the patient's medical and dental history is crucial for identifying potential underlying causes of halitosis, such as systemic diseases, medications, and oral hygiene practices. Clinical examination of the oral cavity includes assessment of periodontal health, tongue coating, salivary flow, and the presence of any local factors that may contribute to odor production. In mouth mirror test, back of the mouth mirror is drawn along the buccal mucosa and the friction is registered accordingly (Aitha et al., 2015). In addition to clinical examination, diagnostic tests such as microbial culturing and salivary analysis may be employed to identify specific pathogens or biomarkers associated with halitosis. The use of electronic nose technology has allowed for studying diseases through breath analysis, with the aromas in breath known to identify diseases dating back to the fourth century (Sánchez et al., 2019). The interpretation of clinical data requires a thorough understanding of the various factors that influence halitosis, including oral hygiene, diet, salivary flow, and systemic health.

Saliva contains proteins, peptides, electrolytes, organic, and inorganic salts secreted by salivary glands and complimentary contributions from gingival crevicular fluids and mucosal transudates (Khurshid et al., 2018). These biomarkers might aid in early detection and diagnosis of diseases, supporting treatment decision making, and monitoring disease progression and/or treatment outcomes (Malon et al., 2014). Further analysis of saliva using various techniques can provide essential information for understanding the potential etiologies of halitosis. Analyzing biomarkers in saliva offers a non-invasive method for identifying diseases early on (Khurshid et al., 2018). Saliva's composition reflects both oral and systemic health status, establishing it as a promising diagnostic fluid (Pittman et al., 2023). Saliva contains biomarkers that can be used as indicators of disease (Liu & Duan, 2012; Yakob et al., 2014). Saliva testing is advantageous because it is non-invasive, easy to collect, and can be used to diagnose, predict, and monitor diseases (Gug et al., 2019; Khurshid et al., 2016). Saliva contains a wide array of proteins that can indicate physiological and pathological conditions, offering insights into early and differential disease markers (Zhang et al., 2012). Salivary analysis, coupled with comprehensive clinical evaluations, facilitates accurate diagnosis and personalized management strategies for individuals experiencing halitosis (Lee et al., 2009) (Tong et al., 2023).

B. Management Strategies For Xerostomia

The management of xerostomia necessitates a multifaceted approach tailored to the individual patient's needs and underlying etiology (Mhatre et al., 2024). Palliative treatments, such as saliva substitutes or artificial saliva, can be used for extended periods in people with chronic dry mouth as a preferred treatment option or as a supplement (Ingle, 2020). These products typically contain carboxymethylcellulose or hyaluronic acid to provide lubrication and moisture to the oral mucosa (Stack & Papas, 2001). Stimulating saliva production with sugar-free chewing gum or lozenges can also provide temporary relief (Atkinson et al., 2005). Prescription medications like pilocarpine or cevimeline, which act as cholinergic agonists, can stimulate salivary gland secretion in patients with residual salivary gland function. However, these medications are associated with potential side effects, such as sweating, flushing, and gastrointestinal disturbances, and should be used with caution. In addition to these symptomatic treatments, addressing the underlying cause of xerostomia is crucial.

In people who have had radiation-induced damage to their salivary glands, new treatment options like stem cell transplantation are being explored, focusing on regenerating the damaged glands. For patients with medication-induced xerostomia, adjusting the dosage or switching to alternative medications with less xerostomic potential may be warranted.

C. Therapeutic Intervention For Halitosis Management

The management of halitosis encompasses a multifaceted approach aimed at addressing the underlying causes and reducing the production of odor-causing substances. Oral hygiene

practices, including regular tooth brushing, flossing, and tongue scraping, form the cornerstone of halitosis management by removing plaque, food debris, and bacteria from the oral cavity (Mani et al., 2020). Antimicrobial mouth rinses containing chlorhexidine, cetylpyridinium chloride, or essential oils may be recommended to reduce the bacterial load and control odor production. Professional dental cleanings and periodontal therapy may be necessary to address underlying periodontal diseases and eliminate reservoirs of bacteria.

Addressing systemic factors, such as medical conditions and medications, is crucial for managing halitosis effectively. For patients with xerostomia, saliva stimulants or artificial saliva substitutes may be prescribed to increase salivary flow and maintain oral moisture. Patients often complain about the food sticking to their teeth when they have dry mouth (Stack & Papas, 2001). In cases of systemic diseases contributing to halitosis, medical management and treatment of the underlying condition are essential. Furthermore, lifestyle modifications, such as smoking cessation, dietary changes, and increased water intake, can improve oral hygiene and reduce halitosis.

The use of probiotics, prebiotics, and synbiotics has emerged as a promising approach for modulating the oral microbiome and reducing halitosis. These interventions aim to promote the growth of beneficial bacteria while inhibiting the growth of odor-producing pathogens. In certain instances, halitosis can be traced to tonsillar irregularities or infections, thus necessitating the intervention of tonsillectomy as a definitive treatment measure (Marsh, 2006). New therapeutic strategies for periodontitis and other dysbiotic conditions, including the use of beneficial microbes to restore healthy microbial flora, may pave the way to improved therapeutic outcomes and more thorough patient management (Mulhall et al., 2020). The success of halitosis management relies on patient education, adherence to treatment recommendations, and regular follow-up appointments to monitor progress and adjust treatment strategies as needed. The use of mouthwashes containing fluoride, alcohols, and antimicrobial agents helps in the control and reduction of dental biofilm (Santos et al., 2023). However, some mouthwashes contain alcohol or astringents and may have an unpleasant taste, worsening the condition (Pedro et al., 2008; Santos et al., 2023).

Management of xerostomic patients is challenging and a combination of various treatment modalities has become a better approach (Aitha et al., 2015). For medication-induced xerostomia, exploring alternative medications with fewer salivary side effects can be a viable strategy (Mhatre et al., 2024). Additionally, maintaining optimal hydration, especially during and after meals, aids in bolus formation and reduces reliance on saliva. Regular dental visits, fluoride therapy, and nutritional counseling are also helpful (Stack & Papas, 2001). The use of saliva stimulants, such as sugar-free candies or chewing gum, can help improve saliva production and provide moisture (Atkinson et al., 2005). For individuals suffering from xerostomia, therapeutic interventions are classified as disease-modifying agents, preventive measures, topical treatments, systemic stimulants and regenerative approaches (Saleh et al., 2014). Artificial saliva can also be used for longer durations as palliative or coadjutant treatments (Ingle, 2020). The therapeutic approach includes the use of topical agents like saliva substitutes and mouthwashes, as well as systemic sialogogues (Miranda-Rius et al., 2015).

D. The Interdisciplinary Approach To Halitosis Research

Interdisciplinary research, which brings together experts from different fields such as dentistry, microbiology, biochemistry, and psychology, can enhance our understanding of the complexities of halitosis. This collaborative approach can lead to the development of more effective diagnostic and treatment strategies. Investigating the psychological impact of halitosis can improve patients' quality of life. Further research is needed to refine diagnostic techniques, identify novel biomarkers, and develop targeted therapies for halitosis.

In conclusion, the effective management of halitosis necessitates a comprehensive understanding of its diverse etiologies, ranging from local oral conditions to systemic diseases. Precise diagnostic methods, incorporating patient history, clinical examination, and advanced diagnostic tools, are pivotal in pinpointing the specific factors contributing to each individual's condition (Millsop et al., 2017). Treatment strategies should be customized, targeting the root causes while emphasizing meticulous oral hygiene practices, antimicrobial interventions, and, when necessary, the management of underlying medical issues. The holistic approach, integrating patient education, lifestyle adjustments, and regular follow-up care, is paramount for achieving sustained improvements in oral health and enhancing the overall quality of life for those affected by halitosis (Napeñas et al., 2009). Furthermore, by probing into the intricate dynamics of the oral microbiome and its interaction with halitosis, researchers are paving the way for innovative therapeutic interventions, including probiotics and targeted antimicrobial agents, to reestablish a harmonious microbial balance.

The role of microorganisms in the etiology of oral diseases has been greatly explored, and novel techniques that aim to control them are being developed (Figdor, 2002; Rath et al., 2021). Such progressive measures hold the promise of more effective and tailored treatments for halitosis, underscoring the significance of ongoing research endeavors in this field. The use of interdisciplinary health promotion and theory-based interventions is essential in improving oral health-related behaviors (Newton, 2012). By integrating clinical expertise with scientific advancements, we can strive towards providing comprehensive and personalized care for individuals suffering from halitosis, ultimately improving their oral health and overall well-being (Spanemberg et al., 2019). Considering the interrelation between oral and systemic health, dental professionals should adopt a comprehensive approach that integrates both systemic and local factors to promote optimal patient outcomes (Arigbede et al., 2012).

CONCLUSION

Based on the research findings, the diagnosis of halitosis requires a comprehensive approach that combines subjective assessments such as organoleptic tests, objective measurements through gas chromatography and sulfide monitoring, and evaluation of the patient's medical and dental history, including saliva analysis as a non-invasive method for early detection. The management of halitosis and related conditions such as xerostomia is multifaceted, including meticulous oral hygiene practices, use of antimicrobial agents, treatment of underlying systemic causes, lifestyle modification, saliva stimulation or use of saliva substitutes for xerostomia, and novel therapeutic interventions such as probiotics to tonsillectomy when indicated. Successful management relies heavily on an interdisciplinary approach that integrates expertise from multiple fields to deepen understanding, refine diagnostic techniques, identify novel biomarkers, develop targeted therapies including modulation of the oral microbiome, and consider psychological impacts, all aimed at providing holistic and personalized care to improve the patient's overall oral health and quality of life.

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