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

Lakshanna Y.
Tutor: PhD, associate professor, Kezhun L.V.

Grodno State Medical University, Grodno

Resume. Patients with type 2 diabetes mellitus (DM) and obesity had their blood plasma levels of vitamin D – 25(OH)D evaluated in an outpatient environment. One hundred percent of the individuals with type 2 diabetes and obesity had a high prevalence of hypovitaminosis D (25(OH)D<30 ng/ml). The practical significance of addressing hypovitaminosis D to enhance the glycaemic profile in diabetes is determined by the inverse connection between the level of 25(OH)D and glycated haemoglobin (HbA1c) in type 2 diabetic patients.
Keywords: obesity, diabetes mellitus, vitamin d, hbalc.

Relevance. Due to its high incidence of death and disability from macro- and microvascular consequences, type 2 diabetes is a major medical and societal issue. Patients with type 2 diabetes are becoming more prevalent. One of the primary risk factors for type 2 diabetes is obesity.

In addition, a significant number of children and adults worldwide suffer from vitamin D shortage and insufficiency each year. One should not undervalue the consequences of vitamin D deficiency.

Numerous studies have found a link between vitamin D deficiency or insufficiency and a higher risk of developing metabolic illnesses like diabetes mellitus and obesity [1] as well as musculoskeletal conditions like osteoporosis and sarcopenia [2].

Studies have shown that type 2 diabetes and obesity are strongly correlated with vitamin D deficiency. A research found that 53,1% of individuals with type 2 diabetes had a vitamin D deficiency, which was made worse by obesity. Inadequate levels were seen in 46,9% of obese subjects. Vitamin D insufficiency is 35% more common in obese people than in populations of healthy weight, and obesity alone raises the risk of vitamin D deficiency [3, 10].

The deficit rate in very obese children is 49%, and it increases to 87% in African-American children [9]. Low vitamin D levels are associated with increased glucose levels and decreased insulin sensitivity, and this deficiency is connected to insulin resistance [4, 10]. Limited sun exposure, demographic factors (age, gender), and processes associated to obesity that sequester vitamin D are important determinants [5, 6, 9]. To reduce deficiency-related problems in these individuals, studies suggest regular screening, supplementation, and lifestyle changes (diet, exercise) [4, 5, 8].

Studies show that both type 1 and type 2 diabetes patients have a significant frequency of vitamin D insufficiency, which is directly linked to diabetes mellitus. Low vitamin D levels may worsen insulin resistance, innate immu-

ISBN 978-985-21-2103-3
УДК 378:61:37.091.212.5:001.83(042.3)(476)
ББК 5+74.58

nological dysfunction, and systemic inflammation, all of which are frequent in diabetes [5, 6].

Vitamin D may improve insulin sensitivity via modifying calcium metabolism and affecting the release of insulin by pancreatic beta cells, among other pathways that relate vitamin D, obesity, and diabetes. Research has found VDR in pancreatic tissues, indicating that vitamin D may have a direct impact on the synthesis of insulin [2, 7].

The third pathway is inflammation, where vitamin D's anti-inflammatory qualities can prevent macrophages from infiltrating adipose tissue – a typical aspect of obesity. Vitamin D may enhance insulin function by lowering systemic inflammation. Adipokines as well as Another component is metabolism. Adipocytes generate bioactive compounds called adipokines, such as adiponectin and leptin. Insulin sensitivity and energy metabolism may be impacted by vitamin D's effects on adipokine production. Vitamin D insufficiency has been linked to low levels of adiponectin (associated with obesity), indicating a critical regulatory role [7, 3, 10].

Therefore, studies show that vitamin D has pleiotropic effects, controls insulin secretion in the pancreatic ß-cells, and when it is deficient, the number of insulin receptors decreases, glucose transport protein and PPAR-receptor activity decreases, and insulin resistance, prediabetes, and DM develop [5, 10].

Because of the increased risk of vascular consequences, the current global epidemic of diabetes and obesity is a major health concern. The study on the prevalence of hypovitaminosis D was relevant because vitamin D insufficiency, a growing epidemic, influences the pathophysiology of diabetes and obesity through multiple mechanisms.

Aim: to determine the frequency of vitamin D deficiency and insufficiency in people with type 2 diabetes and obesity.

Matherials and methods. The study involved 32 patients, with 46,9% (n=15) of them being obese – group 1. The average age of this group was 65 (50; 77). Another 53,1% (n=17) of participants had DM type 2 – group 2. The average age in this group was 68 (63; 71). The data were analyzed by the 4D client program at the State Healthcare Institution "Grodno City Polyclinic No. 6". We analyzed: body mass index (BMI), blood pressure (BP), vitamin D level – 25(OH)D, glycated hemoglobin – HbA1c, creatinine, triglycerides (TG), and cholesterol (CH). The vitamin D status was assessed by the level of 25(OH)D in blood plasma, which corresponds to the optimal level of vitamin D as 25(OH)D > 30 ng/ml, while insufficiency is 29-20 ng/ml and deficiency is <20 ng/ml. We performed statistical analysis by using program "STATISTICA 10.0".

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

ISBN 978-985-21-2103-3
УДК 378:61:37.091.212.5:001.83(042.3)(476)
ББК 5+74.58

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 ($p<0,05$).

According to the results in Table 1, group 1 BMI was higher than group 2 (34, 2 kg/m² vs. 30,1 (28,8; 31,2) kg/m², p=0,01). When comparing group 2 to group 1, HbA1c and BGL were increased ($p<0,05$). Age, blood pressure, creatinine, and CH did not differ across the patient groups under analysis ($p>0,05$).

Patients in group 1 had blood plasma levels of 25(OH)D of 14,2 (10,0; 18,8) ng/ml, with vitamin D deficiency in 80% (n = 12) and insufficiency in 20% (n = 3). In contrast, group 2 – 25(OH)D level was 14,3 (11,8; ng/ml), with vitamin D deficiency in 70,6% (n = 12) and insufficiency in 29,4% (n = 5) of the patients.

Patients from both groups had blood plasma levels of 25(OH)D that were not within the normal range. The subjects 25(OH)D levels and the ratio of vitamin D deficiency to insufficiency did not differ significantly ($p>0,05$).

In group 2, we discovered a negative correlation between 25(OH)D levels and HbA1c (R =-0, 50, p = 0,04) and a positive correlation 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). Our findings of the correlation between vitamin D levels and HbA1c are in line with previous research. Thus, low 25(OH)D values were linked to an increase in diabetes markers like HbA1c, HOMA-IR, and a decrease in insulin sensitivity [1, 4], and vitamin D deficiency is more prevalent in patients with uncontrolled diabetes [4], according to research by Alharazy S. et al. and Patel, D. et al.

Conclusions. The study found that among patients with type 2 diabetes and obesity, vitamin D deficiency and insufficiency were significantly more common (100%). In individuals with type 2 diabetes, there was an inverse relationship between the level of 25(OH)D and HbA1c. These findings suggest that normalising and correcting vitamin D levels in this group of individuals can improve glycaemic control and regulate the metabolic syndrome.

ISBN 978-985-21-2103-3
УДК 378:61:37.091.212.5:001.83(042.3)(476)
ББК 5+74.58

Literature

1. Association between vitamin D and glycaemic parameters in a multi-ethnic cohort of postmenopausal women with type 2 diabetes in Saudi Arabia / Sh. Alharazy [et.al.] // BMC Endocr Disord. – 2021. – Vol. 21, № 1. –162 p.

2. Berridge, M.J. Vitamin D deficiency and diabetes / M.J. Berridge // Biochem J. – 2017. – Vol. 474, № 8. – P. 1321–1332.

3. Obesity and vitamin D deficiency: a systematic review and meta-analysis / M. Pereira-Santos [et.al.] //Obes Rev.2015. Vol. 16, № 4. – P. 341-9.

4. Patel, D. Prevalence and severity of vitamin D deficiency in type 2 diabetic patients/D. Patel, H. Pandya // International Journal of Advances in Medicine. 2020. Vol.7, № 8. – P. 1251-1255.

5. Prevalence of Vitamin D Deficiency in Type 2 Diabetes Mellitus Patients: A Cross-Sectional Study/G. S. Vijay [et al.] // Cureus. 2023. Vol. 15, № 5.38952.

6. Prevalence of vitamin D deficiency in a population of patients with prediabetes and type 2 diabetes mellitus/ B. L. Sánchez // Endocrine Abstracts.-2019.Vol. 63.174 p.

7. Relationship between Vitamin D Deficiency, Diabetes, and Obesity / A. Alloubani // Diabetes Metab Syndr.2019. Vol. 13, № 2. – P. 1457-1461.

8. Serum Vitamin D Levels in Persons with Type 2 Diabetes Mellitus in Lagos, Nigeria / A. C. Anyanwu [et al.] // Int J Diabetes Clin Res.-2020. Vol. 7.133p.

9. Turer, C. B. Prevalence of vitamin D deficiency among overweight and obese US children/Ch. B. Turer, H. Lin, G. Flores // Pediatrics.2013. Vol. 131, № 1. – 152-161.

10. Vitamin D deficiency is a risk factor for obesity and diabetes type 2 in women at late reproductive age /E. N. Grineva [et.al.] //Aging (Albany NY). – 2013. – Vol. 5, № 7. – P. 575-581.

ВСТРЕЧАЕМОСТЬ ДЕФИЦИТА/НЕДОСТАТОЧНОСТИ ВИТАМИНА D У ПАЦИЕНТОВ САХАРНЫМ ДИАБЕТОМ 2 ТИПА И ОЖИРЕНИЕМ

Лакшанна Й.

Научный руководитель: канд. мед. наук, доц. Кежун Л.В.

Гродненский государственный медицинский университет, г. Гродно

Резюме. У пациентов с сахарным диабетом (СД) 2-го типа и ожирением в амбулаторных условиях оценивали уровень витамина D – 25(OH)D в плазме крови. У 100% пациентов с СД 2 типа и ожирением отмечалась высокая встречаемость гиповитаминоза D (25(OH)D<30 нг/мл). Практическая значимость устранения гиповитаминоза D у пациентов СД 2 типа определяется обратной связью между уровнем 25(OH)D и уровнем гликированного гемоглобина (HbA1c) для улучшения гликемического профиля при СД.

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

ISBN 978-985-21-2103-3
УДК 378:61:37.091.212.5:001.83(042.3)(476)
ББК 5+74.58