

Relationship between Severity of Periodontitis and Serum Lipid Profile in Type 2 Diabetic Patients

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Abstract

Background: Periodontitis and serum lipid disorder are prevalent in type 2 diabetic patients. Serum lipid disorder is one of the established risk factors for cardiovascular disease while periodontitis is a probable another one. Some studies have reported an existence of a relation between serum lipid disorder and periodontitis while others have found no significant relation.

Aim of study: To assess the relation between serum lipid profile and severity of periodontitis in type 2 diabetic patients.

Materials and methods: One hundred and twenty type 2 diabetic patients (60 males and 60 females) were enrolled in this study. Their periodontal status was determined by measuring Probing Pocket Depth (PPD), Gingival Recession and Clinical Attachment Level (CAL). Patients were selected consecutively but with consideration of sex and certain exclusion criteria to compose three groups based on CAL and PPD measurements. These three groups were:

- 1.Group 1: 20 males and 20 females patients with Mild/No Periodontitis (G1)
- 2.Group 2: 20 males and 20 females patients with Moderate periodontitis (G2)
- 3.Group 3: 20 males and 20 female's patients with severe periodontitis (G3).

Serum lipid profile involved an estimation of serum total cholesterol (TC), serum triglycerides (TG), high density lipoprotein cholesterol (HDL-C), and a calculation of low density lipoprotein cholesterol (LDL-C).

Results: The mean serum levels of TC and TG were compared between the study groups. There were significant differences between G1 vs. G3 ($P < 0.05$) while the differences were statistically non significant between G1 vs. G2 and G2 vs. G3. When HDL-C and LDL-C levels were compared between the study groups (G1 vs. G2, G2 vs. G3 and G1 vs. G3 groups) no statistically significant differences were found. Analysis of correlation showed that the correlations between PPD and both TC and TG were highly significant ($P < 0.001$). Concerning the correlation between CAL and TC or TG, both correlations were significant ($P < 0.05$) while there was no significant correlation between both PPD and CAL with HDL-C or LDL-C.

Conclusion: Higher serum levels of TC and TG are associated with the more severe forms of periodontitis in type 2 diabetic patients.

Keywords: Periodontitis, serum lipid disorder, Diabetes mellitus

Introduction:

Diabetes mellitus (DM) is a metabolic disorder that is characterized by hyperglycemia due to defective secretion or action of insulin ⁽¹⁾. DM is associated pathologically with macrovascular and microvascular complications.

The macrovascular complications include cardiovascular and cerebrovascular disease as well as hypertension and serum lipid disorders ^(2,3). Serum lipid disorders are prevalent in type 2 diabetes, the most common pattern consists of elevated triglycerides (TG) and decreased high density lipoprotein- cholesterol (HDL-C) levels ⁽⁴⁾. The concentration of low density lipoprotein – cholesterol (LDL-C) in diabetic patients is usually not significantly different from that in non-diabetic individuals. However, type 2 diabetic patients typically have a preponderance of smaller and denser LDL particles which possibly increase atherogenicity and risk of cardiovascular disease even if the absolute concentration of LDL-C is not significantly increased ⁽⁴⁾.

Periodontitis is a chronic inflammatory disease of the tissues that support and attach the teeth to the jaws ⁽⁵⁾ and it is the second main cause of oral cavity disorders, after caries, affecting the population ⁽⁶⁾. A number of studies have reported a higher prevalence of periodontal disease in diabetic patients than in healthy controls ⁽⁷⁻¹⁰⁾ and so periodontitis has been considered as an important complication of DM ⁽¹¹⁾. Also, periodontitis by itself, like serum lipid disorder

has been associated with increased relative risk for cardiovascular disease ⁽¹²⁾ some studies have reported an existence of a relation between serum lipid disorder and periodontitis ⁽¹³⁻¹⁸⁾ while others have found no significant relation ^(19,20). Such controversy between studies may be related to the difference in the grading of periodontitis.

The aim of this study is to assess the relation between serum lipid profile and the severity of periodontitis in type 2 diabetic Iraqi patients.

Materials and Methods: This study was conducted in the National diabetes center, University of Al – Mustansiriyah, Baghdad-Iraq during the period from November 2011- February 2012. One hundred and twenty patients (60 males and 60 females) with type 2 diabetes mellitus (T2DM) were enrolled in the study. Their ages were in the range of (30-72) years and the duration of their disease ranged from (1-21) years.

Medical examination: Medical history was taken by personal interviewing with the help of a printed questionnaire. All measurements were undertaken by the same examiner. Exclusion was made for those who had a concurrent acute illness or another major systemic disease. Also patients who were taking lipid lowering agents or were smokers were excluded.

The following clinical characteristics were reported:

- 1- Age and gender.
- 2- Weight and height in order to calculate body mass index (BMI).

Periodontal examination: measurements were undertaken by a single experienced examiner (the examiner has passed both inter- and intra-examiner calibrations).

The patients who were enrolled in this study had to have up to fifteen teeth and the third molars were included in the examined teeth.

The periodontal examination was carried out with calibrated periodontal probes with William's markings. The periodontal status was determined using measurements of Probing Pocket Depth (PPD), Gingival Recession and Clinical Attachment Level measurements (CAL) from four sites on each tooth (buccal, mesial, lingual / palatal, distal)⁽²¹⁾. PPD was taken as the distance from the gingival margin to the base of the gingival sulcus / periodontal pocket. Gingival recession was measured as the distance from the cemento- enamel junction to the gingival margin. These scores were then added up to indirectly obtain the values for CAL.

The patients were categorized into three groups and each group consisted of forty (20 males and 20 females) based on CAL and PPD measurements, using the criteria proposed by the joint working group of the Centre for Disease Control and Prevention in collaboration with the American Academy of Periodontology in 2003⁽²¹⁾. These three groups were:

1. Mild / No Periodontitis (Group 1): Neither "moderate nor "severe" periodontitis.
2. Moderate periodontitis (Group 2): When periodontal pocket (PD) ≥ 2 inter proximal site with PD ≥ 5 mm or (not on same tooth) attachment level (CAL) ≥ 2 interproximal sites with CAL ≥ 4 mm.
3. Severe periodontitis (Group 3): When periodontal pocket PD ≥ 1 inter proximal site with PD ≥ 5 mm and (not on same tooth) attachment level (CAL) ≥ 2 interproximal sites with CAL ≥ 6 mm

Laboratory analyses: Specimen: Serum samples were used for glucose and lipid profile analyses that were performed on the same day of the visit of the patient.

Serum glucose assay: Serum glucose was measured by enzymatic method using kits supplied by Biocon Company, Germany.

Lipid profile assay: Serum total cholesterol (TC) and serum triglycerides (TG) were determined by totally enzymatic methods. Using kits supplied by bioMerieux company, France. Estimation of serum HDL-C was done by precipitation with phosphotungstate-MgCl₂ solution followed by enzymatic determination of cholesterol in the

supernatant. Using kits supplied by bioMerieux company, France. Serum LDL-C level was calculated by the method of Bairaktari et al 2004⁽²²⁾.

Statistical analysis: Data were presented in simple statistical measures of number, mean and standard deviation. Statistical analysis for the significance of difference of quantitative data was done by using ANOVA test for more than two independent means and LSD was used to measure the precision of a variety of means between two mean values. A probability value ($p < 0.05$) was considered to be statistically significant and ($P < 0.01$) was considered to be statistically highly significant.

Data were presented in simple statistical measures of number, mean and standard deviation. Statistical analysis was done by using one-way ANOVA to determine whether significant differences existed between the studied groups. LSD post hoc test for multiple comparisons was applied to identify which groups had a difference. A probability value ($p < 0.05$) was considered to be statistically significant while ($P < 0.01$) was considered to be statistically highly significant.

Results:

The mean values of age, duration of DM, BMI and fasting blood sugar of G1, G2 and G3 showed no statistically significant difference (Table 1).

The mean values of probing pocket depth and clinical attachment loss in G1 were (1.87 ± 0.43 and 1.38 ± 0.62 mm respectively), in G2 were (2.88 ± 0.55 and 2.99 ± 0.48 mm respectively) and in G3 were (3.44 ± 0.39 and 4.11 ± 0.57 mm respectively) and the differences between G1 vs. G2, G2 vs. G3 and G1 vs. G3 groups were statistically highly significant ($P < 0.01$) in regard to both parameters (Table 2).

The mean values of missing teeth number in G1, G2 and G3 were (5.55 ± 2.8 , 7.78 ± 3.16 and 9.5 ± 3.95 respectively) and the difference between G2 vs. G3 groups was significant ($P < 0.05$) while the difference between G1 vs. G2 and G1 vs. G3 groups were statistically highly significant ($P < 0.01$ and $P < 0.001$ respectively) (Table 2).

The mean serum levels of TC and TG were compared between the study groups in (Table 3). The mean serum levels of TC and TG in G1 were (178.63 ± 48.07 and 125.05 ± 48.37 mg/dl respectively) while in G2 were (188 ± 53.47 and 147.75 ± 66.05 mg/dl respectively) and in G3 were (200.80 ± 41.01 and 160.15 ± 73.6 mg/dl respectively).

The differences in the levels of TC and TG were significant between G1 vs. G3 ($P < 0.05$) while were statistically not significant between G1 vs. G2 and G2 vs. G3.

The mean values of HDL-C and LDL-C of G1, G2 and G3 showed no statistically significant difference (Table 3).

Analysis of correlation showed that the correlations between Probing pocket depth and both TC and TG were highly significant ($P < 0.001$) (Table

4). Also the correlations between Clinical attachment loss and both TC and TG were significant ($P < 0.05$). On the other hand, there were

no significant correlations between both PPD and CAL with HDL-C or LDL-C (Table 4).

Table 1: Clinical characteristics and fasting serum glucose levels of the study groups of type 2 diabetic patients

Characteristic	Study groups	Mean $\pm$ SD	ANOVA- test		LSD-test		
			Study groups of patients		G1 vs. G2	G1 vs. G3	G2 vs. G3
	Patients	N=40	F-value	P-value	P-value		
Age (year)	Group 1(G 1)	50.18 $\pm$ 9.52	1.400	0.251	0.142	0.159	0.950
	Group 2 (G2)	53.73 $\pm$ 12.68					
	Group 3 (G3)	53.58 $\pm$ 9.69					
Duration of DM (year)	Group 1(G 1)	5.75 $\pm$ 5.2	0.825	0.441	0.494	0.551	0.202
	Group 2 (G2)	6.53 $\pm$ 5.8					
	Group 3 (G3)	5.09 $\pm$ 3.95					
BMI	Group 1(G 1)	29.53 $\pm$ 3.62	0.468	0.628	0.875	0.459	0.367
	Group 2 (G2)	29.32 $\pm$ 5.88					
	Group 3 (G3)	30.47 $\pm$ 6.88					
Fasting serum glucose (mg / 100 ml)	Group 1(G 1)	183.43 $\pm$ 65.55	0.567	0.569	0.951	0.343	0.375
	Group 2 (G2)	184.3 $\pm$ 54.15					
	Group 3 (G3)	197.05 $\pm$ 71.22					

N: number, SD: standard deviation, $P > 0.05$: Non-significant

G1: Mild / No periodontitis, G2: Moderate periodontitis, G3: Severe periodontitis

Table 2: Periodontal assessment of the study groups of type 2 diabetic patients

Periodontal examination	Study groups	Mean $\pm$ SD	ANOVA- test		LSD-test		
			Study groups of patients		G1 vs. G2	G1 vs. G3	G2 vs. G3
	Patients	N=40	F-value	P-value	P-value		
Probing pocket depth (mm)	Group 1(G 1)	1.87 $\pm$ 0.43	117.572	0.000**	0.000**	0.000**	0.000**
	Group 2 (G2)	2.88 $\pm$ 0.55					
	Group 3 (G3)	3.44 $\pm$ 0.39					
Clinical attachment loss (mm)	Group 1(G 1)	1.38 $\pm$ 0.62	240.738	0.000**	0.000**	0.000**	0.000**
	Group 2 (G2)	2.99 $\pm$ 0.48					
	Group 3 (G3)	4.11 $\pm$ 0.57					
Missing teeth (No.)	Group 1(G 1)	5.55 $\pm$ 2.8	14.065	0.000**	0.004**	0.000**	0.023*
	Group 2 (G2)	7.78 $\pm$ 3.16					
	Group 3 (G3)	9.5 $\pm$ 3.95					

N: number, SD: standard deviation, * $P < 0.05$: significant, ** $P < 0.01$: highly significant

G1: Mild / No periodontitis, G2: Moderate periodontitis, G3: Severe periodontitis

Table 3: Serum lipid profile of the study groups of type 2 diabetic patients

Analytes	Study groups	Mean $\pm$ SD	ANOVA- test		LSD-test		
			Study groups of patients		G1 vs. G2	G1 vs. G3	G2 vs. G3
	Patients	N=40	F-value	P-value	P-value		
TC (mg/dl)	Group 1(G1)	178.63 $\pm$ 48.07	2.171	0.119	0.382	0.04*	0.233
	Group 2 (G2)	188 $\pm$ 53.47					
	Group 3 (G3)	200.80 $\pm$ 41.01					
TG (mg/dl)	Group 1(G 1)	125.05 $\pm$ 48.37	3.137	0.047*	0.113	0.015*	0.385
	Group 2 (G2)	147.75 $\pm$ 66.05					
	Group 3 (G3)	160.15 $\pm$ 73.6					
HDL-C (mg/dl)	Group 1(G 1)	46.33 $\pm$ 6.34	1.276	0.283	0.706	0.128	0.251
	Group 2 (G2)	45.85 $\pm$ 4.31					
	Group 3 (G3)	44.4 $\pm$ 5.98					
LDL-C (mg/dl)	Group 1(G 1)	102.06 $\pm$ 41.17	1.308	0.274	0.702	0.123	0.245
	Group 2 (G2)	105.55 $\pm$ 44.32					
	Group 3 (G3)	116 $\pm$ 36.21					

N: number, SD: standard deviation, * $P < 0.05$: significant, G1: Mild / No periodontitis, G2: Moderate periodontitis, G3: Severe periodontitis

Table 4: Correlations between periodontal measurements and serum lipid profile of type 2 diabetic patients

Periodontal measurements	N=120	Serum lipid profile			
		TC	TG	HDL-C	LDL-C
Probing pocket depth	r	0.237**	0.303**	-0.140	0.170
	P-value	0.009	0.001	0.127	0.063
Clinical attachment loss	r	0.185*	0.212*	-0.107	0.134
	P-value	0.043	0.020	0.244	0.145

N: number, *P<0.05: significant, **P<0.01: highly significant

TC: Total cholesterol, TG: Triglycerides, HDL-C: High-density lipoprotein cholesterol, LDL-C: Low-density lipoprotein cholesterol.

Discussion:

This study has investigated the presence of any relation between periodontitis and serum lipid disorder in T2DM patients who were grouped, according to the severity of periodontitis, into three groups (Mild/or No, Moderate and Severe periodontitis). The study has found that mean serum levels of TC and TG were higher when the severity of periodontitis was increased but the difference between study groups has reached a significant level only when we compared Group 1 (Mild / No periodontitis) with Group 3 (Severe periodontitis).

Many recent studies have suggested that a relationship between periodontal disease and serum lipid disorder and in particular, higher TC and TG were more common in T2DM patients than in healthy controls^(13,16,18). In a study conducted on individuals with apparently healthy medical history, with controlling of factors related to elevated serum cholesterol levels (such as BMI, age, diastolic blood pressure and smoking), positive relations between periodontal pocket (as a periodontal index) and elevated serum levels of total cholesterol and LDL-C were confirmed⁽¹⁷⁾. A study conducted by Morita et al 2004 has reported a significant relation between elevated TG and periodontitis while serum level of HDL-C in periodontitis group was lower than in control group but the difference was not significant which is similar to our results⁽²³⁾. On the contrary, Machado et al 2005 found that the average cholesterol and TG were not significantly higher in periodontal patients than healthy ones⁽²⁴⁾. Moreover, Valentaviciene et al in 2005 have studied the relation between serum lipids level and periodontal condition as assessed by CPITN index (Community Periodontal Index of Treatment Needs) and revealed that the serum lipid levels in periodontal patients did not have any difference from healthy subjects⁽²⁰⁾. To explain such controversy, it may be stated that each study has had its own specifications such as definition of periodontitis, study design and age and number of patients that may be responsible for the differences in the results obtained.

In studies that reported the presence of a relation between periodontitis and serum lipid disorder, it was not possible to confirm an aetiological relationship between serum lipid disorder and periodontitis and the majority was unable to demonstrate a correlation between periodontitis and

a significant change in all components of serum lipid profile (TC, TG, LDL-C and HDL-C). In order to explore any cause-effect relationship, Losche et al 2005 have conducted a study on the effect of local therapy of periodontitis on serum lipid levels. They found some coordination between the decrease of inflammation and serum lipid levels but the change in lipid levels was still not significant⁽²⁵⁾. Some workers have postulated that an increase in pro-inflammatory cytokines in periodontitis is related to a significant elevation of TG and a lowering of HDL-C^(23,26) and our findings are somewhat consistent with such postulation.

In conclusion, higher levels of serum TC and TG are associated with the more severe forms of periodontitis and they may be predisposing factors for progression of periodontitis.

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