The relationship between the dental caries and the blood glucose level among type II non insulin dependent diabetic patients

Hawraa Khalid Aziz, B.D.S., M.Sc. [(1)]

ABSTRACT

Background: Diabetes mellitus is one of the most common chronic diseases in the general population that effects the oral cavity so the probability of detecting an increased of dental caries in diabetic patients is more controversial. The aims of this study to compare the dental caries among the diabetic and non diabetic patients and its relation with the blood glucose level, medical history and oral health behaviors among type II non-insulin dependent diabetic mellitus patients.

Materials and methods: The samples were composed of 180 subjects of diabetic patients and 180 subjects of non diabetes. Both gender and age range 40 -70 years for both groups. The data were gathered by questionnaire, clinical examination and laboratory investigations included frequency of oral hygiene practices, caries experience using the DMFT Index, blood glucose including the fasting blood glucose level, and random blood glucose level. Independent t-test, Chi-square, correlation coefficient, as well as Z-proportion tests were used for statistical comparisons.

Results: It indicated that there was no significant difference in DMFT between the diabetic and non-diabetic groups. In addition to blood glucose level was higher in diabetes than non diabetes with increased dental caries with the increase of blood glucose level either random or fasting blood glucose level.

Conclusion: This study indicated that the presence of dental caries is not significantly elevated in most diabetics but the blood glucose level and the age effect on the dental caries as well as diabetic subjects should improve their oral hygiene practices.

Key words: dental caries, diabetes mellitus, blood glucose level, oral hygiene. (J Bagh Coll Dentistry 2012; 24(sp. Issue 1):108-114).

INTRODUCTION

Diabetes mellitus (DM) is a common chronic metabolic disorder which affects millions of people. The prevalence of diabetes for all age groups worldwide was estimated to be 2.8% in 2000 and may reach 4.4% by 2030. Additionally, the diabetic population is expected to rise from 171 million in 2000 to 3666 million by 2030 [(1)]. Roglic reported that the almost 3 million deaths per year are attributed to diabetes, equivalent to 5.2% of all deaths [(2)]. There are two basic types of the diabetes mellitus: type I diabetes mellitus is caused by autoimmune damage to the pancreatic beta cells resulting in failure of insulin production and secretion leading to absolute insulin deficiency. Hence individuals with type I diabetes are prone to ketosis in the basal state and depend on life exogenous insulin injection to prevent ketosis and sustain health. It occurs primarily in persons younger than 40 years but also occur at any age. While type II diabetus mellitus occurs as aresult of insuln resistance with relative isulin dificincy. Patients with type II are not ketosis-prone under normal condition. The majoraty of type II diabetes are adult above 40 years of age. However occure in younger age groups. The globel prevalance of young type II inceased in last two decades [(3)] .

As a systemic disorder, the disease affects the oral cavity. Investigators have reported several oral lesions and conditions associated with the disease. These include among others, xerostomia, burning mouth, altered taste sensation, gingivitis, periodontal disease, candidal infection and lichen planus [(4-6)] .

However, among researchers there was a lack of consensus about the relationship between DM and dental caries. They reported increased [(7-9)], decreased [(10)] and similar [(11,12)] caries experiences between those with and without diabetes.

Taylor and others concluded in their literature review that there was insufficient evidence to determine whether a relationship exists between diabetes and coronal or root caries risk,and they recommended that further investigations should be carried out [(13)] .

Beside the contradictory findings on caries prevalence in diabetic populations, similarly conflicting results have been reported on the identity of the underlying risk factors of such relationships [(14)]. It is not clear whether this variability is mainly related to different patho-physiologic changes of diabetes such as the type, duration or degree of control, or is in part a reflection of racial and environmental differences among diabetic populations worldwide. Therefore the association between the variation of the blood glucose level to assess the degree of the control of

(1)Lecturer. College of Health and Medical Technologies Foundation of Technical Education. Baghdad.

the disease as well as the efforts should be made to evaluate the etiological risk factor of dental caries such as oral health among diabetic groups [15].

By all of the above information, this study was carried out with the following objectives:

1. To compare between the distibution of the diabetic and control subjects according to the age and gender and oral health status.
2. To evaluate the dental caries among the group of diabetics versus non-diabetic controls and its relation to the age.
3. To evaluate the blood glucose level among a group of the diabetics and non-diabetic group and its effect on the caries experience.
4. To evaluate some selected caries-risk factors and its relation to dental caries in the sampled diabetics.

MATERIALS AND METHODS
Study Population
One hundred eighty diabetic patients and 180 healthy controls participated in this study. The diabetic group was recruited from the diabetic patients of health care centers and Al-hussain hospital in Karbala city with age range from 40-70 years old during sampling day were asked to participate and 100% of those who were invited to participate in the study agreed. The control group included age and gender-matched healthy volunteers with no history of diabetes. Individuals who had received antibiotics or steroid therapy or had been using antiseptic mouthwashes during the previous 3 weeks were excluded from the study. Also they had no history of any other systemic disease, or under medication therapy, no orthodontic treatment or wearing any prosthodontic appliance.

Data Collection
The data were gathered through questionnaire, clinical examination and laboratory investigations. The questionnaire included questions on medical history and oral health behaviors. Medical history records were included duration of the diabetes, physician follow up, degree of the control of the diabetic state well controlled or poor controlled. The oral health behaviors included the frequency of the tooth brush per day and the type of oral cleaning methods tooth brush only or both tooth brush with dental floss. Also they asked about the regular dental visit and if they are smokers or not which are rated on scale yes or no.

Clinical Examination
The clinical examination included an evaluation of dental caries, by using dental mirror and dental probe under light source. The dental caries was assessed using the decayed missing filled teeth (DMFT) Index according to the criteria and recommendations of the World Health Organization [16].

Laboratory examination
The blood samples were collected from each participant diabetic and non diabetic. The fasting blood glucose level (FBGL) and random blood glucose level (RBGL) were assessed by "One Touch TM®" complete blood glucose monitoring system, Johnson & Johnson, California, USA. For diabetic patients, the sample of blood was used to measure the glycosylated hemoglobin concentrations (HbA1c) which assess the glycemic control of that patient by measuring three fasting blood glucose level [17]. Those with values measures of less than or equal to 7 mmol / ml (< 120 mg/dl) were classified as indicating satisfactory (good) control of diabetes while the values more than 7 mmol / ml (>120 mg/dl) were classified as poor control of diabetes [18].

Statistics
Data were collected and analyzed using SPSS program version 12. The data were analyzed descriptively and comparison between the groups was done using independent t-test, Chi-square, correlation coefficient, as well as Z-proportion test whenever applicable.

RESULTS
The distribution of participating subjects according to the age, gender is shown in (Table1). The caries experience and its components showed the mean of DT component for diabetes group was higher than the mean for the non diabetic, also the mean of MT component for the diabetes was higher than those for non diabetes, while the mean of the FT component for diabetes was lower than those for control group, finally the mean of the DMFT for diabetes was more than those for the non diabetes group. The statistical comparison of studied variables between the diabetes and non diabetes showed that there were no significant differences of the caries experience DT, and DMFT (P > 0.05) except that there was a significant difference of MT among diabetes and control groups (P < 0.05) and highly significant difference of FT between the two groups (P<0.01) (Table 2).

On the other hands, the result of the distribution of the caries experience (for both groups) according to the age showed the mean

values of DMFT index were increased when the age increased from 40 years to 70 years as shown in (Figure1). Statistically the correlation between the DMFT teeth and age showed there was highly significant correlation for both diabetic and non diabetic groups (P<0.01) (Table 3).

The results of the oral health behavior questionnaire are illustrated in (Table 4). The results showed better oral health habits regarding brushing frequency among the non diabetic group in comparison to the diabetic patients. The majority of subjects who brushed twice daily were in the non-diabetic group with high significant difference in distribution regarding to tooth brush frequency between the two groups (P<0.01), while the results showed there were no association regarding to the cleaning methods as well as the dental visits among the studied groups. The result of the tobacco use showed there was higher percentage of the smoking among the diabetic group than non diabetic with high significant difference in distribution between diabetic and control groups.

The mean values of the blood glucose level both fasting and random blood glucose level for both group diabetic and non diabetic group were shown in (Table 5) that was showed the mean values of both the fasting and random blood glucose level was higher in the diabetic group than the non diabetic group with high significance between them. In the relation of the blood glucose level and the dental caries the results showed the caries experience (DMFT) was increased with the increase of the blood glucose level either fasting or random blood level among the diabetic group as shown in (Figure 2). Statistically, there were highly significant correlations between the DMFT teeth and fasting blood level and significant relation of dental caries and random blood level among the diabetic group (Table 6).

The distribution of diabetic patients in relation to duration of the disease, physician fellow up, and degree of diabetic control were shown in (Table 7). Statistically, the Z- test showed there was an association between the diabetic patients in relation to duration of disease, the physician fellow up, and the degree of the diabetic control among the diabetic patients.

In the relation of the duration of the disease with caries experience the results showed that the mean values of DMFT was lower in the group of diabetes less than 5 years than those with duration from 5-10 years while the highest mean DMFT for the diabetes more than 10 years (Figure 3) but statistically, there was not significant correlation between the DMFT and duration of the disease (Table 6).

As well as the comparison of caries experiences among the diabetic patients according to the degree of the control the results showed that the mean values of the DMFT was higher in well controlled group than poorly controlled group, but statistically there was non significant difference between the two groups (P<0.05) (Table 8).

DISCCUSION

Studies that address the association between diabetes mellitus (DM) and dental caries are many, but their results have not revealed any strong pattern of association [8-11]. Diabetes mellitus is a chronic disease that may impact on personal behavior. Therefore, caution should be taken when assessing the impact of the pathophysiology of diabetes on oral health status when these factors are not considered [12].

The results of this study showed that there was no significant differences of dental caries between the diabetic and non diabetic groups this result agreed with other studies [11,19] and disagreed with other who found that an increase in dental caries in permanent teeth was observed among diabetics [18]. One more study showed that diabetics have higher DMFT values as compared to control group children [20]. Also a study demonstrated that diabetic patients have more active dental caries than control subjects [21]. This may be attributed to low-carbohydrate diabetic diets should theoretically reduce caries prevalence. As well as authors usually attribute it to the fact that diabetics have traditionally been counseled to consume a diet low in refined carbohydrates, especially sucrose, and have been advised to have an increased protein intake which enhances the buffering capacity of saliva[13].

On the other hands, the result of the distribution of the dental caries for both groups according to the age showed the mean values of DMFT Index were increased when the age increased with strong correlation this result agreed with many others who reported high caries prevalence among older diabetics [10,12], but disagreed with Arrieta-Blanco and others who found no significant differences in the number of caries, missing teeth and fillings in different age groups of the diabetic population [6].

The result of the oral health behavior questionnaire showed better oral health habits regarding brushing frequency among the non diabetic group in comparison to the diabetic patients this result agreed with other study that was showed the frequency of the tooth brushing was high among the non diabetic patients [22], while the result showed there were no association regarding to the cleaning methods and also for the

regular dental visits between the non diabetic and diabetic group this results disagreed with other study which was found the use of dental floss and dental visits are better among the non diabetic group[23], other result showed the diabetics were somewhat less likely to visit their dentists for routine examination[24] the possible explanation, apart from their medical status, was a lack of dental health education among the diabetic group. Regarding to the tobacco use the result showed there was high difference in the distribution of smoking in the diabetic group than control this result disagreed with Moore et al. study which was found that tobacco use in diabetic subjects and oral health behavior were similar to those of non-diabetic subjects. [25].

Regarding to the blood glucose level the values of FBGL and RBGL were higher among diabetics than non-diabetic subjects. It is well-established that poor glycemic control among the diabetic patient than non diabetic patients[22]. In this study, it was observed the severity of dental caries increased with the increase in the blood glucose level with positive correlation. This finding is an indicator of the need for improving oral health status among diabetic patients. This may be attributed to elevated salivary glucose levels and xerostomia may predispose this population to caries because of lack of insulin or insulin resistance, as seen in DM, results in an inability of insulin-dependent cells to use blood glucose as an energy source and an elevation in blood ketones leads to diabetic ketoacidosis. As blood glucose levels become elevated (hyperglycemia), glucose is excreted in the urine and increased fluid loss leads to dehydration and excessive thirst [21, 26] . As a part of the oral manifestations of diabetes, some authors reported changes in the salivary gland, such as increase in size, with alteration of its histology and changes in salivary flow rate and in the composition[18]. Salivary buffering capacity is an important parameter for the maintenance of normal pH levels in saliva and plaque. With decrease the salivary flow rate there is increased in dental caries because the deficient in the salivary flow rate which is high important in clearing the cariogenic food from the mouth and neutralizing effect[27].

Regarding to the effect of the duration of the disease on caries experience the results showed that there was no correlation between DMFT teeth and the duration of the disease this results agreed with some studies who considered that there was no relationship between the diabetes duration and caries experience [6,7] and disagreed with other study which reported greater experience in

subjects with a longer duration [8]. In the comparison of caries experiences among the diabetic patients according to the degree of the control showed that there was non significant difference between them this result agreed with several studies that found there were no associations between the metabolic control of disease and dental caries in the studies groups [6,8,11,12], and disagreed with other study that was found the risk of dental caries was increased among poorly controlled patients than well-controlled DM and non diabetic control subjects [28].

The present study confirmed that the presence of dental caries was not significantly elevated in most diabetic patients, but suggested that it increased with age as well as with the increase of the blood glucose level. Furthermore the diabetic patients should be improving the general and oral health behaviors.

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Table 1: The distibution of the diabetic and control subjects according to the age and gender

Patient condition	Age (years)	No.	%	Gender	No.	%
Diabetic patient	40-50	60	33.3%	Males	76	42.2%
	51-60	60	33.3%	Females	104	57.8%
	61-70	60	33.3%			
	Total	180	100%	Total	180	100%
Non diabetic patients (Control)	40-50	60	33.3%	Males	70	38.9%
	51-60	60	33.3%	Females	110	61.1%
	61-70	60	33.3 %			
	Total	180	100 %	Total	180	100%

Table 2: The mean value of the dental caries among diabetic and non-diabetic patients

Caries experience	Patient condition	No.	Min.	Max.	Mean	± SD	t - test
DT	Diabetic	180	0	11	2.11	1.46	**NS**
	Control	180	0	7	1.93	1.63	
MT	Diabetic	180	0	32	10.84	7.27	**2.32 ***
	Control	180	0	28	9.17	6.32	
FT	Diabetic	180	0	6	1.03	1.37	**2.843 ***
	Control	180	0	7	1.47	1.56	
DMFT	Diabetic	180	2	34	14.04	7.06	**NS**
	Control	180	1	28	12.65	8.22	

* Significant, P< 0.05
** Highly significant, P< 0.01

Table 3: Correlation between the DMFT and age among diabetic and control groups

Patient condition	r-value	P-value	Significance
Diabetic	0.531	0.000	**Highly significance**
Control	0.482	0.000	**Highly significance**

Table 4: Oral health behavior among diabetic and non diabetic patients

Variables	Diabetic patients		Non diabetic (control)		P -value
	No.	%	No.	%	
Tooth brushing frequency					
NON	72	40	46	26	X² = 14.79**
1/ day	43	24	48	27	P = 0.005
2/ day	23	13	44	24	df = 4
3/ day	6	3.3	2	1.1	
irregular	36	20	40	22	
Oral cleaning methods					X² = 4.711
Brush	87	48	80	44	P = 0.09 NS
Brush + floss	21	12	36	20	df = 2
No	72	40	64	36	
Regular dental visit					X² = 0.93
Yes	15	8.3	20	11	P = 0.062 NS
No	79	44	80	44	df = 2
Sometimes	86	48	80	44	
Smoking					X² = 12.33**
Yes	43	24	18	10	P = 0.000
No	137	76	162	90	df = 1

** Highly significant, P< 0.01

Table 5: Mean of the blood glucose level among diabetic and non diabetic patients

Blood glucose level	Patient condition	No.	Mean	± SD	t- test
FASTING BLOOD GLUCOSE LEVEL	Diabetic	180	171.26	48.23	22.495**
	Control	180	88.14	11.46	
RANDOM BLOOD GLUCOSE LEVEL	Diabetic	180	265.75	70.93	26.251**
	Control	180	123.31	16.37	

** Highly significant, P< 0.01, df = 358

Table 6: Correlation between the DMFT and fasting blood level, random blood glucose level, duration of the disease among diabetic groups

Patient Variable	r-value	p-value	Significance
Fasting blood glucose level	0.198	0.008	Highly significance
Random blood glucose level	0.186	0.024	Significance
Duration of the disease	0.079	0.293	Non significance

Table 7: Medical characteristic of the diabetic group

Variables	Diabetic patients		z-test	p-value
	No.	%		
Disease duration (years)				
< 5 years	102	56.7	2.462	0.048*
5 – 10 years	56	31.1	2.147	0.049*
> 10 years	22	12.2		
Physician follow up				
< 3 month	78	43.3	4.985	0.028*
3 month- 1 year	28	15.6	4.023	0.031*
> 1 year	74	41.1		
Degree of the control of the diabetic state				
Well controlled	119	66.1	3.024	0.044*
Poor controlled	61	33.9		

* Significant, P< 0.05

Table 8: Comparison between the DMFT of the well diabetes control and poor diabetes control

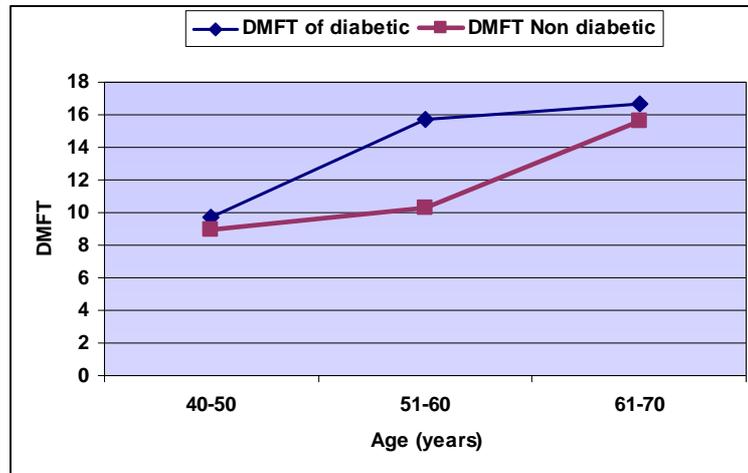| Patient condition	No.	Min.	Max.	Mean	± SD	t-test
Well Diabetic Control	119	2	34	13.92	7.74	NS
Poor Diabetic Control	61	6	28	14.28	5.59	

Figure 1: Distribution of the dental caries according to the age among diabetic and non diabetic patients
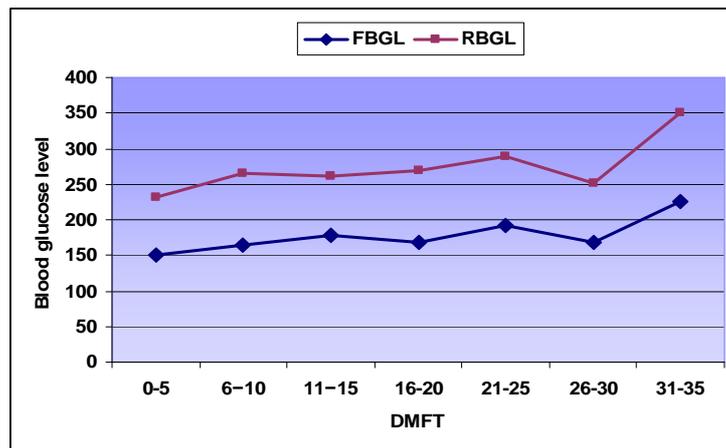

Figure 2: The relation between the blood glucose level ad dental caries among diabetic patient
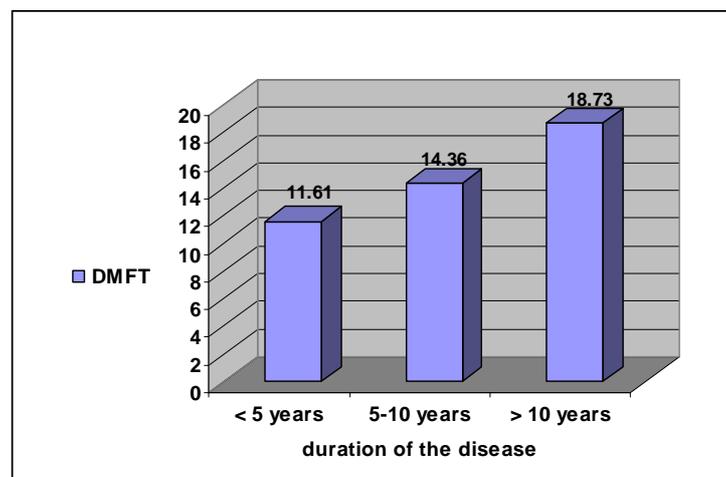

Figure 3: The relation between the dental caries and the duration of the diseases in diabetic patient