

Comparison of Serum Lipid Levels in Periodontal Health and Disease in Systemically Healthy Subjects – A Clinical and Biochemical Study

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Abstract

Aim: To compare the serum lipid levels in systemically healthy subjects with and without periodontal disease and to correlate the results between hyperlipidemia and periodontitis.

Material and Methods: A total of 80 subjects of both sexes (42 males and 38 females), in the age group of 35-55 yrs were divided into two groups of 40 each as study and controls. All the patients were evaluated for serum cholesterol, serum triglycerides, LDL and HDL cholesterol. Variables related to high cholesterol levels, including age, sex and body mass index were also evaluated. The dental parameters recorded consisted of probing pocket depth (PPD), community periodontal index (CPI) and periodontal disease index (PDI).

Results: Total cholesterol, LDL cholesterol and triglycerides were marginally increased in study group but were not found to be statistically significant ($p=0.106$, $p=0.100$ & $p=0.199$ respectively). Triglycerides showed a positive correlation with CPI and PDI after adjusting for age and disease. However, the correlation of triglycerides with PDI was minimal compared to the correlation of triglyceride with CPI.

Conclusion: The findings of this study showed that there was no significant relationship between periodontal disease, regardless of its intensity, and blood lipid levels in the study population.

KEYWORDS: Periodontitis, Hypercholesterolemia, Triglycerides, Serum lipids, Community periodontal index.

Introduction

Periodontal disease is an infectious disease caused by a small group of predominantly anaerobic gram-negative bacteria present on the tooth surface as biofilm. Lipopolysaccharides and other microbial substances gain access to the gingival tissues, initiate and perpetuate inflammation, resulting in production of high levels of pro-inflammatory cytokines, which lead to the destruction of the periodontal ligament and alveolar bone.(1) Several studies have indicated that subjects with periodontal disease may have a higher risk for cardiovascular diseases when compared to subjects with a healthy periodontium.(2,3,4) So far, the causality and possible pathways of the association between periodontal disease and cardiovascular disease are obscure. Factors that place individuals at risk for periodontitis may also place them at risk for cardiovascular disease; that means that periodontitis and cardiovascular disease may share common risk factors, such as smoking, diabetes, behavioral factors, ageing, and male gender. In a number of case-control and cohort studies, even after adjusting for these factors in multivariate analysis, the association between periodontitis and cardiovascular disease remained statistically significant (3,5,6). Thus, one can speculate that periodontal disease as a chronic infection may be related with cardiovascular disease.

Hyperlipidemia is considered as one of the major cardiovascular disease risk factors. (7) Recently, a causal relation has been demonstrated between high serum lipid levels and periodontal disease. Also, recent studies illustrate the existence of a relation between periodontal disorders and hyperlipidemia, which power the probable effect of periodontal disease as an underlying factor for hyperlipidemia. This theory was presented by *Losche et al.*, who demonstrated significantly higher levels of Total serum Cholesterol and LDL among the patients suffering from periodontitis than in the control group (1). This theory was supported by other studies also (8-10); however some studies reported an insignificant relation between the two parameters tested (11-13). Due to this controversial data and the rising trend of serum lipid levels resulting in consequently unknown complications, this study was undertaken to determine the relation between chronic periodontitis and fasting serum lipid levels in an Indian population.

Material and Methods:

40 control subjects- Group I (16 females and 24 males, mean age 41.98 ± 5.90) and 40 patients with periodontitis-Group II (22 females and 18 males, mean age 43.33 ± 6.69) were included in the study. After ethical approval from the Institutional ethical committee, subjects were selected from the outpatient section of, D A Pandu Memorial R V Dental College, Bangalore, during the study period from December 2010 to June 2011. After being informed about the purpose of the study, all the subjects gave written consent to be included in the study. Both periodontitis and control subjects were asked to answer a questionnaire with regard to their social and general medical status. The selected subjects had no history of any dental treatment during the past six months and were in good general health without any history of systemic disease or compromising medical conditions.

Exclusion Criteria: Smokers, person with diabetes mellitus, endocrine disorders, myocardial infarction, stroke and cancer, and persons on medication for hypercholesterolemia.

The physical examination included measuring weight (in kilograms) using a calibrated weighing scale, and height (in centimeters) using a tape measure. The obesity level was assessed through the Body Mass Index (BMI); individuals with BMI ≥ 30 were considered obese (14).

Serum Lipid levels measurement:

All the subjects were asked to fast for 8-12 hours before reporting for blood sample collection. The blood samples were assessed at Thyrocare Laboratory-Bangalore, for Total cholesterol, LDL cholesterol, HDL cholesterol and triglycerides using enzymatic method. To identify subjects with pathological values, the following cut-off points were used according to the laboratory's recommendation: total cholesterol >200 mg/dl, LDL-cholesterol >130 mg/dl, HDL-cholesterol <30 mg/dl, triglycerides >200 mg/dl.

Dental variables:

All the subjects were examined by the same examiner. All dental variables were assessed at 6 different sites around each tooth.

- Probing pocket depth was measured with William's graduated periodontal probe. Pockets were categorized as healthy (up to 3mm), moderately diseased (4 and 5mm), and advanced disease (≥ 6 mm).
- Periodontal disease index (Ramfjord index) (15) was recorded for all the subjects. The pre-selected teeth included 16, 21, 24, 36, 41, and 44.
- Community periodontal index (CPI) was recorded using CPI probe (Hu-Friedy, Chicago, IL, USA). The teeth examined were 17, 16, 11, 26, 27, 31, 36, 37, 46, and 47. Although 10 index teeth were examined, one relating to each sextant was made. When both or one of the designated molar teeth was present, the worst finding from these tooth surfaces was recorded for the sextant. If no index teeth were present in a sextant qualifying for examination, all the remaining teeth in that sextant were examined. If no teeth were present in the sextant then it is coded as X. (15)

Statistical analysis:

Student t test has been used to find the significance of homogeneity of study characteristics between the two groups of patients. Unpaired, two-tailed student t test has been used to find the significance of lipid parameters between both the groups (Statistical software SPSS statistical package (Version 17.5), SPSS, Chicago, IL.) was used for the analysis of the data recorded.

Results:

The present study was conducted on 80 subjects, including 40 cases of periodontitis and 40 control subjects. According to the questionnaire, there were no differences in the social status of periodontitis and control subjects. The prevalence of abnormal serum lipid levels in both the groups is tabulated in **Table-1**. The frequency of abnormal triglyceride levels in periodontitis group was about 2.5 times more compared to controls. The levels of the abnormal LDL and HDL cholesterol were 1.75 and 1.5 times more compared to controls respectively. These findings are in agreement with the findings of *Loesche et al.* (1) and *Moeintaghavi et al.* (10) However, no difference between the groups was found for total cholesterol levels. This finding is contradictory to the findings of study by *Losche et al* (1) where they found increased frequency of abnormal total cholesterol levels in study patients compared to controls. One possible explanation for this discrepancy is the cut-off

Table-1: Comparison of frequency of abnormal lipid parameters along with cut-off value between the two groups

Lipid parameters with Cut off value (mg/dl)	Group I- Controls (n=40)	Group II- Periodontitis group (n=40)	P value
Total cholesterol (>200mg/dl)	4 (10.0%)	3 (7.5%)	1.000
HDL (<30mg/dl)	4 (10.0%)	6 (15.0%)	0.497
LDL (>130 mg/dl)	4 (10.0%)	7 (17.5%)	0.330
Triglycerides (>200mg/dl)	4 (10.0%)	9 (22.5%)	0.130

Results are presented as number of patients and percentage (%)

Table-2: Age, BMI and serum lipid levels in both the groups

Variable	Control Group (Mean ± SD)	Test Group (Mean ± SD)	Student's t test (p≤0.05)
Age (years)	41.98±5.90	43.33±6.69	0.341
Body mass index (kg/m ²)	24.4±2.6	25.0±3.3	0.52
Total Cholesterol (mg/dL)	163.63±26.44	173.68±28.55	0.106
Triglycerides (mg/dL)	155.59±33.86	172.35±74.41	0.199
LDL(mg/dL)	98.26±21.33	107.31±26.93	0.100
HDL(mg/dL)	39.28±7.83	38.75±8.78	0.774

Table-3: Correlation of Lipid parameters with CPI and PDI

Lipid Parameters	CPI		PDI	
	Beta value	P value	Beta value	P value
Total Cholesterol	-0.035	0.730	0.007	0.944
Triglycerides	0.178	0.050*	0.126	0.182
LDL	-0.076	0.433	0.044	0.655
HDL	-0.060	0.520	0.087	0.367

point used for total cholesterol in Losche's study was >230 mg/ml, whereas the cut-off point for total cholesterol in our laboratory setup was >200 mg/ml.

The summary of the statistical analysis of the age, BMI and serum lipid levels for the test and control groups are shown in **Table-2**. Among the individuals of test group, 85% presented with severe periodontitis and remaining 15% with moderate periodontitis.

The correlation of lipid parameters with CPI and PDI is tabulated in **Table-3**. Triglycerides showed positive correlation with CPI after adjusting for age and disease. PDI also showed positive correlation with triglycerides; however the Total cholesterol, HDL and LDL minimally correlated with PDI.

Discussion

Periodontitis is an inflammatory, chronic, destructive disease that affects the tissues that support the teeth. The complex correlation between microorganisms, its products and the host's defense mechanisms, innate and acquired, determine the result of the periodontal disease, whose progression is not linear but sporadic. (16) It is well-established that marginal periodontitis and cardiovascular disease share some common risk factors, such as diabetes mellitus, smoking, poor oral health care habits. The social background of both the groups was balanced in this study, and smokers were excluded. Presently, there is a great concern with the blood lipid level, since the rise of these rates represents an important risk factor for cardiovascular diseases. (17) The prevalence of hyperlipidemia is still scarcely established, and the results of the studies in literature are controversial. Moreover, such prevalence is geographically variable, depending on the cultural or

acquired eating habits, as well as on the life style of the different populations. (13)

The present study demonstrated slightly higher serum lipid levels in study group as compared to control group, although the difference was not statistically significant. Some studies in the literature address a relation between chronic periodontitis and serum lipid levels (1, 8-10) while some results of some other studies reported lack of such a relation. (11-13) Each of these studies have their own specifications, such as criteria for definition of periodontal disease, assay for serum lipid levels, study design, number of cases, and cut-off value for the various parameters tested.

There are some theories that periodontitis predispose individuals to systemic disease. *Iacopino & Cutler* (18) confirmed that an increase in pre-inflammatory cytokine in response to chronic periodontitis causes a rise in serum lipid levels. Infection with Gram negative periodontal pathogens could prompt release of systemic IL-1 β and TNF- α , causing chronic hypertriglyceridaemia. *Morita et al.* reported a significant relation between elevated TG (over 149 mg/dl) and periodontal disease. Although HDL serum level in case group (with periodontal disease) was lower than control group, this difference was not significant, which is similar to our results. (19)

Only one study, performed by *Katz et al.* (20), found in the literature verified the degree of obesity, another important factor since it leads to disturbances in general health conditions, such as psychological changes, hypertension, cardiovascular diseases, and hyperlipidemia, among others. Overweight affects about 1/3 of the adult population and presents a growing tendency in the last decades. In the present study there

was no statistically significant difference between the BMI of the study and control groups.

Losche et al. assayed plasma lipid concentration before and three months after local therapy in 32 patients suffering from periodontitis. Although periodontal treatment caused dramatical decrease in local inflammation and tissue damage and pre-treatment value of LDL coordinated with clinical inflammatory parameters and periodontal erosion, the difference between plasma lipid levels before and after treatment was not significant.(21) Results of another study in 2007 conducted by *Fentoglu et al.* showed that periodontitis could cause some changes in total cholesterol and LDL serum levels and local periodontal treatment could causes to noticeable decrease in these markers (22). *Velanta Viciente et al.* studied the relation between serum lipids level and periodontal condition by CPITN index. The results of this study revealed that serum lipid levels in periodontal patients did not have any difference with healthy subjects. The author concluded the results of their study were influenced from low age status (average 38 years) and ignorance of diet factors, emotional stress and physical behavior (12).

Machado et al in a similar study found that the average cholesterol and TG were not significantly higher in periodontal patients than healthy ones (13). Also Lopes-Virella study did not confirm a relation between hyperlipidemia and infection (11).

Finally, the disagreements observed in the studies relating periodontal disease with hyperlipidemia may be in part due to the great number of variables involved such as diet and physical activity habits, socio-economical conditions, age and stress, which are factors subjected to the environment in which the individual lives, interfering with the study results since they are situations that are difficult to control.

Conclusion

Based on the results of the present study, it can be concluded that there was no significant statistical relationship between chronic periodontal disease and the serum levels of total cholesterol, low- and high-density lipoproteins and triglycerides in the studied population. Since this study was of a cross sectional nature conducted on a modest sample size of 80 subjects, studies with larger sample sizes need to be carried out in future to endorse the results observed in our study.

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