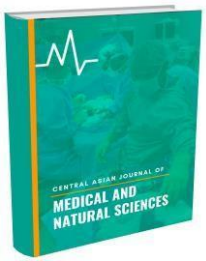

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Article

Correlation Between Vitamin D Deficiency and Hyperglycemia

Atyaf Adnan Nayaf*, Tabark Ali Hasan, Wurood Alaa Hasan

Ibn Sina University of Medical and Pharmaceutical Sciences, Baghdad, Iraq
* Correspondence: atyaf.adnan@ibnsia.edu.iq

Abstract: Diabetes is a chronic condition affecting the body's use of food as fuel and poses significant health risks during pregnancy for both women and their unborn children. Abnormalities in vitamin D synthesis and metabolism are associated with calcium metabolic diseases. This study aimed to investigate the relationship between vitamin D3 levels and diabetes. Blood samples from 60 participants, including 50 with hyperglycemia and 10 controls, were analyzed for HbA1c, fasting blood sugar, and vitamin D3 levels. Results indicated that diabetic participants had significantly lower vitamin D3 levels compared to the control group. The findings suggest that low vitamin D3 levels may contribute to higher blood sugar levels in diabetic patients, highlighting the importance of monitoring and managing vitamin D3 levels in this population.

Keywords: Diabetes, Vitamin D3, Hyperglycemia, HbA1c, Serum Preparation

1. Introduction

Diabetes is considered a chronic impairment that arises from the body's inability to adequately utilize the insulin produced by the pancreas or from insufficient production of it. Insulin is one hormone , that regulates blood sugar. Three main types of diabetes is present nowadays: type 1, type 2, and gestational. Although type 1 diabetes may happen to anyone at any age, it typically strikes children or young adults. To hold their blood sugar concentrations under control, people suffer from type 1 diabetes may require daily insulin injections. Approximately 90% of all occurrences of diabetes are type 2, which is the most common kind of the impairment. Insulin resistance, in other words a condition in which the body does not react to insulin as intended, is typically used to describe it. Because insulin isn't working properly, blood glucose levels keep rising and more insulin is released [1].

Among the four fat vitamins characterized by being soluble (together with vitamin A, E, and K) is vitamin D. It can be retained in your body for extended periods of time since it dissolves and stores in your fatty tissues rather than in water [2]. Many bodily systems require vitamin D3 to function normally. Numerous symptoms and illnesses, including fibromyalgia, persistent fatigue syndrome, osteoporosis, and renal disease, have been linked to vitamin D3 insufficiency. Cancer, asthma, and cardiovascular disease [3]. Research shows that more than a billion people worldwide are deficient in vitamin D. Among the symptoms include hair loss, exhaustion, inflammation, weak bones, and muscle and joint pain. Numerous medical disorders, including eczema, depression, high blood pressure, and arthritis, can be brought on by a deficiency. Thus, vitamin D levels can be checked with a easy blood test [4].

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Across the world, low vitamin D levels are a common problem for both people with and without diabetes. As demonstrated by a 2011 Canadian study, there is a consistent body of evidence linking low vitamin D levels in insulin-resistant patients to an increased risk of type 2 diabetes. In 2017, Wu C, Qiu S, Zhu X, and others According to Jennifer Smith, CDE, RD, "this most recent research seems to demonstrate that supplementing before or shortly after diagnosis preserves the body's capacity to react more effectively to insulin at the cellular level, countering the hallmark of type 2 diabetes — insulin resistance" [5].

Diabetes is persistent medical condition that happens when the body either cannot use the insulin that the pancreas either produces insufficient doses of insulin or the body is unable to utilize it effectively. Uncontrolled diabetes often results in what is known as hyperglycemia, or elevated blood sugar, which over time leads to major harm to various bodily systems, most notably the blood vessels and neurons [6].

Type 1, type 2, and gestational diabetes , are the three main forms of the disease. Diabetes type 1 Type 1 diabetes affects about 10% of all diabetics. This kind of diabetes is brought on by an autoimmune response, in which the body's defense mechanisms target the cells responsible for producing insulin. The body thus makes either inadequate or no insulin at all. Although the precise causes are unknown, a combination of environmental and genetic factors are thought to be involved [7].

Type 1 diabetes is characterized by a number of symptoms, the most prevalent of which are excessive thirst and dry mouth, abrupt reduction in body weight, frequent urination, low energy, fatigue, persistent hunger, blurred vision, and bed wetting.

About ninety percent of instances of the diabetes are type 2, which is the most common kind of the (disease). Insulin resistance, in which the body does not fully respond to insulin, is the general characteristic of it. Blood glucose levels continue to rise, which causes insulin to become less effective and release more insulin. This can eventually wear out the pancreas in some type 2 diabetics, which causes the body to produce less insulin and even higher blood sugar concentrations (hyperglycemia) [8].

The symptoms of type two of the diabetes impairment resamples to those of type one diabetes, moreover to: wounds that take a long time to heal, skin infections that come back, and tingling or numbness in the hands and feet.

Diagnosis :

1. Random Sugar Test (RBS) To find out how much glucose is in your blood, a random blood sugar test is performed.
2. Fasting Blood Sugar Levels (FBS) entails depriving oneself of food and liquids for eight hours, except for water.
3. A blood test known as hemoglobin A1C (HbA1C) test determines the average glucose (blood sugar level) for the previous 2 to 3 months.

Vitamin D3. One of the four fat-soluble type of vitamins (together with other vitamin like A, E, and K) is vitamin D. It is dissolved and stored in your adipose tissue as opposed to water, which has the advantage of allowing it to stay in your body for extended periods of time. But where vitamin D varies from other nutrients is that it's actually a hormone made from cholesterol that your body produces when it is exposed to UV radiation from the sun [9].

Vitamin D Deficiency Related with Diabetes. Type 2- Diabetes: Investigations has shown that there is link in between of low vitamin D levels and the introduction of this form of diabetes. Numerous studies show that vitamin D may influence insulin secretion and sensitivity, which in turn may enhance glucose tolerance [10].

2. Materials and Methods

Table 1. Lists the chemicals utilized in this investigation along with the company's name and place of origin.

Chemical	Company / Origin
Vitamin D3	BDH/England
HbA1c	Bio system /Turkey

Forty patients between the ages of 25 and 75 participated in a two-month research study, and blood samples were collected and analyzed in a lab [11].

Blood samples are collected randomly, and HbA1c. Samples have been separated by centrifugation at 2000 g for time of 15 min at 4 °C, and stored at -20 °C within a time of 1 h of collection. (NPB-3900; Nellcor Puritan Bennett, Pleasanton, CA) at rest [12].

Serum Preparation. After two hours from the venipuncture, separate serum from red blood cells. As soon as the specimen is collected, mix it with the additive. After that, wait for the specimens to coagulate in a clot tube (such as a gel-barrier or red-top tube) before centrifuging them. Hemolysis, in which red blood cells break down and components leak into serum, should also be avoided. Subsequently, promptly label and transfer the specimens. Lastly, use a centrifuge to extract the serum and separate the blood's constituent parts. Following that, the serum will freeze for later use [13].

Statistical analysis. Using the Statistical Analysis System (SAS) (2018) software, the impact of the differences in the study parameters between patient and control groups was determined. The t-test was employed to compare means statistically. A significant comparison between percentages (0.05 and 0.01 probability) was made using the Chi-square test [14].

3. Results and Discussion

A vital function of vitamin D is to control how the body uses calcium. In fact, calcium has a minor yet significant impact on insulin secretion. The body's capacity to create insulin will unavoidably be compromised if inadequate vitamin D inhibits the body's capacity to regulate calcium levels [15].

There are multiple ways that vitamin D can increase the manufacturing of insulin by entering beta cells and interacting with different types of receptors that bind together to stimulate the insulin gene. This is one way that vitamin D can favorably function.

The Vitamin D stimulate the receptors that influence insulin sensitivity through the same, receptors linked to its effect on the production of insulin. The contact along with binding with these receptors really results in an increase in the overall number of insulin receptors located in the body through a complex physiological process.

Table 2. Distribution of the sample study according to Gender and Age in patients and control alike

Factor		Patients (No=44)	Control (No= 10)	P-value
Gender	Male	17 (38.64%)	5 (50.00%)	0.2553 NS
	Female	27 (61.36%)	5 (50.00%)	
Age (year)	<50 yr.	17 (38.64%)	6 (60.00%)	0.0912 N
	≥ 50 yr.	27 (61.36%)	4 (40.00%)	
	Mean ±SE	53.14 ±2.16	49.20 ±3.66	0.422 NS
NS: Non-Significant.				

Table 3. Comparison between control groups and patients in FBS, HbA1c and Vit. D3

Group	Mean ± SE		
	FBS (mg/dl)	HbA1c (%)	Vit. D3 (ng/ml)
Patients	242.25 ±9.74	8.29 ±0.17	13.18 ±1.51
Control	93.10 ±3.14	5.17 ±0.13	34.90 ±0.79
T-test	41.437 **	0.772 **	6.467 **
P-value	0.0001	0.0001	0.0001
** (P≤0.01).			

Table 4. The impact of Gender on FBS, HbA1c and Vit. D3 of patients group

Gender	Mean ± SE		
	F.B.S. (mg/dl)	HbA1c (%)	Vit. D3 (ng/ml)
Male	240.47 ±16.02	8.32 ±0.27	10.21 ±1.31
Female	243.37 ±12.51	8.28 ±0.24	15.06 ±1.27
T-test	38.02 NS	0.479 NS	4.267 *
P-value	0.751	0.895	0.0485
* (P≤0.05), NS: Non-Significant.			

Table 5. The impact of Age on FBS, HbA1c and Vit. D3 of patients group

Age group	Mean ± SE		
	F.B.S. (mg/dl)	HbA1c (%)	Vit. D3 ()
<50 yr.	230.06 ±10.67	8.32 ±0.30	11.40 ±1.34
≥ 50 yr.	249.92 ±14.35	8.28 ±0.23	14.31 ±2.31
T-test	35.912 NS	0.407 NS	3.166 NS
P-value	0.371	0.902	0.175
NS: Non-Significant.			

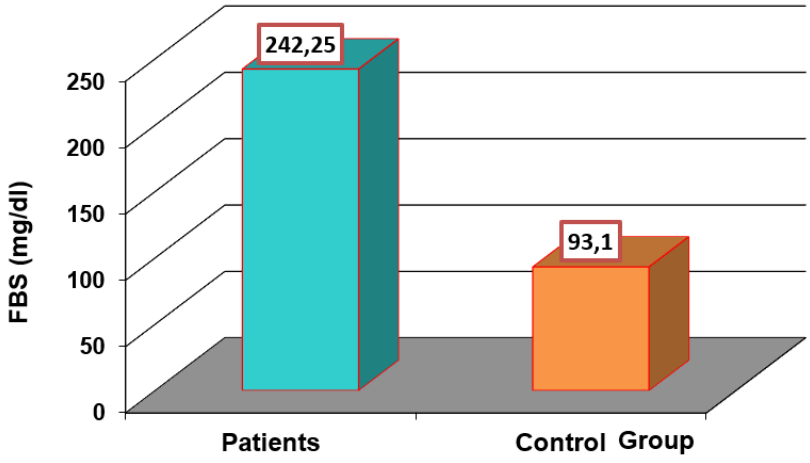

Figure 1. A Comparison between patients and control groups in FBS

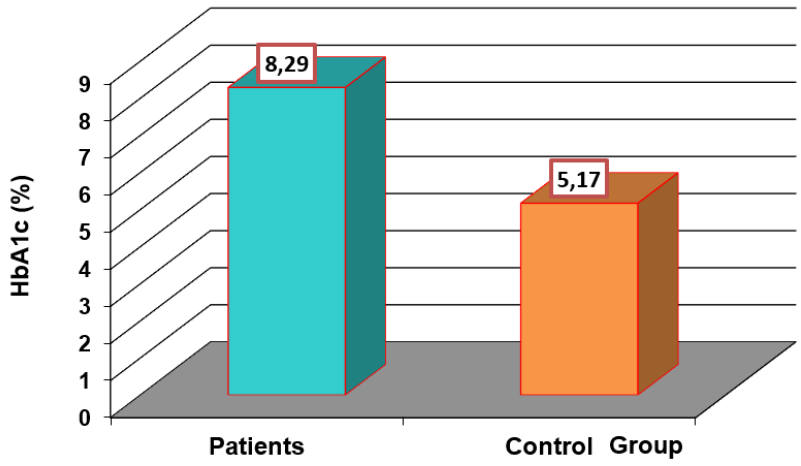

Figure 2. A Comparison between patients and control groups in HbA1c

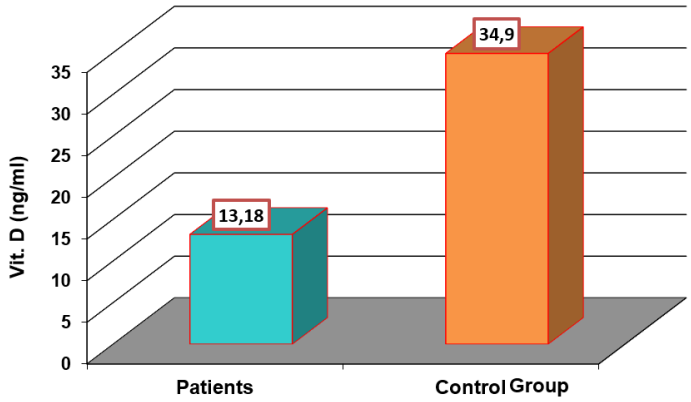

Figure 3. A Comparison between patients and control groups in Vit. D

Subsequent investigation revealed that patients with diabetes have lower amounts of vitamin D3 than people without the disease (Figs. 1.2 and 3). The reality that low levels of D3 might cause patients' blood sugar to rise should help to explain this result.

4. Conclusion

Diabetes treatment and development seem to be influenced by one's standing. It's probable that those with diabetes, those at risk of developing diabetes, and those without diabetes will require different serum vitamin D concentrations. A large number of diabetics have inadequate vitamin D levels. Given that vitamin D is known to aid in the regulation of insulin levels, this is an important discovery. Recent research has examined the potential benefits of vitamin D supplementation in the treatment of type two diabetes impairment.

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