

Relationship Between Vitamin D and HbA1c Levels in Patients with Type 2 Diabetes Mellitus of Bengaluru City

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Abstract

Background: Studies show that vitamin D affects insulin sensitivity and insulin secretion, and vitamin D deficiency may also contribute to impaired glucose tolerance. ^{1, 2}

Objectives: The purpose of this study was to examine the association between serum 25 (OH)D and glycosylated haemoglobin (HbA1c) levels in patients with type 2 diabetes mellitus of Bengaluru city.

Materials and Method: A total of 50 type 2 diabetics were included in the study with a mean age of 55.78 (SD:13.77) years of both gender previously diagnosed regardless of their sociodemographic characteristics and were invited for the assessment of vitamin D and HbA1c levels in Infilife healthcare private limited of Bengaluru city.

Results: Mean (SD) HbA1c and vitamin D levels were 7.17% (2.451) & 19.43 (16.094) ng/ml respectively. There was no statistically significant correlation between HbA1c and vitamin D levels with a correlation coefficient (r) of -0.109 [p = 0.05].

Conclusion: In the present study, there was no correlation between vitamin D levels and glycaemic control in patients with type 2 diabetes mellitus of Bengaluru city. Since there are conflicting results in the literature, further investigations may be more beneficial to highlight the relationship between glycaemic control and vitamin D.

Keywords: HbA1c, vitamin D, diabetes mellitus.

Introduction

One of the most common causes of vitamin D deficiency is reduced exposure to sunlight which ignites the synthesis of vitamin D through skin. ¹ Apart from its most commonly understood roles with muscles and bones, vitamin D has numerous other functions. ^{4, 5}

Vitamin D has recently gained substantial importance in the field of medicine and endocrinology because of the latest research on new receptors at tissue

level on which it particularly acts and exerts its multiple metabolic effects besides on bones and muscles. ⁶ Pertaining to diabetes mellitus (DM), vitamin D has a significant role in maintaining glucose homeostasis. Decreasing vitamin D levels in serum have proven to increase insulin resistance (IR) and development of type 2 diabetes mellitus (T2DM). ⁷ Studies have proved that vitamin D affects insulin secretion and tyrosine phosphorylation of the insulin receptor. ⁸ Observational studies all over the world have inferred an association between hypovitaminosis D and IR. Also, studies have observed inverse relationship between glycated haemoglobin (HbA1c) levels and vitamin D status in diabetics. ⁹ A meta-analysis proved that vitamin D supplementation was associated with reduction in fasting blood sugar and HbA1c levels among type 2 diabetics having vitamin D deficiency. ¹⁰ One more trial also exhibited that with vitamin D supplementation, mean

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HbA1c was controlled to 6.76±0.18% as compared to metformin-only to 7.73±0.23% (p=0.002) after 12 weeks.¹¹ But one trial has reported that there was no difference whether vitamin D supplementation was given or not (p=0.52). Multiple studies have conflicting results and conclusions.

Therefore the present study was attempted to investigate whether there is any relationship between glycaemic control and vitamin D levels in patients with type 2 DM of Bengaluru city.

Materials and Method

In the current, cross-sectional investigation, a total of 50 patients with mean age of 55.78 (SD:13.77)years of both gender and previously diagnosed with type 2 diabetes recorded in their medical records and confirmed by the study author in Infilife healthcare private limited, Bengaluru, were invited for the study purposes between December 2017 and April 2018.

The patients met eligibility criteria if they were male or female, on insulin, oral anti-diabetic agents, or its combination regardless of their sociodemographic aspects. The patients with pregnancy, Type 1 diabetes mellitus, gestational diabetes or breastfeeding mothers and those with acute conditions such as acute myocardial infarction, acute diabetic ketoacidosis, acute pulmonary embolism, acute pulmonary oedema, and acute chest infection were not included in the study. In addition, patients with clinical proximal myopathy; intake of vitamin D, calcium or omega-3 supplements within the past 3 months; use of medications that could potentially influence vitamin D metabolism, notably oestrogens and calcitonin, within the past 3 months; any other concomitant clinical disease that could influence vitamin D metabolism; renal, hepatic, other endocrinological disorders like parathyroid disease; malignancies diagnosed on the basis of history were excluded from the study.

Fasting venous blood was drawn from all the 50 participants attending the out-patient department of Infilife Healthcare Private Limited, Bengaluru.

Serum 25-hydroxyvitamin D (s-25 (OH)D) was measured using high-pressure liquid chromatography tandem mass spectrometry, with Waters Acquity UPLC and Waters triple quadrupole mass spectrometer instruments.

HbA1c was analyzed on a cation exchange column chromatograph using an automated high-pressure liquid chromatography instrument

Results

A total of 50 diabetics were included in the study with a mean (SD) age of 55.78 (13.77) years.

Table 1: Descriptive statistics about the age group of the participants

Age (Years)	Male	Female	Total (%)
25-45	10 (34.48%)	3 (14.29%)	13 (26%)
46-65	10 (34.48%)	9 (42.86%)	19 (38%)
>65	09 (31.03%)	9 (42.86%)	18 (36%)
Total	29 (100%)	21 (100%)	50 (100%)

Among 50, 29 (58%) were males with a mean (SD) age of 53.20 (14.29) years and the rest 21 (42%) were females with a mean (SD) age of 59.33 (12.48) years

Table 2: Mean values and standard deviation of the HbA1c and vitamin D levels of the 50 type 2 diabetics

Variable	Mean	Std. Deviation
HbA1C (%)	7.17	2.451
VITAMIN D (ng/ml)	19.43	16.094

Table 3: Correlation statistics between HbA1c and vitamin D levels of the 50 type 2 diabetics

		HbA1C (%)	Vitamin D (ng/ml)
HbA1C (%)	Pearson Correlation	1	-.109
	Sig. (2-tailed)		.568
	N	30	30
VITAMIN D (ng/ml)	Pearson Correlation	-.109	1
	Sig. (2-tailed)	.568	
	N	30	30

No significant correlation between HbA1c and vitamin D levels

Correlation between HbA1c and Vitamin D (r=,p0.05)

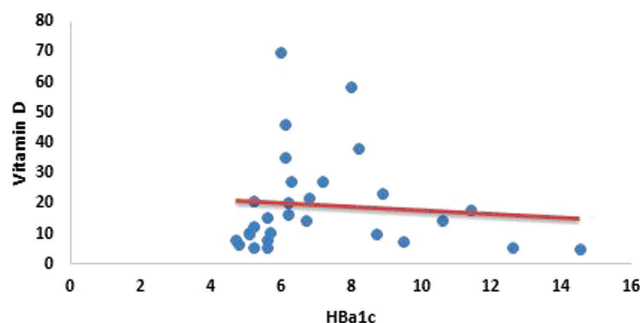


Figure 1

Discussion

The results of the current study revealed that there was no statistically significant correlation between HbA1c and vitamin D levels in type 2 diabetic patients of Bengaluru city.

Clinical trials have inferred mixed results regarding association of low vitamin D and development of diabetes even though epidemiological studies have established strong linkages between hypovitaminosis D and impaired glucose tolerance (IGT).¹² Some epidemiological studies also advocate a relationship between low vitamin D and microvascular diabetic complications.¹³ Besides, 1, 25 dihydroxycholecalciferol exerts its action in maintaining euglycaemic environment in multiple ways. Activated vitamin D acts on beta cells of pancreas to impart insulin receptor gene expression.¹⁴ Moreover, vitamin D after its activation causes increase in serum calcium levels by enhancing its small intestinal absorption and calcium is a prerequisite for the insulin release from beta cells of pancreas. In the recent past, studies on beta cells of pancreas have discovered that they have receptors for active form of vitamin D and these receptors have intrinsic capacity to convert inactive form of vitamin D to its active form.¹⁵

Researchers studied the role of vitamin D on glucose homeostasis and IR in T2DM patients and concluded that vitamin D replacement significantly declines HbA1c.¹⁶ Another research contrarily exhibited no significant difference in the change of HbA1c between the groups.¹⁷ The study on the effect of vitamin D supplementation on glycaemic control in T2DM (SUNNY Trial) also endorsed that mean baseline HbA1c was same in both groups even after 6 months.¹⁸ Another interventional study done amongst 129 Korean patients failed to prove a therapeutic role of vitamin D in improving HbA1c or IR despite achieving its physiological serum levels.¹⁹ A team of researchers did meta-analysis to see the results of vitamin D supplementation and improved vitamin D status on blood sugar levels and IR in diabetic patients. They concluded that supplementation of Vitamin D, a minimum dose of 100µg/d (4000 IU/d), significantly reduces fasting blood glucose, HbA1c, and homeostatic model assessment of insulin resistance (HOMA-IR) index, and helped to control glycaemic response and improve insulin sensitivity in T2DM patients.²⁰ These conflicting conclusions led to some more interventional clinical trials and a landmark meta-analysis reported that there is no substantial or statistical evidence to date that

vitamin D in its active form has a clinical and therapeutic role in treatment of T2DM patients in addition to the conventional anti-diabetic medicines.²¹ On the contrary, a substantial number of observational studies established impaired glucose tolerance and hypovitaminosis D. Many ongoing studies have made the observations that deficiency of vitamin D is an independent risk factor for development of type 2 diabetes.²² It still is a question to be answered that if vitamin D insufficiency and IR are a cause and effect phenomenon as both these entities are explicit among diabetics.

Vitamin D is a crucial factor in type 2 DM because it regulates adipogenesis during adipocyte differentiation, stimulates insulin synthesis, protects pancreatic B cells and decreases insulin resistance in muscles.²³

In a study conducted on patients with diabetes mellitus, Al-Timimi DJ et al. showed that vitamin D deficiency was significantly associated with glycaemic control.²⁴

In this present study, contrary to Al-Timimi DJ et al., there was no association between vitamin D and glycaemic control.

Even though diabetic patients have lower vitamin D values than healthy control in the literature, there is currently inadequate evidence of the useful effect in recommending vitamin D supplementation as a means of improving glycaemia or insulin resistance.²⁵

Conclusion

Based on the results obtained from this present study, the following conclusions can be drawn:

Vitamin D wasn't associated with glycaemic control.

Finally, a major limitation of our study was the cross-sectional study that was considered. Single blood sampling was the other limitation. The other major limitation of the present study was small sample size; further large sample size prospective studies are required in this direction. For these reasons, further investigations may be more beneficial to highlight the relationship between glycaemic control and vitamin D.

Conflict of Interest: This study authors declare that there is no conflict of interests regarding the publication of this article.

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