

The effect of salivary flow rate on the risk of bad breath (halitosis) during the Ramadan fasting

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Abstract

Background: Ramadan fasting is a significant religious practice for Muslims, characterized by abstinence from food and drink from dawn to sunset. This fasting routine induces physiological changes, including reduced salivary flow and altered salivary composition, which may compromise oral health. These changes increase the risk of halitosis and other oral issues due to decreased protective functions of saliva and the proliferation of volatile sulfur compound (VSC)-producing bacteria.

Objective: To review the relationship between reduced salivary flow during Ramadan fasting and the risk of halitosis, as well as to identify effective preventive measures to mitigate these effects.

Method: A literature review was conducted using secondary data from databases such as PubMed, ScienceDirect, and Google Scholar. The inclusion criteria focused on studies published between 2017 and 2025 that explored salivary flow rate, halitosis, and the effects of Ramadan fasting.

Results: The review highlighted a significant reduction in salivary flow, with rates decreasing up to 50% during fasting. This reduction leads to an increase in VSC levels, which are the primary contributors to halitosis. Additionally, fasting affects the composition of saliva, including lower levels of phosphate and calcium, further exacerbating oral health issues.

Conclusion: Ramadan fasting significantly influences oral cavity health by reducing salivary flow and altering its composition, increasing the risk of halitosis and other dental issues. Halitosis is primarily caused by volatile sulfur compounds produced by gram-negative anaerobic bacteria thriving in reduced saliva conditions.

Keywords: Ramadan; Fasting; Halitosis; Salivary Flow Rate; VSC; Volatile Sulfur Compounds

1. Introduction

Ramadan is a special period of the year when Muslims fast for a whole month, not eating or drinking anything from dawn to sunset. During the fast, they avoid activities that can break the fast, such as swallowing something. Muslims also refrain from acting on things, such as swallowing water or other liquids, even when undergoing dental treatment [1]. Since food and drink consumption is only from sunset to dawn, this lifestyle change during the lunar month can affect oral health. A Muslim may be exempted from the obligation to fast during Ramadan for several reasons, including pregnancy, breastfeeding, diabetes mellitus, or mental illness. However, despite these exemptions, many Muslim patients with chronic medical conditions still choose to fast [2].

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Saliva is a liquid secreted by the minor and major salivary glands in the oral cavity. The major salivary glands are the parotid, submandibular, and sublingual glands, which are responsible for more than 90% of salivary secretion and the minor glands are distributed throughout the oral mucosal surface [3]. Salivary secretions make up 99% of water, while the remaining 1% consists of solutes. Organic substances in saliva include enzymes such as ptyalin and lingual lipase, as well as other components such as lysosomes, calcitriol, urea, uric acid, cholesterol, and mucin. For inorganic substances, Na⁺, Cl⁻, K⁺, and HCO₃⁻ ions, while ions such as Ca²⁺, PO₄³⁻, and Br⁻ are only present in small amounts [4].

Saliva has important roles in the oral cavity, including maintaining moisture and lubrication, protecting mucosal tissue and assisting the wound healing process, providing antimicrobial protection, maintaining dental health, and supporting the immune system [5]. The rate of salivation is also often related to several health problems in the oral cavity. In Muslims who fast, it can reduce the rate of saliva. A decrease in salivary flow rate can facilitate the growth of bacteria in the oral cavity, especially gram-negative facultative anaerobic bacteria, which can potentially cause halitosis. In this case, the author will discuss the relationship between salivary rate and the risk of bad breath (Halitosis) in a Muslim who is fasting [6].

2. Material and methods

This research is a literature review. This research uses secondary data obtained from three databases: Google Scholar, PubMed, ScienceDirect. The keywords used in the journal search included salivary rate, halitosis, Ramadan fasting. The inclusion criteria for this study included national and international literature published between 2017 and 2025, with a focus on research related to the effect of salivary rate on the risk of halitosis in Ramadan fasting.

3. Results and discussion

Table 1 Results of a review of research articles regarding effect decrease salivary flow rate on the risk of bad breath (halitosis) during the Ramadan Fasting

No	Writer	Title	Object	Method	Result
1	Besbes et al [2]	The Impacts of Ramadan Intermittent Fasting on Saliva Flow-Rate and Metabolic Data: A Systematic Review	The study involved healthy Muslim adults who fasted during Ramadan.	A systematic review with literature search was conducted in PubMed and Scopus databases until July 15, 2021 using the keywords "saliva and fasting".	There is a 10% decrease in fasting flow rate (SFR) during Ramadan. The role of the hormone melatonin can maintain circadian patterns but its level decreased significantly, while the hormone cortisol increased during Ramadan.
2	Aripin et al [7]	A review of salivary composition changes induced by fasting and its impact on health	Review fasting-induced changes in salivary composition and their impact on health, with a particular focus on salivary metabolites such as nitrate/nitrite and their role in supporting health.	A literature search was conducted through PubMed, ScienceDirect, and other databases using the keywords "Saliva", "Fasting", "Nitric Oxide".	Fasting reduces salivary flow rate significantly, especially in conditions without food and water. Salivary nitrite levels increase during fasting, which favors the formation of Nitric Oxide (NO). NO produced from fasting saliva may have an important role in protecting vascular

					health and fighting viral infections.
3	Arinawati [8]	Ramadan Fasting and Saliva Characteristics: A Review	Assess the effect of Ramadan fasting on salivary characteristics, such as flow rate, composition, and oral complaints during the fasting period.	Literature Review by searching journals and scientific articles obtained from Google Scholar and PubMed. Using the keywords "saliva", "fasting", "ramadan fasting", "salivary flow", "saliva composition", "biochemistry of saliva".	A decrease in salivary flow rate during fasting can affect oral health, increasing the risk of complaints such as halitosis (bad breath), dehydration, and a decrease in natural oral cleansing ability.
4	Peedikayil et al [9]	Oral Health of Fasting Muslims	305 fasting Muslim individuals in Kannur District, Kerala, India.	Questionnaire-based cross-sectional study design with sampling techniques from the local Muslim community.	57% reported experiencing halitosis (bad breath) while fasting. Methods of reducing halitosis include rinsing with water (20%), brushing teeth while fasting (11%), using mouthwash (7%), and consulting a dentist (2%). Most (62.5%) practiced tongue cleaning during Ramadan.
5	Khalighefar et al [10]	The Effect of Ramadan Fasting on Biochemistry of Saliva	Identify the effect of Ramadan fasting on salivary biochemical composition, specifically uric acid concentration, alkaline phosphatase (ALP) and aspartate aminotransferase (AST) enzyme activities in healthy individuals.	35 healthy men aged 30-50 years, non-smokers, without oral or systemic diseases. Subjects underwent full Ramadan fasting.	There was an increase in ALP activity, while AST activity in saliva decreased.
6	Hussein et al [11]	Ramadan Fasting in Relation to Salivary Uric Acid and Selective Physical Parameters	Evaluate the impact of Ramadan fasting on salivary flow rate, salivary pH, and salivary uric acid concentration in healthy male dental students in Iraq.	An observational study conducted over three periods: one week before Ramadan (as baseline), the last week of Ramadan, and one month after Ramadan.	Salivary flow rate decreased significantly from baseline to Ramadan, but increased back to normal levels after Ramadan.

During fasting, changes occur in our body, especially in the oral cavity. The decrease in salivary secretion can cause many things in our oral cavity. According to research conducted by besbes, et al who evaluated the effect of fasting on salivary flow rate and metabolic parameters. Salivary flow rate decreased by 10% during fasting [2]. During fasting, gustatory stimulation decreases as a result the rate of salivation decreases. The autonomic nervous system controls the rate of salivation and secretion of various salivary compounds [12]. During fasting reduced activity with minimal

orofacial movement and slowed metabolism in the cells of body tissues, including in the cells of the oral cavity, can affect the low stimulation of the autonomic nervous system [10].

According to Khalighefar et al, ALP levels showed an increase again in mid-Ramadan compared to before Ramadan. While this increase in ALP may indicate an increased risk of dental caries or oral disease, the change is not considered significant enough to cause a serious disease condition. AST, an enzyme that plays a role in the metabolism of various body tissues, also showed a significant decrease in activity during Ramadan. This decrease in AST activity is attributed to the reduced metabolism of body cells due to fasting, including cells in the oral cavity, which in turn contributes to a decrease in salivary flow rate during the fasting period [10].

The decrease in salivary flow rate during fasting could be due to the dehydration experienced during the period, which directly affects salivary production. However, this study also showed that one month after Ramadan, salivary flow rate increased significantly. This increase is most likely influenced by the return to normal eating and drinking patterns after Ramadan, which stimulates chewing and tasting activities, thereby increasing salivary production [11]. Salivary flow rate during fasting decreases dramatically to 0.098 mL/min, half of normal conditions [7]. This low salivary flow rate can cause bad odor in the oral cavity [9].

Halitosis is largely caused by microbial activity that breaks down shed human epithelial cells, blood debris, dental plaque, as well as proteins in saliva and blood, including sulfur-containing amino acids in the tongue coating. Volatile sulfur compounds (VSCs) are formed as a result of the decay of sulfur-containing amino acids. About 90% of VSCs in halitosis consist of hydrogen sulfide (H₂S), methyl mercaptan (CH₃SH), and a small amount of dimethyl sulfide. These VSCs are the main factors that cause halitosis. Gram-negative anaerobic microorganisms, such as Porphyromonas gingivalis, Treponema denticola, and Tannerella forsythia, are known to increase VSC levels, which are also closely associated with periodontal disease [13].

During Ramadan, dietary changes due to fasting contribute to this condition. In addition, the composition of saliva also changes, with reduced levels of inorganic components, such as phosphate and calcium. This decrease in saliva production can compromise its protective function, increasing the risk of oral health problems, including dental problems and discomfort. Halitosis or bad breath can be minimized through thorough cleaning using toothpaste or miswak after breaking the fast. Studies also show that dental caries, periodontal disease, and other oral health problems are caused by the interaction between diet and the natural microflora in the oral cavity [8]. Chlorhexidine, as an antiseptic mouthwash, is often recommended in dental care when needed. However, for individuals who are fasting, its use is often avoided due to concerns regarding absorption through the mucosa or the risk of accidental ingestion. Alternatively, this mouthwash can be used outside of fasting times [10].

4. Conclusion

Ramadan fasting significantly affects oral health by decreasing salivary flow and altering its composition, which increases the risk of halitosis and other dental problems. Halitosis is mainly caused by volatile sulfur compounds produced by gram-negative anaerobic bacteria that thrive in reduced salivary conditions. While these challenges exist, maintaining good oral hygiene through regular brushing, tongue cleaning, and strategic use of antiseptic mouthwash outside of fasting hours can effectively reduce these risks. Raising awareness and encouraging preventative measures during Ramadan is crucial to improving the oral health and general well-being of fasting individuals.

Compliance with ethical standards

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Disclosure of conflict of interest

All the authors declare that there is not any conflict of interest with this document's release

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