L. Aljebbawi

РОЛЬ НЕДОСТАТОЧНОСТИ/ДЕФИЦИТА ВИТАМИНА D В ФОРМИРОВАНИИ КАРДИОМЕТАБОЛИЧЕСКОГО РИСКА У ПАЦИЕНТОВ С ГИПЕРТОНИЕЙ И ОЖИРЕНИЕМ

Научный руководитель: ст. преп. А.Л. Орловская
Кафедра поликлинической терапии
Белорусский государственный медицинский университет, г. Минск

L. Aljebbawi

THE ROLE OF VITAMIN D INSUFFICIENCY/DEFICIENCY IN THE FORMATION OF CARDIOMETABOLIC RISK IN PATIENTS WITH HYPERTENSION AND OBESITY

Tutor: senior lecturer A.L. Arlouskaya
Department of outpatient therapy
Belarusian State Medical University, Minsk

Резюме. Проведено поперечное сравнительное исследование 100 пациентов (50 с гипертонией, ожирением и дефицитом витамина D и 50 здоровых контрольных) в 34-й Минской городской поликлинике с ноября 2025 по март 2026. У основной группы выявлены значительно более высокие показатели систолического и диастолического артериального давления, индекса массы тела, общего холестерина, ЛПНП, триглицеридов и глюкозы натощак по сравнению с контролем. Полученные данные подтверждают необходимость рутинного мониторинга витамина D у пациентов с гипертонией и ожирением.

Ключевые слова: витамин D, артериальная гипертензия, ожирение, кардиометаболический риск.

Resume. A cross-sectional comparative study of 100 patients (50 with hypertension, obesity and vitamin D deficiency and 50 healthy controls) was conducted at the 34th Minsk City Polyclinic from November 2025 to March 2026. The main group showed significantly higher systolic and diastolic blood pressure, body mass index, total cholesterol, LDL, triglycerides and fasting glucose compared to controls. These findings confirm the need for routine vitamin D monitoring in patients with hypertension and obesity.

Keywords: vitamin D, hypertension, obesity, cardiometabolic risk.

Relevance. Vitamin D deficiency is a global health problem affecting more than 1 billion people worldwide. In recent years, accumulating evidence has suggested that low vitamin D levels are not only associated with bone metabolism disorders but also with cardiovascular diseases, hypertension, obesity, insulin resistance and dyslipidemia. However, the relationship between vitamin D insufficiency/deficiency and cardiometabolic risk in patients with concurrent hypertension and obesity remains insufficiently studied in the Belarusian population.

Aim: to evaluate the relationship between the level of vitamin D insufficiency/deficiency, the degree of obesity and blood pressure in patients with arterial hypertension.

Objectives:

1. To compare vitamin D levels between hypertensive obese patients and healthy controls.

2. To assess the differences in BMI, systolic and diastolic blood pressure between the two groups.

3. To analyze lipid profile (total cholesterol, LDL, triglycerides) and fasting glucose levels in both groups.

4. To determine the association between low vitamin D status and cardiometabolic disorders.

Materials and methods. A cross-sectional comparative study was conducted at the 34th Minsk City Polyclinic. Vitamin D levels were analyzed between November 2025 and March 2026. The study included 100 patients: 50 patients in the main group (arterial hypertension for ≥6 months, BMI ≥30 kg/m², vitamin D <28.9 ng/ml, age 18-65 years) and 50 patients in the control group (normal blood pressure, BMI 18.5-24.9 kg/m², vitamin D ≥30 ng/ml, no chronic diseases, age 18-65 years). The main group consisted of 47 females and 3 males; the control group consisted of 43 females and 7 males. Exclusion criteria for both groups: secondary forms of hypertension; chronic kidney disease stage 4–5 (eGFR <30 mL/min/1.73 m²); type 1 diabetes mellitus; oncological diseases; use of vitamin D supplements at doses >2000 IU/day within 3 months prior to analysis; pregnancy and lactation, osteoporosis.

Statistical analysis was performed using Python 3.10 (SciPy, NumPy). Quantitative variables are presented as M ± σ. Normality of distribution was tested using the Shapiro–Wilk test, and equality of variances was assessed using Levene's test. For comparisons between independent groups, Welch's t-test was used and effect size (Cohen's d). The significance threshold was set at $p < 0.05$ (two-tailed test).

Results and their discussion. The study included 100 patient records (50 – case group, 50 – control). Groups were comparable in age and sex, confirming the correctness of matching «Table 1 Demographic characteristics of the groups».

Tbl. 1. Demographic characteristics of the groups

Parameter	Group 1 (n=50)	Group 2 (n=50)	P
Age, years (M ± SD)	58.76 ± 6.63	57.02 ± 4.42	0.126
Sex: female, %	72.0	74.0	0.780

Main results of group comparison are presented in «Table 2 Comparative characteristics of clinical and laboratory parameters ».

Tbl. 2. Comparative characteristics of clinical and laboratory parameters

Parameter	Group 1 (AH+obesity+↓VitD)	Group 2 (Healthy)	t	p	Cohen's d
SBP, mmHg	131.30 ± 9.19	126.40 ± 5.15	3.288	**0.0015**	0.66
DBP, mmHg	79.90 ± 5.49	72.40 ± 6.41	6.287	**<0.0001**	1.26
BMI, kg/m²	32.68 ± 3.66	22.44 ± 1.53	18.275	**<0.0001**	3.66
25(OH)D, ng/mL	21.77 ± 5.02	41.00 ± 8.80	−13.420	**<0.0001**	−2.68
TC, mmol/L	6.01 ± 1.24	4.68 ± 0.60	6.855	**<0.0001**	1.37
LDL-C, mmol/L	3.77 ± 0.95	2.84 ± 0.38	6.124	**<0.0001**	1.22
TG, mmol/L	1.49 ± 0.85	0.89 ± 0.28	4.785	**<0.0001**	0.96
Glucose, mmol/L	5.20 ± 0.59	4.83 ± 0.34	3.859	**<0.0001**	0.77

Blood Pressure. Patients in the case group had significantly higher levels of both systolic and diastolic blood pressure. The difference in DBP (+7.5 mmHg) showed a large effect size (d=1.26), indicating high clinical significance of this difference.

Vitamin D Status and Anthropometry. The level of 25(OH)D in the case group was nearly twofold lower than in controls (21.77 vs. 41.00 ng/mL), with 100% of patients having suboptimal status (<30 ng/mL): deficiency (<20 ng/mL) in 28%, insufficiency (20–29.9 ng/mL) in 72%. In the control group, 96% of patients had normal vitamin D levels. The difference in BMI (+10.24 kg/m²) showed an extremely large effect size (d=3.66), confirming the correctness of group formation. Lipid Profile and Glucose Metabolism. Patients with the triad of pathologies demonstrated significantly higher levels of all atherogenic lipid fractions. Of particular note is that 52% of patients in the case group had LDL-C levels >3.4 mmol/L (threshold for considering statin therapy in high-risk patients), whereas no such cases were observed in the control group. Fasting glucose levels were also significantly higher in the case group, with 28% of patients showing values corresponding to prediabetes criteria (5.6–6.9 mmol/L).

Conclusions. The obtained data confirm the hypothesis of a synergistic negative effect of obesity and vitamin D deficiency on the patient's cardiometabolic profile. The identified differences in blood pressure, lipid profile, and glucose have not only statistical but also clinical significance, as evidenced by large effect sizes ($d \geq 0.8$ for 6 out of 8 analyzed parameters).

The elevation of diastolic blood pressure by 7.5 mmHg in the case group is consistent with literature data indicating that obesity is associated with increased peripheral vascular resistance and RAAS activation [1]. Vitamin D deficiency may exacerbate these mechanisms through suppression of renin expression and impairment of endothelial function [2]. Pronounced dyslipidemia in the case group (elevated TC, LDL-C, TG) reflects classic metabolic disturbances in insulin resistance: enhanced lipolysis in visceral adipose tissue, increased hepatic VLDL production, and reduced clearance of atherogenic lipoproteins [3, 4]. Notably, the effect size for LDL-C (d=1.22) is comparable to that for DBP, emphasizing the importance of the lipid component in the risk structure of this patient cohort. The practical value of this study lies in substantiating the rationale for comprehensive assessment of vitamin D status in patients with AH and obesity. Screening for 25(OH)D may help:

1. Identify patients with the most pronounced cardiometabolic risk;
2. Justify prescription of vitamin D supplements as part of complex therapy;
3. Motivate patients toward lifestyle modifications (dietary correction, increased physical activity, sensible sun exposure).

Literature

1. Holick, M.F. Vitamin D deficiency / M.F. Holick // N Engl J Med. – 2007. – Vol. 357, No. 3. – P. 266-281.

2. Wang, L. Vitamin D and cardiovascular disease / L. Wang, Y. Song, J.E. Manson // Annu Rev Public Health. – 2015. – Vol. 36. – P. 79-97.

3. Pilz, S. Vitamin D and cardiovascular disease prevention / S. Pilz, A. Tomaschitz, W. März // Nat Rev Cardiol. – 2010. – Vol. 7, No. 8. – P. 478-488.

4. Kunadian, V. Vitamin D deficiency and coronary artery disease / V. Kunadian // J Am Coll Cardiol. – 2014. – Vol. 64, No. 1. – P. 49-60.