A Comparison of Plasma Lipid Levels and Fasting Blood Sugar in Patients with Chronic Periodontitis and in Healthy Individuals

Original Article

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Abstract

Introdouction:
Recent studies have reported the connection between increased risk of cardiovascular diseases and diabetes with the presence of chronic periodontitis. The aim of this study was to determine the relationship between chronic periodontitis and triglyceride, high- and low-density lipoprotein (HDL and LDL), and glucose levels.

Materials and methods:
A total of 102 individuals participated in this comparative case-control study and were divided into a test group (51 people with chronic periodontitis with at least two periodontal pockets of >5 mm depth) and a control group (individuals with healthy periodontium or gingivitis). Plasma lipid levels and blood glucose were measured, and the data were statistically analyzed using chi-square and t-tests at $p < 0.05$ with SPSS version 21.

Results:
A significant increase in serum triglyceride, cholesterol, and glucose ($p < 0.0001$) was observed in the test group (group I), whereas serum HDL and LDL showed no significant increase in the test group (group I) compared to the control group (group II) ($p = 0.244$ and $p = 0.127$, respectively).

Conclusion:
This study suggested a connection between hyperglycemia and hyperlipidemia with chronic periodontitis, however, the etiology could not be precisely determined.

Key words:
•Cardiovascular Diseases• Hyperlipidemias• Periodontal Diseases• Risk Factors.

Introduction

Chronic periodontitis is the most common form of periodontitis and may be aggravated in the presence of systemic or environmental factors such as diabetes, smoking, and stress, which alter the host's response to the accumulation of plaque.[1] Chronic periodontitis is an infectious disease and results in chronic inflammation of tooth supportive structures, proceeding attachment and bone loss.

Severe systemic or chronic infections such as periodontitis can cause changes in the plasma density of cytokines and hormones that result in altering lipid metabolism.[2] Periodontal disease transfers bacteria into the bloodstream and initiates a change in blood coagulation and fortitude of endothelial, coronary walls and platelet function, which can ultimately cause coronary alteration and atherosclerosis.[3] An increase in pre-inflammatory cytokines, as a response to infection caused by chronic periodontitis, increases the plasma lipid levels.[4]

Studies have shown that people with chronic periodontitis are more prone to develop cardiovascular diseases. As shown by epidemiologic studies in USA, after regulating the known cardiovascular risk factors, coronary disease risk in men with periodontitis is 50%–70% higher.[5-7]

On the other hand, the relationship between diabetes and periodontal diseases is well known. Several clinical studies have shown that periodontal diseases are more common among the diabetics. Smoking and poor oral health habits are the other risk factors for cardiovascular and periodontitis problems.[8-9] On the other hand, periodontal problems may play a role in the advancement of diabetes. Because periodontal diseases are infectious and infection causes tissue resistance to insulin and blocks glucose from entering the target cell, treatment of chronic periodontitis can be effective in controlling patient's blood sugar.[10-12]

Sandi et al. [13] showed that patients with chronic periodontitis face a considerable rise of LDL cholesterol levels in their blood serum, which is a risk factor for cardiovascular disease. Poplawska et al. [14] showed the connection between type II diabetes and periodontitis.

Due to the current life style, increased diabetes and blood lipids in the population and hyperlipidemia are main causes of cardiovascular diseases; therefore, special attention must be paid to periodontal treatments and reduction or elimination of periodontal pocket for cardiovascular or diabetic patients. Thus, the purpose of this study is to compare blood serum levels and fasting blood sugar in the periodontium of patients with.

Materials and Methods

This case-control study was conducted on 102 patients referring to the periodontology department of Rasht dentistry school of GUMS (Guilan University of Medical Sciences). The exclusion criteria were systemic diseases such as heart strokes (MI= Myocardial Infarction), cancer, liver, and kidney problems, cases with hypertension, receiving periodontal treatment in the past 6 months, corticosteroid or anabolic steroid consumption, pregnant or breastfeeding, mental or physical disability, and interfering effects on self-plaque control.

This study was approved by the Ethics Committee of Research Deputy in GUMS. Written informed consent was obtained from all the participants at the beginning of the study. All participants were informed of the voluntary nature of participation and were assured about confidentiality of their personal information.

Patients were divided into two groups of case and control with 51 in each group, and were based on personal and social (age and gender) characteristics. Patients in the case group were having moderate or severe chronic periodontitis [moderate chronic periodontitis, clinical attachment loss (CAL) = 3–4 mm; severe chronic periodontitis, CAL ≥ 5 mm with at least two periodontal pockets of ≥5 mm), and patients in the control group were 51 individuals with healthy periodontal tissue or gingivitis. Participants filled a questionnaire regarding their general health history and smoking habits, and then their clinical parameters of probing depth, bleeding on probing, and clinical attachment loss (CAL) were recorded. Patients were then referred to the laboratory and a blood sample of 3 cc for analyzing triglyceride, FBS glucose, and LDL-HDL cholesterol was collected.

LDL cholesterol was calculated using total HDL cholesterol and for measuring triglycerides according to Friedwald et al. (1972).[15]

LDL = TC–(HDL- TG/5)
TG = Triglyceride.
TC = Total cholesterol.
HDL = High-density lipoprotein cholesterol.
LDL = Low-density lipoprotein cholesterol.
Blood samples were used only if they were collected on a fasting state and with a TG of <400.

Table 1. The table below shows the normal blood lipid

Hyper lipidemia	Normal	Lipid
TG	40–160	>160
TC	125–200	>200
HDL	29–80	>80
LDL	66–178	>178

Table 2. The table below shows theblood glucose levels based on laboratory data.

	Normal	High
Blood Glucose	70-100 (mg)/dl	>100 mg/dl

Pathological values for TG, cholesterol, LDL, and blood sugar (glucose) were higher than normal, whereas they were lower than normal for HDL. It should be noted that a fasting glucose level should be >100 mg/dl but <125 mg/dl (meaning it is placed in the division of prediabetes and it shows that the person has a high risk for developing type II diabetes), and if the blood glucose level in a fasting state is 126 mg/dl, it further indicates that the person is diabetic.

The collected data were analyzed using independent t-test and chi-square test. The Statistical Package for Social Sciences (SPSS) version 21.0 was used for analysis and processing of data at $p < 0.05$.

Results

A total of 26 females and 25 males comprised the test group and 24 females and 27 males comprised the control group. The mean age was 48.65 ± 10.23 years for men and 46.22 ± 13.76 years for women. Regarding plasma lipids and blood glucose levels, LDL and HDL were not significantly different from each other in healthy or periodontitis group, but blood glucose, blood cholesterol, and blood triglyceride levels were significantly different ($p < 0.001$) (Table 3). Comparison of plasma lipids and blood glucose levels of men in both groups showed no statistical differences, as shown in Table 4 (blood glucose, cholesterol, and triglyceride; $p = 0.001$, $p < 0.0001$, and $p = 0.027$ respectively). Similar results were obtained for women, as shown in Table 5 ($p = 0.002$, $p < 0.0001$, and $p = 0.002$ for blood glucose, cholesterol, and blood triglyceride, respectively). Comparison of age among both study groups revealed that blood glucose level had a direct relation with the age of the subjects (Figure 1). An increase in plasma lipids, however, did not occur with age.

Table 3. Plasma lipids and blood glucose in the two study groups

Group	Unhealthy	Healthy	P value
Factor	mean ± standard deviation	mean ± standard deviation	
FBS	103.98 ± 25.30	86.65 ± 9.93	0.0001
CHOL	186.86 ± 29.20	158.04 ± 23.49	0.0001
TG	183.16 ± 72.90	141.17 ± 38.38	0.0001
HDL	41.24 ± 8.41	39.50 ± 6.52	0.244
LDL	106.51 ± 27.77	98.87 ± 22.52	0.127

Table 4. Plasma lipids and blood glucose in men of both groups

Group	Unhealthy	Healthy	P value
Factor	mean ± standard deviation	mean ± standard deviation	
FBS	101.14 ± 20.13	86.29 ± 11.78	0.001
CHOL	188.76 ± 32.52	155.25 ± 25.23	0.0001
TG	195.14 ± 82.29	156.18 ± 38.74	0.027
HDL	40.04 ± 8.08	38.07 ± 6.55	0.319
LDL	106.32 ± 26.92	94.79 ± 23.88	0.093

Table 5. Plasma lipids and blood glucose in women of both groups

Group	Unhealthy	Healthy	P value
Factor	mean ± standard deviation	mean ± standard deviation	
FBS	108.57 ± 31.46	87.08 ± 7.44	0.002
CHOL	187.24 ± 21.19	159.13 ± 21.62	0.0001
TG	16781 ± 57.60	123.67 ± 30.17	0.002
HDL	43.05 ± 8.90	41.17 ± 6.20	0.411
LDL	107.14 ± 30.15	103.62 ± 20.28	0.644

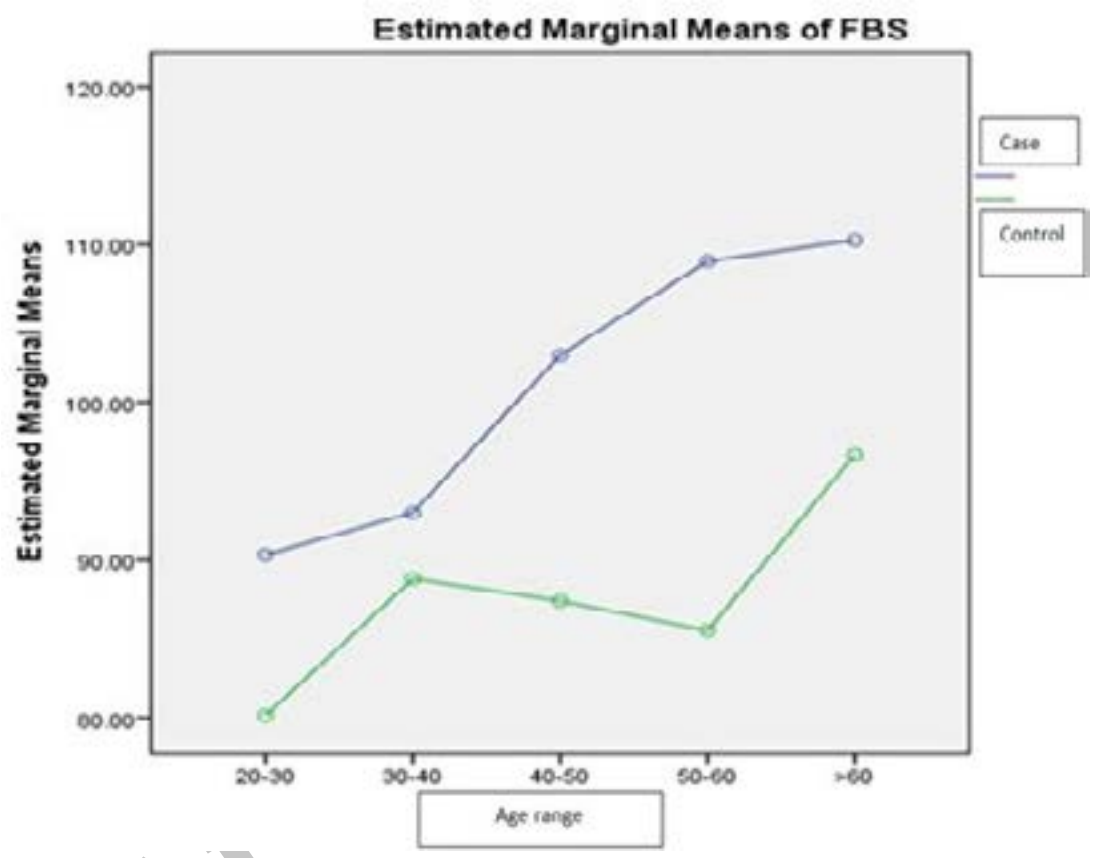

Figure 1. Comparison of the two study groups of patients and controls according to different age groups.

Discussion

Chronic periodontitis is a topical chronic infection that causes alteration in cytokine plasma density and hormone as well as in transferring bacteria into the blood stream (bacteremia).[3] Moreover, Plasma LDL cholesterol activates monocyte/macrophage response to bacterial lipopolysaccharide and thus high levels of LDL in daily diet can trigger a higher discharge of destructive inflammatory cytokines by monocyte/macrophage.[16] This not only causes atheromatous lesions but can also initiate a greater periodontal destruction in chronic periodontitis.

Results of this study showed that patients with chronic periodontitis had significantly higher levels of cholesterol and triglyceride.

Consistent with these results, Moeintaghvai et al.[17] found that in people with periodontal problems, mean cholesterol and triglyceride levels were significantly higher than those in healthy people. Their LDL and HDL levels were higher than those of the control group as well, though not significant. In another trial, Parsa et al.[18] focused on the connection between periodontitis, blood cholesterol, and cardiovascular diseases. They sorted their study groups based on their age, gender, smoking habits, and diet and found that people with periodontitis had a higher level of blood cholesterol compared to

healthy individuals. In two separate studies by Golpasandhagh et al.[19] and Taleghani et al.[20], the relationship between chronic periodontitis and plasma lipids was evaluated and they showed that cholesterol and triglyceride levels in cases with chronic periodontitis were significantly higher than those in healthy individuals; LDL and HDL in the case group were higher as well but were not statistically significant; similar results were obtained in the current study.

However, Valentaviciene et al.[21] concluded that no connection exists between plasma levels of triglyceride, LDL, HDL, and cholesterol in people with gingivitis and in individuals suffering chronic periodontitis, which is inconsistent with the results of the present study. It must be mentioned that this is a case-control study performed on 102 individuals with an average age of 47.48 ± 11.90 years, whereas the aforementioned one was a cross-sectional study on 261 cases with an age average of 38 years.

Sandi et al.[12] showed high levels of plasma lipid in chronic periodontitis to be a risk factor for patients with cardiovascular disease by showing an elevated level of cholesterol and LDL, but triglyceride and HDL levels of both groups were not significantly different. Their findings are in contrast with the present research, which showed a significant increase of cholesterol and triglyceride levels but no difference in LDL and HDL levels. It should be reminded, however, that Sandi et al. studied 80 people in case-control groups synchronized by age, and they used body mass index in their criteria (people with a BMI of <20 were eliminated, only retaining those with BMI of 20–25 and >30). Therefore, the reason for this difference can be attributed to the scopes of population, the types of synchronization, and considering/not considering BMI. Diabetes has been considered to be a risk factor for periodontal diseases and reduces host's defense against infection, and a poor blood sugar control is a real danger in periodontitis.[1] Periodontal infections must be treated decisively: oral hygiene must be taught to diabetics and mechanical debridement must be implemented for eliminating topical factors that ought to be performed for them. Diabetes not only affects the prevalence and severity of periodontitis, but it is also important in its progression: bone destruction progression is 4.2 times more likely to occur in diabetics.[22-24]

Tetracycline, along with scaling and root planning, is the single most useful drug for antimicrobial treatment for periodontal diseases.[25]In addition, in cases when the patients' blood sugar control is poor and they need periodontal surgery, prophylactic antibiotics are prescribed.

Regarding type II diabetes and periodontal diseases, Poplawska et al. [13] showed that 83.5% of type II diabetics were suffering from periodontitis, which shows a direct connection between these two and is consistent with the results of the current study.[26] Nabegh et al.[22] reported that in comparison to fasting blood sugar of non-diabetics with chronic periodontitis and non-diabetics with no periodontal disease, an increase in gingival inflammation results in a higher blood sugar in people with periodontitis.

Katz [27] reported a connection between periodontitis and increased levels of glucose serum, as well.

In a study regarding cholesterol, LDL, HDL, CRP, fibrinogen, IgG levels against six known periodontal pathogens, glucose, albumin, and iron in two groups of healthy and periodontitis-affected individuals, Craige et al.[28] concluded that although serum glucose had a tendency to increase in the case group, it was not statistically significant. It must be mentioned, however, that in the mentioned study, blood sugar measurement was not done in a fasting state, also, glucose was reflecting both blood sugar and patients' recent diet.

Conclusion

This study shows that there exists a direct connection between chronic periodontitis and increased levels of cholesterol, triglyceride, and fasting blood glucose. In addition, although LDL and HDL levels of case group were higher than those of control group, the difference was not statistically significant. Therefore, there is a relationship between hyperlipidemia/hyperglycemia and chronic periodontitis.

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