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Article

The Connection Between a Diabetic Patient's Hba1c Level and Vitamin D3

Ola Adel Mhsen[1], Meriam Mohamed Hussain[2], Layla Jabir Kazem[3], Eman Ali Yawar[4], Estabraq Mukhlis Abed Alhusain[5]

1,2,3 University of Karbala, College of Applied Sciences, Department of Pathological Analysis
4 University of Diyala, College of Science, Department of Biotechnology
5 University of Karbalaa, College of Sciences, Department of Biology
* Correspondence: la9258785@gmail.com

Abstract: This research aimed to examine the correlation between vitamin D3 levels and HbA1c in individuals with type 2 diabetes compared to healthy subjects. Human blood and serum samples were collected from private laboratories, including samples from diabetic patients and healthy individuals. The study utilized various laboratory equipment and assays, such as plane centrifuge, micropipette, and Cobas e 411 for analysis. The findings indicated an increase in vitamin D3 levels in 32.5% of males and 70% of females in both study groups. There was a positive correlation between vitamin D3 and HbA1c levels in both control and type 2 diabetes groups. However, no significant correlation between vitamin D3 and HbA1c was observed in either group. The study concludes that there is no significant difference in vitamin D3 and HbA1c levels between diabetic patients and healthy individuals. Further research is needed to elucidate the impact of vitamin D on glucose regulation.

Keywords: Vitamin D3, HbA1c, Type 2 Diabetes, Blood Glucose Regulation, Serum Samples, Diabetes Mellitus.

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1. Introduction

Diabetes is a major global health concern. It is brought on by persistently elevated blood glucose levels as a result of the body's cells using insulin inefficiently or the pancreatic beta cells' (Ấ cells') insufficient ability to produce insulin [1]. Diabetes comes in two basic forms: type I diabetes (TID) and type 2 diabetes (T2D), according to Berbudi et al. (2020). A metabolic disease known as type 2 diabetes (T2D) is characterized by elevated blood glucose levels that are brought on by insufficient pancreatic insulin production. Adipocytes and macrophages in adipose tissue produce inflammatory mediators that trigger an inflammatory response in addition to the immune system's reaction to raised blood glucose (Berbudi et al., 2020).

Hyperglycemia is the outcome of insufficient insulin production caused by this low-level, chronic inflammation that destroys pancreatic beta cells. Diabetic individuals may find it challenging to stop the spread of invasive infections due to immune response failure caused by hyperglycemia. Therefore, it stands to reason that those with diabetes have a higher risk of infection. As T2D becomes more common, the incidence of infectious diseases and their related comorbidities will increase (Ronacher et al., 2015). The three

primary markers of prediabetes are impaired fasting glucose (IFG), increased glycated haemoglobin A1c (HbA1c) levels, or impaired glucose tolerance (IGT). elevated amounts of fasting plasma glucose compared to normal

do not match the diagnostic criteria for diabetes are the hallmark of individuals with IFG levels. According to Abdul-Ghani et al. (2006), Individuals with IFG levels show impaired early (first phase) insulin secretion and hepatic insulin resistance, while those with IGT levels show impaired late (second phase) insulin secretion and muscular insulin resistance. following a meal. Those with prediabetes range widely in their clinical characteristics and pathophysiological profiles, with HbA1c values between 5.7% and 6.4%. According to Gerstein et al. (2007), Between 3% and 11% of people with prediabetes go on to develop type 2 diabetes each year. Insulin is produced and secreted into the bloodstream by islet κ cells in response to rising blood glucose levels following meals.

Reduced blood glucose levels are the consequence of increased cell absorption and glucose transporter translocation to the cell membrane caused by the binding of insulin and insulin receptors in cell membranes. Hyperglycemia is caused by either poor insulin action, insufficient pancreatic synthesis of insulin, or both.This is linked to the aging of the dam and the eventual collapse of several organs and tissues (Vrieling et al., 2018). Sunlight contact with the skin provides more vitamin D, sometimes known as the sunshine vitamin, than diet alone. However, hypovitaminosis D, or vitamin D insufficiency, is becoming more common in diabetics and is detected in a growing number of persons as the disease advances. Numerous organs, including pancreatic beta cells, include vitamin D receptors, which are responsible for the growth, differentiation, and additional regulation of insulin secretion in these cells. Therefore, a shortage in it is known to result in hyperparathyroidism, which in turn causes glucose intolerance (Lips et al., 2017). Its duties include maintaining the skeletal system and guarding against cancer, autoimmune diseases, cardiovascular disease, and type II diabetic mellitus (T2DM). as well illnesses that spread quickly (Holick et al., 2011).

Study's objective:

1. a study on the notable variations between individuals with type 2 diabetes and those in good health the HbA1C, uric acid, and vitamin D3 levels.
2. Find the relationship between VD3 and HbA1c in the two research groups.

A large prospective research of women with a 20-year follow-up demonstrated an inverse relationship between vitamin D concentrations and the occurrence of diabetes. (Pittas et al., 2006). There is ongoing disagreement over the correlation between vitamin D insufficiency in T2DM and microvascular consequences such as retinopathy, neuropathy, and nephropathy (Wan et al., 2019).

Individuals in The vitamin D-deficient members in our sample showed higher levels of TG and HbAlc. There is a connection between 25-hydroxyvitamin D levels and hemoglobin ALC.For the best control of HbAlc levels, it's critical to keep 25-hydroxyvitamin D levels at bay. and dyslipidemia in individuals with type 2 diabetes (Verma et al., 2021). While vitamin D insufficiency is common in both non-diabetic and T2DM, subjects' link to Glycemic control or insulin resistance in people with type 2 diabetes

Was unconfirmable in our population. This could be a significant discovery. proving that improving vitamin D level is not the sole way to enhance public health component that contributes to an individual's improved health, but food and lifestyle A number of factors appear to be involved in improving overall health, such as vitamin D levels, insulin resistance, and hemoglobin glycation (Sheth et al., 2015). T2DM has grown to be a serious global health concern.

2. Materials and Methods

Samples of whole blood and serum were obtained from private labs, and a combination of patient and healthy individual samples were incorporated into the research. Data were gathered for this investigation from both clinical patients.

and healthy control groups using a set of equipment .

Equipments ::

Plane Centrifuge

Micropipette

refrigerator

Cobas e 411

ichroma devise HbAlc test

method for vitamin D3 Assay Methodology Determine how many separate ELISA plate wells the assay will require. After allowing the necessary number of strip packets to come to room temperature (at least 30 minutes), extract the necessary number of strip wells and firmly insert them into the frame that has been given. Each test run needs to contain controls at all times.

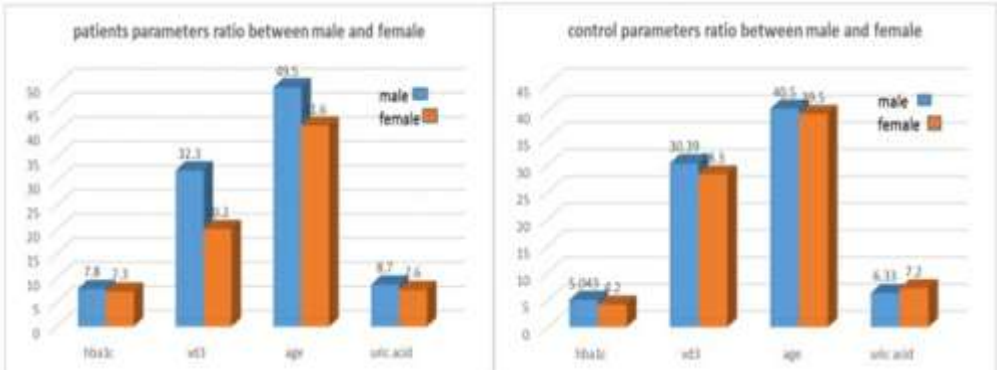
The prediluted Standards 16, Control 1, and Control 2 were transferred into the appropriate wells using pipettes. 2. Before the samples were pipetted into each test well (200 µl of prediluted samples), they were incubated at room temperature (+18 °C to +25 °C) for two hours. Following the two hours of incubation, samples ought to be aspirated or disposed away. Once again, aspirate or dispose of the samples after adding 300 µl of Wash Buffer. Two more iterations of this process, using one 300 µl Wash Buffer each, produced three washings. 4. Using a pipette, add 100 µl of the enzyme conjugate to each well. Incubate for 30 minutes at room temperature (+18 to +25 °C).5. After incubating for 30 minutes, aspirate or discard the reagent from the wells. After adding 300 µl of Wash Buffer, aspirate or discard again. Repeat the procedure twice more with each 300 µl Wash Buffer to create a total of three washings. Invert the wells and carefully tap them on a dry, clean surface to remove any last Droplet of Wash Buffer.6. Transfer 100 microliters of the chromogen/substrate solution into every well, and leave it undisturbed for 15 minutes at room temperature (avoid direct sunlight!). 7. Fill each well with 100 µl of Stop Solution to halt the substrate reaction and turn the blue color to yellow. It is recommended to obtain photometric measurements of the color intensity at 450 nm and a reference wavelength between 620 nm and 650 nm within 30 minutes of administering the stop solution. Before measuring, give the microplate a gentle shake to ensure that the fluid is dispersed uniformly.

HbA1c kits: These are specialized kits made by the Korean biotech-medical company Ichromax that are used to measure the HbA1c levels in various samples. Fundamental idea of the approach: The test uses a sandwich immune-detection method in which the detector antibody migrates onto nitrocellulose matrix after binding to the antigen in the sample and becoming immobilized on the test strip, thereby capturing the detector antibody in the buffer. The quantity of antigen in the sample raises the quantity of antigen-antibody complexes, which amplifies the detector antibody's fluorescence signal. A tool for ichromaTM tests shows the percentage of total hemoglobin in blood that is glycated.

Standard value: The IchromaTM test instrument measures the test sample's HbA1c concentration in percentage terms and automatically computes the test result. Standard deviation: 4.5–6.5% Examining Data Through Statistics: To deduce the significance, mean, and standard error (SE), as well as to represent the correlations using linear equations and correlation coefficients for each association, the statistical package for social science (SPSS) version 16.0 was utilized. These elements show how the two axes' extent and the linear relations' nature are expressed (George et al., 2003).

3. Results and Discussion

It should be with the interpretation of the results and their comparison with those of other studies. No need to repeat the results, review literature, references that do not have a close relationship with the present result in the manuscript.



The patient's demographic information for type 2 diabetes Control demographic data in Figure 2

The results supported the conclusion made by Kautzky-Willer et al. (2023) that a significant percentage of diabetes patients—70% of them male and 30% of them female—were in both research groups. Both sexes are more likely than women to have type 2 diabetes mellitus, Nonetheless, men are frequently diagnosed with the illness at a younger age and with lower body fat percentages. The underlying reasons of biological "sex differences" in type 2 diabetes clinical outcomes are genetic and hormonal influences on pathophysiology, clinical manifestation, diagnosis, and drug response (Nielsen, et al., 2021).

Figures 1 and 2's vitamin D3 levels showed 20.2% in female patients and 32.5% in male patients, in line with Kader et al.'s (2019) conclusion revealed women had noticeably lower vitamin D3 levels than men. Patients with diabetes also have these values. Low vitamin D levels have been associated with type 2 diabetes (T2D) in several investigations, with two primary mechanisms being identified: First, vitamin D stimulates pancreatic b cells to secrete insulin; as a result, insulin resistance is associated with vitamin D insufficiency. Secondly, low vitamin D levels increase inflammatory indicators and encourage

inflammation. It also has a connection to the onset of metabolic syndrome. Furthermore, vitamin D genetic variation may result in poor glycemic control (Abugoukh et al., 2022).

According to Wang et al. (2020), changed concentrations Low serum vitamin D levels are associated with type 2 diabetes (T2D), which is explained by the potential for reduced fasting glucose and high-density lipoprotein, low-density lipoprotein, and total cholesterol. On the other hand, the male had a high percentage of uric acid (7.2%) and the female had a high percentage of 7.6% when compared to the diabetic patient group. This implies that a statistically significant rise in blood uric acid levels was associated with the beginning of insulin in diabetic patients.

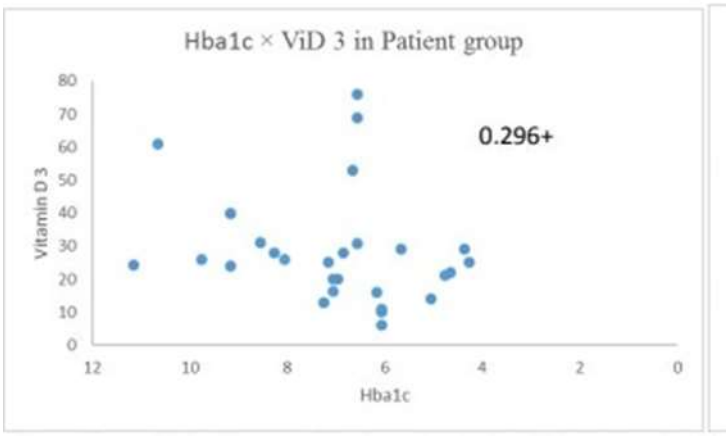


Figure 3: Hbalc and ViD3 association in patients with type 2 diabetes

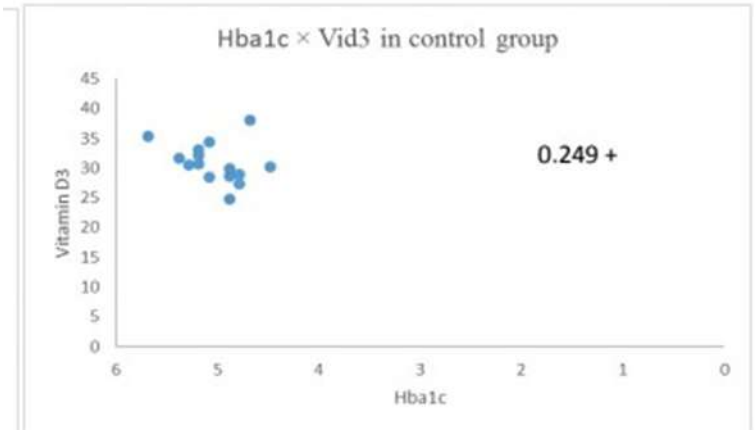


Figure 4 shows the patient's Hba1c and ViD3 association.

Research from both epidemiological and experimental settings has linked vitamin D insufficiency to reduced insulin release, insulin resistance, and type 2 diabetes (lips et al., 2017). Additional clinical research found that there is still much to learn about vitamin D's role in blood glucose regulation. The onset and treatment of diabetes mellitus appear to be influenced by vitamin D levels. The findings demonstrated a positive relationship between vitamin D3 and Hbalc levels in the control and type 2 diabetic patient groups (figures 3, 4). To better understand the impact of vitamin D on diabetes, we compiled data from several studies that showed a connection between vitamin D deficiency and the onset of type 1 and type 2 diabetes.

The hypothesis that sufficient vitamin D supplementation could improve the metabolic regulation of glucose levels in people with type 1 diabetes was supported by the majority of studies on the effect of vitamin D on glucose metabolism. Most trials, however, did not show that vitamin D treatment resulted in a statistically significant increase in hemoglobin AIC levels in those with type 2 diabetes. There has to be more research done to pinpoint the exact association between vitamin D and diabetes, as the prevalence of vitamin D insufficiency is on the rise and diabetes is becoming more common.

4. Conclusion

In summary 1. Patients with diabetes do not significantly differ in terms of hbale and vitamin D3. 2. Male patients have a higher percentage of diabetes than female patients do. Advice 1. Makes extensive use of this study with a lot of patients 2. Conduct fresh statistical analysis to identify variations in vitamin D3 and other indicators betwe

REFERENCES

[1] Abdul-Ghani, M. A., Tripathy, D. & DeFronzo, R. A. Contributions of B-cell dysfunction and insulin resistance to the pathogenesis of impaired glucose tolerance and impaired fasting glucose. Diabetes Care 29, 1130-1139 (2006).

[2] Abugoukh, T. M., Al Sharaby, A., Elshaikh, A. O., Joda, M., Madni, A., Ahmed, I., ... & Abdelrahman, N. (2022). Does Vitamin D Have a Role in Diabetes?. Cureus, 14(10),

[3] Angellotti E and Pittas AG. The role of vitamin D in the prevention of type 2 diabetes: to D or not to D? Endocrinology 2017;158: 2013-2021.

[4] Berbudi, A., Rahmadika, N., Tjahjadi, A. I., & Ruslami, R. (2020). Type 2 diabetes and its impact on the immune system. Current diabetes reviews, 16(5), 442-449.

[5] Bikle DD. Vitamin D metabolism, mechanism of action, and clinical applications. Chem Biol 2014: 21:319-329.

[6] Bouillon R. Marcocci C. Carmeliet G. Bikle D. White JH, Dawson-Hughes B, et al. Skeletal and Extraskeletal Actions of Vitamin D: Current Evidence and Outstanding Questions. Endocr Rev 2019:40(4):1109-51.

[7] Butler, A. E., Dargham, S. R., Latif, A., Mokhtar, H. R., Robay, A., Chidiac, O. M., ... & Atkin, S. L. (2020). Association of vitamin D3 and its metabolites in patients with and without type 2

[8] Čaušević, A., Semiz, S., Mačić-Džanković, A., Cico, B., Dujić, T., Malenica, M., & Bego, T. (2010). Relevance of uric acid in progression of type 2 diabetes mellitus. Bosnian journal of basic medical sciences, 10(1), 54.

[9] Chakhtoura M. Rahme M. Chamoun N, et al. Vitamin D in the Middle East and North Africa. Bone Rep 2018; 8: 135-146.

[10] Copur, S., Demiray, A., & Kanbay, M. (2022). Uric acid in metabolic syndrome: Does uric acid have a definitive role?. European journal of internal medicine, 103, 4-12.

[11] D and subsequent occurrence of type 2 diabetes. Epidemiology 2008;19:666-71.26. Ley, S. H., Hamdy, O., Mohan, V. & Hu, F. B. Prevention and management of type 2 diabetes:

[12] DeFronzo, R. A. & Abdul-Ghani, M. A. Preservation of B-cell function: the key to diabetes prevention. J. Clin. Endocrinol. Metab. 96, 2354-2366 (2011).

[13] DeFronzo, R. A., Ferrannini, E., Groop, L., Henry, R. R., Herman, W. H., Holst, J. J., ... & Weiss, R. (2015). Type 2 diabetes mellitus. Nature reviews Disease primers, 1(1), 1-22.

[14] diabetes and their relationship to diabetes complications. Therapeutic advances in chronic disease, 11, 2040622320924159.

[15] dietary components and nutritional strategies. Lancet 383, 1999-2007 (2014)

[16] Ferrannini, E., Gastaldelli, A. & Iozzo, P. Pathophysiology of prediabetes. Med. Clin. North Am. 95, 327-339 (2011).

[17] Ford ES, Ajani UA, McGuire LC, Liu S. Concentrations of serum vitamin D and the metabolic syndrome among US adults. Diabetes Care 2005:28:1228-30. 29.

[18] Forman JP, Curhan GC, Taylor EN. Plasma 25-hydroxyvitamin D levels and risk of incident hypertension among young women. Hypertension 2008:52:828-32.

[19] Gardner, D. S. & Tai, E. S. Clinical features and treatment of maturity onset diabetes of the young (MODY). Diabetes. Metab. Syndr. Obes. 5, 101-108 (2012).

[20] Garg R. Agarwal V. Agarwal P. Singh S, Malhotra N. Prevalence of vitamin D deficiency in Indian women. Int J Reprod Contracep Obst Gynecol 2018; 7(6): 2222.

[21] Garvey, W. T. et al. Prevention of type 2 diabetes in subjects with prediabetes and metabolic syndrome treated with phentermine and topiramate extended release. Diabetes Care 37, 912-921 (2014).

[22] Gerstein, H. C. et al. Annual incidence and relative risk of diabetes in people with various categories of dysglycemia: a systematic overview and meta-analysis of prospective studies. Diabetes Res. Clin. Pract. 78, 305-312 (2007).

[23] Giovannucci E. Vitamin D and cancer incidence in the Harvard cohorts. Ann Epidemiol 2009:19:84-8. 24.

[24] Hawa, M. I. et al. Adult-onset autoimmune diabetes in Europe is prevalent with a broad clinical phenotype: action LADA 7. Diabetes Care 36, 908-913 (2013).

[25] Hidayat R, Setiati S. Pradana S. The association between vitamin D deficiency and type 2 diabetes mellitus in elderry patients. Acta Med Indones 2010:42:123-9.
[26] Holick MF. Vitamin D: evolutionary, physiological and health perspectives. Curr Drug Targets 2011:12(1):4-18.
[27] Kader, S., Comaklı, H., & Tekindal, M. A. (2020). Evaluation of serum vitamin D levels according
[28] Kautzky-Willer, A., Leutner, M., & Harreiter, J. (2023), Sex differences in type 2 diabetes. Diabetologia, 66(6), 986-1002. Knekt P. Laaksonen M. Mattila C, Harkanen T. Marniemi J, Heliovaara M, et al. Serum vitamin
[29] to gender and age at Karapınar City: a follow-up study from Turkey. Dubai Medical Journal, 2(4), 141-145.