Original Article

Role of vitamin D as a supplementation in Type 2 Diabetes mellitus

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Abstract : Over the past decades numerous non skeletal diseases have been reported to be associated with vitamin D deficiency including type 2 diabetes mellitus. Different studies provide evidence that vitamin D may play a functional role in glucose tolerance through its effects on insulin secretion and insulin sensitivity. This study evaluates the effects of vitamin D supplementation on insulin resistance in Type 2 DM. **Method:** A comparative study was conducted in 20 T2DM patients of age 30 to 60 years attending the medicine OPD of RMC. The subjects were randomly divided into two groups A and B with 10 patients in each group. Grou p A (Control group) without vitamin D supplementation and group B and at the end of the study (8 weeks). Patients received 2000 IU of vitamin D3orally daily for eight weeks. Statistical analysis was made by using paired and unpaired t test. **Result:** 20 participants, Group A and Group B participated in this study. All results were presented as Mean+- Sd. The result at baseline (0 weeks) and at the end (8 weeks), for HbAlc were (Group A 6.82% +- 1.17%, 6.82 +-, 1.17%) (Group B 6.60 % +- 0.76%, 6.82%+-+- 0.56%) respectively. **Conclusion:** Our data showed significant improvement in HbAlc levels after treatment with vitamin D, suggested that vitamin D supplementation could reduce insulin resistance in T2DM.

Keywords: Diabetes Mellitus; Vitamin D; Insulin Resistance; Glycemic Control.

Introduction

Vitamin D is a hormone related to skeletal integrity(1).Over recent decades, numerous non skeletal diseases associated with vitamin D deficiency have been reported including T2DM(2). Vitamin D deficiency appears to be related to the development of diabetes mellitus. Mild to moderate vitamin D insufficiency has been proposed as a risk factor for type 2 diabetes. Higher plasma vitamin D has been shown to be related with a lower risk for the development of diabetes mellitus in high risk patients(3). Some studies have shown a relationship between vitamin D deficiency and T2DM (4). Also some other studies have shown that vitamin D may play a functional role on glucose tolerance through its effects on insulin secretion and insulin sensitivity(5).

Vitamin D reduces insulin resistance probably through its effect on calcium and phosphorus metabolism and through up regulation of the insulin receptor gene(6). Moreover, vitamin D seems to affect glucose homeostasis, vitamin D levels having been found to be inversely related to glycosylated hemoglobin levels in diabetes mellitus(7). A recent review indicates that vitamin D deficiency may predispose to glucose intolerance, altered insulin secretion and type 2 diabetes(8), either through a direct action via vitamin D receptor (VDR) activation or indirectly via calcemic hormones and also via inflammation(9).

One follow-up study, through 20 years with T2DM, showed that vitamin D intake was associated with reduced prevalence of the T2DM(10).T2DM is considered to develop from a state of increased insulin resistance and β-cell dysfunction(11). Depending upon the etiology of DM, factors contributing to hyperglycemia may include reduced insulin secretion, decreased glucose utilization and/or increased glucose production(12) Non-pharmacological (e.g. diet, exercise and weight loss) and pharmacological therapy are necessary to achieve optimal glycemic control and reduction in incidence of disease related complications(13).

In contrast to type 1 diabetes, which is related to autoimmune destruction of pancreatic β cells, leading to absolute insulin deficiency, type 2 diabetes development involves impaired pancreatic β cell function, insulin resistance and inflammation. Although mechanistically unclear, it has been suggested that both environmental and genetic factors seem to be involved in type 2 diabetes development(14);which involves insufficient insulin secretion, reduced responsiveness to endogenous or exogenous insulin, increased glucose production, and/or abnormalities in fat and protein metabolism(15)

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Type 2 DM is progressive and complex disorder that is difficult to treat effectively in long term, its management includes a good metabolic control, prevention of complications by pharmacological measures and non-pharmacological measures enabling the patients to live a normal life span (13) Data regarding association of 25(OH)D with insulin resistance in Asians is very limited. Therefore our study is expected to shed light as to whether oral vitamin D supplementation can be an adjunct therapy, and the importance of optimizing vitamin D levels for improved glycemic control of T2DM patients in the Indian population.

Sample	Age(years)	HbA1c (%)	
		0 Wk	8 Wk
Group A	45.5 ± 6.06	6.82±1.17	6.72±0.88
Group B	45.5± 6.79	6.82±0.56	6.60±0.76

TABLE 1: Comparison of parameters in group A and B of type 2 diabetic subjects

Materials and method

A prospective open label randomized comparative pilot study of 8 weeks was conducted in diagnosed T2DM patients of age between 30 to 60 years without any associated diseases. The study protocol was approved from the Institutional Medical Ethics Committee. A written informed consent was obtained from all the eligible candidates. The subjects were randomly divided into two groups(Group A and Group B) of 10 patients each attending the medicine OPD of RMC.

Group A- (control group) 10 Type 2 Diabetic subjects on oral hypoglycemic therapy **without vitamin** D supplementation.

Group B- (study group) 10 Type 2 Diabetic subjects on oral hypoglycemic drugs **with** vitamin D supplementation.(2000 IU orally per day)

All the patients were followed up for the compliance and side effects if any. HbA1c levels were recorded for both groups at 0 weeks and 8 weeks. The results of both groups were compared and data was statistically analyzed using unpaired and paired t test. The results were significant.

Observation and results

20 diabetic patients (group A) and (group B) participated in this study. The mean age of participants was 45.5±6.06 years. Mean HbA1c concentration of group A was 6.82% ±1.17% at 0 weeks and 6.72% ±0.88% at 8 weeks and of group B was 6.82%±0.56% at 0 weeks and 6.60%±0.76% at 8 weeks. The data was analyzed using Unpaired and paired t test. Comparison of mean for HbA1c levels before and after treatment with vitamin D supplementation was done. Significant reduction was seen in Group B at 8 weeks after vitamin D supplementation. **Refer Table No -1**

Discussion

The main purpose of this study was to investigate the effects of vitamin D supplementation on glucose homeostasis. The results showed that vitamin D supplementation significantly decreased HbA1c levels. Effects of vitamin D supplementation on glucose homeostasis have been shown in numerous studies. Our findings are consistent with results of many other published studies, in which the insulin resistance appears to be decreased in T2DM patients who had received vitamin D.

Inzucchi et al on 5,677 subjects with impaired glucose tolerance showed that vitamin D supplementation increased insulin sensitivity by 54%(16). **Gedik O et al** also found that increased vitamin D intake improves insulin sensitivity(17). Another study on 126 healthy people showed that there is a direct relation between insulin sensitivity and 25(OH)D level and that vitamin D deficiency had a negative effect on β-cell function in pancreatic β-cells(18). A comparative study, on patients with T2DM, showed that vitamin D intake was associated with reduced prevalence of the T2DM(19).**Von Hurst** (2009) showed that vitamin D supplementation significantly improved insulin sensitivity and insulin resistance(20).In a prospective observational study with a mean follow up of 2.7 years, higher plasma 25(OH)D_3 assessed repeatedly was associated with a lower risk of incident diabetes in high-risk patients(21) In a prospective study in high risk Asian subjects, 25(OH)D_3 deficiency was associated with a higher risk for the development of type 2 diabetes mellitus. In a longitudinal study of the determinants of insulin resistance and the metabolic syndrome, a significant inverse association of baseline 25(OH)D_3 with fasting glucose at follow up was observed(22) In a recent study, **Eftekhari and colleagues** were not able to elicit the same improved metabolic profile in an Iranian T2DM population, which was probably due to a shorter duration of supplementation (12 weeks) (23). Other studies also found no improvement of

insulin sensitivity after a high dose vitamin D intervention. This was probably partly due to the supplementation itself and/or because the subjects were apparently healthy

As to these studies, our study shows that mean HbA1c was significantly reduced after increased vitamin D intake. Monthly supplementation with 120,000 units of vitamin D also improved insulin sensitivity(24)

The findings of this study indicate that the metabolic profile of T2DM subjects, is significantly improved after the onset of vitamin D3 supplementation, suggesting that vitamin D correction is a promising cardio-protective intervention in vitamin D-deficient populations. . The current study adds to an increasing body of evidence that vitamin D supplementation is most beneficial not only to those who are at risk for osteoporosis and other bone-related diseases, but also to those who are deficient and have other extra skeletal chronic diseases, such as diabetes T2DM and cardiovascular disease

Based on the results it would be physiologically correct to recommend vitamin D supplementation to improve glucose control in type 2 diabetes mellitus patients. In summary, the present interventional study performed suggests that daily 2000 IU vitamin D3 supplementation in a vitamin D deficient T2DM population is associated with measurable cardio-protective indices.

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