A Prospective Study of Association between Vitamin D3 and Serum Lipid Parameters of Adults in Bhagalpur District

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INTRODUCTION

The many health benefits of vitamin D have led to a recent uptick in studies examining human vitamin D status.[1] It is 1,25-dihydroxy vitamin D that primarily facilitates vitamin D's effects. Bone mineralization, intestinal calcium absorption, and enhanced bone development and remodeling are all benefits of this active form.[2] The regulatory mechanisms of vitamin D's biological effects are mediated by vitamin D receptors, which are present in tissues unassociated with calcium metabolism.[3]

Vitamin D can be preserved in adipose tissue, according to multiple research.[4] During times of increasing fat mass, like in overweight and obese people, adipose tissue has the ability to store a considerable amount of vitamin D. [5]Obese people have lower amounts of circulating (OH)D25 than normal-weight people, according to the research. A person's vitamin D status can be accurately determined by looking at their body fat mass and percentage. [6]

AIMS & OBJECTIVES

- Our current study's objective is to determine blood lipid profile and vitamin D3 levels.
- To determine the connection between serum levels of vitamin D3 and serum lipids.

MATERIALS & METHODS

Type of Study

This is a prospective observational study.

Place of Study

Researchers from Jawaharlal Nehru Medical College in Bhagalpur, Bihar, India, chose study participants from the general medicine outpatient department.

Period of the Study

The study was conducted over a period ofJuly 2022 to June 2024.

Study Population

- **Sample Size:** A total of 200 adults participated in the study.

Inclusion Criteria

- Adults aged 18 years and above.
- Individuals diagnosed with vitamin D deficiency and dyslipidemia.

- Participants willing to provide informed consent.

Exclusion Criteria

- Individuals with known metabolic disorders.
- Participants taking lipid-lowering medications.
- Individuals with chronic kidney or liver disease.

Data Collection Procedure

Baseline Assessment:

Serum Vitamin D3 Measurement: Researchers from Jawaharlal Nehru Medical College in Bhagalpur, Bihar, India, chose study participants from the general medicine outpatient department and private practitioners.

Serum Lipid Profile Measurement: In order to evaluate the lipid profile, which comprise triglycerides, total cholesterol, low-density lipoprotein (LDL), including, each participant had their blood drawn while fasting. A semi-auto analyzer was used to process the samples.

Intervention:

In order to evaluate the lipid profile, The components of the lipid profile include total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL), and triglycerides, each participant had their blood drawn while fasting. A semi-auto analyzer was used to process the samples.

Follow-Up:

After starting vitamin D3 treatment, participants were re-evaluated at 3-month and 6-month intervals. Similar procedures to the initial evaluation were used to reevaluate the lipid profiles and serum vitamin D3 levels.

Data Collection and Analysis

Lipid profiles, baseline serum vitamin D3 levels, and demographic information were gathered. At the 3-month and 6-month follow-ups, the researchers examined the changes in these indicators. The purpose of this statistical analysis was to determine whether there was a relationship between the lipid characteristics and the fluctuations in serum vitamin D3 levels. The demographic data was summarized using descriptive statistics in SPSS ver-26, and changes over time were assessed using paired t-tests or ANOVA. Any p-value less than 0.05 was deemed to have statistical significance.

Ethical Considerations

Institutional review boards at Jawaharlal Nehru Medical College in Bhagalpur gave its clearance to the research. Prior to being included in the study, all participants were asked to provide their informed permission. Everyone who took part in the study was given the option to stop at any moment and their information would remain private.

RESULTS & ANALYSIS

Table: 1. Age distribution among study population (n=200)

Age groups (Years)	No of cases	Percentage
18 -30	25	12.5
31 - 40	35	17.5

41 - 50	80	40.0
51 - 60	32	16.0
61 - 70	28	14.0
Total	200	100.0

Figure: 1. Age distribution among study population

There were a total of 200 people who took part in the research; 40% of that group fell into the age bracket of 41–50. Roughly 17.5% of the participants were in the 31–40 age bracket, while 12.5% were in the 18–30 youth bracket. People in the age bracket of 51–60 years and 61–70 years accounted for 16% and 14% of the total, respectively.

With respect to where they called home, 62% of the sample came from cities and 38% from the countryside.

According to their smoking habits, 21% of the subjects smoked cigarettes and 79% did not.Of the individuals, 18% admitted abusing alcohol, whereas 82% did not.According to their eating habits, 16% of the people who took part in the study were vegetarians, and 84% followed a mixed diet.

The average measurements of the study's participants were 168.54 ±12.45 cm for height, 66.41 ±9.66 kg for weight, and 25.98 ±2.41 kg/m² for body mass index (BMI).

Vitamin D levels were 6.45 ng/ml (±2.11) on average at the beginning of the study, with 6% of the individuals having levels below 10 ng/ml. A quarter of the participants had vitamin D levels between 10 and 20 ng/ml, with an average of 13.45 ng/ml (±4.52), while a thirteenth had levels between 21 and 30 ng/ml, with an average of 22.46 ng/ml (±4.31). Half of the people who took part in the study had vitamin D levels higher than 30 ng/ml, with an average of 41.23 ng/ml (±10.22). Vitamin D levels averaged 16.84 ng/ml (±5.17) in the entire study group.

Table: 2. Baseline Lipid profile among study population (n=200)

	Limit	Percentage	Minimum	Maximum	Mean & SD Value
T. Cholesterol	>200 (mg/dl)	90 (45.0%)	215.0	255.0	238.45±11.26
	<200 (mg/dl)	110 (55.0%)	127.0	182.0	149.22±25.63
Triglyceride	>150 (mg/dl)	98 (49.0%)	170.0	350.0	247.64±69.42
	<150 (mg/dl)	102 (51.0%)	112.0	135.8	127.23±11.10
HDL	<40 (mg/dl)	90 (45.0%)	29.0	38.0	32.45±4.21
	>40 (mg/dl)	110 (55.0%)	41.0	52.0	45.32±8.74

A total of 45% of the individuals in the study had cholesterol levels above 200 mg/dl, according to their baseline lipid profile. The average level was 238.45 mg/dl (±11.26), with a range of 215.0 to 255.0 mg/dl. On the other hand, cholesterol levels below 200 mg/dl were seen in 55% of the participants, with a mean of 149.22 mg/dl (±25.63) and a range of 127.0 to 182.0 mg/dl. About half of the participants had triglyceride levels below 150 mg/dl, with an average of 127.23 mg/dl (±11.10), ranging from 112.0 to 135.8 mg/dl, while nearly half had levels above 150 mg/dl, with 49% having levels beyond this threshold (mean of 247.64 mg/dl, ±69.42, ranging from 170.0 to 350.0 mg/dl). With an average of 32.45 mg/dl (±4.21) and a range of 29.0 to 38.0 mg/dl, 45% of the individuals had high-density lipoprotein (HDL) values below 40 mg/dl, while 55% had HDL levels over 40 mg/dl, with an average of 45.32 mg/dl (±8.74) and a range of 41.0 to 52.0 mg/dl.

Treatment resulted in statistically significant improvements in vitamin D and lipid profiles, both at the mean and standard deviation levels. The average vitamin D level was 19.23 ng/ml (±22.31) before therapy, and it rose to 39.93 ng/ml (±5.69) after treatment, with a p-value of less than 0.0001. The average total cholesterol level decreased from 228.34 mg/dl (±11.34) to 196.20 mg/dl (±31.26) after treatment, with a p-value of less than 0.0001. With a p-value less than 0.0001, triglycerides decreased considerably after therapy, going from an average of 298.10 mg/dl (±46.43) to 237.47 mg/dl (±28.10). The average HDL level increased from 29.33 mg/dl (±4.26) to 33.20 mg/dl (±11.26) after the treatment, and the p-value was less than 0.0001.
Ninety cases were assessed in a study that followed the progression of dyslipidemia improvement. There was a 28.9% improvement rate (26 instances) after 3 months. A total of 12 out of 64 instances (or 18.8% of the total) demonstrated improvement after 6 months. A total of 38 out of 90 cases demonstrated improvement, yielding a 42.2% improvement rate.

DISCUSSION

Vitamin D levels increased to levels above 30 ng/ml in all 90 participants after three months of supplementation, even though they were below 30 ng/ml to begin with. The successful repair of insufficiency was indicated by the mean post-treatment vitamin D level of 39.93 ng/ml (±5.69). At the same time that vitamin D status improved significantly, lipid profiles also improved, with HDL levels rising and total cholesterol and triglycerides falling.

This study's favorable impact on lipid profiles from vitamin D supplementation is consistent with previous clinical trial results. Take **Zittermann et al**.'s study as an example. They proved that people with baseline deficiencies in vitamin D can significantly improve their lipid profiles by supplementing with the vitamin. These results add to the growing body of evidence suggesting vitamin D has a role in lipid metabolism, maybe by controlling the expression of enzymes that contribute to cholesterol synthesis and degradation.[114]

Research using both observation and intervention can be located. Our analysis started with a review of observational research. It should be mentioned that this topic's attention is not new, nevertheless. In 1992, one of the first publications was a research from Belgium that had 358 participants. From blood samples, the researchers in this study determined total serum calcium, 25OHD, TC, HDL-C, and total protein. The study found that serum 25OHD, HDL-C, and apo A-I were positively correlated.[115] It is recognized that high HDL-C has a protective influence, in contrast to LDL-C and TGs. The results of cross-sectional studies with very large populations showed a favorable link with HDL-C and an inversely significant correlation with 25OHD, TGs, and LDL-C. This was previously reported by Aumerxet al. From blood samples, the researchers in this study determined total serum calcium, 25OHD, TC, HDL-C, and total protein. The study found that serum 25OHD, HDL-C, and apo A-I were positively correlated. The number 115 It is recognized that high HDL-C has a protective influence, in contrast to LDL-C and TGs. The results of cross-sectional studies with very large populations showed a favorable link with HDL-C and an inversely significant correlation with 25OHD, TGs, and LDL-C. This was previously reported by Aumerxet al.[115]

The findings of this prospective observational study revealed a strong correlation between individuals' lipid profiles and their vitamin D levels in the Bhagalpur region of Bihar. Results showing an increase in HDL and decreases in total cholesterol and triglyceride levels suggest that vitamin D3 supplementation improves lipid metabolism.

A high frequency of vitamin D deficiency was associated with unfavorable lipid profiles in the research population, which was characterized by various demographics and lifestyles. There was an increase in lipid markers and a considerable improvement in vitamin D status after supplementation with vitamin D3, indicating that vitamin D3 may have a therapeutic effect in the management of dyslipidemia.

Ensuring adequate vitamin D levels is essential for preserving cardiovascular well-being, as evidenced by the associations between vitamin D levels and lipid constituents. These findings provide more evidence that vitamin D3 treatment may help lower cardiovascular risk in patients with dyslipidemia.

Additional research is needed to validate these findings in a larger population and to understand the processes causing these connections, but this study lends credence to vitamin D3 as an adjuvant therapy for better lipid profiles.

REFERENCES

1. Dibaba, D. T. Effect of vitamin D supplementation on serum lipid profiles: a systematic review and meta-analysis. *Nutr. Rev.* **77**(12),890–902 (2019).
2. Hariri, Z. *et al.* Higher dietary vitamin D intake influences the lipid profile and hs-CRP concentrations: cross-sectional assessmentbased on the national health and nutrition examination survey. *Life.* **13**(2), 581 (2023).
3. Serrano, N. C. *et al.* Efficacy of vitamin D supplementation in reducing body mass index and lipid profile in healthy young adults in Colombia: a pilot randomised controlled clinical trial. *J. Nutr. Sci.* **12**, e29 (2023).
4. Al-Oanzi, Z. H. *et al.* The role of vitamin D in reducing the risk of metabolic disturbances that cause cardiovascular diseases. *J. Cardiovasc. Dev. Dis.* **10**(5), 209 (2023).
5. Nikparvar, M. *et al.* Dyslipidemia and its associated factors in southern Iranian women, Bandare-Kong Cohort study, a crosssectional survey. *Sci. Rep.* **11**, 9125 (2021).
6. Dos Santos, S. D., Dos Reis Costa, P. N., Gouvea, T. G., de Almeida, N. F. & Cardoso, F. S. Influence of hypovitaminosis D during pregnancy on glycemic and lipid profile, inflammatory indicators and anthropometry of pregnant and newborn. *Clin Nutr. ESPEN.* **11**(54), 81–93 (2023).
7. Stounbjerg, N. G., Molgaard, C., Cashman, K. D., Michaelsen, K. F. & Damsgaard, C. T. Vitamin D status of 3-year-old children in Denmark: determinants and associations with bone mineralisation and blood lipids. *Eur. J. Nutr.* **62**(3), 1441–1451 (2023).
8. Yu, J. R. *et al.* Serum vitamin d status and its relationship to metabolic parameters in patients with type 2 diabetes mellitus. *Chonnam Med. J.* **48**(2), 108–115 (2012).
9. Rosenstreich, S. J., Rich, C. & Volwiler, W. Deposition in and release of vitamin D 3 from body fat: evidence for a storage site in the rat. *J. Clin. Investig.* **50**(3), 679–687 (1971).
10. Vanlint, S. Vitamin D and obesity. *Nutrients.* **5**(3), 949–956 (2013).
11. Di Nisio, A. *et al.* Impaired release of vitamin D in dysfunctional adipose tissue: new cues on vitamin D supplementation in obesity.*J. Clin. Endocrinol. Metab.* **102**(7), 2564–2574 (2017).
12. Radkhah, N., Zarezadeh, M., Jamilian, P., & Ostadrahimi, A. The effect of vitamin D supplementation on lipid profile: an umbrella review of meta-analysis. *Adv. Nutr.* (2023)
13. rsall M.C., Korcarz C.E., Kaufman J.D., Liu K., Burke G.L., Shea S., Greenland P., et al. Progression of Carotid Arterial Stiffness With Treatment of Hypertension Over 10 Years: The Multi-Ethnic Study of Atherosclerosis. *Hypertension (Dallas Tex. 1979)* 2017;69:87–95.
14. Creager M.A., Beckman J.A., Loscalzo J. In: *Vascular Medicine. A Companion to Braunwald's Heart Disease.* 3rd ed. Creager M.A., Beckman J.A., Loscalzo J., editors. Elsevier; Philadelphia, PA, USA: 2020.
15. Scragg R., Stewart A.W., Waayer D., Lawes C.M.M., Toop L., Sluyter J., Murphy J., Khaw K.T., Camargo C.A., Jr. Effect of Monthly High-Dose Vitamin D Supplementation on Cardiovascular Disease in the Vitamin D Assessment Study: A Randomized Clinical Trial. *JAMA Cardiol.* 2017;2:608–616.
16. Avenell A., MacLennan G.S., Jenkinson D.J., McPherson G.C., McDonald A.M., Pant P.R., Grant A.M., Campbell M.K., Anderson F.H., Cooper C., et al. Long-term follow-up for mortality and cancer in a randomized placebo-controlled trial of vitamin D(3) and/or calcium (RECORD trial) *J. Clin. Endocrinol. Metal.* LaCroix A.Z., Kotchen J., Anderson G., Brzyski R., Cauley J.A., Cummings S.R., Gass M., Johnson K.C., Ko M., Larson J., et al. Calcium plus vitamin D supplementation and mortality in postmenopausal women: The Women's Health Initiative calcium-vitamin D randomized controlled trial. *J. Gerontol. Ser. A Biol. Sci. Med. Sci.* 2009;64:559–567.

17. Manson J.E., Cook N.R., Lee I.-M., Christen W., Bassuk S.S., Mora S., Gibson H., Gordon D., Copeland T., D'Agostino D., et al. Vitamin D Supplements and Prevention of Cancer and Cardiovascular Disease. *N. Engl. J. Med.*
18. Holick, M. F., et al. (2011). "Vitamin D deficiency: what a pain it is."*Mayo Clinic Proceedings*, 86(1), 50-60.