

Factors Associated with Hypovitaminosis D in People Living with HIV/AIDS (PLWHA) Followed up in Porto-Novo in 2019

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Abstract

Background: Vitamin D deficiency is very common among PLWHA compared to the general population and is promoted by several factors. **Aim:** To identify the factors associated with hypovitaminosis D in people living with HIV/AIDS (PLWHA) followed up in Porto-Novo in 2019. **Methods:** This was a cross-sectional, descriptive and analytical study. PLWHA who were monitored on an outpatient basis and who gave their consent were included in this work. Subjects unable to answer questions or under ongoing vitamin D supplementation or suffering from chronic liver diseases were not included. Hypovitaminosis D was defined by a blood level of 25 hydroxy-vitamin D less than 30 ng/mL. **Results:** A total of 270 PLWHA were included in the study. The mean age of the patients was 39.51 ± 6.85 years with a female predominance (73.3%). The frequency of hypovitaminosis D was 56%. Hypertension, low protein intake, anemia and low glomerular filtration rate were associated with vitamin D deficiency. **Conclusion:** Vitamin D deficiency is common among PLWHA, which justifies routine screening, especially among those at risk.

Keywords

Hypovitaminosis D, PLWHA, Malnutrition, Denutrition, Porto-Novo

1. Introduction

Since the advent of highly active antiretroviral therapy in 1996, there has been an improvement in the quality of life and prognosis of HIV-infected individuals, as

regards the decrease in the frequency of opportunistic diseases. Despite this significant improvement, HIV infection remains a public health problem. In 2018, 1.7 million new infections were recorded worldwide and 1 million deaths were due to HIV infection; the majority of these occur in developing countries [1]. This mortality is multifactorial including not only opportunistic conditions but also metabolic abnormalities such as vitamin D deficiency [2]. Indeed, vitamin D deficiency is very common among PLWHA compared to the general population with a prevalence that varies between 70% and 85% depending on the studies [3] [4]. Several factors promote this vitamin deficiency including low exposure to sunlight, low dietary intake of vitamin D, alcohol consumption [3], chronic inflammation caused by the virus and antiretroviral treatment including protease inhibitors and non-nucleoside reverse transcriptase inhibitors [2]. Vitamin D deficiency is associated with high morbidity including bone, cardiovascular, metabolic [5] [6] [7] [8]. Several studies have reported the beneficial effects of a normal vitamin D level in the prevention of opportunistic conditions and thus the reduction of mortality [9] [10]. In Africa, studies on vitamin D deficiency in PLWHA are rare and non-existent in Benin. That's what justifies the present work whose aim is to identify the prevalence of vitamin D deficiency and its contributing factors.

2. Patients and Method

It was a transversal, descriptive and analytical study that took place from January 2 to February 5, 2019 at the Medical Center (MC) of Oganla in Porto-Novo. The study population consisted of PLWHA followed at this center. Outpatients PLWHA who gave their consent were included in this study. Subjects who were unable to answer questions or under ongoing vitamin D supplementation or who had chronic liver diseases were not included.

All patients followed up in the center who met the inclusion criteria were considered and it was a sampling by commodity.

Definition of variables: the dependent variable was hypo-25-hydroxy-vitamin D and the independent variables related to sociodemographic characteristics, lifestyle, history and comorbidities, nutritional status, dietary data and biological data (including hemoglobin, transaminases, creatinine and CD4 levels).

Hypo 25 hydroxy-vitamin D was defined by a blood level below 30 ng/mL [11] [12].

Physical inactivity was defined for a moderate intensity activity practice such as brisk walking less than 30 minutes.

Nutritional status was assessed by the body mass index (BMI) and interpreted as follows: underweight if BMI less than 18.5 Kg/m²; Normal BMI if between 18.5 and 24.9 Kg/m²; overweight if BMI between 25 and 29.9 Kg/m²; obesity if BMI greater than or equal to 30 Kg/m².

The food intake was appreciated by the reminder of the 72 hours and the dietary needs appreciated by the Alimenthèque software; the daily energy intake

was normal if it is equal to ± 200 kcal of the calculated energy needs, the protein intake was considered low if it is less than 15% of the energy needs.

A daily consumption of fruits and vegetables less than 5 servings was considered low.

The glomerular filtration rate less than 60 ml/min/m² was considered low.

Data collection techniques: Data collection was done through an individual face-to-face interview followed by clinical examination, anthropometric data measurement, 72-hours recall, and bioassay.

Data processing and analysis: The data were entered into Epi info 3.5 and analyzed using Statistical Package for Social Sciences (SPSS) version 20.0. The Chi² test was calculated. A p-value < 0.05 was considered statistically significant.

Ethical aspects: the various measures taken before, during and after the collection of the data were the obtaining of an authorization from the administrative officials, the consent of the patients after explaining to them the purpose of the study and the role of vitamin D in the health of the population in general and more specifically in PLWHA and finally the respect of the confidentiality and anonymity of the results obtained.

3. Results

3.1. General Characteristics of the Study Population

A total of 270 PLWHA were included in the study. The mean age of the patients was 39.51 ± 6.85 years with a female predominance (73.3%).

History and comorbidities were represented by tuberculosis, high blood pressure and diabetes in 14.4%, 18.9% and 3.3% respectively.

Lifestyle was characterized by alcohol consumption (58.9%), physical inactivity (55.6%), use of oral contraceptives (16.7%), use of skin creams (27.8%) and the practice of depigmentation (31.1%). Therapeutically, 2.6% of PLWHA were on protease inhibitors and in 97.4% of cases Efavirenz was used (**Table 1**).

3.2. Nutritional Status, Food and Biological Data

Nutritionally 27 patients (10%) were underweight. On the dietary level, a low energy intake was observed in 25.6% of patients and a low protein intake was present in 48.9% and all patients had a low consumption of fruits and vegetables.

Regarding biological abnormalities, anemia was noted in 45.9% of patients, a low glomerular filtration rate in 24.1% of cases and a CD4 < 200/mm³ level in 55.6% of cases.

Among the respondents, 150 had a low vitamin D level, a prevalence of 55.6% with mean value of 27.24 ng/mL and extremes of 2 and 52.97 ng/mL (**Table 2**).

3.3. Factors Associated with Hypovitaminosis D

Factors associated with hypovitaminosis D in multivariate analysis were high blood pressure, anemia, low protein intake and low glomerular filtration rate (**Table 3**).

Table 1. General characteristics of PHA followed in Porto-Novo in 2019 (n = 270).

	n	%
age		
<40 years	144	53.3
≥40 years	126	46.7
sex		
Male	72	26.7
Female	198	73.3
complexion		
tanned	96	35.6
black	174	64.4
History and comorbidities		
tuberculosis	39	14.4
High blood pressure	51	18.9
diabetes	9	3.3
Lifestyle		
tobacco	9	3.3
alcohol	159	58.9
Physical inactivity	150	55.6
Contraceptives	33	16.7
Skin creams	75	27.8
depigmentation	84	31.1
Antiretroviral treatment		
With protease inhibitors	7	2.6
Treatment with Efavirenz	263	97.4

Table 2. Nutritional status, food and biological data of PHA monitored in Porto-Novo in 2019 (n = 270).

	n	%
Nutritional status		
Underweight	27	10
normal	123	45.6
overweight	90	33.3
obesity	30	11.1
Food data		
Low energy input	69	25.6
Low protein intake	132	48.9
Insufficient consumption of fruit and vegetables	270	100

Continued

Biological data		
anemia	124	45.9
Hepatic cytolysis	57	21.1
Low glomerular filtration	66	24.4
CD4 < 200/mm ³	150	55.6
Vitamin D deficiency	150	55.6

Table 3. Factors associated with vitamin D deficiency among PHAs followed in Porto-Novo in 2019 (Multivariate analysis).

	gold	95% CI	P
High blood pressure			0.04
Yes	7.56	1.15 - 49.6	
No	1		
Low protein intake			0.01
Yes	1		
No	0.26	0.07 - 0.98	
anemia			0.02
Yes	1	0.03 - 0.70	
No	0.14		
Glomerular filtration rate			0.03
low	1	0.11 - 0.70	
normal	0.27		

4. Discussion

The present study, which aimed at studying vitamin D deficiency in PLWHA, is one of the few conducted in Benin. At the end of this study, it appears that the prevalence of vitamin D deficiency in this population was 56% and that the factors associated with it were high blood pressure, anemia, low protein intake and low glomerular filtration rate...

The high prevalence of vitamin D deficiency found in our work is similar to that reported by Arnedo-Pena (45.1%) [13]. In the general population, the prevalence of vitamin D deficiency is lower; in the study of Tangoh *et al.* [14] in Cameroon, and was 3.2%. In USA, Pasquale M. *et al.* has reported a high prevalence of hypovitaminosis D among HIV-infected subjects ranging from 70.3 to 83.7% [15].

The factors associated with vitamin D deficiency in the present study were similar to those found in the literature. Indeed, Magurno [16] and Fondio [17] respectively reported in their studies that high blood pressure was associated with vitamin D deficiency. The association between cardiovascular diseases and vitamin D deficiency has been explained by some authors. Indeed, In HIV-infected

subjects atherogenesis is enhanced by several factors: HIV-induced chronic inflammation and immune activation (demonstrated by increased levels of proinflammatory cytokines and endothelial activation markers), excess of traditional risk factors, and antiretroviral drug-related dyslipidemia, hyperglycemia, central obesity, and lipodystrophy [18] [19] [20]. Vitamin D influences cardiovascular health by suppressing the renin-angiotensin system and stimulating cellular proliferation and differentiation via 1,25(OH)₂D binding to vitamin D receptors in the heart, the endothelium, and the vascular smooth muscle [21] [22].

In addition, subjects with anemia were at increased risk of vitamin D deficiency according to Kumari *et al.* [23] and Mehta S *et al.* [24].

A low-protein diet associated with vitamin D deficiency was noted by Parva *et al.* [25]. Indeed, this low protein intake can promote undernutrition which is recognized as a factor associated with vitamin D deficiency [26] [27]. The association between decreased glomerular filtration rate *i.e.* renal failure and vitamin D deficiency was reported by Ali [28] and Singh [29]. This would be due at least in part, to the renal synthesis defect of 1 α hydroxylase necessary for vitamin D metabolism. Moreover, chronic inflammation due to HIV infection and subsequent TNF- α overproduction may be responsible for renal 1 α -hydroxylase impairment, reducing the PTH (parathyroid hormone) stimulatory effect on the production of the hormonally active 1,25(OH)₂D (1,25-dihydroxyvitamin D) [15].

However, these findings are limited by the use of a cross sectional design.

5. Conclusion

Vitamin D deficiency is very common among PLWHA. The identified risk factors were high blood pressure, anemia, low protein intake and low glomerular filtration rate. Systematic screening for vitamin D deficiency should be done especially among those at risk to provide adequate care. A future study may assess the impact of vitamin D supplementation on the morbi-mortality of PLWHA with deficiency.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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