Original Article

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What Is the Role of Oral Factors in Halitosis in Patients with Gastroesophageal Reflux Disease?

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Abstract

Background: Prevalence of Halitosis includes a variety of 22 up to 50% in different societies. There have been reports of remarkable improvements in Halitosis after Gastroesophageal Reflux Disease (GERD) treatment. The aim of this study was to investigate the relationship between oral factors and halitosis in patients suffering from GERD.

Methods: This cross-sectional analytical study was conducted on 98 patients (45 females and 53 females) with mean age of 19.4 years whose gastroesophageal reflux was diagnosed by gastroenterologist. Halitosis was detected by organoleptic method. Decayed, Missing, and Filled Teeth (DMFT) was utilized to record the dental status. Oral hygiene was evaluated using the Oral Hygiene Index (OHI-S), Debries Index (DI), Calculus Index (CI), and coated tongue. Data were analyzed by Spearman and Pearson correlation tests.

Results: There was not a significant relationship between halitosis and DMFT, OHI-S, and debris index and calculus index, and coated tongue ($p>0.01$). Also, there was a direct and significant relationship between DI and CI ($p<0.01$).

Conclusion: Based on the results of the present study, there is no relationship between oral factors (debris index, calculus index, oral hygiene index, and DMFT) and halitosis in patients with GERD. Therefore, the presence of halitosis might be attributed to the presence of GERD in these patients.

Keywords: Calculi, Gastroesophageal reflux, Halitosis, Humans, Oral hygiene

Introduction

Bad breath, also known as halitosis, is an unpleasant odor that comes out of the mouth or nose with exhaled air (1). The prevalence of bad breath is reported to be between 22 and 50% (2,3). Since bad breath is inhaled through the mouth, dentists are certainly the first group who can help these people (3). Approximately 80-90% of the halitosis cases have oral origin (4). Although the coated tongue with less frequency, periodontitis, and gingivitis have so far been identified as the most significant cause of bad breath; the dentists should not be unaware of the risk of more serious causes and underlying diseases (5). Few systemic diseases can also cause specific odors in the mouth, including kidney problems, liver disease, diabetes, ear and throat infections as well as gastritis (6,7).

Gastroesophageal Reflux Disease (GERD) is "a chronic disorder related to the retrograde flow of gastro-duodenal contents into the esophagus and/or adjacent organs, resulting in a spectrum of symptoms, with or without tissue damage" (8). Some studies have shown that halitosis is one of the common symptoms of gastroesophageal reflux as far as it can be described as an extra-oral manifestation of the disease (4,6).

In a study of the relationship between gastroesophageal reflux and halitosis, Moshkowitz *et al* (9) showed that halitosis is one of the common symptoms of gastroesophageal reflux and may be considered as an extra-esophageal manifestation of gastroesophageal reflux. In the review study conducted by Struch *et al* (10), it was shown that the risk of halitosis increased with the severity of the gastroesophageal reflux symptoms.

In most studies regarding the relationship between gastroesophageal reflux and halitosis, the role of oral agents as the most important cause of bad breath has been ignored.

Due to the limited number of the mentioned studies in Iran and since bad breath causes many communication and social problems for patients, the purpose of this study was to evaluate the effect of oral agents on bad breath in patients with GERD.

Materials and Methods

This analytical cross-sectional study was performed on 98 patients (45 males and 53 females) with mean age of 19.4 years. They all had upper GI symptoms and GERD diagnosis was made by a gastroenterologist through endoscopy.

Patients had to have four upper and lower anterior teeth and at least one normal posterior tooth without a crown in each quadrant. Patients with dry mouth and dehydration, sinusitis, kidney problems, diabetes, and liver disease, smokers, and toothless patients were excluded from the study.

After obtaining a written consent, participants were entered into the study. These patients were then examined by a dentist. A checklist including intraoral examinations and systemic disease assessment of all patients was completed. Oral examinations included evaluating halitosis, coated tongue, and oral hygiene, and measuring debris index, calculus index, and Decayed, Missing, and Filled Teeth (DMFT) index.

A plate (50×70 *cm)* was inserted between the patient and the examiner to avoid observation, and a transparent tube (2.5 *cm* in diameter and 10 *cm* in length) was inserted in the middle of the plate. The patient was first asked to close his/her mouth for 60 seconds without swallowing his/her saliva, then slowly exhaled air out of the tube inside his/her mouth (11,12). DMFT criterion was used to record dental status. This scale is obtained by counting the Decayed (D), Missing (M) and Filled (F) teeth and then summing them (4).

To determine the coated tongue, a rating of 0 to 4 was utilized as follows: 0 = tongue without any coating, 1 = thin coating in less than one-third of the tongue, 2 = thin coating between one-third and two-thirds of the tongue, 3 = thin coating in over two-thirds of the tongue or thick coating between one-third and two-thirds, and 4 = thick coating in over two-thirds of the tongue (11).

Oral hygiene was assessed using the Simplified Oral Hygiene Index (OHI-S), which is the sum of the two Simplified Debris Index (DI-S) and the Simplified Calculus Index (CI-S). In this method, six surfaces of two anterior teeth (the upper right central labial surface, and the lower left central labial surface) and four posterior teeth (buccal surface of the upper first molars, and lingual surface of the lower first molars, in the case of first, second or third molars missing) are selected. The amount of debris and its mass are rated as well.

The simplified debris index was rated as follows:

0 = no debris, 1 = debris less than a third of the tooth surface, 2 = debris between one-third and two-thirds of the tooth surface, 3 = debris more than two-thirds of the tooth surface. Then the sum of the scores on the buccal surfaces is summed up with the sum of the scores on the lingual surfaces and divided by the sum of the number of surfaces examined (13).

The simplified calculus index was rated as follows:

0 = no calculus, 1 = calculus above the gingiva less than one-third of the tooth surface, 2 = calculus above the gingiva between one-third and two-thirds of the tooth surface or presence of calculus patches under the gingiva in the cervical region, 3 = calculus above the gingiva more than two-thirds of the exposed surfaces in the mouth or a continuous strip of mass under the gingiva around the cervical region (11).

The obtained data were analyzed using Spearman and Pearson correlation statistical tests and SPSS 23 and $p<0.01$ was considered statistically significant.

Results

After being examined by the organoleptic method, 65 patients were diagnosed with halitosis and 33 patients were not diagnosed with halitosis. In evaluating the frequency distribution, both the mean DMFT index and tongue coating (coated tongue), were higher in patients with halitosis than in patients without halitosis. The mean score of the oral hygiene based on the OHI-S index in patients with halitosis was 0.63±0.44 and in patients without halitosis was 0.72±0.7 (Figure 1). The mean score obtained from the Simplified Calculus Index (CI-S) was 0.3±0.3 for samples with halitosis and 0.37±0.54 for samples without halitosis (Figure 2). The mean score obtained from the Simplified Debris Index (DI-S) was 0.33±0.21 for samples with halitosis and 0.35±0.26 for samples without halitosis (Figure 3).

According to the Pearson's correlation, there was no significant relationship between halitosis and calculus index (r=-0.018, p=0.89), halitosis and debris index (r=0.033, p=0.80), halitosis and coated tongue (r=-0.110, p=0.41), halitosis and DMFT (r=-0.110, p=0.41), and halitosis and OHI-S (r=-0.086, p=0.51). According to the Spearman's correlation, there was a direct and significant relationship between DI and CI (r=0.610, p=0.001).

Discussion

Most of the halitosis cases have oral origin (4). Some studies indicated that halitosis is a frequent symptom of GERD (9,10). In the previous studies regarding halitosis in GERD patients, the role of oral factors was ignored. This was what occurred in previous studies on the relationship between *Helicobacter pylori* and halitosis, and the role of oral factors as the most important cause of halitosis had been neglected,

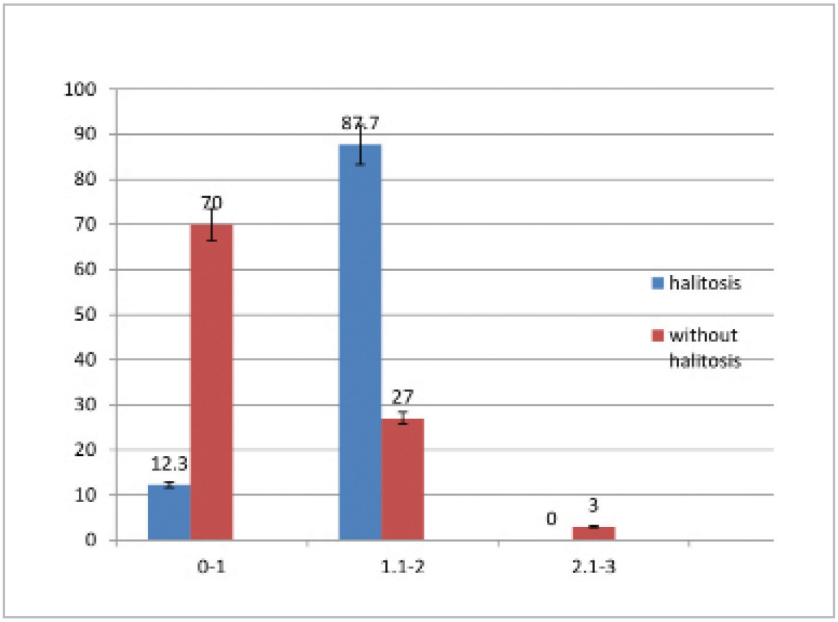

Figure 1. Percentage of OHI-S index in patients with halitosis and without halitosis.

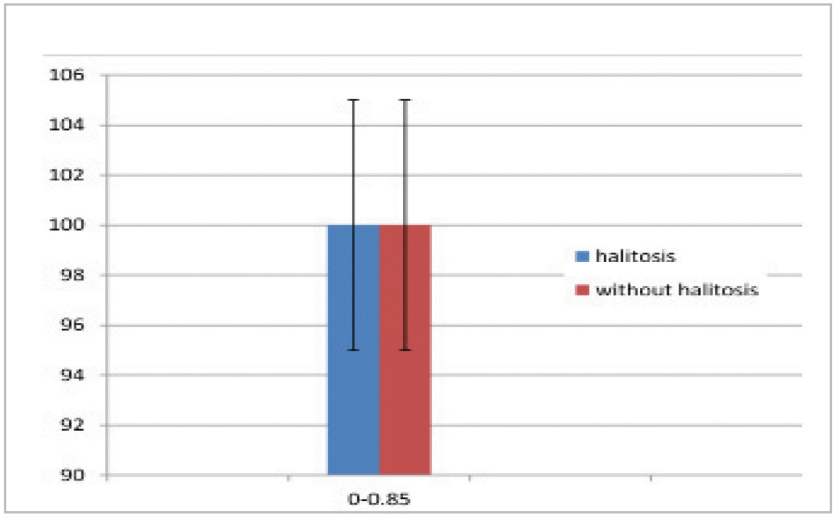

Figure 2. Percentage of DI-S index in patients with halitosis and without halitosis.

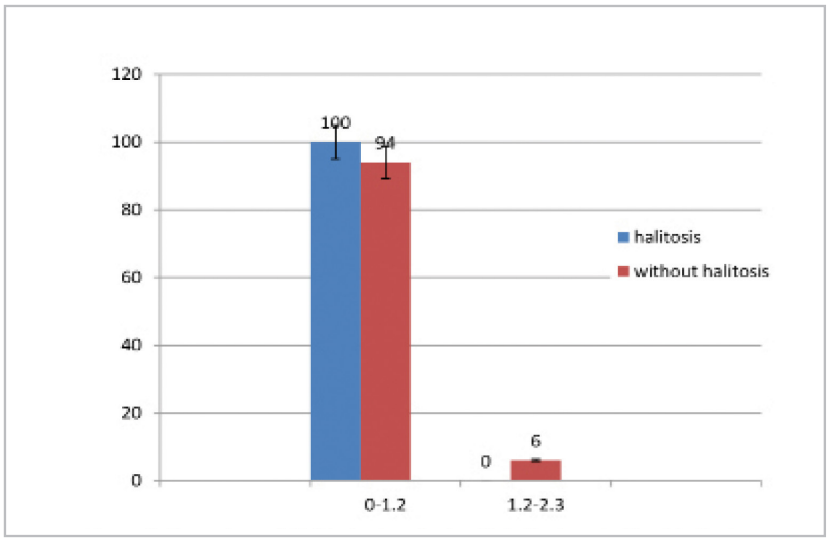

Figure 3. Percentage of CI-S index in patients with halitosis and without halitosis.

but some recent studies highlighted the role of oral factors in halitosis in helicobacter positive patients (14). Thus, this study was designed to assess the role of oral factors in halitosis in patients with GERD. All the cases who were included in the study had GERD. According to the results of the present study, there was no significant relationship between oral factors and bad breath in patients with gastroesophageal reflux disease (GERD), that means halitosis in patients with GERD might not originate from their mouth. As reported by Kinberg *et al* (11), some patients with halitosis reported a significant improvement in halitosis after drug treatment for GERD. Since research has shown that 80–90% of cases of halitosis have oral origin (15-17) and several studies have also found a relationship between halitosis and GERD

(9,12,18), it can therefore be concluded that there is a relationship between bad breath and GERD.

In general, gastroesophageal reflux can occur at all ages, but is more common in the fourth and fifth decades of life (9,19). However, in their study, Bolepalli *et al* (20) have shown that the incidence of GERD at a younger age is also common, which is consistent with the present study, where the mean age of patients was 19.4.

In studying gender, it has been shown that there is no gender difference in the incidence of GERD (21), which is similar to the studies of Farjam *et al* (19) and Martinucci *et al* (20); but it seems to be due to the sampling of the studies, as in the study of Moshkowitz, the number of men with this disorder was more than women (9).

According to the results of the present study, 66% of the patients with GERD had halitosis, whereas in the studies of Struch (10) and Moshkowitz (9), 21 and 45% of the patients had halitosis, respectively. The reason for this discrepancy may reside in the diagnosis of halitosis based on the patients' statements in these two studies. However, in the present study, halitosis diagnosis was performed by using the organoleptic method with a trained examiner in the diagnosis of halitosis. Therefore, it is likely that the mild cases of halitosis had not been reported by patients in the above studies, thus the frequency of halitosis in patients with GERD in these studies is less than in the present study.

Although the mean DMFT in patients with GERD and halitosis was significantly higher than in patients without halitosis (11.11 to 5.1), there was no statistical correlation between DMFT and the frequency of halitosis in patients with GERD in this study. Inflammation and damage to the esophagus due to reflux can cause ulcers and inflammation in the esophagus where infection caused by it can give rise to bad breath. Kinberg *et al* (11) showed that erosive changes in esophageal mucosa are strongly correlated with VSC (Volatile Sulphur Compounds) levels measured by halimeter. Therefore, it seems that patients with GERD, regardless of oral status, may have halitosis. Therefore, it can be concluded that in the present study, 34% of the patients who had GERD but had no halitosis on clinical examination were probably in the early stages of GERD.

There was no significant relationship between coated tongue and presence or absence of halitosis, which is inconsistent with the study conducted by Bolepalli *et al* (20), which may be due to differences in the study groups. In the Bolepalli study, patients who were systemically healthy were studied, but the present study was performed on patients with GERD (20).

In this study, there was no significant relationship between halitosis in patients with GERD and measured oral indexes (including debris index, calculus index, DMFT, oral hygiene index, and coated tongue), which is not consistent with the Struch's study (10). The reason for this discrepancy may reside in the halitosis assessment procedures used, as in the study by Struch, halitosis was assessed based on the patients' reports that may reduce the number of patients (especially those with mild halitosis); but in current study, halitosis was assessed by utilizing the organoleptic method with a trained person in diagnosing halitosis. Also, in the study of Lu *et al* (22) in which the OHI-S index was used to assess oral hygiene status, no significant relationship was found between this index and halitosis that is consistent with our study.

Conclusion

Based on the results of the present study, there is no relationship between oral factors (debris index, calculus index, oral hygiene index, and DMFT) and halitosis in patients with GERD. Therefore, the presence of halitosis might be attributed to the presence of GERD in these patients.

Acknowledgements

The present research was approved by Ethics Committee (GUMS.1398.288951127) of Guilan University of Medical Sciences.

Conflict of Interest

The authors declare that there are no conflicts of interest.

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