

# The Association between Vitamin D Deficiency and Dyslipidemia

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## ABSTRACT

**Background:** Vitamin D deficiency is one of the commonest disorder found in all age groups. Some studies suggest that vitamin D deficiency may have an influence on lipid parameters. Dyslipidemia is an independent risk factor in development of cardiovascular diseases.

**Aims and objectives:** The aim of our study was to find the association between Vitamin D deficiency and dyslipidemia.

**Materials and Methods:** The study group comprised of 50 patients with Vitamin D deficiency in the age group of 20-60 years. 50 age and sex matched healthy participants comprised the control group. The blood samples of all the participants were used for measuring vitamin D levels and Lipid profile. HDL cholesterol level and total cholesterol was measured by Cholesterol Oxidase Peroxidase method. Triacylglycerol estimation was done by Glycerol 3-Phosphate Oxidase - Peroxidase method. VLDL and LDL cholesterol were calculated by formula given in Tietz textbook.

**Results:** Total cholesterol and LDL were significantly elevated in participants with vitamin D deficiency compared to the control participants. Total cholesterol, Triglyceride and VLDL have significant negative correlation with vitamin D deficient patients, whereas there was no significant correlation with the lipid parameters in control participants.

**Conclusion:** The present study showed increased levels of triglycerides, total cholesterol, VLDL, LDL and decreased HDL in vitamin D deficient patients compared to the control participants. Thus patients with vitamin D deficiency should be evaluated for abnormalities in lipid profile.

**Key words:** Vitamin D, Dyslipidemia, Lipid profile, Diabetes Mellitus

## INTRODUCTION

Vitamin D has a history of 500 million years. The research from the past few years has shown us the possibility of the action of Vitamin D is central to cell and organ homeostasis. Initially the function of Vitamin D was restricted to the maintenance of calcium homeostasis, but now it is found to regulate approximately 2000 genes. Prevalence of vitamin D deficiency is around 30-50% worldwide. <sup>(1)</sup> In India the prevalence ranges from 70-100% in general population. <sup>(2)</sup> The patients suffering from

type 2 Diabetes mellitus along with associated alteration in the lipid profile are more to develop cardiovascular complications. <sup>(3,4)</sup> Dyslipidemia is an independent risk factor for cardiovascular diseases. <sup>(5)</sup>

Some reports have shown that deficiency of vitamin D is associated with atherosclerosis. <sup>(6)</sup> The diagnosis of hypovitaminosis D or Vitamin D status in the body is done by measuring 25 (OH) D (25, hydroxy vitamin D3), <sup>(7)</sup> as it is main circulating form, has longer half life and can

be easily measured. Modification in the Vitamin D status can be one of the modifiable risk factor in the prevention of atherosclerosis and thus reducing the prevalence of cardiovascular diseases. Thus the aim of our study was to find the association between Vitamin D deficiency and dyslipidemia.

## MATERIALS AND METHODS

The study group comprised of 50 patients with Vitamin D deficiency in the age group of 20-60 years visiting medicine Out Patient Department of Sanjay Gandhi Institute of Trauma and Orthopedics, Bengaluru, Karnataka. 50 age and sex matched healthy participants comprised the control group. The research protocol has been examined and approved by institutional ethics committee.

After obtaining informed written consent, 5ml of fasting venous blood sample was collected from all the participants under all aseptic conditions. The blood samples were used for measuring vitamin D and Lipid profile. 25 OH Vitamin D levels were measured by fully automated chemi luminescent immunoassay. HDL cholesterol level [8] and total cholesterol was measured

by Cholesterol Oxidase Peroxidase method. [8] Triacylglycerol estimation was done by Glycerol 3-Phosphate Oxidase - Peroxidase method. [8] VLDL and LDL cholesterol were calculated by formula given in Tietz textbook. [8]

### Exclusion criteria:

Patients with previous history of diabetes mellitus, thyroid disorders, metabolic bone disorders, malignancy, hyperparathyroidism, antiosteoporotic therapy, dyslipidemia and on statins were excluded from the study. Patients on systemic glucocorticoids and those taking vitamin D supplements were also excluded from the study.

## RESULTS

**Table 1** shows Total cholesterol and LDL were significantly elevated in participants with vitamin D deficiency compared to the control participants.

**Table 2** shows Total cholesterol, Triglyceride and VLDL have significant negative correlation with vitamin D deficient patients.

**Table 3** No significant correlation with the lipid parameters in control participants.

**Table 1: Biochemical Parameters in Vitamin D deficient cases and Control Participants**

Sl No	Parameters	Controls (n=50)	Vitamin D deficient cases (n=50)	p-value
1	25-OH Vitamin D	38.08±7.28	8.63±3.30	p<0.001*
2	Total Cholesterol	179.82±34.75	197.02±32.16	p<0.01*
3	LDL	127.92±28.8	174.38±100.2	p<0.002*
4	Triacylglycerol	185.26±99.08	197.02±32.16	p=0.42**
5	VLDL	38.74±27.4	40.01±37.15	p=0.84**
6	HDL	42.64±8.12	39.74±7.47	p=0.066**

p = Significant, p\*\* = Non significant, n= number of participants.

**Table 2: Correlation coefficients with 25-OH vitamin D for various Biochemical Parameters in Vitamin D deficient cases.**

Sl no	Total Cholesterol	HDL	LDL	Triacylglycerol	VLDL
r value	-0.369	0.338	-0.149	-0.025	-0.134
p value	0.008*	0.016*	0.30**	0.856**	0.35**

p = Significant, p\*\* = Non significant

**Table 3: Correlation coefficients with 25-OH vitamin D for various Biochemical Parameters in control participants.**

Sl no	Total Cholesterol	HDL	LDL	Triacylglycerol	VLDL
r value	0.369	0.2691	0.052	0.399	0.019
p value	0.082**	0.0588**	0.7173**	0.061**	0.891*

p\*\* = Non significant

**Statistical analysis:** The results are expressed as mean±SD. The results are further subjected to students 't' test, differences between means are considered

significant at p<0.05. The Pearson's correlation coefficient was calculated. All statistical analysis was done using Prism statistical software.

## DISCUSSION

Several studies either it is prospective, epidemiological or meta-analysis, have suggested an inverse association between development of cardiovascular disease and hypovitaminosis D. The presence of Vitamin D receptors in the endothelium is found to inhibit macrophage cholesterol uptake and thus decreasing foam cell formation. Thus vitamin D helps in the prevention of atherosclerosis. Vitamin D receptors are also expressed in Beta cells of pancreas. Vitamin D helps in stimulating insulin sensitivity. As cardiovascular complications are seen in both Vitamin D deficiency and Diabetes mellitus, we planned to study the association of dyslipidemia in patients with Vitamin D deficiency. The best method to determine the status of Vitamin D is estimation of 25(OH) D levels. <sup>(9)</sup> Serum levels of vitamin D lower than 20ng/ml was taken as vitamin D deficiency status. <sup>(10)</sup>

In our study we found that Total cholesterol ( $p < 0.01$ ) was significantly elevated in participants with vitamin D deficient patients compared to the control participants (Table 1). Results from study by Pallavi Mahajan <sup>(11)</sup> also showed similar results. Some studies suggests that increase of calcium absorption can reduce the secretion and synthesis of hepatic triglyceride and also decrease the fatty acid absorption in the intestine due to formation of insoluble calcium fatty acid complex. Calcium also reduces the level of cholesterol by facilitating the conversion of cholesterol into bile acids. <sup>(12)</sup> The present study shows LDL cholesterol ( $p < 0.002$ ) was significantly elevated in participants with vitamin D deficient patients compared to the control participants (Table 1). Study by Jaydip Ray Chaudhuri et al <sup>(13)</sup> also showed similar results. Vitamin D can help in prevention of atherosclerosis by lowering the formation of foam cell and reducing the deposition of LDL in macrophages. <sup>(14)</sup> The present study also showed that HDL cholesterol ( $p < 0.066$ ) was lowered in participants with vitamin D deficient patients compared to the control

participants (Table 1). Pinal A. Patel also showed similar results. <sup>(15)</sup> The concentration of apolipoprotein A-I which is the main component of HDL cholesterol is found to be increased by Vitamin D. Hence the deficiency of Vitamin D may lead to decreased concentration of HDL cholesterol. <sup>(16)</sup>

The study showed negative correlation with HDL and positive correlation with Total cholesterol, VLDL, LDL and triglyceride in Vitamin D deficient patients, whereas no such association was seen in the control participants (Table 2 and 3). Richa Giri <sup>(17)</sup> et al also showed similar results. The deficiency of Vitamin D leads to elevated levels of PTH; it is known that low serum PTH can reduce triglycerides by increasing the peripheral removal of triglycerides. <sup>(18,19)</sup> Thus deficiency of vitamin D leads to increased triglyceride levels. From the above results it can be stated that the deficiency of vitamin D can adversely affect the lipid parameters leading to dyslipidemia. Hence patients with vitamin D deficiency should be evaluated for abnormal lipid profile and treated accordingly. And also patients prone for developing dyslipidemia can be supplemented with Vitamin D, which can help in decreasing the incidence of dyslipidemia related complications.

## CONCLUSION

The present study showed increased levels of triglycerides, total cholesterol, VLDL, LDL and decreased HDL in vitamin D deficient patients compared to the control participants. Thus patients with vitamin D deficiency should be evaluated for abnormalities in lipid profile.

**Limitations:** One of the limitation of our study was that this was a cross sectional study and the association of the lipid parameters with 25(OH) could be by chance; hence an interventional longitudinal trial on a larger cohort can be required to confirm causation. Hence further studies are required.

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