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Salivary Alpha-Amylase Alteration as a Possible Indicator for Diabetes

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ABSTRACT

Diabetes mellitus has been documented to be associated with alterations in salivary composition and function. Therefore, the main aim of this case-control study was to determine the alterations of salivary alpha-amylase in diabetics compared to healthy people. A total of 40 type 2 diabetic subjects (15 male/ 25 female, aged from 42-70 years, mean age 55.6 ±7.11) were selected. Also, the control group consisted of 40 clinically health people (20 male/ 20 female, aged from 49-70, mean age 56.08 ±8.8).Salivary alpha-amylase, salivary flow rate and DMFT index were evaluated in these two groups. Data were analyzed using Chi-square test and t-test. There were significant differences in salivary alpha-amylase level, salivary flow rate and DMFT index between diabetic patients and control group. Salivary level of alpha- amylase is significantly higher in diabetics compared to healthy people. Our results in consistent with the literature propose an idea regarding the possible role of salivary alpha- amylase as a diagnostic aid.
KEY WORDS: Saliva, Alpha-amylase, Diabetes, Diagnosis, Iran

INTRODUCTION

Diabetes is a metabolic disorder characterized by abnormalities in the metabolism of carbohydrate, lipid and protein that results either from a profound or an absolute insufficiency of insulin secretion (type 1) and/or target tissue resistance to its cellular metabolic actions (type 2) [1,2]. The world wide number of diabetics is set to rise from 180 million in year 2000 to 320 million in 2025 [2,3]. Diabetic patients suffer from many systemic complications .For example, presence of myocardial infarction, blindness, and end stage renal disease [4]. Diabetes mellitus has been documented to be associated with alterations in salivary composition and function [1]. Although differences in salivary compositions from diabetic and non diabetic subjects have been evaluated in some previous studies, but these findings were not classified.

The use of saliva rather than serum has recently been promoted as a diagnostic medium. Saliva offers advantages over blood because it can be collected non-invasively by persons with modest training, and it offers a cost-effective approach for the screening of large samples [5].

Amylase is one of the most important enzymes in saliva. This enzyme was first described in saliva in year 1831 [6]. Basement membrane permeability of the parotid gland is higher in diabetics which can lade to greater level of salivary alpha-amylase in these patients [1,7]. In contrast, lower level of alpha-amylase in diabetics compared to healthy subjects was reported by some authors [8-10]. Therefore, the main aim of this case-control study was to determine the alteration of salivary alpha-amylase in diabetics compared with healthy subjects. In addition, we also reviewed the results of previous studies from 1942 up to now.

MATERIALS & METHODS

Participants:

With approval from the institutional ethics committee, this study was carried out at the Department of Oral Medicine, Dental School, Hamadan University of Medical Sciences, Hamadan, Iran. The group of patients was recruited from members of Hamadan Research Diabetes Center. A total of 40 type 2 diabetic subjects (15 male/ 25 female, aged from 42-70 years, mean age 55.6 ±7.11, duration of disease 11±5.7 were selected. Also, the control group consisted of 40 clinically health people (20 male/ 20 female, aged from 49-70, mean age 56.08 ±8.8). Informed consent were taken from all individuals participated in the study.

The case and control groups were matched with their age, sex, weight and body mass index. Subjects were informed about the aim of the investigation and written consent was obtained from all participants. Exclusion criteria for control group are listed as follows: pregnancy, smoking, alcohol dependency, chronic diseases and history of diabetes within the previous years, history of medications within the previous three months. All

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persons were asked not eat, smoke and drink (except water) for an over night prior to collection of saliva samples [2,11].

Salivary collection:

Un-stimulated whole saliva from diabetics and control group was collected according to the Navazash method [12]. Saliva collection was done between 8:00 and 10:00 a.m. The subjects were asked to swallow saliva and stay motionless and allow the saliva to flow for 5 minutes over the lower lip into a pre-weighed test container fitted by a funnel. Saliva samples were centrifuged (at 4000 rpm for 15 minutes) and the supernatants were immediately frozen at -70°c and stored for analysis. Salivary alpha-amylase was measured using specific kit (alpha-amylase kit, Parsazmoon Co, Tehran, Iran). Salivary flow rate was measured in term of millimeters per minute. In addition, DMFT (decayed, missing and filling teeth) index was calculated according to the Berker [13] et al., in diabetic and control groups as a part of oral health assessment. The DMFT index was created to express caries experience. The D component is for untreated caries, M for missing teeth, and F for filling. The T means index per tooth [13].

Statistically analysis:

The data were analyzed via SPSS for windows software (version 18). The statistical signification was measured using Chi-square and t-test for qualitative and quantitative variables, respectively. The level of significance was p.value less than 0.05.

RESULTS

The demographic characteristics of the diabetic and control groups based on interview are shown in table 1.There were no significant differences in age, sex, weight and body mass index between diabetic and control groups. There were significant differences in salivary alpha-amylase level, salivary flow rate and DMFT index between diabetic patients and control group (Table 2).

In this study the results of previous studies (from 1942 up to now) were reported in the article and tables 3,4.

Table1. Characteristics and interview data of patients and control group

Characteristics and interview data	Type 2 diabetes	Control group	P.value
Age (Years),(mean ±SD)	(55.6 ± 7.11)	(56.08 ± 8.8)	0.44
Sex(male/female),(n/n)	(15/25)	(20/20)	0.25
Weight(Kg),(mean ±SD)	(72.32 ± 13.15)	(73.02 ± 11.13)	0.32
Body mass index	(26.77±1.43)	(24.91±1.22)	0.50
Sensation of dry mouth (n:%)	21:52.5	0	0.006
Sensation of burning mouth (n:%)	7:17.5	0	0.000

Table2. Salivary α-amylase, flow rate and DMFT in studied groups

Study groups	Salivary α- amylase AU/dl	Flow rate ml/min	DMFT Index
Type 2 diabetic patients	106.217±77.6	0.39±0.17	13.42±5.09
Control group	68.257±29.2	0.22±0.11	10.55±2.59
P.value	0.05	0.001	0.003

DISCUSSION

In our study, salivary alpha-amylase level was significantly higher in diabetics than control group. This finding was in agreement with Aydin [11], López [14] et al., Pal [15] et al., Meaurmen [16] et al., Dodds [17] et al., Ben-Aryeh [18] et al., Recio [19] et al., and Hu [20] et al. However, there are studies with opposite findings. Our search showed that the number of studies reporting the higher level of salivary alpha-amylase in diabetic patients was greater than those showed lower level of salivary alpha-amylase (11,14-22, 1,8-10,23). Some 5 previous reports about the salivary alpha-amylase alteration in diabetic patients were summarized in table 3 [1,8-11,14-23]. Differences in findings may be related to variations in glycemic control, duration of disease, or age of patients. Meanwhile, according to several studies reporting high levels of salivary alpha-amylase in diabetic patients, it seems that salivary level of this enzyme can be used as a non invasive diagnostic aid, which needs further investigation to be approved. Mandel [24] et al., and Murrah [25] et al., demonstrated that increased basement membrane (BM) permeability ,associated with diabetes, is one of the most important possibilities for the increased passage of proteins (such as amylase) from parotid glands into their secretions in some patients. These changes in BM permeability may also lead to an enhanced leakage of serum derived components into saliva via gingival crevices. In a recent study, Piras [7] et al., showed a greater expression of the amylase and cyclic AMP receptor in parotid glands of diabetic patients than that of non-diabetics. In this present report, salivary flow rate was significantly lower in diabetics than control group. This finding was in

agreement with Bakianian Vaziri [2] et al., and Ben-Aryeh [18] et al. In addition, both increase or decrease of salivary flow rate in diabetics were also reported in previous studies.[1,2,9,11,13,16,18,21,26-37] Decrease in diabetic salivary flow rate may be related to the negative effects of diabetes on the autonomic nervous system (sympathetic and parasympathetic), polyuria, microangiopathy, dehydration, hormonal changes, local inflammations, infections and drug therapy for diabetes [1,2]. Meurman [16] et al., reported that decrease in salivary secretion in type 2 diabetes seems to be particularly related to xerogenic drugs and autonomic neuropathy.

In our study, complaint of dry mouth and burning mouth sensation was significantly higher in diabetic subjects than healthy group. This finding is in agreement with Bakianian Vaziri [38] et al. Dryness of the mouth associated with diabetes was first described in 1942 [39]. Carda [34] et al., also showed that type 2 diabetes can be a risk factor for dry mouth. In addition, Newrick [21] et al., demonstrated that this feature is related to microvascular disease and neuropathy affecting the major salivary glands. Prolonged dryness may contribute to oral infections, altered taste, oral malodor and oral mucosal soreness [40]. In contrast to these findings, Ogunbodede [26] et al., did not find any significant differences in burning mouth sensation, mucositis, glossitis, angular cheilitis and altered taste between diabetic and non diabetic persons.

According to our report, DMFT index was significantly higher in diabetics than control group. This result is in agreement with Bakianian Vaziri [38] et al., and Albrecht [41] et al. Albrecht [41] et al., demonstrated that higher rates of DMFT index in diabetic patients have usually been determined to be due to grater number of missing teeth. This finding was also supported by Norlan [42] et al. Moor [43] et al. pointed out that the prevalence of decayed and filled surfaces in the root was significantly higher in diabetic subjects as compared to control group. This difference was not significant for decayed and filled surfaces in the crown. Karjalainen [44] et al described that poor glycemic control in type 1diabetes could be a risk factor for dental caries, while type 2 diabetes seemed to have no effect on the occurrence of dental caries. Furthermore, Pohjamo [45] et al. found a higher prevalence of lingual surface caries in diabetic patients. They also assumed that this finding might be related to a high glucose level in gingival exudates. According to Carda [34] et al., moderate dental caries, severe dental caries, tooth loss less than 10 and more than 10 were seen in 23.5%, 52.9%, 29.4% and 47.0% of diabetic patients, respectively. In contrast to these findings, Collin et al., found no significant relationship between diabetes and occurrence of dental caries in diabetic adults. Also, Collin et al showed that the count of S. mutans, lactobacilli and yeasts did not differ between diabetics and nondiabetics.

In addition, it is demonstrated that a salivary flow rate of at least 0.8 ml/min was related to dental caries [46]. These differences in presented results about dental caries may be related to difference in level of blood sugar, glycemic control, salivary dysfunction, dietary habits, oral hygiene, age or type of diabetes [2,38,42]. In our study, two groups were matched in terms of age, sex, BMI, and weight. Moreover, all diabetic patients had type 2 diabetes. In order to confirm the hypothesis of "salivary alpha amylase as a diagnostic tool", more comprehensive studies with adequate sample size and matching of two groups in terms of duration of diabetes, level of glycemic control, and diabetic complications are needed. In addition, it is suggested that the study be conducted on pre diabetics instead of control group.

Conclusions: According to the results of this study, the salivary level of alpha- amylase is significantly higher in diabetics compared to healthy people. Our results in consistent with the literature propose an idea regarding the possible role of salivary alpha amylase as a diagnostic aid, but further studies should be done to clarify our findings.

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