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Original Research Article

Evidence from a Eastern Bihar Cross-Sectional Study Linking Low Serum Vitamin D Levels to Lipid Abnormalities

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Abstract:

Background: Vitamin D, once thought to primarily regulate calcium and bone health, is increasingly recognized as an active player in metabolic and cardiovascular physiology. Deficiency of this micronutrient may alter lipid metabolism and contribute to cardiovascular risk.

Aim: This study's purpose was to ascertain whether dyslipidemia in patients undergoing treatment at a Eastern Bihar tertiary hospital is linked with lower serum vitamin D levels.

Methods: Five hundred adults participated in a one-year cross-sectional study conducted at Katihar Medical College Hospital. After estimation, serum 25(OH)D was classified as acceptable (>30 ng/mL), insufficient (20–30 ng/mL), or impaired (<20 ng/mL). Using NCEP ATP III guidelines dyslipidemia and fasting lipid profiles were measured. Data were analyzed using SPSS v21.

Results: Among the 500 individuals, 286 (57.2%) were Vitamin D deficient, 128 (25.6%) insufficient, and 86 (17.2%) sufficient. Dyslipidemia was identified in 302 participants (60.4%). Patients with low Vitamin D showed significantly higher mean cholesterol (210.8 ± 35.2 mg/dL), LDL-C (134.6 ± 29.4 mg/dL), triglycerides (178.5 ± 46.3 mg/dL), and reduced HDL-C (37.2 ± 6.5 mg/dL) compared with sufficient groups ($p < 0.05$). Correlation analysis revealed inverse relationships between Vitamin D and LDL-C ($r = –0.32$) and triglycerides ($r = –0.28$), while HDL-C correlated positively ($r = +0.25$).

Conclusion: In this group, vitamin D insufficiency was common and closely linked to unhealthy lipid trends. Assessing vitamin D levels as part of the cardiovascular risk assessment process may enhance preventative measures.

Keywords: Vitamin D, Dyslipidemia, Lipid Disorders, Cardiovascular Risk, Bihar.

Introduction

Vitamin D is a fat-soluble prohormone that is essential for calcium balance and bone strength. However, recent research has expanded its biological significance, linking it to immune function, endocrine regulation, and cardiometabolic health. Low Vitamin D has been implicated in obesity, insulin resistance, hypertension, and more recently, lipid disturbances that precede atherosclerotic disease.

Dyslipidemia, characterized by elevated cholesterol, triglycerides, or decreased HDL, continues to be a significant risk factor for cardiovascular morbidity in India. With rising prevalence of diabetes, obesity, and sedentary lifestyles, lipid abnormalities are increasingly observed in younger populations. Parallel to this trend, more than half of Indians are said to be deficient in vitamin D, driven by inadequate sunlight exposure, dietary insufficiency, and sociocultural practices. There may be a biological link between vitamin D insufficiency and aberrant lipid metabolism because of these overlapping disorders.

Although international studies have explored this relationship, results remain inconsistent, partly due to ethnic variations, environmental differences, and methodological diversity. Data from eastern India, particularly Bihar, are scarce. This study therefore aimed to measure adults' vitamin D levels at a Katihar tertiary hospital and to evaluate its association with dyslipidemia.

Materials and Methods

Study design and setting: From April 2023 to March 2024, this prospective, cross-sectional study

was carried out by the medical department of Katihar Medical College Hospital in Katihar, Bihar.

Sample size and participants: A total of 500 adults (≥18 years) presenting to outpatient and inpatient services were enrolled consecutively after obtaining informed consent.

Exclusion criteria: Patients with known kidney or liver disease, thyroid dysfunction, pregnancy, lactation, or those on Vitamin D or lipid-lowering medication were excluded to minimize confounding.

Data collection: BMI, Age, sex, nutrition, and lifestyle were among the clinical and demographic information recorded. After overnight fasting, blood samples were taken to measure serum 25(OH)D and lipid profiles.

- **Vitamin D status:**
  - Sufficient: >30 ng/mL
  - Insufficient: 20–30 ng/mL
  - Deficient: <20 ng/mL
- **Dyslipidemia:** Defined according to NCEP ATP III: LDL-C ≥130 mg/dL, HDL-C <50 mg/dL in women<40 mg/dL or in male, TG ≥150 mg/dL and TC ≥200 mg/dL.

Statistical Analysis: The mean ± SD was used to express continuous variables. ANOVA and the Student's t-test were used to evaluate group differences. Pearson correlation was utilized to look for relationships between lipid markers and vitamin D. The threshold for significance was $p < 0.05$.

Results

Vitamin D distribution: Of the 500 subjects, 286 (57.2%) had deficiency, 128 (25.6%) insufficiency, and only 86 (17.2%) normal Vitamin D levels.

Table 1:

Vitamin D Category	Participants (n)	Percentage (%)
Impaired (<20 ng/mL)	286	57.2
Insufficient (20–30 ng/mL)	128	25.6
Adequate (>30 ng/mL)	86	17.2

Prevalence of dyslipidemia: Dyslipidemia was detected in 302 patients (60.4%), with significantly greater occurrence among those with inadequate levels of vitamin D in comparison to those with adequate levels.

Lipid parameters in relation to Vitamin D: Vitamin D-deficient participants exhibited markedly higher LDL-C, TC, TG, and lower HDL-C.

Table 2:

Lipid Parameter (mg/dL)	Deficient (n=286)	Insufficient (n=128)	Sufficient (n=86)
Total Cholesterol	210.8 ± 35.2	198.3 ± 31.6	184.5 ± 28.9
LDL-C	134.6 ± 29.4	121.5 ± 26.8	110.2 ± 25.7
HDL-C	37.2 ± 6.5	41.6 ± 7.2	46.8 ± 8.0
Triglycerides	178.5 ± 46.3	161.2 ± 39.7	145.4 ± 34.5

Correlation Analysis: Vitamin D and LDL-C ($r = -0.32$) and triglycerides ($r = -0.28$) were found to be inversely correlated by Pearson's correlation, whereas HDL-C was positively correlated ($r = +0.25$). ($p < 0.05$) These were statistically significant.

Discussion

This study identified Vitamin D deficiency in nearly three-fifths of the study population, a prevalence consistent with earlier Indian surveys. Dyslipidemia was present in about 60% of patients, reaffirming its growing burden in eastern India. Importantly, those with lower Vitamin D levels demonstrated significantly worse lipid parameters, indicating a potential interplay between these two conditions.

The link between Vitamin D and lipid metabolism may involve several mechanisms. Vitamin D influences gene expression regulating lipid synthesis, enhances insulin sensitivity, and reduces systemic inflammation. Deficiency may therefore contribute to higher cholesterol and triglyceride levels and lower HDL. Our findings of negative correlations between Vitamin D and LDL/TG and positive correlation with HDL strengthen this hypothesis.

International literature provides mixed evidence. While some studies have failed to detect a clear relationship, many, particularly from South Asia, have reported similar associations. Disparities may reflect differences in diet, sun exposure, genetic predisposition, and laboratory methods. Our study's strength is its standardized laboratory testing and comparatively high sample size.

Nevertheless, cross-sectional design limits inference on causality. It remains unclear whether Vitamin D deficiency contributes to dyslipidemia or whether both share common risk determinants such as obesity, low outdoor activity, or poor nutrition. Interventional studies assessing whether Vitamin D

supplementation improves lipid profiles could provide clarity.

Given the high prevalence observed, public health strategies targeting both Vitamin D deficiency and dyslipidemia are urgently required. Measures such as routine screening, fortification programs, lifestyle modification, and supplementation could help reduce cardiovascular risk in this population.

Conclusion

The study showed that vitamin D insufficiency is strongly linked to lipid abnormalities and is very common among individuals who visit a tertiary hospital in Eastern Bihar. Deficient individuals had higher cholesterol, LDL, triglycerides, and lower HDL compared with Vitamin D-sufficient patients. These results imply that vitamin D testing could be a helpful supplement in assessing individuals who are at risk for cardiovascular disease, and that addressing a deficit could be an easy and affordable preventative strategy.

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