Original Article

Evaluation of Salivary Glucose, IgA and Flow Rate in Diabetic Patients: A Case-Control Study

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Abstract:

Objective: An association between diabetes mellitus and alterations in the oral cavity has been noted. In this study, we evaluated differences between salivary IgA, glucose and flow rate in diabetic patients compared with healthy controls.

Materials and Methods: Forty patients with type 1 diabetes, 40 patients with type 2 diabetes and 40 healthy controls were selected. Whole unstimulated saliva samples were collected by the standard method and the salivary flow rate was determined. Nephelometric and Pars method were used to measure salivary IgA and salivary glucose concentrations, respectively. Statistical analysis was performed by Chi-square and t test.

Results: There were no significant differences in salivary IgA and glucose concentrations between type 1 and type 2 diabetic patients and their matched control subjects ($P>0.05$). Salivary flow rate was significantly lower in diabetic patients ($P<0.05$). In addition, DMFT was higher in diabetic patients than the controls.

Conclusion: Determination of salivary constituents may be useful in the description and management of oral findings in diabetic patients.

Key Words: Immunoglobulin A; Glucose; Diabetes Mellitus; Saliva

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INTRODUCTION

Diabetes mellitus is a metabolic syndrome characterized by hyperglycemia and disturbances in the metabolism of carbohydrates, proteins, and lipids [1]. Hyperglycemia is the main characteristic of diabetes which results from insufficient insulin secretion and hepatic gluconeogenesis [2,3]. Type 1 or insulin dependent diabetes and type 2 or none insulin dependent diabetes are the two major types of diabetes. The worldwide figure of people with diabetes is set to rise from 180 million in year 2000 to 320 million in 2025 [4,5]. This disease is clinically complex and associated with many complications such as nephropathy, retinopathy, neuropathy and cardiovascular diseases [6,7]. In addition, some oral complications in diabetic patients are xerostomia, tooth loss, gingivitis, periodontitis, odontogenic abscesses and soft tissue lesions of the tongue and oral mucosa [6,8,9]. It has been reported that the alterations in salivary flow rate and its compositions could affect the development, symptoms and severity of oral changes in diabetic patients and it also has been noted that detection of salivary constituents in diabetic patients

may be useful in the understanding and management of the oral manifestations [10-12].

MATERIALS AND METHODS

The patients participated in this study consisted of forty 9 to 61-year-old subjects with type 1 diabetes (19 male/ 21 female) and forty 39 to 82-year-old subjects with type 2 diabetes (20 male/20 female) from the Center of Diabetes Research in Hamadan, 2008. The control group consisted of 40 clinically healthy people (20 male /20 female) in the age range of 39 to 67 years who had been referred to Besat Hospital, Hamadan. Because of the age and weight differences between type 1 and 2 diabetes, the control subjects were divided into two sub groups according to age, sex, and weight. Exclusion criteria for the control group were pregnancy, alcohol dependency, smoking (former and current), any chronic diseases and history of diabetes within the previous years. Consequently, the control subjects did not report any health problems and did not take any medication other than vitamins or occasional analgesics. After explaining and completing an informed consent, all subjects were asked not to eat, drink (except water) and smoke for an overnight period prior to collection of saliva samples.

In addition, DMFT index was taken in diabetic patients and control subjects as a part of oral health assessment. Unstimulated whole saliva from the diabetic patients and control subjects was collected using the Navazesh method [13]. Collection of unstimulated whole saliva was done from each subject between 8:00 and 10:00 am. Firstly, the subjects were asked to swallow saliva and then stay motionless and allow the saliva to passively drain for five minutes over the lower lip into a pre-weighed test tube fitted by a funnel. Salivary flow rate volume was determined with a standard glass container. The saliva samples were centrifuged at 4000 rpm for 15 minutes to remove any particulate material and then supernatants were immediately frozen at -70˚C and stored for later analysis [1,13]. IgA was assessed by the nephelometric method (Minineph ^{TM} Human Kit, Binding Site Ltd, Birmingham, UK) and glucose by Pars method (glucose Oxidase Kit, Pars Azmoon Co, Tehran, Iran). Statistical analysis was performed using SPSS version 16 for windows software. All values were reported as mean (SD). The statistical signification was measured by t-test and Chi-square test for quantitative and qualitative variables, respectively. P value, less than 0.05 was considered as significant.

RESULTS

Demographic data of the subjects are shown in Table 1. There were no significant differences between the patients and control subjects considering sex, age, and weight. Salivary IgA, glucose, and flow rate values in diabetic patients and control groups are shown in Table 2. There were no significant differences in salivary IgA between type 1 diabetic patients and control group 1 (P=0.15). This was the same for type 2 diabetic patients and control group 2 (P=0.67). No significant difference in salivary glucose concentration was found between type 1 diabetic patients and control group 1 (P=0.88) as well as type 2 diabetic patients and

Table 1. Characteristics of patients with diabetes mellitus and control subjects.

Group	Age (year)			Sex	Weight (Kg)		
	mean	SD	range	(male/female)	mean	SD	range
Type1 diabetes (n=40)	[a] 28.8	11.63	(9-61)	[c](19.21)	[e]62.92	9.92	(28-86)
Control 1 subjects (n=20)	[a] 27.65	5.65	(20-38)	[c](10.10)	[e]62.55	13.59	(47-80)
Type2 diabetes (n=40)	[b]54.02	10.10	(39-82)	[d](20.20)	[f]61.35	11.43	(50-86)
Control 2 subject (n=20)	[b]54.3	7.11	(40-67)	[d](10.10)	[f]71.9	10.31	(54-90)

[a,b,c,d,e,f]: Values with the same letters were not significantly different (P> 0.05).

control group 2 (P=0.19). However, the salivary flow rate was significantly lower in type 1 and type 2 diabetic patients compared to the matched control groups (P=0.000 and P=0.001, respectively). Moreover, there were no significant differences in salivary IgA (P=0.12) and glucose concentrations (P=0.18) between type 1 and type 2 diabetic patients. DMFT index was higher in the two diabetic patient groups than their matched control subjects (Table 3).

DISCUSSION

Blood sample is the most common biologic fluid utilized for diagnosis and monitoring of diseases. However, whole saliva is frequently studied as an alternative for blood that can be useful even for diagnostic purposes. Whole saliva contains locally produced substances as well as serum components that can be used for diagnosis of a variety of systemic diseases and understanding of their oral manifestations [14]. Two of the advantages of salivary assessment are its non-invasive collection and cost effectiveness for screening large populations [14].

Mata et al [15] reported alterations of salivary composition in diabetic patients. These biologic changes in diabetic whole saliva were different from one study to another that may be due to the diversity in sample selection criteria and study design [16]. In this study, we found no significant differences in salivary IgA levels between diabetic patients and their matched controls. Yavuzyilmaz et al [10] demonstrated a significant increase in salivary IgA levels in diabetic patients. They suggested that it could be related to local factors such as calculus and higher bacterial plaque accumulation in these patients. The findings of this study on salivary IgA levels were in contrast with other studies [17-19]. These differences may be due to differences in the type of saliva collected (stimulated or unstimulated), the salivary collection methods, the stage of the disease, and the metabolic control status of the disease. The salivary glucose concentrations in the present study were in disagreement with other studies [18,20-22]. Belazi et al [18] showed higher salivary and serum glucose concentrations in children with insulin dependent diabetes mellitus. Aydin [20] showed that salivary glucose and α-Amylase levels were higher in diabetic subjects than controls.

Darwazeh et al [21] demonstrated concentration of salivary glucose was related to blood glucose but there was no relationship with HbA1c. Furthermore, Kjellman [22] detected higher levels of glucose in the whole saliva and gingival fluid of patients with diabetes mellitus. These differences may be due to the diabetes status and glycemic control. Reuterving et al [23] demonstrated that salivary glucose concentration was lower during better glycemic control. Review of the literature about salivary flow rate in diabetic patients has demonstrated some differences [20].

Salivary flow rate in the present study was decreased in diabetic patients but this finding was in disagreement with Lamey et al study [24]. Aydin [20] has also showed no difference

Table 2. Salivary IgA, glucose, and flow rate values in diabetic patients and control subjects.

Groups	IgA (mg/l)			Glucose (mg/dl)			Flow Rate (ml/min)		
	Mean	SD	P value	Mean	SD	P value	Mean	SD	P value
Type1 Diabetes	0.100	0.150	0.15	14.52	10.46	0.88	0.21	0.09	0.000
Control 1	0.069	0.030		14.82	8.36		0.49	0.27	
Type2 Diabetes	0.066	0.032	0.67	18.67	16.54	0.19	0.32	0.14	0.001
Control 2	0.067	0.200		15.61	9.10		0.39	0.17	
Type1 Diabetes	0.100	0.150	0.12	14.52	10.46	0.18			
Type2 Diabetes	0.066	0.032		18.67	16.54				

SD= Standard Deviation

Table 3. DMFT mean values in diabetic patients and control subjects.

Groups	DMFT			
	Mean	SD	Max	Min
Type1 Diabetes	10.16	4.52	22	2
Type2 Diabetes	13.42	5.09	24	5
Control 1 Subjects	8.26	3.85	15	1
Control 2 Subject	10.55	2.59	16	5

SD= Standard Deviation, Max= Maximum, Min= Minimum

in the salivary flow rate between diabetic and control subjects. Nevertheless, a decreased salivary flow rate has been noted in diabetic patients by Ogunbodede et al, Chávez et al, and López et al [25-27]. Negative effects of diabetes mellitus on the sympathetic and parasympathetic nervous system, microangiopathy, dehydration and hormonal changes may cause discrepancies in the salivary flow rate [11,28]. In addition, it was demonstrated that neuropathies affecting the parasympathetic or sympathetic nervous system might have different effects on the flow rate and composition of saliva [19].

DMFT index in the present study was higher in diabetic patients compared with control subjects. Decreasing the salivary flow rate and xerostomia may result in dental problems and is compatible with a higher rate of DMFT, which was in agreement with Collin's et al study [28]. Moreover, the higher rate of dental problems in diabetic patients may be related to salivary dysfunction, existing acidogenic microorganisms, poor glycemic control, poor dental hygiene and higher dental plaques [26,29,30]. It has been noted that the antimicrobial function of saliva is not impaired in diabetic patients but caries protective properties of saliva might be less effective [28].

CONCLUSION

In the present study, no significant differences were found in salivary IgA and glucose concentrations between type 1 and type 2 diabetic patients and control subjects. Significantly, lower salivary flow rate and higher DMFT values were observed in diabetic patients when compared to the controls. Since alterations in the oral cavity may have some role in the development and severity of oral changes, determination and monitoring salivary constituents may be useful in the description and management of oral findings in diabetic patients.

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