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The Relation of Some Salivary Physiochemical Characteristics with Periodontal Status in Type I Diabetic Patients

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Abstract

Diabetes mellitus plays a substantial role in the dentition and oral health. Oral manifestation identified with Diabetes mellitus may have a strong inclination to periodontal disease. This study was to assess the relation of salivary pH, flow rate, and buffer capacity with severity of periodontitis among patients with type 1 diabetes mellitus in comparison with healthy volunteers. A study was conducted on 58 volunteers (aged 18-25 years), of them 28 volunteers had type I diabetes mellitus (study group), and 30 volunteers were health persons with absence of medical conditions that could decrease salivary flow (control group) from both genders. Stimulated whole saliva was collected, salivary flow rate (ml/min), pH, and buffer capacity were measured and they examined orally to evaluate the plaque index according to Sinless and Löe (1964) and the calculus index according to Green and Vermillion (1964), all information recorded. There were a significant difference (p-value<0.01) in plaque index in the diabetic group in compared with heathy group, while the calculus index shown no differences. The salivary pH decreased significantly (p<0.045) in diabetic group in compared with heathy group, while other parameters (salivary flow rate and buffer capacity) had no effect. There were no differences in both genders.Periodontitis can be seen in the same severity in both genders, and in diabetic patients more than the normal individuals. The clinical indicators of periodontitis that observed in diabetic patients are more common than the normal individuals.

Introduction:

"Diabetes mellitus defined by the World Health Organization (WHO) as metabolic disorder of several etiological factors, resulting from defects in insulin action, insulin secretion or both and characterized by chronic hyperglycemia which associated with disturbances of carbohydrate, protein and fat metabolism" [(1)]. There are two main types of diabetes mellitus (DM): type I or insulin-dependent diabetes mellitus (IDDM), which is the most common

endocrine metabolic disorder of childhood and adolescence and type II or non-insulin-dependent diabetes mellitus (NIDDM) [2]. It is a disease, which may induce several oral manifestations. Oral problems seem to be related to the degree of metabolic control, usually measured as the concentration of glycosylated haemoglobin, Hblc. The introduction of self-blood glucose monitoring and intensive insulin treatment regimens had improved the possibility to achieve near normal blood glucose levels [3]. Generally, NIDDM manifests at adulthood (>40 years) [4], and the risk of NIDDM increases with age, reach maximum level between the age of 65 and 74 years [5]. It's appears to be related to a genetic predisposition (non-immune cause), since no destruction of pancreatic cells is seen microscopically [6]. As a result of vascular alterations and neuropathies in diabetic patients, dental patients with a DM have a higher vulnerability to infections [7]. One of the most important oral manifestation of diabetes is the periodontitis which is a chronic disease characterized by inflammation and destruction of the supporting parts of the teeth (the periodontal ligament and alveolar bone). It considers as one of the most significant health problems; since periodontitis leads, if not treated, to loss of teeth in its terminal stages [8]. Saliva is a complex secretion. 99% of saliva is water and 1% of saliva is consist of organic and non-organic molecules. The components of saliva maintain oral health, its plays an essential role in maintaining the integrity of the oral structures, in the digestion, and in the oral infections control [9]. Saliva buffering capacity maintains oral pH to guarantee teeth integrity and to prevent acid produce by bacterial plaque [10]. The aim of the current study was to assess the relation of salivary pH, flow rate, and buffer capacity with severity of periodontitis among patients with type 1 diabetes mellitus in comparison with healthy volunteers.

Subjects and methods:

Subject Sample

The study was carried out from October 2016 to march 2017. The study group is comprised of 58 volunteers, their ages ranged between 18-25 years old. Both genders were considered. The study group included 28 diabetic adult's patients; they were examined at Teaching Hospital in Tikrit city, Iraq. All of them were confirmed to have type 1 DM with a minimum duration of at least 5 years. While the control group was including 30 adults, healthy-looking dental students. Verbal consent was obtained from each participant after explaining the aim of the study to them, and they were accepted to participate in this study.

Saliva Collection

Stimulated salivary samples was collected under standard condition following Tenovuo and Legerlof [11] instruction. Stimulated mixed saliva were collected by uniform stimulus (Arabic gum), at the room temperature, the saliva collected by spiting in a sterile calibrated test tube with labeled screw capped, the collection time fixed as [5] minutes. All individual instructed to rinse their mouth with water before saliva collection. Estimation of salivary flow rate (ml/min) done via dividing saliva volume (ml) by the fixed collected time (min) at the time of collection. while the pH of saliva was measured by using an electronic pH meter, which done 1-2 hours after collection, the buffer capacity of saliva was measured according to that clarify by Ericsson in 1959 [12], after measuring the pH of saliva. Under standardized conditions, the oral examination was carried out following the basic methods of WHO for oral health surveys [13]. Dental Plaque scored following Silness and Loe [14] criteria of Plaque Index (PlI). This index was used for assessment of plaque accumulation, and recorded before salivary sample collection. The four surfaces of each tooth except the third molar were examined and scored in. While the Dental Calculus scored following the Simplified Oral Hygiene Index of Green and Vermillion criteria of Calculus Index (CalI-S) [15], which recorded also by examining the four surfaces of each tooth except the third molar and scored in. Statistical Analysis of the data were performed using SPSS version 23. The statistical tests included t-

test and Pearson's correlation coefficients. P-values <0.05 were considered statistically significant, and highly significance when P-value< 0.01.

Results:

Table (1), shows the mean and standard deviation of plaque index and calculus index among the study and control groups. It was found that the mean value of plaque index was higher (1.714±0.299) in the study group than that in the control group (0.8±0.188) with statistically significant of (p-value<0.05). While the mean value of calculus index was non-significant among both group. There was no significant difference among both genders for both plaque and calculus indexes. Table (2) represents the salivary pH and the flow rate of secretion of stimulated saliva expressed in ml/min, in addition to buffer capacity of saliva for the study and control groups. The result showed that the total samples of the salivary pH were increase statistically with significant (p<0.05) in the control group (7.413±0.046) when compared to the study groups (7.260±0.058), while the other parameters (flow rate and buffer capacity) shown no effect in both groups and for both genders. Table (3) shows the correlation between salivary pH, flow rate and buffer capacity with oral variables (PlI and CalI) in both groups. It was found that no significant co relations between salivary parameters and oral variables in study and control groups (p-value>0.05).

Discussion:

Diabetes is among the most well-known endocrine issue and has numerous foundational impacts. In children and adolescents with IDDM, the disease plays a significant part in the dentition and oral health. The outcomes of DM concerning oral health are regarding the fundamental changes caused by the infection; however, the outcomes are in certain cases clashing. Oral findings identified with DM may have a strong effect to periodontal disease [(16)]. In this study, there was a relation between the diabetes disease and the periodontal disease by certain increased in the plaque accumulation (which is the main cause of periodontal diseases) which is significantly higher in diabetic patients in comparison to normal subjects. These results agree with many researchers like Löe [(17)], who considered periodontal disease the 'sixth' complication of diabetes, and Rees [(18)], who in a review paper, concluded the evidence that there is an immediate connection between diabetes mellitus and periodontal infection, Also with Chandna et al. [(19)], who considered periodontitis as a distinguish complication of DM and it was more common in patients with high levels of glucose, and Sarita et al. [(20)], who conclude that diabetic patients had significantly higher oral complications compared to those without diabetic disorder. The patient with type I DM had a great risk of oral candidiasis, attachment loss, and gingival bleeding. Evidence showed that periodontitis in patients with poor glycemic control is at risk for the development of further complications of diabetes. Also in this study, the salivary pH in DM patients (study group) was decreased significantly more than normal subjects (control group). This may be attributed to the metabolic changes in DM patients which results in increase the glucose level leads to acidic environment, and thus associated periodontitis, also have a secondary effect lead to decrease salivary flow rate and pH value. In diabetic patients, there is reduction in the level of bicarbonates in all body fluids, which lead to metabolic acidosis of all body fluids. This agree with Gamze *et al*. who found that the mean values for salivary pH from the diabetic groups were significantly lower than that in control groups [(21)]. He suggests that increase level of glucose in the oral cavity will reduce pH as it elevates the acids produce by cariogenic bacteria [(22)]. The acidic salivary pH of patients with IDDM is a strong clue of reduced salivary buffer capacity and increased risk of dental caries. In this study, female volunteers were rated lower than the male; this limited number of female that analyzed at time of data collections restrict the study. The higher level of glucose in oral fluids influences

bacterial proliferation, increasing dental plaque formation and consequently leads to periodontal disease. In addition, this can increase the risk of oral health problems such as gum disease, which occurs when bacteria within the mouth begins to form into a sticky plaque which sites on the surface of the teeth and are not related to the genders. Finally, this study showed signs (but not significant) of hyposalivation. The diminished salivary flow rate might reflect the presence of neuropathy in type I DM patients, through an implication in saliva secretion. Dehydration may lead to irreversible changes in the salivary gland structures in patients with IDDM. These salivary disorders could be associated with poor quality of life could increase the susceptibility to caries.

In conclusion, periodontitis can be seen in the same severity in both genders, and more severe in diabetic than non-diabetic group. The clinical indicators of periodontitis that observed in diabetic patients are more common than the normal individuals. Dental experts need exhaustive information of their diabetic patients, learning that having diabetes is not adequate to evaluate the impacts of the disorder regarding oral disease and dental care. This requirement is underlined by the high and regularly expanding number of diabetic patients in Iraq. Diabetic patients should focus on dental health and direction to oral treatment. At last, teamwork for the treatment of patients with diabetes is profoundly suggested.

Table (1): Mean Values of the Oral Health Status among the Samples by Genders in Control and Study groups.

Parameters	**Sex**	**Control Group**		**Study Group**		**t- test**	**P-value**
		No.	**mean±SD**	**No.**	**mean±SD**		
Plaque index	Male	6	1 ± 0.355	22	1.909 ±0.353	1.28 n.s	0.211
	Female	24	0.75 ±0.219	6	1 ±0.447	0.51 n.s	0.615
	Total	30	0.8±0.188	28	1.714±0.299	**2.62**	**0.011**
Calculus Index	Male	6	0.666±0.333	22	1.363±0.233	1.45 n.s	0.158
	Female	24	0.708±0.221	6	0.5±0.233	0.45 n.s	0.654
	Total	30	0.7±0.185	28	1.178±0.199	1.75 n.s	0.08

Significant of bold value was $p<0.05$.
n.s; non significant.

Table (2): The differences of salivary physicochemical characteristics according to genders in control and study groups

Parameters	Sex	Control Group		Study Group		t- test	P-value
		No.	mean±SD	No.	mean±SD		
pH	Male	6	7.466±0.058	22	7.281±0.073	1.28 n.s	0.212
	Female	24	7.4±0.056	6	7.357±0.060	1.84 n.s	0.076
	Total	30	7.413±0.046	28	7.260±0.058	**2.05**	**0.045**
Flow rate	Male	6	5.166±0.494	22	5.372±0.280	0.35 n.s	0.732
	Female	24	5.6±0.383	6	6.166±1.046	0.61 n.s	0.543
	Total	30	5.513±0.330	28	5.542±0.308	0.07 n.s	0.947
Buffer capacity	Male	6	5.416±0.087	22	5.35±0.061	0.53 n.s	0.602
	Female	24	5.35±0.051	6	5.516±0.119	1.41 n.s	0.170
	Total	30	5.363±0.044	28	5.385±0.055	0.32 n.s	0.751

Significant of bold value was $p<0.05$.
n.s; non significant.

Table (3): Correlation Coefficient of Salivary Physicochemical Characteristics among the Sample by Genders in Study and Control groups.

Salivary parameters	**sex**	**Plaq. Index**				**Cal. Index**			
		Control Group		**Study Group**		**Control Group**		**Study Group.**	
		R-value	**p-value**	**R-value**	**p-value**	**R-value**	**p-value**	**R-value**	**p-value**
pH	Male	0.327 n.s	0.536	0.097 n.s	0.666	-0.478 n.s	0.377	-0.006 n.s	0.972
	Female	-0.380 n.s	0.066	-0.248 n.s	0.635	-0.159 n.s	0.456	0.372 n.s	0.467
	Total	-0.305	0.100	0.103	0.598	-0.133	0.332	0.055	0.777
Flow rate	Male	0.276 n.s	0.595	0.254 n.s	0.253	-0.235 n.s	0.652	-0.281 n.s	0.204
	Female	-0.366 n.s	0.078	0.000 n.s	1.000	-0.128 n.s	0.550	0.213 n.s	0.684
	Total	-0.305 n.s	0.101	0.118 n.s	0.549	-0.135 n.s	0.477	-0.219 n.s	0.262
Buffer capacity	Male	-0.631 n.s	0.179	0.169 n.s	0.450	-0.420 n.s	0.406	-0.136 n.s	0.545
	Female	0.209 n.s	0.327	0.436 n.s	0.386	0.183 n.s	0.391	0.311 n.s	0.547
	Total	0.107 n.s	0.571	0.135 n.s	0.492	0.106 n.s	0.573	-0.159 n.s	0.416

n.s: non-significant.

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