

## ASSOCIATION OF VITAMIN D STATUS WITH BODY MASS INDEX IN ADOLESCENTS IN UKRAINE

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received: September 17, 2018      accepted: December 04, 2018

available online: December 25, 2018

### Abstract

**Background and aims:** Vitamin D status in many health managements have been researched extensively, but its dependence with obesity still remains controversial. This article is devoted to examination of blood cholecalciferol levels in Ukrainian population with establishment the association of cholecalciferol levels and body mass index (BMI).

**Materials and methods:** For this observed investigation, data were collected during the summer 2017, over a period of one week from three township areas in Carpathian region, Ukraine from 304 adults aged 19–78 years. Measured variables contained 25(OH)D level, weight and weight applied to check BMI degree. The average level of vitamin D among adolescents presented  $23.1 \pm 8.2$  ng/ml. Female gender was associated with lower vitamin D concentrations ( $22.9 \pm 9.3$  ng/ml vs.  $26.2 \pm 8.5$  ng/ml for men). Among the participants, 74.4% had a BMNI of  $25 \text{ kg/m}^2$  and over, and in 27.3% of them the number was  $30 \text{ kg/m}^2$  and over. **Results:** Violation of vitamin D status was detected in 90.5% persons. 1.8% people had been identified as severe 25(OH)D deficiency. Measurement of cholecalciferol demonstrated meaningful connection between its level and BMI only in persons with BMI  $25\text{--}29.9 \text{ kg/m}^2$ . Average vitamin D concentrations in persons with BMI over  $30 \text{ kg/m}^2$  did not vary to a significant range from data in persons with normal body weight. **Conclusions:** Vitamin D status among the adolescents in Ukraine is far from optimum. Our results confirm reliable association between cholecalciferol level and BMI in persons with overweight. Interchange between conservation of vitamin D and BMI needs additional surveys.

**key words:** vitamin D status, body mass index, obesity

### Background and aims

Obesity is a global health concern that has a pronounced impact on morbidity and mortality in many communities [1]. During the last years, researchers investigate the influence of cholecalciferol in different conditions [2]. Vitamin D deficiency have been researched

extensively in many health maintenances, but its dependence with obesity still remains controversial [3,4]. In review S. Wang [5] accented the importance of acceptable level of cholecalciferol on the normal functioning of cardiovascular system. D. Truesdell et al. [6] have been described an opposite relationship

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between size of body mass index (BMI) and blood cholecalciferol level.

J. Wortsman et al. [7] have shown that skin in patients with obesity and in persons with normal weight makes the identical level of 25(OH)D at the identical terms. Thus, 57% less cholecalciferol is sucked in rotation of individuals with normal weight from the increased quantity of hypodermic fat enticed vitamin D [8]. Total period for skin required incoming to reveal to sun for arrangement and achieve sufficient ultraviolet-B exposition considering adequate vitamin D synthesis is counting on latitude and other atmospheric state [9]. In accordance with modern data, there is an intercommunication between the cholecalciferol levels and cardiovascular pathology, obesity, violation of carbohydrate metabolism, arterial hypertension, and lipid disorders. Although the pathogenicity remains vague yet, vitamin D deficiency / insufficiency was combined with increased risk of the above-mentioned disorders.

This article is devoted to the examination of cholecalciferol levels in Ukrainian population, establishment the intercommunication between serum vitamin D concentration and the BMI data. We hypothesized that cholecalciferol levels in adolescents will be defective and conversely connected with BMI.

## Material and method

### *Study design and patients*

For this observational study, data were collected during the summer 2017, over a one week period from three township areas in Carpathian region, Ukraine (Kolomyja, Kosiv and Verhovyna). From each starting point, written informed consents were collected from all participants aged 19–78 years. All individuals were congregated at the Bucovinian Centre of Endocrinology where anthropometric calculations were carried out as well as blood

samples obtained to detect 25(OH)D level. Body weight was resolved according to current guidelines [10]. Height was calculated precise to 5 mm. According to guidelines of WHO [11] BMI was estimated in  $\text{kg/m}^2$ .

Exclusion criteria were cholecalciferol therapy, type 2 diabetes mellitus, advanced liver or kidneys disorders, malabsorption. Any individuals were recognized to be optimal weight if the BMI was  $<25 \text{ kg/m}^2$ ; overweight – if the BMI was  $25 - 29.9 \text{ kg/m}^2$ , obesity – if it was  $\geq 30.0 \text{ kg/m}^2$ .

### *Laboratory, anthropometric and clinical data collection*

A chemiluminescent immunoassay was applied to obtain blood 25(OH)D concentrations. Blood 25(OH)D concentrations lower than 30.0 ng/ml were accepted as vitamin D deficiency. Blood 25(OH)D levels of  $\geq 30.0 \text{ ng/ml}$  suggested an optimal cholecalciferol concentration. Rate of 20.0-30.0 ng/ml showed insufficiency of vitamin D, and a level  $<20.0 \text{ ng/ml}$  indicated deficiency of vitamin D [12].

### *Statistical analysis*

Results of investigation presented as mean  $\pm$  SD or percentage. Statistical determinations were carried out using program STATISTICA for Windows (version 6.0). We executed one-way ANOVA test, regression and correlation analysis. The differences were recognized to be statistically reliable at p value  $<0.05$ .

Ethical authorization was acquired from the Ethics Board in the Bukovinian Medical University.

## Results

Characteristics of 304 individuals (74 males, 230 females; mean age 59.6 years) recruited for this investigation are given in [Table 1](#).

**Table 1.** Features of participants in relation to age and BMI.

Variable	Kolomyja	Verhovyna	Kosiv
n	204	48	52
Age, years	59.5±15.2	58.7±13.1	62.9±12.5
Weight, kg	76.2±16.9	73.8±16.5	79.1±17.8
Height, m	1.67±0.09	1.66±0.08	1.67±0.07
BMI, kg/m <sup>2</sup>	27.9±5.9	27.2±6.2	28.6±5.9

**Table 2.** Cholecalciferol concentration in the study population.

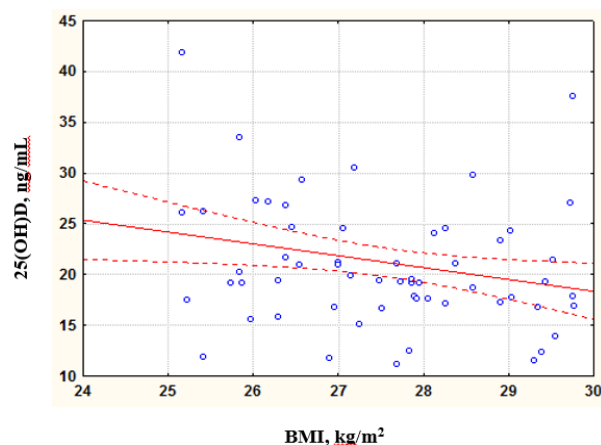
Variable	Kolomyja	Verhovyna	Kosiv
n	204	48	52
25(OH)D, ng/ml	22.4±6.4	23.8±8.7	23.1±7.8
Vitamin D insufficiency, n (%)	97/204 (47.5%)	18/48 (37.5%)	18/52 (34.6%)
Vitamin D deficiency, n (%)	96/204 (47.1%)	20/48 (41.7%)	16/52 (30.8%)
Acceptable vitamin D status, n (%)	9/204 (4.4%)	10/48 (20.8%)	9/52 (17.3%)

Mean value of 25(OH)D in adolescents presented  $23.1 \pm 8.2$  ng/ml. Female gender was correlated with decreased level of cholecalciferol ( $22.9 \pm 9.3$  ng/ml in compare with  $26.2 \pm 8.5$  ng/ml for men).

High frequency of overweight and obesity was detected in observed participants. Almost  $\frac{3}{4}$  individuals were overweight and obese in accordance to BMI, especially in women.

Low cholecalciferol level was established in the most part of the individuals of this investigation, as signified in [Table 2](#). Vitamin D deficiency / insufficiency were recognized among 90.5% persons. 1.8% people had been detected to be severely deficient cholecalciferol concentration.

[Figure 1](#) shows reliable intercommunication between cholecalciferol level and BMI only among persons with BMI 25.0-29.9 kg/m<sup>2</sup>. The average concentration of cholecalciferol in persons with BMI >30.0 kg/m<sup>2</sup> did not vary to a significant range from data in persons with normal body weight.

**Figure 1.** Vitamin D status in relation to BMI category 25-29.9 kg/m<sup>2</sup>

## Discussion

In this study, a high prevalence of overweight and obesity (75.2%) was found. 90.7% of individuals had no acceptable cholecalciferol concentration (> 30.0 ng/ml). An inverse connection between blood cholecalciferol concentrations and BMI was found among participants with overweight. Reliable relation between blood cholecalciferol

levels and BMI data in obesity persons (BMI > 30.0 kg/m<sup>2</sup>) was not found.

When comparing our participants with community of developed societies where meal is usually strengthened with cholecalciferol, it was discovered that the average cholecalciferol levels of 23.2 ± 8.1 ng/ml in Ukrainian adolescent were not reliable lower in data of NHANES (US National Health and Nutrition Examination Survey), where males have 25.2 ng/ml and females have 24.6 ng/ml) [13]. The same data reported for individuals from other studies [14].

The prevalence of vitamin D insufficiency / deficiency rises among people aged after 70 years [15]. Residence location also influences on 25(OH)D status. The available determinant that might provide to the deficiency of vitamin D was the place of residence of Carpathian region indicated by low grade of daylight. Results of our investigation validated a high frequency of overweight and obesity among a population from the Carpathian region.

We would be desirable to underline the limited amount of study participants and outpatient foundation of this survey. Future investigations to evaluate the influence of cholecalciferol concentration on BMI in other countries are desired.

### Conclusions

*Vitamin D status among the adolescents in Ukraine is far from optimum. Our results confirm reliable intercommunication between cholecalciferol level and BMI among persons with overweight. Interchange between conservation of vitamin D and BMI needs additional surveys.*

**Acknowledgements.** The patients are thanked for participating in this study. We thank V. Povorozniuk, N. Balatska for their excellent scientific and technical assistance.

The authors announce that they do not have a conflict of interest associated with this manuscript.

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