

Research Article**Serum Vitamin D Levels in Newly Detected Type 2 Diabetes Mellitus**Dr. G. B. Doddamani¹, Dr. Umakant Boke², Dr. Shreeram Kora¹, Dr. Renuprasad Chickmath³¹Professor, Department of General Medicine, S. N. Medical College & HSK Hospital, Navanagar, Bagalkot, India²Assistant Professor, Department of General Medicine, S. N. Medical College & HSK Hospital, Navanagar, Bagalkot, India³Post Graduate, Department of General Medicine, S. N. Medical College & HSK Hospital, Navanagar, Bagalkot, India***Corresponding author**

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Abstract: Vitamin D deficiency is strongly associated with onset and progression of Type 2 diabetes mellitus. Daily supplementation of vitamin D to people with impaired glucose tolerance delayed progression to overt diabetes mellitus. Thus it is debated that wide spread prevalence of diabetes mellitus could be related to hypovitaminosis D. This is 1 year study on 50 patients with newly detected type 2 diabetes mellitus coming at S.Nijalingappa Medical College, Hanagal Shri Kumareswar Hospital and Research Centre, Bagalkot. For measuring Vitamin D levels, 25OH Vitamin D chemiluminescent immunoassay was used. Patients with Osteoporosis, complicated cases of diabetes mellitus, post-menopausal women, diagnosed cases of Type 2 diabetes mellitus on treatment, cancer, renal failure (renal osteodystrophy), on medication that affect vitamin D metabolism/its absorption (phenytoin, rifampin, isoniazid, ketoconazole) were excluded from the study. Our study showed that 70% (35 cases) of the newly detected type 2 diabetes mellitus patients were vitamin D deficient (< 20 ng/ml). In 28 out of 35 cases, vitamin D levels are in range of 10-20ng/ml. And in 7 patients vitamin D levels are <10ng/ml. Optimal levels of vitamin D (20ng/ml) is found in 15 patients. In conclusion, Vitamin D is a risk factor for development of type 2 diabetes mellitus. There might be potential beneficial role of vitamin D supplementation and improving glycemic status in type 2 diabetics.

Keywords: Vitamin D; Type 2 diabetes mellitus; glycosylated hemoglobin

INTRODUCTION

Diabetes mellitus is a metabolic disease which is caused by absolute or relative insulin deficiency, that can affect nearly every organ system in the body. It has been estimated that 380 million individuals would be affected with diabetes worldwide by the year 2025. Disease incidence is increasingly evident in children [1]. If left untreated, T2DM can lead to a multitude of chronic microvascular and macrovascular conditions such as retinopathy, nephropathy, neuropathy and cardiovascular disease (CVD). (2) Physical inactivity, poor nutrition practices and obesity contributes significantly to development of type 2 diabetes mellitus. Recently, vitamin D has sparked widespread interest in the pathogenesis of diabetes [1, 2]

The primary route via which people obtain vitamin D is through exposure to ultraviolet B (UVB) sunlight at wavelengths between 290-315 nm. UVB sunlight activates 7-dehydrocholesterol (7-DHC), a pre-cursor synthesized from cholesterol and found within the skin to form cholecalciferol. This cholecalciferol undergoes two successive hydroxylations from the liver by 25-hydroxylase (25(OH)ase) to form 25(OH)D₃ (also known as calcidiol) and by the kidneys by 25(OH)D₃-1 α -hydroxylase (1 α (OH)ase) to form 1,25dihydroxyvitamin-D₃ (1,25(OH)₂D₃) (also known as calcitriol) [3].

One of the hallmarks of T2DM is low-grade inflammation which can be a result of an increase in circulating cytokine such as TNF α and IL-6 which contribute significantly to insulin resistance in muscle and adipose tissue [4]. Vitamin D acts as a potent immunosuppressor. It tends to down-regulate the transcription of various proinflammatory cytokine genes like Interleukin-2, Interleukin-12, and Tumor Necrosis Factor- α [5, 6].

The 1 α (OH)ase enzyme is identified in pancreatic β -Cells [7]. 1,25(OH)₂D₃ is thought to be essential for insulin exocytosis by increasing the expression of calbindin-D28K in β -cells. Calbindin-D28K plays an integral role in regulating intracellular calcium levels in β -Cells, thus facilitating insulin exocytosis, a calcium-dependent process. In addition, calbindin-D28K plays a protective role by decreasing inflammatory cytokine-induced β -cell apoptosis [1, 8].

Vitamin D is found to have protective effect on β cell mass. The increase in β -cell apoptosis may be a result of an increase in any one of the following: excessive ROS production, cytokines (TNF- α , IL-6), glucotoxicity or lipotoxicity, which are often present in individuals with T2DM. Vitamin D prevents apoptosis of β cells and preserves β cell mass [9]. Recently, Riachy et al demonstrated that 1,25(OH)₂D₃ preserve the insulin content of human islets and prevent MHC-I expression,

IL-6 production and NO release also 1,25(OH)2D3 induced and maintained high levels of A20, an anti-apoptotic protein, in rat RINm5F cells and human islets after exposure to inflammatory cytokines. Vitamin D may act in two possible pathways; vitamin D may act directly to induce beta-cell insulin secretion by increasing the intracellular calcium concentration via non-selective voltage-dependent calcium channels or it may mediate activation of beta-cell calcium-dependent endopeptidases to produce the cleavage that facilitates the conversion of proinsulin to insulin [1,10-13].

So it was decided to undertake this study with following aims and objectives

- Serum vitamin D levels in newly detected Type 2 diabetes mellitus.
- Correlation of serum vitamin D levels in newly detected Type 2 diabetes mellitus with glycemic levels and glycosylated hemoglobin

MATERIAL AND METHODS

This is 1 year study on 50 patients with newly detected type 2 diabetes mellitus coming at S.Nijalingappa Medical College, Hanagal Shri Kumareswar Hospital and Research Centre, Bagalkot. Vitamin D levels was measured by, 25 OH Vitamin D Chemiluminescent Immunoassay is used.

Inclusion criteria

Newly detected Type 2 diabetes mellitus

- Fasting blood glucose \geq 126mg/dl
- Glycated hemoglobin \geq 6.5%
- Oral glucose tolerance test(OGTT) \geq 200mg/dl.
- Symptoms of diabetes mellitus-polyuria, polydipsia, fatigue, weight loss.

Exclusion criteria

- Osteoporosis
- Complicated cases of diabetes mellitus.
- Post menopausal women
- Diagnosed cases of Type 2 diabetes mellitus on treatment
- Cancer, renal failure (renal osteodystrophy)
- Medication that affect vitamin D metabolism/its absorption (phenytoin, rifampin, isoniazid, ketoconazole).

Following investigations are done in this study FBS, PPBS, Glycated Hemoglobin levels, Serum 25 (OH) cholecalciferol levels, Blood.Urea, Serum Creatinine, Fundoscopy, ECG

RESULTS

Number of patients studied is 50. Mean age of population under study is 47.06 yrs.

Table 1 shows distribution of Vitamin D levels in 50 cases. An optimal level of Vitamin D is found in 15 patients. In most of cases (28), Vitamin

D levels are in range of 10-20ng/ml. And 7 patients Vitamin D levels are <10ng/ml.

Table 2 shows that there exists inverse relationship between vitamin D levels and FBS and glycosylated hemoglobin . At optimal vitamin D levels(20 ng/ml) ,mean FBS is 159.07mmg% & 6.88%, at vitamin D levels between (10-20ng/ml) , mean FBS is 185.63mg% & 7.86% , at vitamin D levels < 10ng/ml , mean FBS is 187.25mg% 8.71% .

Table 1: Distribution of Vitamin D levels in 50 cases

Vitamin D levels(ng/ml)	No. of cases
<10	7
10-20	28
20-30	13
>30	2

Table 2: Showing relationship between vitamin D levels and FBS & glycosylated hemoglobin

Vitamin D levels (ng/ml)	No. of patients	Mean FBS	Mean glycosylated hemoglobin
<10	8	187.25	8.71%
10-20	27	185.6296	7.86%
>20	15	159.0667	6.88%

V FBS - P=0.0067, ANOVA=5.57(Highly significant)
 GLYCO Hb- P=<0.001, ANOVA=18.94(Highly significant)

Table 3: Mean age of population under various studies

Present Study	Dalgard <i>et al.</i> [15]	Shanti <i>et al.</i> [14]	Hyponnen <i>et al.</i> [16]	Orwell <i>et al.</i> [17]
47.06 yrs	72.5 yrs	43.42±7.877yrs	45 yrs	61±8 yrs

DISCUSSION

A total of 50 patients were included in the study based on inclusion and exclusion criteria.

The mean age of the population under our study & other studies done worldwide is shown in table 3.

In a study conducted by Dalgard and associates on 158 type 2 diabetics more than 50% of the study population was vitamin D deficient [15]. But here vitamin D deficiency was taken at a level of less than 50ng/ml. This study correlates well with our study. In another study conducted by Chiu *et al.* on 126 healthy , glucose tolerant subjects 47 subjects were detected to have vitamin D levels to be less than 20ng/ml.(10) This correlates well with our study where 68% of control population was detected to have vitamin D deficiency.

In another study conducted at Sree Balaji Medical College and Hospital, Chrompet, Chennai, the mean vitamin D value was 18.492±3.49 among the 50 cases

of type 2 diabetics [14]. Our study also shows vitamin D levels tend to be lower in diabetics. The mean FBS value in patients with vitamin D deficiency was higher than in cases with optimal vitamin D levels. The inverse relation between vitamin D levels and FBS in diabetics was also seen also seen in other studies. In study done at Sree Balaji Medical College and Hospital, Chrompet, Chennai, on 50 cases of type 2 diabetics the mean vitamin D level was 18.492 with mean FBS value being 146.22mg/dl. Chiu *et al.*, 2004 serum 25(OH) D3 is positively correlated with ISI and negatively correlated with post-prandial glucose concentration [10].

In diabetics the mean HbA1c levels were higher in vitamin D deficient patients compared to those with optimal levels of vitamin D levels. Additionally HbA1c levels were higher in patients with severe vitamin D deficiency when compared to subjects with mild to moderate deficiency. The inverse association between vitamin D and HbA1c is similar to other studies. The study conducted by Dalgard and associates on 668 Faroese residents, where an increasing concentration of HbA1c was associated with decreasing levels of vitamin D levels. This was independent of sex, smoking status, body habitus [15].

Study conducted at Chennai, also showed inverse relationship between vitamin D and HbA1c, it also emphasised on that patients with severe vitamin deficiency had additional higher HbA1c levels [14].

In a study by Hyponnen and Power, participants with HbA1c more than 7% had lower 25 hydroxy vitamin D levels (36.9nmol/l) compared to the total population under study (52.7nmol/l) [16].

CONCLUSION

Vitamin D deficiency is a risk factor for development of type 2 diabetes mellitus. There might be potential beneficial role of vitamin D supplementation and improving glycemic status in type 2 diabetics.

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