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РАСПРОСТРАНЕННОСТЬ ДЕФИЦИТА И НЕДОСТАТОЧНОСТИ ВИТАМИНА D У ПАЦИЕНТОВ С ОЖИРЕНИЕМ И САХАРНЫМ ДИАБЕТОМ 2 ТИПА

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PREVALENCE OF VITAMIN D DEFICIENCY AND INSUFFICIENCY IN PATIENTS WITH OBESITY AND DIABETES MELLITUS TYPE 2

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Резюме. В амбулаторных условиях проведена оценка уровня витамина D – 25(OH)D в плазме крови у пациентов с ожирением и сахарным диабетом (СД) 2 типа. Выявлена высокая распространённость гиповитаминоза D (25(OH)D<30 нг/мл) у 100% обследованных пациентов как с ожирением так и с СД 2 типа. Уровень 25(OH)D имел обратную корреляционную связь с гликированным гемоглобином (HbA1c) у пациентов с СД 2 типа, что определяет практическое значение коррекции гиповитаминоза D для улучшения гликемического профиля при СД.

Ключевые слова: ожирение, сахарный диабет, витамин D, HbA1c.

Resume. In an outpatient setting, the level of vitamin D – 25(OH)D in the blood plasma was assessed in patients with obesity and type 2 diabetes mellitus (DM). A high prevalence of hypovitaminosis D (25(OH)D<30 ng/ml) was revealed in 100% of the examined patients with both obesity and type 2 DM. The level of 25(OH)D had an inverse correlation with glycated hemoglobin (HbA1c) in patients with type 2 diabetes, which determines the practical significance of correcting hypovitaminosis D to improve the glycemic profile in diabetes.

Keywords: obesity, diabetes mellitus, vitamin D, HbA1c.

Relevance. Type 2 DM is a significant medical and social problem due to the widespread prevalence of the disease and the high incidence of mortality and disability due to macro- and microvascular complications of diabetes. The number of patients with type 2 DM continues to increase. Obesity is one of the main risk factors for the development of type 2 DM.

At the same time, vitamin D deficiency and insufficiency is a global health problem that affects a huge number of children and adults every year. The impact of vitamin D deficiency cannot be underestimated. Many researchers note the connection between vitamin D deficiency/insufficiency and an increased risk of developing a number of diseases of both the musculoskeletal system (osteoporosis, sarcopenia) and metabolic disorders - obesity, diabetes mellitus [2].

Vitamin D deficiency is highly prevalent in individuals with type 2 DM and obesity, with studies showing strong correlations between these conditions. Among type 2 DM patients, 53.1 % were vitamin D deficient in a the study, with obesity exacerbating this deficiency 46.9% of obese participants had insufficient levels. Obesity independently

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increases vitamin D deficiency risk, with a 35% higher prevalence in obese individuals compared to healthy-weight populations [3,10].

Severely obese children show a 49% deficiency rate, rising to 87% in African-American children [9]. This deficiency is linked to insulin resistance, with low vitamin D levels correlating with elevated glucose levels and reduced insulin sensitivity [4,10]. Key factors include limited sun exposure, demographic variables (age, gender), and adiposity-related mechanisms that sequester vitamin D[5,6, 9]. Studies recommend routine screening, supplementation, and lifestyle modifications (diet, exercise) to mitigate deficiency-related complications in these populations[4, 5, 8].

Diabetes mellitus is closely tied to vitamin D status, with studies indicating a high prevalence of deficiency in both type 1 and type 2 diabetes patients. Insulin resistance, innate immune dysfunction, and systemic inflammation common in diabetes may be exacerbated by low vitamin D levels [5, 6].

There are mechanisms linking Vitamin D, Obesity, and Diabetes which includes, Insulin sensitivity where Vitamin D may enhance insulin sensitivity by modulating calcium metabolism and influencing the secretion of insulin by pancreatic beta cells. Studies have identified VDR in pancreatic tissues, suggesting that vitamin D may directly influence insulin production [2, 7].

Inflammation is the next mechanism of where Vitamin D possesses anti-inflammatory properties that can counteract the infiltration of macrophages into adipose tissue, a common feature of obesity. By reducing systemic inflammation, vitamin D may further improve insulin action. Adipokines and Metabolism is one of another factors, Adipocytes produce bioactive substances known as adipokines, which include leptin and adiponectin. Vitamin D may influence adipokine secretion, thereby affecting energy metabolism and insulin sensitivity. Low levels of adiponectin (linked with obesity) have been associated with vitamin D deficiency, suggesting a crucial regulatory role [7, 3, 10].

Thus, according to research, vitamin D has pleiotropic effects, regulates insulin secretion in β-cells of the pancreas, and with its deficiency, the number of insulin receptors decreases, the activity of glucose transport proteins and PPAR-receptors decreases, insulin resistance, prediabetes and DM develop [5, 10].

Thus, the current worldwide epidemic of diabetes and obesity is a serious health problem due to the high toll of vascular complications. Vitamin D deficiency, as an emerging epidemic, affects the pathophysiology of diabetes and obesity through various mechanisms, which determined the relevance of the study on the prevalence of hypovitaminosis D.

Purpose: to assess the prevalence of vitamin D insufficiency/deficiency in individuals with obesity and diabetes mellitus type 2.

Materials and methods. The study involved 32 patients: group 1 – 46,9% (n=15) with obesity and group 2 – 53,1% (n=17) with DM type 2. The average age in this groups were 65 (50; 77) and 68 (63; 71) respectively, ($p>0.05$). The data were subjected to analysis using the 4D client software provided by the State Healthcare Institution «Grodno City Polyclinic No. 6». The following parameters were examined: creatinine, triglycerides (TG), cholesterol (CH), glycated hemoglobin (HbA1c), blood pressure (BP), body mass index (BMI), and vitamin D level (25(OH)D). The vitamin D status was assessed by the level of 25(OH)D in blood plasma: the optimal level of vitamin D as 25(OH)D > 30 ng/ml;

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insufficiency is 29-20 ng/ml; deficiency is <20 ng/ml. Statistical analyses were conducted using the "STATISTICA 10.0" software.

Results and their discussion. The laboratory and anthropometric data of patients in groups 1 and 2 are presented in Table 1.

Tbl. 1. Laboratory and anthropometric data indicators

Indicators and units of measurement	Group 1 (n=15)	Group 2 (n=17)
Age, years	65 (50; 77)	68 (63; 71)
BMI, kg/m²,	34,2 (31,2; 35,9)*	30,1 (28,8; 31,2)
Systolic BP, mm Hg	130 (130; 130)	130 (120; 130)
Diastolic BP, mm Hg	80 (80; 80)	80 (80; 80)
25(OH) D, ng/ml	14,22 (10,04; 18,8)	14,32 (11,8; 20,31)
HbA1c, %	5,1 (5,1; 5,1)	6,7 (6,5; 8)*
BGL, mmol/l	5 (4,7; 5,2)	7,3 (6,2; 8,3)*
GFR, ml/min/1,73m²	62,2 (51,7; 72,6)	70 (53,9; 80,7)
Creatinine, µmol/l	81 (74; 93)	83 (70; 93)
Urea, µmol/l	5,4 (4,8; 6,7)	6 (4,5; 8,6)
Cholesterol, µmol/l	5,8 (4,7; 6,6)	5,8 (4,4; 6,5)
Triglyceride, µmol/l	1,96 (1,52/2,21)	2,09 (1,37; 2,37)

* – significant differences between groups 1 and 2 ($p<0,05$).

As follows from the data presented in Table 1, BMI was higher in group 1 if compared to group 2 (34,2 kg/m2 vs 30,1 (28,8; 31,2) kg/m², p=0,01). HbA1c, BGL was higher in group 2 if compared to group 1 ($p<0,05$). The analyzed groups of patients had not differences in age, BP, creatinine, CH, or TG ($p>0,05$).

The level of 25(OH)D in the blood plasma of patients in group 1 was 14.2 (10.0; 18.8) ng/ml with vitamin D insufficiency in 20% (n=3) and deficiency in 80% (n=12) of patients with obesity. While in group 2, the level of 25(OH)D was 14,3 (11,8; 20,3) ng/ml, with vitamin D insufficiency in 29,4% (n=5) and deficiency in 70,6% (n=12) of patients.

The level of 25(OH)D was not found to be within the normal range in the blood plasma of patients from either group. There were no significant differences observed in 25(OH)D levels among the participants, nor was there a notable difference in the ratio of vitamin D deficiency to insufficiency ($p>0.05$).

We found a negative relationship between 25(OH)D levels and HbA1c (R =-0,50, p=0,04) in group 2, as well as a positive relationship between HbA1c levels and TG (R=0,61, p=0,01), TC (R=0,53, p=0,03) and glucose levels (R=0,55, p=0.02). The data we obtained on the relationship between vitamin D levels and HbA1c are consistent with other studies. Thus, according to the results of studies by Alharazy S. et al., and Patel, D. et al., low 25(OH)D values were associated with an increase in such markers of diabetes as HbA1c,

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HOMA-IR, and a decrease in insulin sensitivity [1, 4], and vitamin D deficiency is more common in patients with uncontrolled diabetes [4].

Conclusion. The study revealed a significant prevalence of vitamin D insufficiency and deficiency (100%) among patients with obesity and DM type 2. The level of 25(OH)D had an inverse correlation with HbA1c in patients with type 2 DM. These results indicate that it is possible to enhance glycemic management and regulate the metabolic syndrome through the normalization and correction of vitamin D levels control in this category of patients.

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