

Role of vitamin D on blood sugar level in diabetic patients

Sushma Kumari^{1,*}, Mritunjay Kumar Upadhyay², Ashok Kumar Deo³

¹Assistant Professor, Dept. of Pharmacology, ²Associate Professor, ³Professor, Dept. of Physiology, Narayan Medical College, Jamuhar, Sasaram (Rohtas)

*Corresponding Author:

Email: drashdeo@gmail.com

Abstract

Background: Vitamin D₃ has been linked to everything as cancer, diabetes mellitus heart disease etc. One important function of vitamin D is on the beta cells of pancreas that secretes insulin. In cases of deficiency of vitamin D there is not only a decreased secretion of insulin but also increased insulin resistance as proved by various studies. Studies have also shown that treatment of vitamin D deficiency delays the development of insulin resistance & so diabetes mellitus.

Methods: Our objective was to examine the association of serum 25-hydroxyvitamin D levels with type 2 diabetes mellitus & effects of vitamin D on it. Analysis were carried out on 200 patients (120 men & 80 women) aged about 35 or above conducted for 1 year in 2014. Diabetes mellitus was defined as fasting plasma glucose > 126mg% or current use of oral hypoglycaemic agents or insulin.

Results: Compared to individuals with a sufficient serum 25(OH)D concentration >75nmol/L, the observed values are divided into 4 groups severe (<25nmol/L), mild (25 to <50 nmol/L), moderate (50 to <75nmol/L) & normal >75nmol/L. The enrolled patients were investigated for blood sugars, vitamin D levels, lipid profiles & HbA1C status at baseline & at the end of 1 year.

Conclusion: Correction of vitamin D deficiency postpones the development of insulin resistance & thus diabetes mellitus & also improves glycemc control.

Keywords: Vitamin D, Type 2 Diabetes Mellitus, Insulin resistance, HbA1C.

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Introduction

A traditional role of vitamin D is promoting calcium & phosphate absorption in the intestine. It maintains adequate concentrations of calcium & phosphate in the circulation & enables normal mineralization of bone by providing these minerals to bone-forming sites. Accordingly, vitamin D deficiency is closely associated with metabolic bone diseases such as rickets in children & osteomalacia in adults. The non-skeletal action of vitamin D are also drawing interest, as it was discovered that most cells of the body have the vitamin D receptors (VDR) & some of them also have the enzyme 25-hydroxyvitamin [25(OH)D] -1alpha-hydroxylase, which converts the primary form of vitamin D to an active form. One of the non-skeletal actions under my investigation is a role of vitamin D in glucose metabolism. Animal & in vitro studies have provided evidence that vitamin D may play a role in glucose homeostasis through its effects on insulin secretion & insulin sensitivity. Previous observational studies have reported an inverse association between vitamin D status & risk of diabetes mellitus in Arab, Americans & Canadians.

Aims & Objective

We study the association between the serum 25(OH)D level & the prevalence of type 2 diabetes mellitus & effect of treatment with vitamin D on type 2 diabetes mellitus.

Materials & Methods

The 200 patients aged 35 years or older were selected from the outdoor in Anugrah Narayan Medical College & Hospital over a period of 1 year starting from January 2014 to December 2014. They were tested for fasting glucose, Total & HDL cholesterol, 25(OH)D levels & HbA1C at baseline & at the end of 1 year. All participants in this study signed an informed consent form. Diabetes mellitus was defined as fasting glucose more than or equal to 126 mg% or current use of an oral hypoglycaemic agents or insulin for glucose, control. The BMI cut off values for overweight & obesity were 23 & 25 kg/m², respectively. Patients are divided into two groups. One group was treated with vitamin D in addition to dietary modifications & or anti-diabetic drugs. Other group was treated with only dietary changes & anti-diabetic drugs.

Observations

1. The age of participants was 50+15 in men & 52+15 in women. Participants with <25nmol/L of serum 25(OH)D accounted for 30% of study population (60), 25 to < 50 nmol/L for 40% (80), 50 to <75nmol/L for 20% (40) & >75nmol/L for 10% (20).

- The average HbA1C (9%) at baseline was higher in patients with severe vitamin deficiency with <25 nmol/L of 25(OH)D, compared to those with levels of 25(OH)D was 25 to 50nmol/L (8%). The average HbA1C was 7.5% in patients with 25(OH)D levels 50 to <75nmol/L & the HbA1C was <6% with 25(OH)D level >75nmol/L.
- At the end of 1 year patients who were treated with vitamin D showed significant reduction in HbA1C values (1-1.5%) as compared to those who are not on vitamin D supplementation (0.5-0.8%).

Table 1: Characteristics of study participants

	<25	25-49.99	50-74.99	>75
Total	60	80	40	20
Age(average)	48	46	50	55
Men	35	45	25	15
Women	25	35	15	5
Smoker	32	40	22	9
Regular walking	45	70	30	16
Diabetes mellitus 2	All	All	All	All
Waist circumference (cm)	80	80	82	82
BMI kg/m ²	23.3	23.6	23.7	23.1
Blood pressure (mm of Hg)	160/84	130/85	150/90	130/88
Fasting blood glucose	160+10mg%	150+10mg%	135+10mg%	162+10mg%
Serum triglyceride	245+10mg%	350+10mg%	300+10mg%	165+10mg%

Serum 25(OH)D level in nmol/L

Discussions

In this study, we demonstrated that low vitamin D status was associated with an increased risk of diabetes mellitus. Although several observational studies have reported an inverse association between vitamin D level & the risk of diabetes mellitus. Regarding the association between vitamin D level & the risk of metabolic syndrome in Asians, Lu et al, reported that a low serum 25(OH)D level is significantly associated with a high risk of metabolic syndrome in Chinese people between 50 & 70 years of age. They also noted serum 25(OH)D level was inversely associated with insulin resistance in overweight & obese Chinese people (BMI > 24kg/m²), but not in their normal-weight counterparts, which is consistent with our result. Vitamin D may play an important role in glucose homeostasis in overweight & obese individuals who already have some degree of insulin resistance.

Potential mechanisms for the effects of vitamin D on glucose homeostasis have been suggested based on the findings from animal & in vitro studies. It appears that vitamin D may play a role in both insulin secretion & insulin resistance. Vitamin D deficiency predisposes individuals to both Type 1 & Type 2 diabetes mellitus & receptors for its active form are found in both pancreatic beta cells, immune cells & skeletal muscles & the activating enzyme, 25(OH)D-1 alpha-hydroxylase, is expressed in pancreatic beta cells. Vitamin D may directly induce insulin secretion by binding to vitamin D receptors on beta cells, or it may indirectly affect beta

cell function by regulating extracellular calcium level & calcium flux through beta cells. Vitamin D stimulates the expression of insulin receptor & enhances insulin responsiveness for glucose transport in cells. It also indirectly affects insulin sensitivity in tissues such as skeletal muscle & fat by regulating extracellular calcium level & ensuring adequate intracellular, cytosolic calcium pool. The most advantageous serum levels of 25(OH)D begins at 75 nmol/L & the optimal level ranged between 90 & 100 nmol/L. Based on this findings, it is recommended that the vitamin D intake in adults should be >1000IU/ d. In the present study, the risk of having diabetes mellitus was higher in participants with low serum 25(OH)D levels compared with those with a sufficient serum 25(OH)D concentration >75 nmol/L. Vitamin D deficiency is associated with higher HbA1 C values & poor glycemic control. Supplementation with vitamin D has been shown to be beneficial in glycemic control.

Although the high prevalence of diabetes mellitus are mainly attributed to increasing obesity & other environmental factors such as dietary habits & inactivity, vitamin D insufficiency may also partly explain this phenomenon, considering the possible role of vitamin D in glucose homeostasis. The present study has some limitation, because it is a cross-sectional observation study, the association found in this study is not proof of a causal relationship & might be confounded by many unmeasured unaccounted variables even after multiple

adjustments. In conclusion, we found that a low serum 25(OH)D concentration is significantly associated with a high risk of diabetes mellitus in adults & supplementation with vitamin D has been shown to be beneficial in glycemic control in diabetic individual.

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