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Evaluation of lipid biomarkers in Indian patients with chronic periodontitis and healthy periodontium: A cross-sectional study

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Abstract:
The impact of periodontitis on lipid metabolism is debatable. Therefore, it is of interest to evaluate and compare the lipid biomarkers in individuals with chronic periodontitis and healthy periodontium. Patients with chronic periodontitis exhibited significantly higher levels of triglycerides, total cholesterol, LDL and VLDL. In contrast, HDL levels were significantly lower in the periodontitis group. Thus, data shows a strong association between periodontal inflammation and dyslipidemia.

Keywords: Chronic periodontitis, dyslipidemia, lipid biomarkers

Background:
Alveolar bone loss and periodontium degradation are hallmarks of periodontitis, a chronic multifactorial disease **[1]**. Although it has long been believed that periodontitis is an oral illness with localised tissue loss within the periodontium, new research indicates that periodontitis may also affect systemic health **[2, 3].** Literature contains various findings about possible relationship between blood serum lipids and periodontal conditions with many studies signifying a positive correlation whereas many studies have had conflicting results **[1].** Hence, the impact of periodontal inflammation on lipid metabolism is controversial **[4].** Therefore, it is of interest to report the lipid biomarkers in patients with chronic periodontitis and patients with healthy periodontium.

Materials and Methodology:
A randomized controlled cross-sectional study had been conducted to compare lipid biomarkers in patients with chronic periodontitis and patients with healthy periodontium in ANMMCH, Gaya and Bihar. Study was conducted amongst a total of 36 subjects, randomly allocated to 2 groups having 18 patients each recruited from the Department of Dentistry, ANMMCH, Gaya and Bihar. Hence, Group I (Healthy Periodontium) consisting of 18 subjects and Group II (Chronic Periodontitis) consisting of 18 subjects. Periodontitis (generalised chronic) cases were defined as subjects with 1 mm or more of CAL at ≥30% of the sites.

Inclusion criteria:
[1] Age group between 25 years -70 years
[2] Either gender
[3] Systemically healthy patients
[4] patients who had ≤20 teeth
[5] Those who gave written consent

Exclusion criteria:
[1] Individuals with established systemic illnesses (such as hypertension, diabetes mellitus, hyperlipidaemia, CVDs, *etc.*)
[2] Smokers
[3] Patients who are obese and have a body mass index (BMI) of more than thirty
[4] Individuals with aggressive periodontitis, those who have had dental treatment within the last six months, including oral prophylaxis and those who have undergone systemic antibiotic medication during the last three months
[5] Uncooperative or unwilling to give permission

Data collection:
Age, gender, height and weight were among the specific demographic factors that were noted. BMI was calculated using the following formula: BMI = body mass (kg)/body height (m^2).A mouth mirror, an explorer and a University of North Carolina-15 (UNC-15) probe were used to record the Plaque index (PI), Gingival index (GI), Probing pocket depth (PPD) and Clinical attachment level (CAL) during a full mouth examination. The participants were referred to the Department of Biochemistry and Pathology, ANMMCH, Gaya, Bihar, for a lipid profile haematological study. Use a sample of fasting blood. Using a 5 ml disposable syringe and a 23-gauge needle, blood samples (5 ml) were obtained by venipuncturing the cubital vein in the antecubital fossa. They were gathered without the addition of an anticoagulant in sterile vacutainer tubes. Serum was extracted from the obtained blood samples, put into a 2 ml vial and kept between 20°C and 80°C for analysis using a standard enzymatic procedure. Serum cholesterol, triglycerides (TG), HDL, very low-density lipoprotein (VLDL) and low-density lipoprotein (LDL) were measured as part of the lipid profile.

Statistical analysis:
The data was entered into MS excel sheet and SPSS 21 software was used to perform statistical analysis using independent t-test, with p-values less than 0.05 had been considered statistically significant.

Results:
Results revealed that patients with chronic periodontitis showed significantly elevated Plaque Index (2.31 ± 0.42 vs. 0.82 ± 0.21; $p < 0.001$) and Gingival Index (2.14 ± 0.37 vs. 0.76 ± 0.19; $p < 0.001$) compared to healthy subjects. Probing pocket depth (PPD) was significantly deeper in the periodontitis cohort (5.6 ±0.8 mm) than in healthy controls (1.8 ±0.4 mm; $p < 0.001$). Clinical attachment loss (CAL) was markedly increased in periodontitis patients relative to healthy subjects (4.9 ±0.7 mm vs. 0.9 ±0.3 mm;

p < 0.001), indicating substantial tissue destruction. Hence, the periodontal parameters including gingival index, plaque index, probing pocket depth and clinical attachment loss were significantly increased in patients with chronic periodontitis as shown in **Tables 1 and 2**. Furthermore, Serum total cholesterol (TC) was significantly elevated in the chronic periodontitis group (212.6 ±24.2 mg/dL) compared to healthy controls (168.4 ±18.5 mg/dL; p < 0.001).Serum triglyceride (TG) levels were significantly higher in subjects with periodontitis (186.9 ±22.1 mg/dL) than in healthy subjects (118.7 ±16.4 mg/dL; p < 0.001). High-density lipoprotein (HDL) levels were significantly reduced in periodontitis patients (39.8 ±4.7 mg/dL) compared to healthy controls (52.1 ±5.6 mg/dL; p < 0.001).Low-density lipoprotein (LDL) and very low-density lipoprotein (VLDL) levels were significantly elevated in the periodontitis group (142.7 ±18.9 mg/dL and 37.4 ±5.1 mg/dL) compared to controls (94.6 ±14.8 mg/dL and 23.7 ±4.2 mg/dL; both p < 0.001). Therefore, patients with chronic periodontitis showed significantly higher serum cholesterol, triglycerides, LDL and VLDL levels as compared to healthy subjects. HDL levels were significantly lower in the chronic periodontitis group as shown in **Table 3**. Henceforth, chronic periodontitis was observed to be associated with severe periodontal destruction alongside a dyslipidemia serum profile.

Table 1: Demographic distribution of study population

Variables	Healthy Group	Periodontitis Group	P value
Mean Age (years)	38.4 ± 7.2	42.8 ± 8.1	0.08
Male/Female	10/8	11/7	0.74
BMI	23.1 ± 2.3	24.0 ± 2.7	0.29

Table 2: Comparison of periodontal parameters

Parameters	Healthy Group	Periodontitis Group	P value
Plaque Index	0.82 ± 0.21	2.31 ± 0.42	<0.001
Gingival Index	0.76 ± 0.19	2.14 ± 0.37	<0.001
PPD (mm)	1.8 ± 0.4	5.6 ± 0.8	<0.001
CAL (mm)	0.9 ± 0.3	4.9 ± 0.7	<0.001

Table 3: Comparison of lipid biomarkers

Lipid Biomarkers	Healthy Group	Periodontitis Group	P value
Total Cholesterol (mg/dL)	168.4 ± 18.5	212.6 ± 24.2	<0.001
Triglycerides (mg/dL)	118.7 ± 16.4	186.9 ± 22.1	<0.001
HDL (mg/dL)	52.1 ± 5.6	39.8 ± 4.7	<0.001
LDL (mg/dL)	94.6 ± 14.8	142.7 ± 18.9	<0.001
VLDL (mg/dL)	23.7 ± 4.2	37.4 ± 5.1	<0.001

Discussion:

The researchers discovered that periodontitis frequently did not exist on its own and that it was frequently linked to other systemic illnesses in the body that were impossible to overlook. A profile lipid is a blood lipid pattern. Triglyceride, which is crucial for the majority of cells, low-density lipoprotein (LDL), high-density lipoprotein (HDL) and total cholesterol (TC) are all included in profile lipids **[5]**. A condition involving lipoproteins in plasma is called dyslipidaemia. High TC, high TG, elevated LDL, elevated VLDL, or decreased HDL was found in the laboratory analysis **[6].** Research has indicated that dyslipidaemia, a disorder characterised by changes in blood lipid levels, may have a significant role in exacerbating periodontal deterioration **[7].** There is growing interest in the connection between dyslipidaemia and periodontitis. Dyslipidaemia is characterised by changes in serum levels of TG, TC, LDL-C and HDL-C **[8, 9].** Thereby, present cross-sectional study was conducted to evaluate and compare lipid biomarkers in patients with chronic periodontitis and healthy periodontium. Based on the clinical and biochemical findings, it was observed that subjects with chronic periodontitis demonstrated significantly altered lipid profiles when compared with periodontally healthy individuals. The periodontal parameters including Plaque Index (PI), Probing Pocket Depth (PPD), Gingival Index (GI) and Clinical Attachment Loss (CAL) were found to be significantly higher in patients suffering from chronic periodontitis, indicating severe periodontal tissue destruction and inflammation. These findings confirm the active inflammatory nature of periodontal disease and its impact on oral health. Biochemical analysis revealed significantly elevated triglycerides (TG), serum total cholesterol, low-density lipoprotein (LDL) and very low-density lipoprotein (VLDL) levels in chronic periodontitis patients, whereas high-density lipoprotein (HDL) levels were significantly reduced compared to healthy controls. The differences observed between the two groups were statistically significant using the independent t-test with p-values less than 0.05. According to recent research published by Mirzaei *et al*. **[10]**, periodontal disorders may possibly be a risk factor for hyperlipidaemia. In cross-sectional and case-control studies, periodontitis was substantially linked to dyslipidaemia, increasing the likelihood of low HDL by 32% and the odds of dyslipidaemia by 15%. Periodontitis indices were raised by raising the lipid profile, with the exception of HDL, which had a protective effect on periodontitis, according to continuous data, which showed significant positive associations between periodontitis indices and mean TG, LDL and TC and a significant negative association with HDL. Even yet, the findings contradict a number of investigations Xu and Duan **[11]** that found no correlation. Hence, the results of the present study suggest a strong association between chronic periodontitis and dyslipidemia. Chronic periodontal inflammation may contribute to systemic inflammatory burden, leading to disturbances in lipid metabolism. Elevated lipid levels may further enhance inflammatory responses, thereby creating a bidirectional relationship between periodontal disease and systemic metabolic alterations. The findings of this study emphasize the importance of periodontal health not only in maintaining oral hygiene but also in preventing systemic complications such as cardiovascular diseases and metabolic disorders. Early diagnosis and effective periodontal therapy may help reduce systemic inflammatory load and improve lipid profile status.

Conclusion:
Chronic periodontitis was significantly associated with altered serum lipid biomarkers. Patients with periodontitis showed higher levels of total cholesterol, triglycerides, LDL and VLDL, along with lower HDL levels. Further longitudinal studies with larger sample sizes are needed to establish a definitive causal relationship between periodontal disease and lipid metabolism.

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