Comparison of Lipid Profile in Patients with Chronic Periodontitis and Patients with Healthy Periodontium

Dr. Shaili Pradhan,[1] Dr. Rejina Shrestha,[2] Dr. Ranjita Shrestha Gorkhali,[1]
Dr. Pramod Kumar Koirala,[1] Dr. Suchana Adhikari[1]

[1]Periodontology and Oral Implantology Unit, Department of Dental Surgery, Bir Hospital, National Academy of Medical Sciences, Mahabouddha, Kathmandu, Nepal;

[2]Department of Dental Surgery, Kanti Children's Hospital, National Academy of Medical Sciences, Maharajgunj, Kathmandu, Nepal.

ABSTRACT

Introduction: A positive relationship has been established between periodontal infections and cardiovascular diseases. Among various aetiological factors of cardiovascular diseases, hyperlipidaemia is a major cause. This study aims to compare the lipid profile in patients with chronic periodontitis and healthy periodontium.

Objective: The objective of the study was to compare the lipid profile in patients with periodontitis and healthy periodontium.

Methods: This analytical cross-sectional study was conducted from August 2020 to January 2021 among a total of 54 subjects recruited in the study who were divided into two groups: chronic periodontitis (CP) group (27 patients) and periodontally healthy group: 27 systemically healthy subjects with healthy periodontium. The periodontal parameters recorded were Plaque index (PI), Gingival index, Probing pocket depth, and Clinical attachment level. Serum levels of lipid profile were measured by enzymatic colorimetric method.

Results: The results showed that mean values of triglyceride and very low-density lipoprotein were higher in CP group than periodontally healthy group with significant difference. The mean value of high-density lipoprotein and low-density lipoprotein was lower in CP group than periodontally healthy group and the mean value of total cholesterol was higher in CP group than in periodontally healthy group with no significant difference.

Conclusions: Increased serum triglycerides was associated with chronic periodontitis. Chronic periodontitis may cause an increased risk for cardiovascular disease.

Keywords: Cardiovascular disease; periodontitis; serum lipid profile.

INTRODUCTION

Periodontitis can be defined as an inflammatory disease of the supporting tissues of the teeth caused by specific microorganisms or a group of specific microorganisms, resulting in progressive destruction of the periodontal ligament and alveolar bone with pocket formation, recession, or both.[1] Periodontal medicine is defined as a rapidly emerging branch of periodontology which focusses on large amount of new data establishing a strong relationship between periodontal health or disease and systemic health or disease.[2]

A positive relationship has also been established between periodontal infections and cardiovascular diseases.[3] An increase in total cholesterol (TC) concentration has been demonstrated as an atherogenic lipid marker, whilst reduced high-density lipoprotein (HDL) cholesterol concentration has been associated with numerous risk factors.[4,5]

To authors knowledge, there is paucity of data on such studies in the Nepali population on the association between lipid profile and periodontitis. Thus, this study aims to compare the lipid profile in patients with periodontitis and healthy periodontium so that if significant correlation is found between Lipid profile and Periodontitis, such patients can be warned about possibility of development of cardiovascular diseases (CVD). Since periodontitis is a preventable disease, prone patients can be educated on prevention of periodontal diseases.

METHODS

An analytical cross-sectional study was done among a total of 54 subjects, recruited from the Periodontology and Oral Implantology Unit, Department of Dental Surgery, Bir Hospital. Patients with healthy periodontium and patients with chronic periodontitis were included in the study from convenience sampling. The study was conducted for a duration of six months from August 2020 to January 2021. Ethical clearance was taken from the Institutional Review Board of National Academy of Medical Sciences (Ref. 1516/2078/79). The minimum sample size was computed using the formula which is the sample size estimation for group comparisons for means:[6]

$$n = \frac{2(Z\alpha + Z\beta)^2 S^2}{d^2}$$

$Z\alpha$ = 1.96 at 95% confidence interval
$Z\beta$ = 0.84 at 80% power, 1.28 at 90% powers
S^2 = pooled variance calculated using S_1 & S_2
d = difference to be calculated (mean of 1st group mean of 2nd group)

$$S^2 = \frac{(n_1.1)S_1^2 + (n_2.1)S_2^2}{n_1 + n_2 - 2}$$

= 27 for each group

The inclusion criteria included patients in the age group between 25 years and 70 years, patients who were systemically healthy and had a minimum of 20 teeth. The exclusion criteria included smokers, subjects with known systemic illness (hypertension, diabetes mellitus, hyperlipidaemia, CVDs etc.), pregnant and lactating females, obese patients with body mass index (BMI) greater than 30, patients who received systemic antibiotic therapy in the past three months, patients with aggressive periodontitis and patients with a history of dental treatment in the past six months, including oral prophylaxis.

Written informed consent was taken from participants who wanted to participate in the study. Detailed demographic variables such as age, gender, height, and weight were recorded. The BMI was recorded according to the formula: BMI = Body mass (kg)/Body height (m²).

The Plaque index (PI), Gingival index (GI), Probing pocket depth (PPD) and Clinical attachment level (CAL) were recorded using a mouth mirror, an explorer, and a University of North Carolina-15 (UNC-15) probe for a full mouth examination. The subjects with 1 mm and more of CAL at ≥30% of the sites were grouped under periodontitis (generalised chronic) cases.

The participants were sent for haematological investigation for lipid profile to the Department of Biochemistry and Pathology, Bir Hospital using fasting blood sample. Blood samples (5 ml) were collected by venipuncture of the cubital vein in the antecubital fossa by using a 5 ml disposable syringe and 23-gauge needle. It was collected in sterile vacutainer tubes with no added anticoagulant. From the collected blood samples, serum was separated and transferred into 2 ml vial and stored at 20°C-80°C for analysis using routine enzymatic method. The lipid profile included serum cholesterol, triglyceride (TG), HDL, very low-density lipoprotein (VLDL), and low-density lipoprotein (LDL) estimation.

The recorded data were compiled and entered into IBM SPSS Statistics for Windows, version 23 (IBM Corp., Armonk, N.Y., USA) for statistical analysis. The independent t-test was performed to compare means of serum lipid levels between periodontitis patients and healthy persons.

RESULTS

A total of 54 patients were included in the study. There were 29 male participants (seven in periodontally healthy and 22 in test group) and 25 female participants (20 in periodontally healthy and five in test groups). The average age was 42.9 years with an age range of 27 to 69 years. The mean clinical attachment loss was 3.71 mm among the chronic periodontitis patients. The lipid parameters: HDL cholesterol and TG levels were among patients with healthy periodontium and chronic periodontitis patients were statistically significant (Table 1).

The results showed that mean values of TG and VLDL were higher in CP group than periodontally healthy group with significant difference at P <0.05. The values were within range among patients with healthy periodontium and above the normal range among chronic periodontitis patients. The mean value of HDL was lower in CP group than periodontally healthy group with no significant difference. The values

Table 1: Lipid parameters among patients with healthy periodontium and chronic periodontitis patients.

Lipid parameters	Periodontally healthy participants (Mean±SD)	Chronic periodontitis (Mean±SD)	P value
Total cholesterol (mg/dL)	165.1±32.8	166.4±38.1	0.90
HDL cholesterol (mg/dL)	48± 9.5	42.8±9.8	0.06
LDL cholesterol (mg/dL)	91.4±28.1	85.5±27.7	0.44
VLDL cholesterol (mg/dL)	25.3±10.2	41.6±22	<0.001
Triglyceride (mg/dL)	128.6±52.2	208.1±109.8	<0.001

were below normal range in both the groups. The mean value of LDL was lower in CP group than periodontally healthy group with no significant difference. The values were within normal range in both the groups. The mean value of TC was higher in CP group than in periodontally healthy group with no significant difference. The values were within normal range in both the groups.

DISCUSSION

The World Health Organisation (WHO) has reported CVD as one of the major causes of mortality worldwide.[7] Among various etiological factors of cardiovascular diseases, hyperlipidaemia is a major cause. The instigation of atherosclerotic plaque is ascribed to the localised accumulation of lipids. Thus, plasma lipids play an indispensable role in the initiation and progress of atherosclerosis.[8]

The underlying mechanism relating periodontitis to increased serum lipid levels may be lipopolysaccharides of dental plaque which travel into the systemic circulation and form specific antibody. This results in disturbance in lipid metabolism and forms a hypercoagulable state through elevation of circulating cytokines. Monocytes derived cytokines such as tumor necrosis factor (TNF-α), interleukins (IL-1, IL-6, IL-8) cause disturbance in hepatic protein synthesis, tissue catabolism, and lipid metabolism. These cytokines alter lipid metabolism by inhibiting synthesis of lipoprotein lipase. Bacterial toxins can also reduce high-density lipoprotein and increased low-density lipoprotein.[9] Thus, the relation between CVD and periodontal disease can be attributed to the release of inflammatory mediators in systemic circulation which promotes atherogenesis.[10] The cytokines promote enhanced lipogenesis, increased lipolysis, and reduced lipid clearance, thereby increasing serum lipid levels.[11] Decreased HDL level has been considered as a risk factor for coronary heart disease.[9]

Besides these, periodontal bacteria are suggested to be independently involved in lowering serum HDL level.[12] Periodontal bacteria have been suggested to be a risk factor for atherosclerosis and myocardial infarction.[13,14] Periodontal pocket depth, bleeding on probing is associated with distorted serum lipid levels. The levels of Porphyromonas gingivalis (P. gingivalis) and Aggregatibacter actinomycetemcomitans antibodies in the serum may be a risk factor for decreased HDL levels. The P. gingivalis and its vesicles also enhance different cytokines resulting in the elevation of triglyceride. Increase of triglyceride increases the binding of LDL to macrophages and the formation of foam cell.[15,16]

Periodontitis increases the risk of dyslipidaemia, such as decreased HDL, increased TG, and increased LDL.[17,18] Their

levels have been shown to be improved by periodontally healthy of periodontal inflammation by standard treatment.[19]

The results in this study showed that the mean values of TG and VLDL were higher in CP group than periodontally healthy group with significant difference at P <0.05. The finding is similar to that found in other studies.[6,20-22] Periodontitis patients have been reported to be 4.1 times at risk to have high triglyceride.[23] Hypertriglyceridemia is also a direct reflection of an insulin resistance condition. In another study, hyperlipidemic patients showed higher values of periodontal parameters compared with normal lipid profile groups.[24]

The mean value of HDL was lower in CP group than periodontally healthy group with no significant difference. Similar results have been found in other studies but with a significant difference of p value.[6,20,22] In a study done by Penumarthy et al., the authors concluded that periodontal infections have a definite role in altering lipid metabolism leading to hyperlipidaemia.[25] This study showed that the values of HDL were below normal range in both the groups. This might be because HDL levels have been shown to be low in the Nepali population.[26] In the South Asian population, the HDL particles are small, dense, and dysfunctional and are found in low level.[26] These factors are strong predictors of cardiovascular disease.[26]

Many studies have shown significantly higher serum levels of LDL in chronic periodontitis groups.[6,20] In a study done by Saxlin et al., no consistent association between serum lipid levels and periodontal infection were seen among normoweight subjects.[27] In present study, the mean value of LDL was found to be lower in CP group than periodontally healthy group with no significant difference. The values were within normal range in both the groups. LDL is found within normal range among 95% of the Nepali population.[28]

The values of TC were also within normal range in both the groups. TC is found within normal range among 92.3% of the Nepali population.[28] The mean value of TC was higher in CP group than in periodontally healthy group with no significant difference. Similar result was found in a meta-analysis done by Nepomuceno et al.[20] In other studies, the values of total cholesterol has been found to be significantly higher in periodontitis patients compared with that of the periodontally healthy individuals.[21,29] Studies have also shown that participants with higher serum total cholesterol are more likely to have periodontitis compared to those with normal levels.[30]

Majority of the studies show that patients with chronic periodontitis exhibit higher serum lipid levels.[6,20,21,22] This indicates that these patients may be at a higher risk for

further coronary events. The association between coronary artery disease and periodontitis has also been confirmed.[22] These results should be interpreted carefully because of the diverse specifications of the study such as definition of periodontal disease, study design and the assay for serum lipid levels assessment.

The limitations of the study are the small sample size and lack of assessment of different factors such as social and cultural influence, genetic influence, familial history, the influence of nutrition, physical activity, and diet. BMI was used to assess obesity which is a simple useful measure for overall abnormal weight, yet not a standard measure for obesity. The association between periodontitis and dyslipidaemia needs to be further explored with larger sample size and multicentric studies.

CONCLUSIONS

Within the limitation of this study, the authors observed an association between periodontitis and elevated serum triglyceride levels. The periodontitis patients should be informed about being prone to cardiovascular diseases and periodontal treatment should be carried out to prevent the occurrence and onset of such diseases in the periodontitis patients.

ACKNOWLEDGEMENTS

Conflict of Interest: None.

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