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Original Article

Evaluation of Unstimulated Saliva Levels in Controlled and Uncontrolled Type 2 Diabetes Mellitus

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Abstract

Introduction: Diabetes is a common syndrome characterized by a steady rise in blood glucose levels and has various side effects, including oral complications such as periodontitis and dry mouth. **Material and Methods:** This case-control study was performed on 30 patients with type 2 diabetes mellitus and 30 normal people who were referred to Kowsar Hospital of Semnan, Iran. The study groups were evaluated for HbA1C, and unstimulated saliva and data were statistically analyzed. **Results:** Unstimulated saliva in diabetic patients was 0.02 ± 0.07 ml/ min and ± 14.0 ± 02.0 ml in the control group (P <0.001). In the diabetic group, 18 out of the 30 diabetic patients (60%) had uncontrolled glucose (HbA1c was 7% or higher), and the rest had controlled glucose. According to the HbA1c study, the mean standard deviation of unstimulated saliva in controlled diabetic patients was 0.08 0 ± 0.02 ml/min and 0.06 ± 0.02 ml/min in uncontrolled patients, which showed a significant difference (p=0.006). **Conclusion:** Dry mouth was more prevalent in people with uncontrolled diabetes, so blood glucose level and its control had a significant effect on the reduction of unstimulated salivation.

Keywords: Diabetes Mellitus, Type 2 Diabetes, Saliva, Unstimulated Saliva, HbA1C.

Introduction

Diabetes is a syndrome caused by abnormal metabolism of fats, proteins, and carbohydrates, which causes a partial or complete deficiency of insulin in the body, which is characterized by elevated blood glucose levels. Another disease type is caused by increased cellular insulin resistance. A third form occurs in pregnant women who show abnormal adaptation to glucose [1, 2].

The prevalence of the disease in 2010 was around 221 million people worldwide, which is 2 or 3 times higher in some areas of the world, such as Africa and Asia. Diabetes, especially its second type, has become increasingly prevalent in developing countries for various reasons such as population growth, age, inactivity, and unhealthy diet. These people are often middle-aged (35-64 years) and have a high-income. In developed countries, however, type 2 diabetes usually occurs more often in older and retired people [2, 3].

Diabetes has many effects that can affect various organs of the body, including the mouth. Numerous complications of diabetes may involve the mouth, such as periodontitis and xerostomia [3]. Diabetes with poor glucose control leads to the destruction of salivary

glands and consequently to xerostomia [4], which may cause many complications including irritation of the dry mucosa, minor ulcerations, microorganisms overgrowth for opportunistic fungi like Candida, and increased gum fluid glucose, expanded dental caries and heightened plaque accumulation [1, 5].

Xerostomia is an uncomfortable complication of diabetes that can decrease a person's quality of life. It is more associated with poor glycemic control and also the medications which deactivate salivary glands rather than diabetes itself. Autonomic system neuropathy is another complication of diabetes that affects and decreases salivary secretion, as the salivary flow is controlled by sympathetic and parasympathetic pathways [1, 5].

Diabetes has many oral manifestations, such as burning mouth, changing in wound healing, xerostomia, increased incidence of infections, candidiasis (especially pseudomembranous acute candidiasis of the tongue, buccal mucosa, and gingiva) and bilateral enlargement of the salivary glands. It is also a proven risk factor for the prevalence and severity of gingivitis and periodontitis [1, 6]. Xerostomia is more likely to be the result of medications taken by a diabetic, not diabetes itself. Dry mucosal surfaces that are caused by a decrease in salivary secretion are easily irritated and lead to minor mucosal ulcers, a burning sensation in the mouth, and an increased likelihood of fungal infections.

The study of Harijanti k. et al. from 2007 showed that 76% of type II diabetic patients have xerostomia [7] and Andrades k. et al. showed in 2011 that the prevalence of the xerostomia in type I diabetic patients was 64% [8]. Abdullah M et al. declared in 2015 that the prevalence of xerostomia was 16.07% in all individuals [9].

There have been numerous studies on the complications of diabetes, but none of the previous studies evaluated the xerostomia in diabetic people from Semnan. In addition, this study will measure the effect of glycemic control on the unstimulated saliva. Due to the above-mentioned problems of xerostomia, we decided to assess the extent of this complication in order to plan, if necessary, to improve the treatment and reduce these significant complications in diabetic patients and cure xerostomia by controlling diabetes.

Material and Methods

Study design and patients

This case-control study was performed by measuring unstimulated saliva using a graduated cylinder. Thirty diabetic patients and 30 healthy patients that were referred to Kosar hospital in Semnan during 2018, were selected by continuous sampling. The subjects were considered diabetic based on fasting blood sugar (FBS) levels of 126 mg/100ml or higher. The included patients fit in the 20-60 age category with the above-mentioned FBS level who signed an informed consent form, and exclusion criteria consisted of those who received antidepressants, antihistamines, decongestants, muscle relaxants and antihypertensives; individuals under chemotherapy and radiotherapy; a history of nerve damage due to head and face injuries, smoking and tobacco use, autoimmune diseases such as Sjögren's disease, AIDS and others; methamphetamine consumption and oral conditions that cause xerostomia irrelevant to diabetes.

Laboratory, anthropometric and clinical data collection

Unstimulated saliva was collected by the spitting method, in which the patients were asked to collect saliva in their mouth, then spit in a pre-weighed tube, every 60 seconds, do this for 5 minutes, then continue for 15 minutes. The confounding variables were identified. Data such as diabetes type, duration of illness, and the latest HbA1c test were also recorded in this questionnaire.

Statistical analysis

Data were then gathered in the form of data collection and analyzed using Shapiro Wilk, Chi-square, one-way ANOVA (t-student analysis), and Tukey's test in linear regression analysis and SPSS 23.0 with a 5% significance level; then, statistical analysis was performed.

Ethical approval

This study was approved by the Ethics Committee of the Semnan University of Medical Sciences (No. IR.SEMUMS.REC.1397.084).

Results

In this study, 30 patients with diabetes and 30 healthy people were evaluated, and the results were as follows:

46.7% (n = 14) of patients from the diabetic and control groups were female, and the sex distribution of the

Table 1: Mean and standard deviation of unstimulated saliva levels in patients with controlled and uncontrolled diabetes.

	HbA1c	Percentage	Number	Average	Standard deviation	p-value
Controlled diabetes	7>	40	12	0.08	0.02	0.006
Uncontrolled Diabetes	7 ≤	60	18	0.06	0.02	0.006

Table 2: The results of regression analysis on factors associated with unstimulated saliva levels in diabetic patients.

Variable	Regression coefficient (β)	The standard error	p-value
HbA1C	-0.039	0.006	<0.001
Constant coefficient	0.346	0.047	<0.001

two groups was homogeneous (P = 0.956). Mean ± SD of the age of the diabetic patients was 41.3 ± 12.0 years, and 42.9 ± 12.0 years for the control group; the difference was not significant (P = 0/541).

The mean ± SD of unstimulated saliva in the control group was 0.14 ± 0.02 ml/min.

Of the 30 diabetic patients, 60% (n = 18) had uncontrolled glucose levels (HbA1c was 7% or higher), and the rest had uncontrolled glucose levels. Mean ± SD of unstimulated saliva in controlled diabetic patients was 0.08 ± 0.02 ml/min and 0.06 ± 0.02 ml/min in uncontrolled diabetic patients; there was a significant difference (p = 0.006) (Table 1).

Linear regression analysis showed that only HbA1c had a negative and significant correlation with unstimulated saliva in diabetic patients (Table 2).

Discussion

The Mean ± SD values of unstimulated saliva in pre-diabetic patients was 0.12 ± 0.01 ml/min and 0.14 ±0.02 ml/min in the control group, which was statistically significant (p <0.001). Because this was the first time that unstimulated saliva was measured in pre-diabetic patients, no similar study was found based on our database search.

The mean ± SD values of unstimulated saliva in controlled and uncontrolled diabetic patients were 0.08 ± 0.02 ml/min and 0.06 ± 0.02 ml/min, respectively (p <0.006).

HbA1C shows the average blood sugar level in the last one to three months. When HbA1C levels were higher than 7%, the patients were considered as uncontrolled diabetics. Regarding the comparison between unstimulated saliva in controlled and uncontrolled patients in this study, decreased unstimulated saliva and increased xerostomia were demonstrated in uncontrolled diabetic patients.

Investigation of the relationship between unstimulated saliva content with HbA1C in order to determine long-term metabolic control of glucose despite multiple searches in all databases was unsuccessful, and the results were inconsistent.

Chavez EM et al. concluded in 2000 and 2001 that diabetic glucose control had an effect on salivation and decreased salivary HbA1C levels [10, 11]. However, regarding the relationship between salivary HbA1C levels and FBS, Andrades K. et al. showed in 2011 that the accuracy of salivary levels is higher than glycemic control, which may be due to the absence of a control group, which is critical in these studies [12].

Siudikiene et al. [13], Busato et al. [14], and Bernardi et al. [15] concluded that glycemic control does not affect the salivary flow rate, contrary to the results we have obtained in this study, which may be due to various reasons. For instance, Siudikiene et al. considered uncontrolled sugar levels above 9% [13], and Busato et al. had a small sample size, did not use a control group, and also opted for an 8% determination to indicate controlled and uncontrolled sugar levels [14], as well as in the Bernardi's et al. study [15].

As Ahadian et al. mentioned, xerostomia and a low unstimulated whole saliva (UWS) flow were more common in DM patients than controls; in addition, they proved that adequate glycemic control could prevent xerostomia, results which are consistent with those of the present study. [16]

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There are numerous oral manifestations in diabetic patients, many of which depend on the degree of glycemic control. Mucosal diseases include oral sensory disturbances such as a burning sensation of the mouth, changes in wound healing, xerostomia, increased incidence of infections (especially acute candidiasis of the tongue, buccal and gingival mucosa) [1, 17-20]. Also, diabetes mellitus is the proven risk factor of the prevalence and severity of gingivitis and periodontitis [20].

Pathophysiologically, in diabetes, xerostomia is a result of bilateral enlargement of the salivary glands or sialadenitis (especially regarding the parotid glands); the effects of anti-glycemic drugs, polyuria, and salivary gland neuropathy may be frequently associated with glycemic control [1]. Therefore, timely diagnosis of this complication, such as delay wound healing post-extraction [21] in pre-diabetic patients, can prevent further difficulties.

There were limitations in this study, such as the quality and chemistry of saliva, as well as the lack of cooperation of the patients that caused the specimens to shed, and more samples were taken to resolve these problems in order to provide a specific sample size.

Conclusion

Dry mouth was more prevalent in people with uncontrolled diabetes, so blood glucose level and its control had a significant effect on the reduction of unstimulated salivation.

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Conflict of Interest

The authors declare no conflict of interest.

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