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Research Article

Correlation Between Vitamin D Levels and Dyslipidemia in Patients at Fann University Hospital

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Abstract

Vitamin D has been recognized for several decades as an important player in bone metabolism. Beyond these classic effects on mineral metabolism, it has numerous extra-osseous effects, including effects on the cardiovascular system. Indeed, several clinical studies suggest a link between vitamin D deficiency and cardiovascular mortality. The general objective is to evaluate the relationship between vitamin D levels and lipid parameters in patients at Fann University Hospital. Included in this study were 214 patients who came to the laboratory and whose vitamin D dosage was requested between December 2023 and April 2024. Lipid profile parameter dosages were performed with the Architect Ci4100 and vitamin D with Iflash 3000. Correlations between vitamin D levels and blood lipids were assessed by descriptive statistical analysis and Spearman's correlation test. The mean age of our population was 60±17 years and the sex ratio was 0.51. The distribution of patients according to the lipid profile showed that 72.42% of the subjects had a lipid abnormality with a predominance of hypo HDL-cholesterolemia (39.71%). Our study showed a positive and significant correlation between low vitamin D levels and low HDL-cholesterol levels. In contrast, no strong link was found with the levels of total cholesterol, triglycerides and LDL-cholesterol. These results highlight the importance of monitoring vitamin D levels in patients with dyslipidemia, and pave the way for future research on the potential role of vitamin D in cardiovascular risk management.

Keywords

Vitamin D, Dyslipidemia, Cardiovascular Risk

1. Introduction

Dyslipidemia is a major risk factor in the occurrence of cardiovascular diseases. Research into this factor and its management would adequately contribute to preventing these diseases, which are the leading cause of death in the world [1]. It is estimated that 17.5 million deaths are attributable to cardiovascular diseases (31% of total global mortality) [2].

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Vitamin D deficiency has been identified as a potential risk factor for a number of diseases unrelated to classical skeletal pathophysiology, such as cancer and cardiovascular diseases [3]. Hypovitaminosis D constitutes a global public health problem. The prevalence of hypovitaminosis remains high; approximately 50% of the world's population is vitamin D deficient [4]. Numerous epidemiological studies have shown an association between low vitamin D levels, dyslipidemia and cardiovascular disease [5]. The association between vitamin D and cardiovascular diseases could be explained by a lipid-lowering effect of vitamin D. This has been confirmed by several cross-sectional studies, and there is a general consensus that high serum 25(OH)D levels are associated with a favorable serum lipid profile [6, 7]. In Senegal, few studies on the association between vitamin D and lipid profile abnormalities have been conducted. It is in this context that we set ourselves the general objective of evaluating the relationship between vitamin D status and lipid profile in patients at the Fann University Hospital.

2. Materials and Methods

This is a prospective study carried out in the biochemistry-hematology laboratory of the Fann University Hospital for a period of five months, from December 1, 2023 to April 30, 2024. Included in this study were patients in whom vitamin D dosage was requested by the clinician. The study did not involve patients with known lipid abnormalities. Blood samples were taken from the subjects included, and the blood was collected in a dry tube. The tubes were centrifuged at 4000 rpm for 5 min. Lipid balance parameters were measured in serum using the Architect Ci4100 and vitamin D was measured using the Iflash 3000 system. The threshold values used to define dyslipidemia are those of the American recommendations of the ATP III of the NCEP [8] (Table 1).

Table 1. *Criteria for defining dyslipidemia (NCEP ATP III).*

Dyslipidemias	Threshold values
Hypercholesterolemia	Total cholesterol >2 g/l
Hypertriglyceridemia	Triglycerides >1.5 g/l
Mixed Hyperlipidemia	Total cholesterol >2 g/l Triglycerides >1.5 g/l
Hypo HDL-Cholesterolemia	HDL cholesterol <0.40 g/l (Men) HDL cholesterol <0.50 g/l (Women)
Hyper LDL-Cholesterolemia	LDL cholesterol >1.3 g/l

As part of our study, we used the usual values from the Biochemistry-Hematology laboratory to assess vitamin status:

1. Vitamin deficiency < 10 ng/ml
2. Vitamin D deficiency: 10 to 30 ng/ml
3. Recommended level: 30 to 70 ng/ml
4. Possible intoxication > 150 ng/ml

The Mann-Whitney test was used to compare means and the Chi2 test was used to compare frequencies. The Spearman test (Spearman's Rho) was used to assess correlation. A p-value less than 0.05 was considered a statistically significant difference.

3. Results

3.1. General Characteristics of the Population

214 subjects were included in our study. The mean age of our population was 60.40 ±17 years with extremes of 8 and 97 years. The sex ratio was 0.51. The mean concentration of vitamin D in our population was 22.46 ±13 ng/ml with minimum and maximum values of 1.98 and 82 ng/ml respectively; the distribution of subjects according to vitamin status shows a deficiency (vitamin D <10 ng/ml) and an insufficiency state (vitamin D: 10-30 ng/ml) respectively in 14.01% and 64.48%. (Table 2)

Table 2. *General characteristics of the population.*

Included	214
Average Age (years)	60.40 ±17
Sex Ratio	0.51
Minimum Vit D (ng/ml)	1.98
Maximum Vit D (ng/ml)	82.11
Mean Vit D (ng/ml)	22.46 ±13
Median Vit D (ng/ml)	18.82
Vit D Deficiency (<10 ng/ml)	14.01%

Vit D Insufficiency (10-30 ng/ml)	64.48%

3.2. Assessment of Vitamin D Status in Our Population According to Age

Analysis of the distribution of plasma vitamin D values by sex showed mean concentrations of 22.46 ng/ml and 22.48 ng/ml in women and men respectively with a non-significant difference (p=0.634). Assessment of vitamin status by age revealed a state of vitamin insufficiency (10 to 30 ng/ml) in all age groups (Table 3).

Table 3. *Average vitamin D concentrations according to age.*

Age groups (years)	Vitamin D (ng/ml)
[5-25[	22.20 ±13.3
[25-45[	22.68 ±13.7
[45-65[	22.5 ±13.8
[65-85[	22.4 ±13.7
[85-105[	21.7 ±13

By assessing the prevalence according to vitamin status, we found an insufficiency (10<Vitamin D<30 ng/ml) in 88% of people in the age group [85-105[and a state of deficiency in 20% of people in the age group [65-85[(Table 4).

Table 4. *Evaluation of vitamin status according to age.*

Age groups (years)	10<Vitamine D <30	Vitamine D<10
[5-25[	50%	50%
[25-45[	67.56%	5.40%
[45-65[	65.78%	10.52%
[65-85[	58.82%	20%
[85-105[	88%	-

3.3. Evaluation of Lipid Profile and Vitamin D Status in Our Population

The distribution of patients according to the lipid profile showed that 72.42% of the subjects had an abnormality in the lipid profile according to the American NCEP ATP III recommendations. The frequency comparison shows a significant difference (p<0.05). (Figure 1)

Hypo HDL-Cholesterolemia is the most common and affects 39.71% of subjects; hyper LDL-Cholesterolemia was found in 32.71% of subjects. Hypertriglyceridemia and hypercholesterolemia were the least common in our population with respective frequencies of 8.87% and 27.57%. Mixed hyperlipidemia (Triglycerides >1.5 g/l and Total cholesterol >2 g/l) was found in 5.60% of patients (Figure 2).

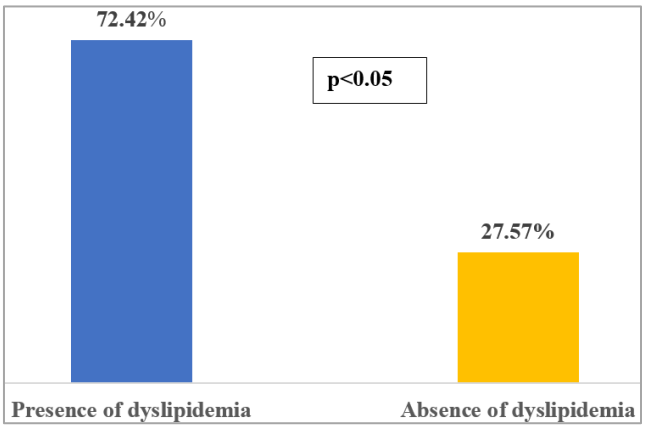

Figure 1. *Distribution of subjects with normo-lipids and dyslipidemia.*

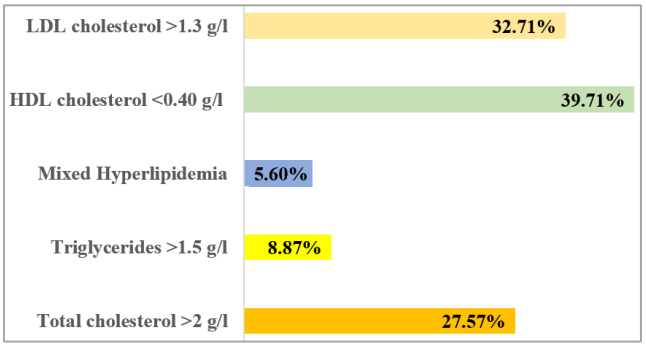

Figure 2. *Distribution of lipid profile parameters in our population.*

Determination of vitamin status based on lipid abnormalities showed a state of insufficiency in our population with mean concentrations of 22.46 ng/ml and 22.51 ng/ml respectively in subjects with dyslipidemia and without dyslipidemia; comparison of the means shows a non-significant difference (Table 5).

Table 5. *Evaluation of vitamin status according to dyslipidemia.*

Dyslipidemias	Frequencies	Average Vitamin D
Presence	72.42%	22.46 ng/ml
Absence	27.57%	22.51 ng/ml
p value	<0.05*	0.076

*: significant difference

The evaluation of the correlation by Spearman test between

lipid profile parameters and vitamin D in our population showed a positive and significant correlation (p=0.048) between vitamin D and HDL-Cholesterol (Table 6).

Table 6. *Correlation between lipid profile parameters and vitamin D in our population.*

Parameters	Vitamine D	
	Rho	p value
Triglycerides	-0.05	0.451
Total Cholesterol	0.001	0.489
LDL Cholesterol	0.01	0.487
HDL Cholesterol	0.11	0.0487*

*:significant difference

4. Discussion

Long confined to its role in phosphocalcic metabolism, vitamin D now appears to be a vitamin with multiple potentialities, since it is involved in numerous physiological processes [9]. Hypovitaminosis D has been reported in many countries and constitutes a public health problem. Epidemiological studies suggest an inverse association between circulating 25(OH)D levels and cardiovascular diseases [10]. However, the underlying mechanism contributing to this association has not been fully elucidated. The objective of our study was to evaluate the association between vitamin D status and lipid profile. The analysis of our results shows a mean age of 60.40 ±17 years with extremes of 8 and 97 years and a sex ratio of 0.51. Huang Fei et al, in a similar study carried out in a Chinese population, found a mean age of 55.53 years [11]. This difference could be related to the prescription of vitamin D dosage which concerns all age groups, but its prevalence is particularly high in the elderly. The distribution of subjects according to vitamin status shows a deficiency (Vitamin D <10 ng/ml) in 14.01% of subjects. This hypovitaminosis has been reported by other studies including those of Huang Fei et al, Daoudi et al [10, 12] with respective prevalences of 42.0% and 60%. However, the prevalence of serum (OH)D25 deficiency or sufficiency varies considerably depending on the criteria used to define it, including population, season, dietary habits, ethnic origin, physical activity, and age group. Indeed, cohort studies, mainly from the United States, show that vitamin D deficiency is more common in the African-American population. While social and environmental factors play a role, pigmentation is the key factor [13]. Analysis of the distribution of plasma vitamin D values by sex showed mean concentrations of 22.48 ng/ml and 22.46 ng/ml in men and women respectively. Our results are similar to those of Huang Fei et al [11] who obtained in their study mean concentrations of 23.10 ng/ml and 20.0 ng/ml in men and women respectively [11]. However, several authors have shown a high prevalence of hypovitaminosis D in women [14]. Djerdjar et al, in a study carried out in an Algerian population, reported that this high vitamin deficiency in women is linked to cultural or religious practices which are often at the origin of sun avoidance behavior in women in countries with high sunshine such as Algeria [15]. In our population, dyslipidemia was found in 72.42% of subjects and hypo HDL-Cholesterolemia was the most frequent (i.e. in 39.71% of the population). The evaluation of vitamin D status according to lipid abnormalities showed a state of insufficiency in our population with average concentrations of 22.46 ng/ml and 22.51 ng/ml respectively in subjects with dyslipidemia and without dyslipidemia. We did not find a significant difference in mean vitamin D concentrations despite the presence of dyslipidemia. A different observation to our study was reported by Sharba et al, who in a cross-sectional study found lower vitamin D levels in subjects with dyslipidemia [16]. Dyslipidemia is one of the major risk factors for developing cardiovascular disease, and significant associations have been found between serum vitamin D levels and lipid profiles in studies conducted [17]. Although multiple mechanisms have been proposed to explain the effects of vitamin D on lipid profiles, the impact of this vitamin on blood lipid levels is still unclear [18]. The evaluation of the correlation by Spearman test between lipid profile parameters and vitamin D in our population showed a positive (Rho=0.11) and significant (p= 0.048) correlation between vitamin D and HDL-cholesterol. This result is similar to those of Jiang et al, Ponda et al [19, 20]. The mechanisms by which vitamin D might affect lipid parameters are unclear. Suggested mechanisms include vitamin-mediated suppression of parathyroid hormone secretion, intestinal calcium absorption, modulation of beta-cell function, and insulin resistance. [20, 21]. Vitamin D deficiency is very common and can be effectively treated with dietary supplementation. However, the role of supplementation in modifying cardiovascular risk is not well established, and it is unclear whether vitamin D status is causally related to disease or simply an indicator of health. The main limitations of our study included:

1. Our study design did not allow us to draw conclusions about the causal nature of vitamin D deficiency and dyslipidemia
2. The lack of data on underlying pathologies that may interfere
3. The different definitions of vitamin D standards may complicate data interpretation

5. Conclusion

The results of this study suggest that insufficient vitamin D levels may be associated with dyslipidemia, particularly decreased HDL cholesterol levels. These findings highlight the importance of monitoring vitamin D levels in the management of lipid disorders, particularly in patients at risk for cardiovascular disease.

Abbreviations

ATP III	Adult Treatment Program III
NCEP	National Cholesterol Education Program

Author Contributions

Kandji Pape Matar: Conceptualization, Investigation, Methodology, Project administration, Resources, Software, Supervision, Writing – original draft

Thioune Ndeye Mareme: Investigation, Methodology, Supervision

Barry Ndéné Oumou Kesso: Investigation, Methodology, Resources, Supervision

Djite Moustapha: Formal Analysis, Investigation, Methodology, Resources, Supervision

Nayo Jean Cédric Godwin: Conceptualization, Methodology, Resources, Supervision

Ndiaye Siny: Methodology, Resources, Supervision

Coly Najah Fatou: Methodology, Resources, Supervision

Ndour El Malick: Methodology, Resources, Supervision

Gueye-Tall Fatou: Methodology, Resources, Supervision

Gueye Papa Madieye: Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing – original draft

Conflicts of Interest

The authors declare no conflicts of interest.

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