Original Article

Salivary Flow Rate and pH in Asthmatic and Non-Asthmatic Patients

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ARTICLE INFO

Article History
Received: Nov 2019
Accepted: Dec 2019
ePublished: Feb 2019

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ABSTRACT

Background and Aim: : Saliva is an essential fluid for protecting the mouth, and any change in its quality or quantity affects the health of the oral cavity. Asthma and the medications used to treat it may decrease salivary flow and change salivary components, including changes in the pH of the dental plaque. The purpose of this study was to determine the salivary flow and pH in asthmatic and non-asthmatic patients referring to the Asthma Clinic of Masih Daneshvari Hospital in Tehran, Iran, in 2019.
Materials and Methods: : This cross-sectional study was performed on 70 patients aged 18-60 years (35 asthmatic patients and 35 healthy controls). After completing the datasheets, saliva was collected by the spitting method for 5 minutes. Its flow rate was recorded in ml/minute, and its pH was measured by a pH meter. The results were analyzed via SPSS 20 software according to the t-test and Mann-U-Whitney statistical test.
Result: The mean salivary flow rate was 4.22 ml/minute in the asthmatic group and 5.44 ml/minute in the healthy group ($P<0.005$). The mean salivary pH in the asthmatic patients and the control group was 6.9 and 7.1 ($P<0.005$), respectively, indicating that salivary flow rate and pH were significantly lower compared to the healthy group. Statistical analyses also showed that the higher the frequency of drug use, the greater the decrease in the salivary flow ($P<0.005$).
Conclusion: It seems that asthma and the drugs used for its treatment reduce salivary flow and pH.

Keywords: Asthma, Anti-Asthmatic Agents, Saliva, Case-Control Studies

J Res Dentomaxillofac Sci 2020, 5(1):40-45

Introduction:

Saliva is an essential fluid for protecting the oral cavity.[1] It plays an important role in oral cavity health, and any change in its quality and quantity endangers oral health.[2] Decreased salivary flow can lead to tooth decay, tooth demineralization, fungal infections, and oral lesions.[1] Asthma is a chronic airway disease characterized by inflammation and bronchoconstriction.[3]

Changes in salivary flow and its constituents have been observed in people with asthma.[1]Asthma and the medications used to treat it may decrease salivary flow and cause alterations in salivary components, including changes in pH and increased dental plaque. [4] Alaki et al in 2013 reported a decrease in salivary flow and pH in asthmatic patients. [3]

According to the results of the mentioned study, the frequency of anti-asthma medication, the severity of asthma, and the use of a combination drug in the treatment of asthma can affect the salivary status of asthmatic children.[3] Santos et al found no change in salivary flow or pH in the two groups of asthmatic and healthy individuals.[4] In a 2010 study by Stensson et al, the volume of stimulated saliva in the asthmatic group was significantly reduced compared to the control group. There was no significant difference between the two groups in the non-stimulated salivary volume and buffering capacity.[5] In 2018, Bulthuis and colleagues reported a significant increase in xerostomia during stress, which was not related to neurological drug use.[1] In 2007, Sag and colleagues examined the combination of long-acting beta2 agonists and corticosteroids on salivary secretion and salivary immunoglobulin-A (sIgA) secretion in asthmatic patients and showed that sIgA, dental plaque index, gingival index, and pocket depth in these patients showed no significant difference before and after treatment.[6] However, salivary secretion was significantly reduced after anti-asthma treatment.[6] In 2007, Shashikiran and colleagues examined the effect of anti-asthma drugs on periodontal disease and dental caries in 105 asthmatic children. The rate of dental caries in the case group was significantly higher than that in the control group. [7]

In 1998, Laurikainen and Kuusisto compared oral health status and salivary flow in asthmatic and non-asthmatic patients.[8] The mean stimulated saliva was significantly different between the two groups. There was no significant difference in salivary pH between the two groups.[8] Dental caries rate was higher in the case group.[8] According to the World Health Organization statistics, asthma is a chronic airway disease. Many studies have reported an increase in the prevalence of xerostomia, caries, and enamel defects in this disease.[9]

Given the prevalence of asthma in recent decades and its importance in community oral health as well as the contradictory information available in related studies, this study aimed to determine the salivary flow and pH in asthmatic and non-asthmatic patients referring to the Asthma Clinic of Masih Daneshvari Hospital in Tehran in 2019.

Materials and Methods

This cross-sectional (descriptive-comparative) study was performed on 70 patients. Purposeful sampling was done by conscious selection in two groups. Thirty-five asthmatic patients referring to the Lung Clinic of Masih Daneshvari Hospital in the age group of 18-60 years, whose asthma was diagnosed by a pulmonary specialist, had no other systemic disease, and did not take any drugs effective on the saliva were recruited as the case group. Thirty-five individuals accompanying the patients were selected as healthy controls and were matched to the asthmatic group according to age, sex, systemic disease, drug use, smoking, and alcohol consumption. These individuals were included in the study after signing a written informed consent form. All people with specific systemic diseases, including kidney disease, hypertension, neurological disease, diabetes, Sjögren's syndrome, thyroid disease, history of chemotherapy and radiotherapy, sarcoidosis, use of anticholinergic drugs, pregnancy, and any disease affecting the oral condition, as well as those over 60 and under 18 years of age, were excluded. The patients were categorized according to the severity of the disease and the drugs used to treat asthma.

After selecting the target group samples, written consent was obtained from both groups indicating a willingness to cooperate. In the asthmatic patient group, the information form was completed according to the patient's medical record. After completing the information form, patients were instructed to collect non-stimulated saliva and were asked to refrain from eating, drinking, chewing gum, smoking, and taking medication for up to two hours before saliva collection. Saliva samples were collected from 8 am to 12 pm. Each patient was given a sterile graded test tube, and the saliva was collected by the spitting method for 5 minutes. [3] During spitting, the patient is asked to collect saliva in their mouth and

then discharge it in a pre-weighed tube every 60 seconds for 5 to 15 minutes. The patient was instructed not to swallow their saliva and to discharge it completely inside the test tube.

After saliva collection, the salivary flow rate was calculated in ml/minute and salivary pH was measured using the Metrohm pH meter (Herisau, Switzerland). Data were analyzed using SPSS 20 software (SPSS Inc., Chicago, IL, USA) according to the t-test and Mann-U-Whitney statistical test.

In this study, no intervention was performed on the patients, and written consent was obtained from all patients.

Results:

The study was performed on 70 samples including 35 asthmatic patients referring to the Asthma Clinic of Masih Daneshvari Hospital with the mean age of 34.9 years and 35 healthy individuals with the mean age of 30.6 years. Patients were matched for mean age, sex, pregnancy and menopause, smoking, and alcohol use (Table 1).

The mean salivary flow rate was 4.22 ml/minute (pH=6.9) in asthmatic patients and 5.44 ml/minute (pH=7.1) in the healthy group. The mean salivary flow rate (t-test) and salivary pH (Mann-U-Whitney) showed a significant difference between the two groups (P<0.001), indicating that salivary flow and pH in the case group were significantly lower than that in the control group (Table 2).

Concerning the correlation between the two parameters of salivary flow rate and pH with a correlation coefficient of 0.525 and P<0.001, a significant positive correlation was detected between the salivary flow rate and pH. The higher the flow rate, the higher the pH.

Of the 35 cases, 16 were affected by asthma for more than 5 years and 19 were affected for less than 5 years according to the information forms, with no significant relationship between years of disease and salivary flow rate.

In addition, nine patients were taking salbutamol, 12 were taking beta2 agonists plus salbutamol, and 14 were taking oral medications in addition to inhaled medication.

On the other hand, seven patients with asthma used the drug once daily, 11 patients used the drug two times a day, and 17 patients used it more than two times per day. There was a significant correlation between the frequency of drug use and saliva reduction. Increasing the frequency of drug use decreases the salivary flow. No significant relationship was found between these three parameters and the salivary flow rate.

Table 1: Distribution of the studied individuals by the group according to individual characteristics

Variables / Groups	Age (year)	Gender		Smoking	Alcohol consumption	Pregnancy	Menopause
		Male	Female				
Case	34.9	15	20	0	0	0	3
Control	30.6	17	18	0	0	1	1

Table 2: Distribution of the studied individuals by the group according to the parameters studied

Indices / Groups	Salivary flow rate (ml/minute)	pH
Case (n=35)	4.22±0.69	6.92±0.29
Control (n=35)	5.44±0.39	7.18±0.19
P-Value	<0.005	<0.005

Discussion:

In the present study of 70 samples, the results showed that salivary flow rate and pH in asthmatic patients were significantly lower than that of the control group, which is consistent with many previous studies.[3,5-8,10] In this study, similar to many previous studies, non-stimulated saliva was used.[4]

The results of this study were inconsistent with a study by Stensson et al that showed no difference in salivary flow in people with asthma and healthy controls.[5] This difference can be justified given the age restriction of the groups (between 12 and 16 years) and the geographical region with different climatic conditions.[5] Mouth breathing has been reported in both case and control groups with a high percentage, and the difference in outcome can be justified by the effect of mouth breathing on saliva.[5] In addition, all of the subjects in this study had prolonged and severe asthma with varying doses and types of medication. In the study by Stensson et al, the plaque pH of patients with asthma was significantly lower compared to the controls.[5] They have suggested the use of inhaled drugs with the multi-drug combination as the reason for this decrease, which is consistent with the present study in terms of the multi-drug combination.

In a study by Santos et al, the salivary flow was not significantly different in asthmatic and healthy subjects.[4] Considering the limitation of the patients to corticosteroids and considering that the inclusion criterion was the use of asthma inhalers even once a week (the patients had mild asthma), the difference in the results is somehow justified. In this study, no differences were detected in the pH of the observed group. The reason for this discrepancy with our results may be differences in the pH measurement method as well as the medications used by the patients being restricted to corticosteroids while in the present study, some patients have used a combination of drugs and most patients have taken the drug twice or more per day. Asthma and its medications reduce saliva and change salivary composition, and these changes increase the dental plaque.[4] It is also likely that the use of medicines reduces the flow and pH of saliva, thereby increasing the pathological bacteria in the mouth.[2] There are inconsistencies in the cause of salivary flow reduction in asthmatic patients, and many believe that salivary flow reduction is mostly due to medications, and the disease itself has no role in this respect.[10] However, some believe that both asthma and its drugs are effective in reducing saliva.[3]

A group of studies has suggested that beta2 agonists decrease the amount of secreted proteins in a dose-dependent manner. In addition, salivary gland dysfunction occurs because of beta2 agonists.[2] Furthermore, decreased salivary flow is associated with repeated use of sympathomimetic drugs.[11] Hormonal status and several neuropeptides affect the synthesis and secretion of saliva.[11] Stimulation of beta-adrenergic receptors enhances protein synthesis.[12]

In a healthy person, even a single dose of beta-blocker can decrease salivary protein.[8] In addition to reducing salivary flow, long-acting beta2 agonists can also increase the effect of corticosteroids and may increase dental caries by decreasing sIgA; this needs further investigation. Increased rate of mouth breathing in patients with allergic asthma due to rhinitis can cause gingivitis.[13] In acute asthma attacks, mouth breathing causes alveolar mucosa dehydration.[14]

One of the changes in the salivary composition, resulting from a decrease in salivary flow, is an increase in myeloperoxidase level, which causes periodontal disease.[15] the increased amount of streptococcus mutans and lactobacillus, due to decreased salivary flow, also increases the risk of caries in these individuals. Nocturnal drug use, lack of proper oral hygiene after drug use, and sugar flavoring in medications are all contributors to increased risk of caries in patients taking inhaled drugs.[7]

Decreased salivary flow can cause oral candidiasis in addition to an increased plaque index.[3,16]

Several studies have examined the correlation of asthma and consequent salivary changes with caries, decay-missing-filled (DMF) index, and periodontal disease.[3-5,7,8,10,17,18]

One of the limitations of this study was the collaboration of hospital staff to review the pa-

tients› records, as well as the cooperation of the study participants to avoid eating and drinking or smoking for two hours before sampling.

To evaluate the effect of medication duration on saliva, patients should be classified according to the duration of drug use in addition to the duration of asthma in future studies.

Considering the importance of saliva quality in oral health and its effect on tooth decay and periodontal diseases, there is an essential need for extensive educational prevention programs and regular periodic examinations to raise awareness and improve the oral condition of asthmatic patients.

Conclusion:

According to the results, asthma and the drugs used to treat it significantly decrease salivary flow rate and pH.

Acknowledgments:

Special thanks to the respected staff of Masih Daneshvari Hospital for their cooperation in implementing this study.

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Please cite this paper as:

Baghban M, Lesan S, Farrokhnia T, Kiani A. Salivary Flow Rate and pH in Asthmatic and Non-Asthmatic Patients. J Res Dentomaxillofac Sci. 2020; 5 (1) :40-45