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Research Article

Association of Serum Vitamin D and Serum Lipid Levels in Chronic Periodontitis Patients- A Comparative Study

Dr. Sakshi Manhas[1], Dr. Sumit Kaushal[2], Navneet Kaur[3]* and Dr. Gurpreet Kaur[4]

[1]*Post graduate student, National Dental College and Hospital, Derabassi, Punjab, India*

[2]*Professor, National Dental College and Hospital, Derabassi, Punjab, India*

[3]*Associate Professor, National Dental College and Hospital, Derabassi, Punjab, India*

[4]*Professor, Head of Department, National Dental College and Hospital, Derabassi, Punjab, India*

***Corresponding Author:** Navneet Kaur., *et al.* Reader, Department of Periodontics and Oral Implantology, National Dental College and Hospital, Derabassi, Mohali, Punjab, India.

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Abstract

Background: Chronic periodontitis is a multifactorial etiological risk factor which includes local and systemic variables affecting the hard and soft tissues of periodontium resulting in gingival inflammation and alveolar bone resorption. Evidence-based researches have shown that there is an existence of plausible relationship between periodontitis, serum vitamin D levels and serum lipid levels that has a direct negative impact on the periodontium and its supporting structures. Vitamin D is helpful in the management of periodontitis and has an antibiotic effect on periodontal infections. It also has a direct impact on bone metabolism.

Aim and Objective: The purpose of the study was to evaluate the association of serum vitamin D levels in patients with chronic periodontitis and to evaluate the association of serum lipid levels in chronic periodontitis patients.

Materials and Methods: A total of 10 patients both males and females (premenopausal) within the age group of 30 - 60 years were randomly divided into 2 groups: group 1 (test group): 5 patients diagnosed with chronic periodontitis and in group 2 (control group): 5 periodontally healthy subjects were enrolled for the study. Clinical parameters included plaque index, gingival index, probing pocket depth, clinical attachment levels were recorded. Biochemical parameters recorded in both the groups included serum vitamin D levels and serum lipid Levels (cholesterol, triglycerides, LDL, VLDL and HDL).

Results: In the subjects with deficient vitamin D, 57.1% were having periodontitis and 42.9% were healthy the difference between the groups b (test and control) was statistically non-significant when analyzed using the chi square test ($p = 0.196$). The difference between the two categories of vitamin D (Insufficient and deficient) for the PI, GI, PD, CAL scores were statistically non-significant. In the subjects with chronic periodontitis, the mean total cholesterol level, LDL and TGL levels were found to be statistically non-significant. The difference between the groups was statistically significant for HDL and VLDL ($p = 0.043$), $p = 0.041$) respectively. In the subjects with chronic periodontitis there was a significant negative correlation between plaque index and total cholesterol levels ($r = - 0.928$). There was a significant negative correlation between VLDL and plaque index ($r = -0.943$*). In the subjects without chronic periodontitis there was a non-significant correlation ($P = 1.000$) between serum lipid profile and clinical parameters like plaque index, gingival index, probing depth and CAL.

Conclusion: In this study, low serum 1,25 $(OH)_2D$ level were not found to be associated with chronic periodontitis but the results related to serum lipid profile levels were statistically significant. Whether this association is causal or not in nature needs to be confirmed in future studies.

Keywords: *Serum Vitamin D; Serum Lipid Levels; Calcitriol; Calcium; Chronic Periodontitis*

Introduction

Most common infectious diseases of the periodontium are gingivitis and periodontitis in which inflammation associated with the loss of periodontal connective tissue and tooth supporting structures. The susceptibility to the disease may vary between the individuals and is affected by a number of systemic diseases and conditions. On the other hand, periodontal infection has been suggested to predispose to systemic diseases and this association may be casual in nature because both the conditions may share a common risk factor [1,2]. The host response to microbial antigens in gingivitis and periodontitis include actions of both innate and adaptive immunity, which are known to be partly modulated by vitamin D especially its active form 1,25 $(OH)_2D$ [3]. Therefore, it is likely that serum vitamin D levels could be associated with the extent and severity of infectious periodontal diseases. Previous study of the relation between the storage form of vitamin D, 25 (OH)D and infectious periodontal disease do not conclusively show markedly positive effect of 25 (OH)D on periodontal condition [4-6]. Moreover, no clear benefits Vitamin D and its role in oral health have recently attracted a considerable interest in both research and clinical care. The main function is maintenance of bone health throughout life. This is achieved through the enhancement of calcium and phosphorous absorption, osteoclastic and osteoblastic activity and by controlling the parathyroid hormone levels [7].

Independently, it has a well recognized role in bone homeostasis, vitamin D status in patients has now been shown to be associated with a wide range of physiologic and diseased state such as immune related diseases. Specifically, vitamin D exerts an indirect antimicrobial and anti-inflammatory effect so that pathologically low level of vitamin D may result in infection or immune dysfunction [8].

The initial defense against the periodontal pathogens includes the expression of a number of host defense peptides such as β-defensins and cathelicidins from oral epithelial cells [9]. In 2004, Wang and coworkers demonstrated for the first time that vitamin D directly induces production of the antimicrobial peptide cathelicidin [10]. Cathelicidin is multifunctional enzyme with anti microbial activity against periodontal pathogens. It has been shown *in vitro* studies 1,25, $(OH)_2D_3$ can induce the expression of cathelicidin and can increase its antibacterial activity against periodontal pathogens suggesting that vitamin D could have beneficial effect in periodontal health [11]. Moreover, 1,25 $(OH)_2D$ has a substantial effect on the production on inflammatory mediators that is 1,25 $(OH)_2$ inhibits the production of pro inflammatory cytokines such has IL-1α, IL-6 and TNF -α in lipopolysaccharides stimulated monocytes. Furthermore, 1,25, $(OH)_2$ effects dendritic cells by reducing the production of IL-12 and IL-17 [12,13].

Ample amount of data is available in the literature investing the association between vitamin D and periodontal diseases. One of the longest and largest prospective study conducted so far (Buffalo Osteo Perio study) that evaluates the association between vitamin D levels and the progression of periodontal disease in 655 post-menopausal women. Disease progression was assessed using changes on alveolar crest height, PD, CAL and bleeding on probing. The author found no association between vitamin D level and periodontal disease progression even after adjusting the number of confounding factors (age, smoking status, history of diabetes, current use of osteoporosis related medicine and BMI) [14].

Hyperlipidaemia is one of the risk factors for cardiovascular diseases [15]. Disturbances in the serum lipid profile, such as elevated blood concentrations of TC, TG, low levels of LDL, low levels of HDL serve as one of the key factors strongly linked to pathophysiology of CVD. Diet that is rich in fats, lack of physical exercise, and genetics are associated with hyperlipidaemia according to the newer data. Recent data point to the possibility that hyperlipidaemia may potentially be at risk due to periodontal disorders [16]. Although there is no correlation in several investigations [17,18]. Three large retrospective studies demonstrated that vitamin D deficiency was associated with increased risk for coronary heart disease, including hypertension, diabetes mellitus, obesity, high serum LDL and triglycerides level and low serum level of HDL. Despite these findings from observational studies, randomized controlled studies are designed to assess the impact of vitamin D supplementation on cardiovascular diseases, outcome are conflicting and unknown. Most of the evidences have shown that vitamin D supplementation has no effect on vascular disease mortality. However, some RCT results have shown that a higher

intake of vitamin D is associated with lower risk of cardiovascular diseases with an effect attributed to an improvement in vascular endothelial function and decrease in inflammation. The anti-atherogenic effect of vitamin D has been attributed to the regulation of immune/inflammatory response. Vitamin D has found to inhibit COX-1/COX-2 expression promote prostaglandin catabolism and reduction of ROS production as well as suppression of pro-inflammatory cytokines [19]. There is a lipid interaction with cell membrane of macrophage which interfere with membrane bound receptor and enzymatic system. It may also alter the macrophage gene expression for essential polypeptide growth factors and pro-inflammatory cytokines namely TNF-α AND IL-1β associated with periodontal diseases. All these mechanism pointed in the direction of involvement in endothelial dysfunction as well as an association between periodontal diseases. Pro-inflammatory cytokine levels in chronic periodontitis can rise steadily, which can result in aberrant serum lipid levels and have a negative impact on overall systemic health [20,21].

Recent data evaluates the existence of an association between periodontal disease and hyperlipidaemia, which power the probable effect of periodontal disease as an underlying factor for hyperlipidaemia. Losche., *et al*. conducted a study, which demonstrated higher level of total serum Cholesterol and LDL among the patients suffering periodontitis than control group significantly [22].

Purpose of the Study

The purpose of the study was to evaluate the association of serum vitamin D levels in patients with chronic periodontitis and to evaluate the association of serum lipid levels in chronic periodontitis patients [23,24].

Materials and Methods

Study population

This was a pilot study done in the Department of Periodontology and Oral Implantology, National Dental College and Hospital, Derabassi, Punjab. An ethical approval for the study was taken from the Institutional Ethical Board Committee at National Dental College and Hospital, Derabassi. A total of 10 patients both males and females (pre-menopausal) within the age group of 30 - 60 years were randomly divided into 2 groups:

- Group 1 - 5 suffering from chronic periodontitis were enrolled.
- Group 2 - 5 healthy subjects were enrolled.

Inclusion criteria:

- Patients who were diagnosed as suffering from generalized moderate to severe chronic periodontitis having minimum of 4 teeth with probing pocket depth (PPD) between 5 - 8 mm, clinical attachment level > 1 mm, gingival index score > 1 were enrolled.
- Patient who had minimum of 16 teeth.
- Patients of both sexes between the age group of 30 - 60 years (premenopausal women).
- Patients who had not received any periodontal therapy for the past 6 months.
- Patients who were not receiving any antibiotic therapy from the past 6 months.

Exclusion criteria:

- Postmenopausal women were excluded.
- Patients who had received vitamin D and calcium supplements.
- Patients with vitamin D deficiency including bone disorders, malignancies, multiple sclerosis and immunodeficiency disease.
- Pregnant women and nursing mothers.
- Any tooth with periapical disease.
- Chronic alcoholic patient.
- Patients on anti-hyperlipidaemic drug therapy.

Assessment of clinical parameters

Plaque index (Loe and Silness), Gingival index (Loe and Silness), PPD and CAL were recorded to the nearest millimeter using UNC-15 periodontal probe. Probing pocket depth was measured from free gingival margin to cementoenamel junction from each tooth site. Clinical attachment loss for each site was also recorded from cementoenamel junction from the bottom of the sulcus.

Vitamin D serum level assessment

Serum vitamin D levels were measured using electrochemiluminescence immunoassay (ECLIA). Normal serum vitamin D levels were within a range of 75 - 250 ng/ml which is considered sufficient, insufficient range between 50 - 74 ng/ml and deficient was < 50 ng/ml. Therefore, vitamin deficiency was defined as < 50 ng/ml and patients were stratified based on this deficiency.

Serum lipid profile assessment: Assessment of serum lipid profile parameters includes total cholesterol, triglycerides; HDL, LDL and VLDL were measured. The optimal level of total cholesterol were considered < 200 mg/dl, triglycerides < 150 mg/dl, LDL < 100 mg/dl, HDL > 40 mg/dl and VLDL < 30 mg/dl.

Methodology

10 patients both males and premenopausal females within the age group of 30 to 60 years participated in the study. Patients were randomly divided into 2 groups:

- **Group 1:** 5 patients diagnosed with chronic periodontitis having 5 - 8 mm probing pocket depth in a minimum of 4 teeth were selected. All the clinical parameters (PI, GI, PPD, CAL) were measured using UNC-15 periodontal probe in 4 surfaces (mesial, distal, buccal and lingual) of all fully erupted teeth. Blood samples were also collected for assessment of serum levels of vitamin D and complete serum lipid profile that included total cholesterol, triglycerides, LDL, HDL, VLDL.
- **Group 2:** 5 healthy individuals were randomly selected. All the clinical parameters (PI, GI, PPD, CAL) were measured using UNC-15 periodontal probe in 4 surfaces (mesial, distal, buccal and lingual) of all fully erupted teeth. Blood samples were also collected for assessment of serum levels of vitamin D and complete serum lipid profile that included total cholesterol, triglycerides, LDL, HDL, VLDL.

Assessment of biochemical parameters (Serum vitamin D level and complete serum lipid profile level)

Patients were seated comfortably with the arm supported. Aseptic measures were taken and tourniquet was applied 2 inches above the elbow of upper arm. Site of puncture was cleaned using sterile gauze dipped in 100% alcohol. Using vacutainer and needle, 5 ml of blood was drawn from antecubital vein in violet vacutainer with EDTA. All the samples were collected and analyzed at the general pathology lab (Lal Path Lab) for the assessment of serum vitamin D level by ECLIA and complete lipid profile (cholesterol, TG, LDL, HDL, VLDL).

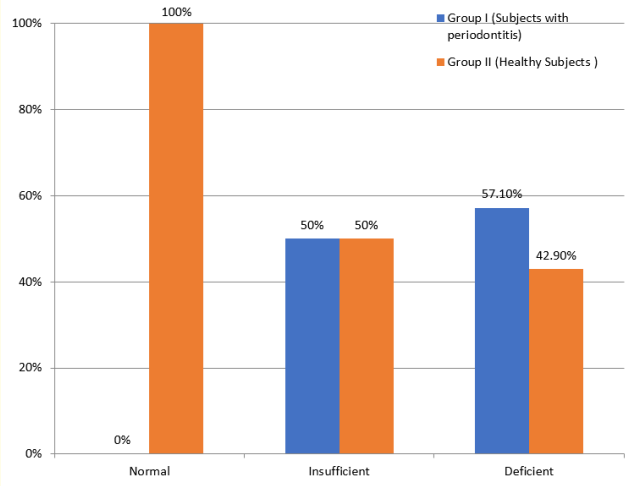
Results

Statistical analysis

The data for the present study was entered in the Microsoft Excel 2007 and analyzed using the SPSS statistical software 23.0 Version. The descriptive statistics included mean, standard deviation. The level of the significance for the present study was fixed at 5%. The intergroup comparison for the difference of mean scores between two independent groups was done using the Mann Whitney U test. The frequencies were compared using the Chi square test. The intergroup comparison between the three groups was done using the Kruskal Wallis test. The Shapiro-Wilk test was used to investigate the distribution of the data and Levene's test to explore the homogeneity of the variables. The data were found to be homogeneous and normally distributed. Mean and standard deviation (SD) were computed for each variable.

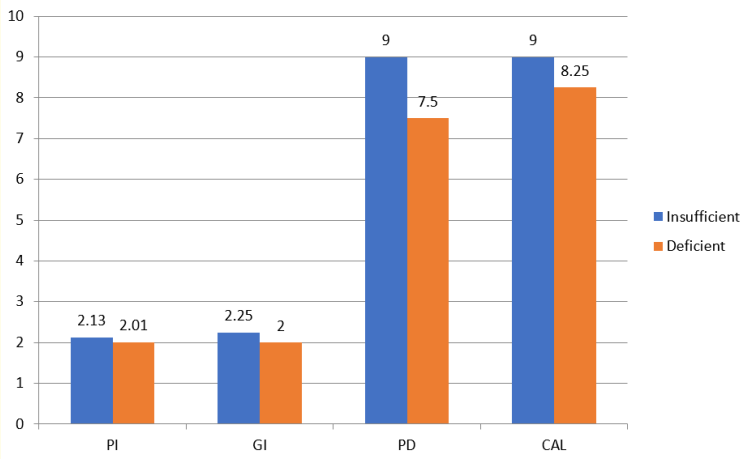
	Group I (Subjects with Periodontitis)	Group II (Healthy Subjects)	Chi Square value	P value
Normal	0%	100.0%	1.143	0.196
Insufficient (50 - 74 ng/ml)	50.0%	50.0%		
Deficient (< 50 ng/ml)	57.1%	42.9%		

Table 1: *Distribution of study population based on vitamin D levels in test and control group.*



Graph 1: *Distribution of study population based on vitamin D levels in test and control group.*

Table 1, graph 1 showed the distribution of the study population based upon test and control group. The normal level of vitamin D were found to be in 100% of healthy subjects and insufficient level of vitamin D were found to be 50% in both the groups. Regarding the deficient levels of vitamin D, 57.1% were having periodontitis and 42.9% were found to be healthy subjects. The difference between the groups were found to be statistically non-significant when analyzed using the Chi square test (p = 0.196*).



Graph 2A: *Correlation between vitamin d levels and clinical parameters in subjects with chronic periodontitis.*

	Group I (Group with Chronic periodontitis)			
	PI	**GI**	**PD**	**CAL**
Insufficient (50 - 74 ng/ml)	2.13 ± 0.03	2.25 ± 0.01	9.00 ± 1.03	9.00 ± 1.00
Deficient (< 50 ng/ml)	2.01 ± 0.02	2.00 ± 0.01	7.50 ± 1.00	8.25 ± 0.95
P value	0.145*	1.00*	0.272*	0.534*

Table 2A: *Correlation between vitamin D levels and clinical parameters in subjects with chronic periodontitis.*

**non-significant; **significant.*

Table 2A, graph 2A showed co-relation between vitamin D levels and clinical parameters (PI, GI, PD AND CAL) in subjects with chronic periodontitis. In the Group I (Subjects with periodontitis), the mean plaque index score was 2.13 ± 0.03 in the subjects with insufficient Vitamin D levels and 2.01 ± 0.02 in the subjects with deficient Vitamin D levels. The difference in between the two categories of Vitamin D levels i.e. insufficient and deficient for the mean plaque index scores was found to be statistically non-significant (p = 0.145). The mean gingival index score was 2.25 ± 0.01 in the subjects with insufficient Vitamin D levels and 2.00 ± 0.01 in the subjects with deficient Vitamin D levels. The difference in between the two categories of Vitamin D levels i.e. insufficient and deficient for the gingival index scores was found to be statistically non-significant (p = 1.000).

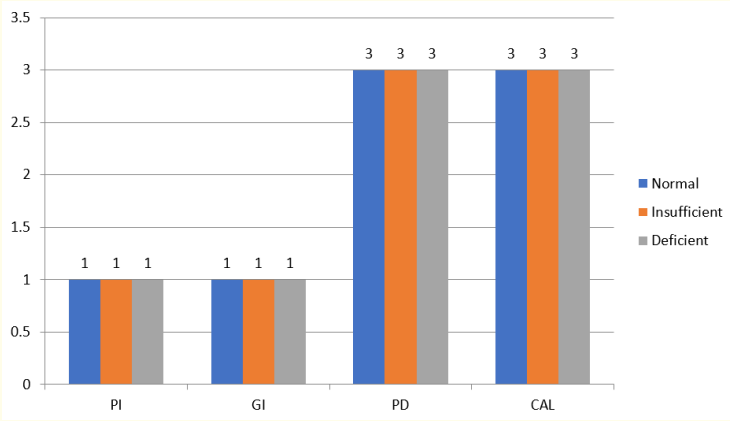
The mean PD score was 9.00 ± 1.03 in the subjects with insufficient vitamin D and 7.50 ± 1.00 in the subjects with deficient vitamin D. The difference in between the two categories of vitamin D levels i.e. insufficient and deficient for the PD scores was found to be statistically non-significant (p = 0.272). The mean CAL score was 9.00 ± 1.03 in the subjects with insufficient vitamin D and 8.25 ± 0.95 in the subjects

with deficient vitamin D levels. The difference between the two categories of vitamin D i.e. insufficient and deficient for the CAL scores was found to be statistically non-significant (p = 0.534).

Group II (Group with Healthy Patients)				
	PI	**GI**	**PD**	**CAL**
Normal	1.00 ± 0.01	1.00 ± 0.01	3.00 ± 0.01	3.00 ± 0.01
Insufficient	1.00 ± 0.01	1.00 ± 0.01	3.00 ± 0.01	3.00 ± 0.01
Deficient	1.00 ± 0.01	1.00 ± 0.01	3.00 ± 0.01	3.00 ± 0.01
P value	1.000*	1.000*	1.000*	1.000*

Table 2B: *Correlation between vitamin D levels and clinical parameters in healthy subjects.*

**indicates non-significant; **indicates significant.*



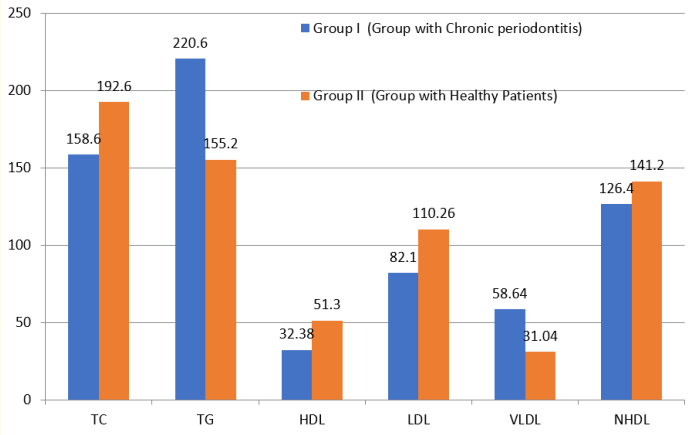
Graph 2B: *Correlation between vitamin D levels and clinical parameters in healthy subjects.*

In table 2B, group II B showed correlation between vitamin d levels and clinical parameters in healthy subjects, in group II (healthy subjects), the mean PI, GI, PD and CAL score were 1.00 ± 0.01, 1.00 ± 0.01, 3.00 ± 0.01, 3.00 ± 0.01 in normal, insufficient and deficient levels of vitamin D respectively. There was non-significant difference between the three categories of vitamin D levels i.e. normal, insufficient and deficient for the PI, GI, PD and CAL scores was found to be statistically non-significant (p = 1.000).

	Group I (Group with Chronic periodontitis)	**Group II (Group with Healthy Patients)**	**P value**
TC	158.60 ± 24.92	192.60 ± 66.86	0.318*
TG	220.60 ± 100.95	155.20 ± 61.10	0.012**
HDL	32.38 ± 6.90	51.30 ± 11.74	0.043**
LDL	82.10 ± 18.54	110.26 ± 58.21	0.333*
VLDL	58.64 ± 46.10	31.04 ± 12.22	0.041**
NHDL	126.40 ± 25.53	141.20 ± 69.28	0.666*

Table 3: *Distribution of study population with serum lipid profile in group I and group II.*

**non-significant; **significant.*



Graph 3: *Distribution of study population with serum lipid profile in group I and group II.*

In group I subjects with (chronic periodontitis), the mean total cholesterol level was 158.60 ± 24.92 and in group II (healthy subjects) the mean cholesterol level was 192.60 ± 66.86. The difference between group I and group II was found to be statistically non-significant (0.318*). The difference between the groups was statistically non-significant. The mean triglyceride level was 220.60 ± 100.95 in subjects with chronic periodontitis and 155.20 ± 61.10 in the healthy subjects. The difference between the groups was statistically significant (p = 0.002). The mean HDL level was 32.38 ± 6.90 in subjects with chronic periodontitis and 51.30 ± 11.74 in the healthy subjects. The difference between the groups was statistically significant (p = 0.043). The mean VLDL level was 58.64 ± 46.10 in subjects with chronic periodontitis and 31.04 ± 12.22 in the healthy subjects. The difference between the groups was statistically significant (p = 0.041).

	Group I (Patients with chronic periodontitis)				
Serum lipid profile parameters		**PI**	**GI**	**PD**	**CAL**
TC	r value	-0.928	-0.798	-0.114	-0.002
	P value	0.023**	0.105*	0.856*	0.997*
TG	r value	-0.623	-0.352	-0.390	-0.172
	P value	0.262*	0.561*	0.517*	0.782*
HDL	r value	0.170	0.010	0.492	-0.035
	P value	0.785*	0.988*	0.400*	0.956*
LDL	r value	-0.632	-0.693	0.089	0.197
	P value	0.252*	0.194*	0.887*	0.750*
VLDL	r value	-0.522	-0.330	-0.458	-0.692
	P value	0.367*	0.587*	0.438*	0.196*
NHDL	r value	-0.943*	-0.775	-0.247	0.002
	P value	0.016**	0.124*	0.689*	0.997*

Table 4A: *Correlation between lipid profile and clinical parametres in the subjects with chronic periodontitis.*

r = Pearson Correlation Coefficient; p = Level of significant (0.05).

**non significant; **significant.*

Table 4A showed correlation between lipid profile and clinical parametres in the subjects with chronic periodontitis. In the subjects with chronic periodontitis, there was a significant negative correlation between plaque index and total cholesterol levels (r = --0.928) and VLDL and plaque index (r = -0.943*). However, correlation between serum lipid profile i.e. TG, HDL, LDL. With clinical parameters (PI, GI, PD, CAL) of chronic periodontitis was found to be non-significant. The Pearson correlation coefficient for TG and LDL was negatively correlated with clinical parameters i.e. PI, GI, PD and CAL in chronic periodontitis patients.

	Group II (Periodontally healthy subjects)				
Serum lipid profile parameters		**PI**	**GI**	**PD**	**CAL**
TC	r value	0.000	0.000	0.000	0.000
	P value	1.000*	1.000*	1.000*	1.000*
TG	r value	0.000	0.000	0.000	0.000
	P value	1.000*	1.000*	1.000*	1.000*
HDL	r value	0.000	0.000	0.000	0.000
	P value	1.000*	1.000*	1.000*	1.000*
LDL	r value	0.000	0.000	0.000	0.000
	P value	1.000*	1.000*	1.000*	1.000*
VLDL	r value	0.000	0.000	0.000	0.000
	P value	1.000*	1.000*	1.000*	1.000*
NHDL	r value	0.000	0.000	0.000	0.000
	P value	1.000*	1.000*	1.000*	1.000*

Table 4B: *Correlation between lipid profile and clinical parametres in the subjects without chronic periodontitis.*

r = Pearson Correlation Coefficient; p = Level of significant (0.05).

**non significant; **significant.*

Table 4B showed correlation between lipid profile and clinical parametres in healthy subjects. In group 2 (healthy subjects), the correlation between serum lipid profile (TC, TG, LDL, HDL, VLDL) and clinical parameters i.e. PI, GI, PD and CAL was found to be non-significant (P = 1.000). No association was found in between serum lipid profile parameters and clinical parameters of healthy based upon the Pearson correlation coefficient.

Discussion

The present study evaluated the relationship between chronic periodontitis and vitamin D level. It was concluded that there is no association between chronic periodontitis and serum vitamin D level. In group I, subjects with (chronic periodontitis), the mean total cholesterol level was 158.60 ± 24.92 and in Group II (healthy subjects) the mean cholesterol level was 192.60 ± 66.86. The difference between group I and group II was found to be statistically non-significant (p = 0.992). The mean triglyceride level was 220.60 ± 100.95 in subjects with chronic periodontitis and 155.20 ± 61 in the healthy subjects. The difference between the groups was statistically significant (p = 0.002). The mean HDL level was 32.38 ± 11.74 in subjects with chronic periodontitis and 51.30 ± 11.74 in the healthy subjects. The difference between the groups was statistically significant (p = 0.043). The mean VLDL level was 58.64 ± 46.10 in subjects with chronic periodontitis and 31.04 ± 12.22 in the healthy subjects. The difference between the groups was statistically significant (p = 0.041). In the subjects with chronic periodontitis, there was a significant correlation between Plaque index, total cholesterol (0.928) and VLDL (r = -0.943).

The normal level of vitamin D were found to be in 100% of healthy subjects and insufficient level of vitamin D were found to be 50% in both the groups. Regarding the deficient levels of vitamin D, 57.1% were having periodontitis and 42.9% were found to be healthy subjects. The difference between the groups were found to be statistically non-significant when analyzed using the chi square test (p = 0.196*). In the group I (Subjects with periodontitis), the mean plaque index score was 2.13 ± 0.03 in the subjects with insufficient vitamin D levels and 2.01 ± 0.02 in the subjects with deficient vitamin D levels. The difference in between the two categories of vitamin D levels i.e. insufficient and deficient for the mean plaque index scores was found to be statistically non-significant (p = 0.145). The mean gingival index score was 2.25 ± 0.01 in the subjects with insufficient vitamin D levels and 2.00 ± 0.01 in the subjects with deficient vitamin D levels. The difference in between the two categories of vitamin D levels i.e. insufficient and deficient for the gingival index scores was found to be statistically non-significant (p = 1.000).

The mean PD score was 9.00 ± 1.03 in the subjects with insufficient vitamin D and 7.50 ± 1.00 in the subjects with deficient vitamin D. The difference in between the two categories of vitamin D levels i.e. insufficient and deficient for the PD scores was found to be statistically non-significant (p = 0.272). The mean CAL score was 9.00 ± 1.03 in the subjects with insufficient vitamin D and 8.25 ± 0.95 in the subjects with deficient vitamin D levels. The difference between the two categories of vitamin D i.e. insufficient and deficient for the CAL scores was found to be statistically non-significant (p = 0.534).

The results indicated that there was a statistically non-significant difference found in between chronic periodontitis and healthy group in terms of serum vitamin D level. There was no association of serum level vitamin D and periodontitis patients.

Vitamin D-binding protein (DBP) levels in plasma of patients with generalized aggressive periodontitis were measured by Zhang., *et al*. and they found no relation between DBP in plasma and periodontal indices [29]. The anti-inflammatory properties of 1,25 $(OH)_2$D have been thoroughly studied over the past few years, and the results are consistent with the hypothesis that 1,25 $(OH)_2$D has a suppressive effect on the production of pro-inflammatory cytokines like tumour necrosis factor-a, interleukin (IL)-6, IL-8, IL-12, IL-17A, matrix metalloproteinases like MMP-1 and MMP-3, as well as plasminogen activator inhibitor [30]. Assessment of total cholesterol showed statistically non-significant results in chronic periodontitis subjects as compared to healthy subjects. The results are in accordance with study conducted by Almeida Abdo., *et al*. showed that TC was significantly increased in patients with type II DM; however, periodontal disease did not show any significant correlation. Serum TG, HDL and VLDL was found to be statistically significant in chronic periodontitis subjects as compared to healthy subjects. Comparing participants with chronic periodontitis to subjects in good health, serum TG, HDL and VLDL levels were found to be statistically significant. There are a few clinical trials demonstrating many parameters of periodontitis in relation to vitamin D level assessment. it has been assessed that pro-inflammatory cytokines and vitamin D levels in rheumatoid arthritis and chronic periodontitis patients and compared the status before and after initial periodontal treatment with healthy individuals. Serum and gingival crevicular fluid (GCF) vitamin levels were measured, and the authors concluded that vitamin D levels might be an important indicator of periodontal bone loss.

Presently, vitamin D deficiency is thought to be associated with some cardiovascular health problems. Low vitamin D levels are independently associated with increased mortality in subjects with cardiovascular disease (CVD) [33]. Lipid/lipoprotein abnormalities such as increased levels of TC, TG and LDL-C and decreased levels of HDL-C have been identified to be important risk factors of atherosclerosis and CVD [34]. It has been established that lowering of serum cholesterol may lead to reduction in cardiovascular disease morbidity. Previous studies have suggested that there is a relationship between 25 (OH)D levels and serum lipids. However, the results are contradictory. A cross-sectional study among 8018 subjects was conducted by Jorde., *et al*. in Norway that indicated a positive association between serum 25 (OH)D levels and TC, HDL-C and LDL-C and a negative association between serum 25 (OH)D and TG [35].

In our study, the serum lipid profile levels were assessed between chronic periodontitis and healthy subjects. Recent data suggests that periodontal disease could be a risk factor for hyperlipidemia. However, it is unclear that how vitamin D influences lipid profile. Previous

data has advocated that increased intestinal calcium absorption may reduce hepatic synthesis and secretion of TG [36]. Vitamin D may inhibit the synthesis and secretion of TG by stimulating intestinal absorption of calcium. It has also been proposed that increased level of intestinal calcium may reduce intestinal absorption of fatty acid because of the formation of insoluble calcium-fatty complexes. As a result, the decreased absorption of fat, particularly saturated fatty acids, lowers the level of LDL in the serum. Higher amounts of 25 (OH) D reduce serum PTH levels, according to other research in the literature [37,38], while high levels of parathyroid hormone (PTH) cause TG levels to rise. Consequently, vitamin D may affect TG concentrations via controlling PTH levels. Additionally, vitamin D may play a direct role in lipid management as it has been linked to lipid metabolism, including the production of bile acid in the liver [38].

Because of the small number of patients, it is not possible to generalize the findings and, therefore, a larger sample sized trial is required to study high lipid susceptibility to periodontitis, which may suggest that increased serum lipid profile is a causative factor of periodontal diseases.

Conclusion

The present study was conducted to estimate the levels of lipid profile (TC, TG, LDL, VLDL and HDL) and serum Vitamin D along with periodontal parameters like Plaque index (PI), Gingival index (GI), Probing pocket depth (PPD) and Clinical attachment level (CAL) were observed in healthy and chronic periodontitis patients. A total of 30 patients including both males and females between 30 - 60 years were selected. The study subjects were clinically (using UNC-15 probe) and biochemically (lipid profile and serum vitamin D) evaluated.

The following conclusions were drawn according to observed results:

1. There is no correlation between serum vitamin D levels and periodontitis patients. Thus, serum vitamin D cannot be used as a clinical parameter for diagnosing severe periodontitis.

2. There is a correlation between serum lipid profile levels and periodontitis patients. So, elevated levels of serum lipid profile could be a risk factor for chronic periodontitis.

Further studies and investigations are needed to further evaluate the contribution of vitamin D deficiency on establishment and progression of periodontal disease.

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