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Evaluation of Salivary pH
in Burning Mouth Syndrome Patients

Ocena pH śliny u pacjentów z zespołem pieczenia jamy ustnej

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A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation; D – writing the article; E – critical revision of the article; F – final approval of article

Abstract

Background. Burning mouth syndrome (BMS) is an intraoral burning sensation for which no medical or dental cause can be found. Since a decrease in pH of oral mucosa below 5.5 is harmful for hard and soft tissues, it can be a result of a decrease in pH.

Objectives. The aim of this study was to compare the salivary pH of patients with burning mouth syndrome to that of healthy subjects in elderly patients.

Material and Methods. The study sample consisted of 50 elderly patients selected by stratified sampling technique from 28 sanitariums in Tehran. A group of 25 cases of BMS and a control group of 25 patients not suffering from BMS were formed. The saliva was collected for 15 min as unstimulated salivary flow. The salivary pH was measured by pH meter and all the data was analyzed statistically with SPSS version 20 and the difference between salivary pH of BMS patient and the control groups was compared with T-test. In addition, logistic regression was also used to determine the effect of variables on salivary pH.

Results. Salivary pH in BMS group was 5.79 ± 0.4 and 5.89 ± 0.7 in the control group. This difference was not statistically significant when compared with T-test (p = 0.93).

Conclusions. In this study there is no difference between BMS patients and the control group in salivary pH (Dent. Med. Probl. 2014, 51, 4, 493–497).

Key words: burning mouth syndrome, saliva, pH.

Streszczenie

Wprowadzenie. Zespół pieczenia jamy ustnej (BMS) polega na wewnątrzustnym pieczeniu, dla którego nie można znaleźć uwarunkowań ogólnomedycznych lub stomatologicznych. Ponieważ spadek pH na błonie śluzowej jamy ustnej poniżej 5,5 jest szkodliwy dla tkanek twardych i miękkich jamy ustnej, to BMS może być związany ze zmniejszeniem pH śliny.

Cel pracy. Porównanie pH śliny pacjentów z BMS z osobami zdrowymi w starszym wieku.

Material i metody. Obserwacje prowadzono u 50 starszych osób dobranych warstwowo z 28 sanitarium w Teheranie. Grupa badana składała się z 25 przypadków BMS, a grupa kontrolna z 25 osób niecierpiących na BMS. Ślina była zbierana przez 15 minut jako śliwa niestymulowana. Wszystkie dane analizowano statystycznie i porównywano pH śliny między grupą badaną a kontrolną za pomocą testu t-Studenta. Dodatkowo wykorzystano regresję logistyczną dla oceny wpływu zmienności pH śliny.

 Wyniki: pH śliny w grupie BMS było 5,79 ± 0,4 a w grupie kontrolnej 5,89 ± 0,7. Różnica między tymi średnimi nie była istotna statystycznie (p = 0,93).


Słowa kluczowe: zespół pieczenia jamy ustnej, śliwa.
According to the International Classification of Headache Disorders, burning mouth syndrome (BMs) is an intraoral burning sensation for which no medical or dental cause can be found [1]. BMs, coded 13.18.5, is classified as a separate group with other cranial neuralgias and central causes of facial pain. Diagnostic criteria include: a) pain in the mouth that is present daily and persisting for most of the day, b) normal appearance of intraoral mucosa and c) exclusion of local and systemic diseases [1].

Burning mouth syndrome has an overall prevalence of 2.5–5.1% in the general population [2]. The majority affected are women with a ratio of 7:1 compared to men [3]. BMs generally affects the middle-aged and elderly population with a mean age of 62 years [4] and is more prevalent in post-menopausal women [5].

In more than one half of the patients with burning mouth syndrome, the onset of pain is spontaneous, with no identifiable precipitating factor [6]. Regardless of the nature of pain onset, once the oral burning starts, it often persists for many years [7]. The burning sensation often occurs in more than one oral site, with the anterior two thirds of the tongue, the anterior hard palate and the lower lip mucosa being the most frequently involved [8]. Such pain does not follow the usual anatomical pain routes or related physiological mechanisms, cannot be alleviated by cutting off the nerve path, and lacks the identifying neuropathic, extraneural, or central origin [9]. Typically, patients wake up without pain but they note increasing symptoms throughout the day and into the evening [6].

The etiology of BMs remains unknown, although a number of local, systemic and psychological factors have been proposed as being of etiopathologic importance [10]. However, no cause-effect relationship between the possible etiological factors and the etiology of the syndrome has been established [11], as its etiology probably involves complex interactions among local, systemic, and psychogenic factors [12]. It must be kept in mind that a certain BMs causative factor in one patient does not necessarily cause burning sensations–pain in another individual suffering from the same problem [6].

Possible causal factors of BMs are classified into 4 categories: local (candidiasis, geographic tongue, reactions to dental materials), systemic (nutritional deficiencies – vitamin B, iron, hormonal disturbances, anemia, diabetes), psychogenic (anxiety, depression) and neurogenic factors (alterations in peripheral nerves, dopamine levels) [13–15].

Saliva plays a significant role in the maintenance of the physical and functional integrity of normal oral mucosa [16]. Examining individuals with altered salivary function reveals the many roles saliva plays in protecting the oral environment from potential aggressors [17]. Because mucosa is continuously bathed in whole saliva, it would be preferable to examine the whole saliva rather than saliva secreted from specific major glands (parotid or submandibular/sublingual), because whole saliva is composed of ingredient originating from other sources besides the salivary glands, such as the mucosa or gingiva, that might affect the mucosa [18].

Moreover, the use of saliva for diagnostic purposes has received special attention, as saliva is easily obtained non-invasively, repetitively, and by individuals with limited training [19]. This leads to many investigations which evaluated saliva in burning mouth syndrome but reported different results.

Since a decrease in pH of oral mucosa below 5.5 is harmful for hard and soft tissues [20], some studies compared oral mucosa pH in patients with burning mouth syndrome with healthy subjects [11, 21]. However, this study measured pH in the surface of oral mucosa. The aim of this study was to compare the salivary pH between patients with burning mouth syndrome and healthy subjects.

### Material and Methods

The study sample consisted of 50 elderly patients selected by a stratified sampling technique from 28 sanitariums in Tehran. A group of 25 cases of BMs and a control group of 25 patients not suffering from BMs were formed. The average age of subjects was 60.16 ± 5.72, which in the study group was 61.58 ± 6.39 and in the control group was 58.4 ± 4.27 (Table 1). In both groups, 10 subjects were male. A clinical examination of the oral cavity was carried out on all patients. The diag-

### Table 1. Demographic data of studied cases

<table>
<thead>
<tr>
<th>Group</th>
<th>Total number</th>
<th>Mean age (years)</th>
<th>Male (n/%)</th>
<th>Female (n/%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMs</td>
<td>25</td>
<td>61.58 ± 6.39</td>
<td>10 (44)</td>
<td>15 (56)</td>
</tr>
<tr>
<td>Control</td>
<td>25</td>
<td>58.4 ± 4.27</td>
<td>10 (44)</td>
<td>15 (56)</td>
</tr>
</tbody>
</table>
nosis of BMS was established when the patient showed symptoms of oral burning sensation and presented with clinically normal mucosa. The case group members were questioned about the burning characteristics, including location, duration and previous management, and examined for any oral lesions in an effort to present the exact diagnosis of BMS. Denture wearing was not a criterion for excluding patients from the study, but only patients who were satisfied with their dentures and had no lesions in the denture bearing areas (such as candidiasis) were included. From our subjects, 8 cases wear denture in each group. Patients with a medical history of cardiovascular diseases (e.g. hypertension and heart failure), diabetes mellitus, anemia and nutritional deficiencies and previous cerebrovascular disease and individuals with dehydration determined by mucosal dryness were excluded and substitution was carried out appropriately. Other systemic diseases were not considered exclusion criteria. Smoking history was taken. Heavy smokers (more than 20 pack/year) were excluded [2]. Drug history was taken, and patients who used drugs that affect saliva dramatically (such as anticholinergics, antihistamines, antihypertensives, antiparkinson’s disease drugs, antiseizures, cytotoxic agents, sedatives and tranquilizers, skeletal muscle relaxants and tricyclic antidepressants) were excluded.

Equal numbers of patients and controls were studied in each sanitarium. The control group was similar to BMS patients from their systemic disease, smoking history and history of drug usage.

The participants were asked to refrain from eating, drinking and smoking for at least 1 h prior to saliva collection. All individuals participating in the study were tested in the morning, approximately at the same time, due to the differences in saliva production during the day. The saliva was collected for 15 min as unstimulated salivary flow. The saliva samples were collected in small test tubes, stored in ice bath and frozen at –80°C immediately after being transferred to the laboratory.

At the laboratory the samples were defrosted in room temperature and centrifuged with 3500 rpm, then superficial liquid was placed in pH meter (AZmiran, Tehran, Iran).

All of the data was analyzed with SPSS 20 statistically and the difference between salivary pH of BMS patient and control group was compared with T-test. In addition, logistic regression was also used to determine the effect of variables on salivary pH.

**Results**

Salivary pH in BMS group was 5.79 ± 0.4 and 5.89 ± 0.7 in the control group. This difference was not statistically significant when compared to the t-test (p = 0.93).

The average salivary pH was measured for males and females in each group separately; this was 5.66 ± 0.7 and 6.2 ± 0.83 in females and males of the control group, respectively, and 5.81 ± 0.49 and 5.74 ± 0.48 in females and males of study group, respectively. The salivary pH difference between males and females was not noticeable (Fig. 1).

**Discussion**

The aim of this study was to compare the salivary pH in burning mouth syndrome patients and healthy subjects. In this study, 67% of BMS cases was female; however, Suzuki [22] reported that there is no sex difference between burning mouth syndrome patients in his study but many investigators, such as Little et al. [23], Rojo et al. [24] and Grushka [25] reported that burning mouth syndrome is more prevalent in females. Some considered that hormonal disturbance or subsequent psychogenic reaction is the reason for this [26].

The pathophysiology of burning mouth syndrome is unknown. Central and peripheral mechanisms were mentioned. Based on Robb’s study [20], a decrease of salivary pH below 5.5 is harmful for oral mucosa. Salivary pH of burning mouth syndrome patients was measured 6.7, 7.01 and 5.7 in Soare’s [11] Aframian’s [21] and our study respectively. Whereas in all of these stud-

![Fig. 1. pH changes according to the sex of studied cases](image)
ies, the measured pH was more than 5.5, despite the difference in their method of measurement, it seems that there is no relationship between pH decrease and burning mouth syndrome.

However, it was mentioned that salivary pH is decreased in burning mouth syndrome patients [27], but in our study there was no difference between salivary pH of burning mouth syndrome patients and the control group which corresponds with Soares et al. [11] and Aframian et al. [21] studies. However, we collected saliva by spitting method and measured pH, whereas they measured pH on the mucosal surfaces. The fact that there is no difference in the salivary pH of burning mouth syndrome patients and the control group amplifies the central mechanism for burning mouth syndrome.

In conclusion, in this study there was no difference between BMs patients and control group in salivary pH.

References


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