

## Vitamin D status and glycemic control in type 2 diabetes mellitus patients

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### Abstract

**Background:** Vitamin D is a fat-soluble vitamin known as the sunshine vitamin; vitamin D is produced by the body in response to skin being exposed to sunlight. It also occurs naturally in a few foods -- including some fish, fish liver oils, and egg yolks. Hypo vitamin D has recently been considered a responsible factor in the onset and progression of diabetes mellitus (DM) and chronic kidney disease (CKD). Vitamin D is involved in different mechanisms related to the development of type 2 diabetes, including beta cell activity and insulin sensitivity. Vitamin D levels are lower in people with obesity and type 2 diabetes, but it is unknown if there is a causal relationship between these events.

**Objective:** To evaluate the vitamin D status and its effect on glycemic control in patients with type 2 diabetes mellitus.

**Patients and Methods:** A cross-sectional study done on 150 type 2 diabetic patients from the outpatient department of the Al-Amiriyah general hospital in Al-Anbar, western Iraq from April to September 2019 were selected as the case group and 150 healthy subjects matched regarding sex and age (as the control group) were evaluated.

**Results:** The patients in the case group were 65 males (43.3%) and 85 females (56.7%), more than half of them were in the age group (41-50) and (51-60) years. The mean age was (50.7) years. While the people in the control group were 67 males (44.7%) and 83 females (55.3%), also more than half of them were in the age group (41-50) and (51-60) year, and the mean age was (53.6) years. Low vitamin D level was observed in 82% of the diabetic patients, while it was observed in 58.7% of healthy individuals. The low vitamin D status was strongly associated with poor glycemic control ( $P < 0.05$ ).

**Conclusion:** Vitamin D deficiency among the patients of diabetes mellitus type 2 was extremely high and was closely related with glycemic control in our sample of diabetic patients. Association of low vitamin D status with poor glycemic control suggests a role of vitamin D in the control of type 2 diabetes mellitus and the importance of early detection of its deficiency and vitamin D supplementation.

**Keywords:** type 2 diabetes mellitus, vitamin D, Al- Amiriyah

### Introduction

Vitamin D is a fat-soluble vitamin naturally present in a few foods such as the liver of some fatty fish and their oils and, to a lesser extent, in butter and egg yolk. Only 10% of the body's vitamin D comes from food, with our skin being the main source of synthesis (with the help of the ultraviolet light interaction)<sup>[1,2]</sup>. Vitamin D plays a number of important roles in the body, including maintaining the health of your bones, teeth and joints, and assisting immune system function. When the sun's ultraviolet-B (UVB) rays are exposed to bare skin, the body converts a cholesterol derivative into Vitamin D<sup>[3,4]</sup>. Once ingested or synthesized in the skin, vitamin D needs to be metabolized mainly by the liver and kidney to obtain its active form. Although the amount of vitamin D adults get from their diets is often less than what's recommended, exposure to sunlight can make up for the difference. If you shun the sun, suffer from milk allergies, or adhere to a strict vegan diet, you may be at risk for vitamin D deficiency<sup>[5]</sup>. Traditionally, vitamin D deficiency has been associated with rickets, a disease in which the bone tissue doesn't properly mineralize, leading to soft bones and skeletal deformities. But increasingly, research is revealing the importance of vitamin D in protecting against a host of health problems. Vitamin D deficiency was defined as serum 25-hydroxy vitamin D [s-25(OH)D] of less than 20ng/ml, insufficiency as 25-hydroxy vitamin D [s-25(OH)D] of 20ng/ml - 30 ng/ml and sufficiency was defined as 25-hydroxy vitamin D [s-25(OH)D] higher than 30 ng/ml<sup>[6]</sup>. The signs of Vitamin D

deficiency can range from bone pain and muscle weakness to depression and weakened immune system, while longer-term deficiency can result in obesity, high blood pressure, psoriasis, osteoporosis, chronic fatigue, Alzheimer's disease, cancer and type 2 diabetes<sup>[3]</sup>. Although the presence of hypo vitamin D increases the risk of rickets and fractures, low vitamin D levels are also associated with hypertension, cancer, and cardiovascular disease. In addition, diabetes mellitus (DM) and chronic kidney disease (CKD) are also related to vitamin D levels<sup>[6]</sup>. Vitamin D plays an essential role in diabetes mellitus (DM) and chronic kidney disease (CKD).

The relationship between vitamin D and insulin secretion, insulin resistance, and  $\beta$ -cell dysfunction are pointed out. Furthermore, supplementation of vitamin D in patients with diabetes mellitus (DM) and chronic kidney disease (CKD) has been reported in several trials and a meta-analysis<sup>[7]</sup>. HbA1c is the most important laboratory parameter indicating glycemic control<sup>[8]</sup>.

The general target of HbA1c is  $\leq 7\%$  for glycemic control; HbA1c values over 7% indicate poor glycemic control<sup>[9]</sup>. In recent years, studies have shown that using vitamin D can help decrease the incidence of diabetes and adjustment of insulin and glucose<sup>[7]</sup>.

### Objective

To evaluate the vitamin D status and its effect on glycemic control in patients with type 2 diabetes mellitus.

**Patients and Methods**

A cross sectional study done on 150 type 2 diabetic patients from outpatient department of the Al-Amiriyah general hospital in Al-Anbar, western Iraq from April to September 2019 were selected as case group and 150 healthy subjects matched regarding sex and age (as control group) were evaluated. Informative and detailed history with general, systemic examination and expanded laboratory investigations were done. We exclude the patients with any disorder except diabetes such as chronic kidney disease, osteomalacia, osteoporosis, inflammatory rheumatism and patients using drugs which interfere with vitamin D metabolisms such as; carbamazepine, phenobarbital, sodium valproate, gabapentin, isoniazid, mineral oil, calcitonin and corticosteroids. Informative and detailed history was carried out focusing on the risk factors of vitamin D deficiency, good general and systemic examination, and important investigations including general urine examination, blood sugar, HbA1c, renal function tests, and liver function tests. Vitamin D level was measured with mini vidas device. Statistical differences between data sets were assessed by using chi-square test. When  $p < 0.05$ , data were considered to be significant.

**Results**

Two groups were included in our study, a case group and control group. Each group consists of 150 patients. The patients in the case group with type 2 diabetes mellitus were 65 males (43.3%) and 85 females (56.7%), more than half of them were fall in the age group (41-50) and (51-60) years. The mean age was 50.7 years as in (table 1).

**Table 1:** Case group (Distribution of patients according to age group and gender)

Age groups	Gender				Total	
	Males		Females		No.	%
	No.	%	No.	%		
31-40	7	50	7	50	14	9.3
41-50	23	41.8	32	58.2	55	36.7
51-60	14	35.9	25	64.1	39	26
61-70	12	54.5	10	45.5	22	14.7
71-80	9	45	11	55	20	13.3
Total	65	43.3	85	56.7	150	100

Table 2 show that peoples within control group were 67 males (44.7%) and 83 females (55.3%), also more than half of them were fall in the age group (41-50) and (51-60) year, and the mean age was 53.6years.

**Table 2:** control group (Distribution of people according to age group and gender)

Age group	Gender				Total	
	Males		Females		No.	%
	No.	%	No.	%		
31-40	6	37.5	10	62.5	16	10.7
41-50	24	45.3	29	54.7	53	35.3
51-60	21	44.7	26	55.3	47	31.4
61-70	15	51.7	14	48.3	29	19.3
71-80	1	20	4	80	5	3.3
Total	67	44.7	83	55.3	150	100

In diabetic patient vitamin D level was low in 123 patients (82%), the peak number of them in the age group (41-50) year as in (table 3).

**Table 3:** Distribution of vitamin D status among case group according to age groups.

Age groups	Vit. D status				Total	
	Low		Normal		No.	%
	No.	%	No.	%		
31-40	11	78.6	3	21.4	14	9.3
41-50	46	83.6	9	16.4	55	36.7
51-60	31	79.5	8	20.5	39	26
61-70	18	81.8	4	18.2	22	14.7
71-80	17	85	3	15	20	13.3
Total	123	82	27	18	150	100

Table 4 show that in the healthy group, low vitamin d concentration was seen in 88person (58.7%), also the peak number of them in same age group (41-50) year.

**Table 4:** Distribution of vitamin D status among control group according to age groups.

Age group	Vit. D status				Total	
	Low		Normal		No.	%
	No.	%	No.	%		
31-40	7	43.8	9	56.2	16	10.7
41-50	34	64.2	19	35.8	53	35.3
51-60	28	59.6	19	40.4	47	31.4
61-70	16	55.1	13	44.9	29	19.3
71-80	3	60	2	40	5	3.3
Total	88	58.7	62	41.3	150	100

High serum level of glycated hemoglobin was found in 116 diabetic patients, 97 patients of them having low serum vit. D level and only 19 patients with normal serum vit. D level as in (table 5)

**Table 5:** Distribution of HbA1c level in patient group according to vitamin D status.

Vit. D status	HbA1c level				Total	
	High		Low		No.	%
	No.	%	No.	%		
Low	97	78.9	26	21.1	123	82
Normal	19	70.3	8	29.7	27	18
Total	116	77.3	34	22.7	150	100

(P\_ value= 0.02)

**Discussion**

There are several studies which have assessed and discussed the rate of incidence of vitamin D deficiency among the masses. This study is the first study done about the vitamin D status and its effect on glycemic control in patients with type 2 diabetes mellitus in al\_ amiriyah general hospital. Two groups were included in this study, a case group which consists of 150 patients with type 2 diabetes and control group which consist of 150 healthy people. The patients in the case group were 65 males (43.3%) and 85 females (56.7%), more than half of them were fall in the age group (41-50) and (51-60) years. The mean age was (50.7) years. While the peoples within control group were 67 males (44.7%) and 83 females (55.3%), also more than half of them were fall in the age group (41-50) and (51-60) year and the mean age was (53.6) years. The results of this study showed that there was a statistical difference between vitamin D concentration in diabetic patients (82%) and the healthy subjects (58.6%). This result is in agreement with other study in Saudi Arabia result was (80%)<sup>[10]</sup> and in Iran was (89.2%)<sup>[11]</sup>. This because the same sunshine exposure, similarity in

types of foods and lifestyle. The lower level of vitamin D can occur among diabetic patients due to the presence of a pre-existing vitamin D insufficiency status, which played a role of contributing factor in the development of DM. The different incidence rates of vitamin D deficiency in DM patients can be caused due to various reasons. The reasons can be alterreddietary habits or lack of exposure to sunlight. In the healthy group, low vitamin d concentration was seen in 88person (58.7%), also the peak number of them in same age group (41-50) year (table 4). Significant negative correlation between HbA1c and 25-hydroxyvitamin D levels in patients with T2DM.High serum level of glycated hemoglobin were found in 116 diabetic patients, 97 patients of them having low serum vitamin D level and only 19 patients with normal serum vitamin D level (table 5). The incidence of poor glycemic control in patients with T2DM was (77.3%), while it was (67.6%) in Saudi Arabia <sup>[10]</sup>. This high result was due to the poor education about the importance of maintaining a good state of vitamin D level in diabetic patients by dietary and vitamin D supplement, in addition to diet restriction and drugs for diabetes. Furthermore, the connection between HbA1c and vitamin D can also occur because of influencing vitamin D outcomes on insulin from beta cells, systemic inflammation, and actions of insulin <sup>[5]</sup>. It has been further described by the research studies that the poor nutritional and ineffective status of the patients will directly affect the glucose level of the blood. Thus, it is said that the diabetes mellitus and Vitamin Dis connected with each other.

### Conclusion

Vitamin D deficiency among the patients of diabetes mellitus type 2 was extremely high and was closely related with glycemic control in our sample of diabetic patients. Association of low vitamin D status with poor glycemic control suggests a role of vitamin D in the control of type 2 diabetes mellitus and the importance of early detection of its deficiency and vitamin D supplementation.

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