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## ORIGINAL ARTICLE

# Prevalence of Vitamin D Deficiency and Nutrition Knowledge Among University Students in Durres, Albania

Jorida Zoga, Majlinda Kallco, Indrit Bimi, Daniela Bimi, Daniela Haxhihyseni, Marsida Krasniqi

*Department of Medical Technical Sciences, University "Aleksandër Moisiu" Durrës, Durres, Albania*

### ABSTRACT

*Background:* **This study aimed to determine 25 OH-vitamin D status and frequency of its determinants related to diet, lifestyle, and exposure to sunlight among young, healthy nursing students, first-year living in Durres, in Durres, Albania.**

*Methods:* **This cross-sectional study included responses gathered on a questionnaire from nursing students at the University "Aleksander Moisiu" Durres (UAMD), Durres, from March through April 2024. Questions regarding demographics, sun exposure, and diet were recorded. Serum 25 (OH) vitamin D3, calcium, and phosphorus levels were measured through laboratory examination. For serum 25 OHD, the cutoff values ≤ 12 ng/mL, ≤ 20 ng/mL, ≥ 21 - 29 ng/mL, and ≥ 30 ng/mL were defined as very deficient, deficient, insufficient, and sufficient, respectively. The reference values for calcium are 8.6 - 10.3 mg/dL and 2.7 - 4.9 mg/dL for phosphorus.**

*Results:* **The total number of nursing students enrolled in the study was 187. Among those, 161 (86.43%) were female and 26 (13.57%) were male. Mean ± SD of age was almost similar between the gender groups (19.00 ± 2.56 vs. 19.03 ± 2.05). In total, 148 (79.40%) of the students had BMI within normal range.**

**Further, 25 OH-vitamin D deficiency was found in 164 (87.7%) participants, insufficiency in 16 (8.5%) participants, and only 7 (3.7%) participants had sufficient levels. In total, 31.6% of students eat one egg per day, 33.1% drink 250 mL of milk per day, and the percentage of students that eat fresh fish was less common, with only 23.8%.**

*Conclusions:* **Deficiency of 25 OH-vitamin D is common among healthy young adults, particularly females, which emphasizes the need to add vitamin D supplements to routine diet.**

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**Correspondence:**
Jorida Zoga
Department of Medical Technical Sciences
University "Aleksandër Moisiu" Durrës
Durres
Albania
Email: joridazoga@uamad.edu.al

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### KEYWORDS

25 OH-vitamin D deficiency, lifestyle, university

### INTRODUCTION

Vitamin D deficiency is now recognized as a pandemic. The primary cause of vitamin D deficiency is the lack of knowledge regarding the fact that sun exposure is the primary source of vitamin D for most humans; very few foods naturally contain vitamin D, and foods that are fortified with vitamin D are often inadequate in satisfying either a child's or an adult's vitamin D requirement [1,2].

The most recognized importance of vitamin D is its key role in bone metabolism and skeletal health via calcium and phosphorus hemostasis [3].
Vitamin D is synthesized endogenously through exposure of the skin to sunlight due to the limited food sources of vitamin D [14]. Natural nutrient materials are not a sufficient source of vitamin D to supply the body requirements; therefore where there is no supplementation of foodstuffs, the main source for vitamin D is produced by UV light [5].
Factors such as age, season, latitude, time of day, skin pigmentation, amount of skin exposed to sunlight, and use of sunscreen can influence vitamin D synthesis [6].
Vitamin D metabolites affect almost every organ in the body [7]. On exposure of skin to sunlight rays, most of the vitamin D is synthesized naturally. Oily fish contains small quantities of naturally occurring vitamin D. Vitamin D is metabolized to a hormone (calcitriol) circulating in the blood [2]. Calcitriol maintains calcium and phosphate hemostasis, which in turn promotes healthy growth and remodeling of the bones [8]. Vitamin D deficiency or insufficiency is very often reported in healthy children and adolescents, and its prevalence is increasing every year [9].
Most individuals with vitamin D deficiency/insufficiency remain asymptomatic, making clinical detection difficult. Complaints like muscular weakness and fatigue can be clinical features associated with vitamin D deficiency; however, they are usually ignored and neglected [10].
The objective of this study was to determine levels of 25 OH-vitamin D among students at UAMD, in Durres, Albania [11], and to establish its association with nutrition knowledge.

## MATERIALS AND METHODS

This cross-sectional study was carried out on 187 (26 male and 161 female) first-year university students [11], selected from the University of Medical Sciences, UAMD. Data gathering was done in March and April 2024. After explaining the study procedure, a demographic questionnaire and a questionnaire on sunlight exposure and nutrition knowledge were conducted.
Also, 5 mL venous blood was drawn. The serum was separated after the blood samples were centrifuged and were then preserved at a temperature of −80°C until final analysis. Serum 25 OH-vitamin D was measured using an electrochemiluminescence method (Cobas E; Roche Diagnostic). All tests were performed at “Talasemia-Lab” using the test analyzer “Roche Diagnostic”. For serum 25 OH-Vitamin D, the cutoff values ≤ 12 ng/mL, ≤ 20 ng/mL, ≥ 21 - 29 ng/mL, and ≥ 30 ng/mL were defined as very deficient, deficient, insufficient, and sufficient, respectively [12]. Calcium and phosphorus were measured using Roche reagent.
Data analysis was done using Statistical Package for Social Sciences (SPSS) software, version 20. Independent sample *t*-test was used to compare quantitative variables, and the chi-squared test was utilized to compare qualitative variables between males and females. Correlations between serum 25 OH-vitamin D and diet and sun exposure were assessed using Pearson´s correlation. A p-value of less than 0.05 was considered significant. The serum levels of calcium and phosphate were measured to evaluate the severity of 25 OH-vitamin D deficiency. Data from the questionnaire, clinical examination findings, and laboratory results were analyzed. Continuous variables were presented as mean ± standard deviations and median, whereas categorical variables were presented in frequencies and percentages. The independent *t*-test was used for normally distributed laboratory parameters (calcium and phosphate levels), and the Mann-Whitney U test was used for non-normally distributed data of 25 OH-vitamin D levels. p-value < 0.05 was considered statistically significant.

## RESULTS

A total of 187 university students (26 male and 161 female) participated in this study. Mean ± SD of age of both gender groups was similar (19.00 ± 2.56 vs. 19.03 ± 2.05). In total, very deficient 25 OH-vitamin D was reported in 57 students (30%), 107 students (57.7%) were deficient, insufficiency was reported in 16 students (8.5%), and only 7 students (3.7%) had sufficient levels. In our study, females had lower vitamin D levels than males.
However, calcium (9.3 ± 0.78; n = 187) and phosphor (4.25 ± 0.9; n = 187) levels were within a normal range for the majority of students.
A total of 145 (77.4%) students walked more than 30 minutes every day in nature. Consumption of up to 250 mL of milk per day was reported by 62 (33.1%) students, dietary intake of one egg per day was reported for 59 (31.6%) students, and intake of fresh fish was reported for only 44 (23.8%) students. We did not detect an effect on 25 OH-Vitamin D status.
Further, 148 (79.40%) students had BMI within normal range (18.5 - 25 kg/m$^2$), 18 (9.6%) students were obese, and 2 (1.06%) were overweight. A 25 OH-vitamin D deficiency was registered in 69% of the students with normal BMI, and 75% of our students had knowledge about 25 OH-vitamin D, but only 25% of them had it measured in laboratory in the last year.
The amount of sunlight exposure that is needed for a sufficient vitamin D intake varies depending on skin type, time of day, altitude, and season. The study subjects live in Durres and walk every day more than 30 minutes to the University, which is located by the sea.

**Table 1. Age, 25 OH-vitamin D status, calcium phosphate, alkaline phosphatase, and BMI of participants by gender.**

| Gender | Female (n = 161) | Male (n = 26) | p-value |
|---|---|---|---|
| Variables | Mean ± SD | Mean ± SD | |
| Age (years) | 19.00 ± 2.56 | 19.03 ± 2.05 | |
| 25 OH-vitamin D | 20.46 ± 10.37 | 26.1 ± 12.87 | < 0.001 |
| BMI (kg/m$^2$) | 19.5 ± 7.8 | 22.7 ± 6.1 | < 0.01 |
| Calcium (mg/dL) | 9.5 ± 0.06 | 10.1 ± 0.03 | < 0.01 |
| Phosphate (mg/dL) | 3.5 ± 0.01 | 4.2 ± 0.02 | < 0.01 |
| Alkaline phosphatase (U/L) | 206 ± 27.3 | 258 ± 15.6 | < 0.01 |

*** Differences between males and females independent sample (t-test). ** Differences between males and females (Mann-Whitney test), SD = standard deviation.**

**Table 2. Status of 25 OH-Vitamin D, calcium, and phosphor.**

| | 25 OH-vitamin D | Calcium (mg/dL) | Phosphor (mg/dL) | Alkaline phosphatase |
|---|---|---|---|---|
| Very deficient | 57 (30%) | | | |
| Deficient | 107 (57.7%) | | | |
| Insufficient | 16 (8.5%) | | | |
| Sufficient | 7 (3.7%) | 187 (100%) | 187 (100%) | 187 (100%) |

**Table 3. Biochemical bone markers according to sun exposure.**

| Sun exposure | > 30 minutes/day | | < 30 minutes/day | | |
|---|---|---|---|---|---|
| Biochemical bone markers | Mean ± SD | Median ± range | Mean ± SD | Median ± range | p |
| Total calcium (mg/dL) | 9.3 ± 0.06 | 9.2 (8.6 - 10.3) | 9.2 ± 0.05 | 9.1 (8.6 - 9.9) | < 0.01 |
| Phosphate (mg/dL) | 3.5 ± 0.05 | 3.3 (2.7 - 4.8) | 3.2 ± 0.04 | 3.2 (2.6 - 4.4) | < 0.01 |
| 25 OH-vitamin D (ng/mL) | 26.2 ± 6.9 | 27.2 (30 - 100) | 16.1 ± 5.8 | 16.5 (20 - 58) | < 0.01 |

**Table 4. Dietary intake in percentages according to food category, along with the number of days of intake.**

| Diet | Once a week | Daily | Never |
|---|---|---|---|
| Milk (250 mL) | 25.5% | 69.7% | 4.8% |
| Egg | 30.4% | 60.4% | 9.2% |
| Fish | 23.8% | 1.2% | 75% |

## DISCUSSION

This study focused on a healthy population without financial barriers to partake in a healthy diet containing Vitamin D; however, the studied population´s 25 (OH)-vitamin D levels were still found to be low. Nearly 96% of the study subjects were vitamin D deficient. Seasonal variation plays a crucial role, influencing 25 (OH)-vitamin D levels, primarily through sunlight exposure differences throughout the year. During summer months, individuals are typically exposed to more ultraviolet B (UVB) rays, which stimulate vitamin D synthesis in the skin. Conversely, in winter, reduced sunlight hours and lower UVB intensity significantly decrease endogenous vitamin D production, leading to seasonal fluctuations in serum 25 (OH)-vitamin D levels.

These findings were consistent with local studies by Faghih S et al. [13], who reported 99% and 95% of their study subjects with vitamin D deficiency., and consistent with the study by Nadeem et al. [8], where 90% of study subjects were found with low 25 OH-vitamin D. Fish was the most important and most prevalent source of 25 OH-vitamin D, despite the fact that only 23.8% of our students took it once a week, while 75% never took it. In the study of Nuti et al. (2024), fish was consumed only 1 - 2 times per week on average.

In our study, almost half of the participants exhibited an overall high knowledge level regarding vitamin D and its role in health, same as in the study of Trebicka et al. [15].

Interestingly, there is quite the similarity between our study and the study of Nadeem et al. [8].

In our study, 69.7% of the subjects that were 25 OH-vitamin D deficient drank a glass of milk and 70.4% of our subjects ate one egg per day, while in the study of Nadeem et al. (2018), it was 77% and 57% of subjects, respectively, indicating that other factors may be involved.

Another interesting finding of our study was that 69% of 25 OH-vitamin D deficient subjects had normal BMI. This correlates with a study conducted by Zhang et al. [16] on Chinese school children, who reported decreased levels of 25 OH-vitamin D with high BMI.

If students test their vitamin D levels at least once a year, the economic impact will improve [15].

## CONCLUSION

Our study concludes that vitamin D deficiency/insufficiency is common in asymptomatic, educated, healthy young medical students in Durres, despite the fact that they have good sun exposure and eat foods containing vitamin D, e.g. eggs, milk, and fish.

### Recommendations

As the students live almost the entire year in Durres, a region with sufficient UVB exposure during summer, winter supplementation may suffice to maintain optimal vitamin D levels. Year-round supplementation may be recommended for those with limited sun exposure, inadequate dietary intake, or higher risk of deficiency.

The opportunity for fortification strategies is suggested in most countries as a public health policy to meet dietary vitamin D recommendations [17], while vitamin D supplements are generally indicated as the recommended alternative when dietary intake is insufficient - in cases of reduced or insufficient UVB radiation - with recommendations for daily intake to be increased to at least 10 µg per day, 25 µg for the elderly (400 IU and 1,000 IU, respectively) [18].

### Limitations

As the study only included students of the Medical Technical Department at the Aleksander Moisiu University of Durres, the data are only conclusive for this population group [19].

**Declaration of Interest:**
The authors reported no conflicts of interest.

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