

To Assess the Prevalence and Severity of Vitamin D Deficiency in Type 2 DM as Well as to Record the Effect of Hyperglycaemia on Serum Vitamin D Level: An Observational Study

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Conflict of interest: Nil

Abstract

Aim: The objectives were to assess the prevalence and severity of vitamin D deficiency in type 2 DM as well as to record the effect of hyperglycaemia on serum vitamin D level.

Methods: The present study was conducted in the Department of Medicine, Sadar Hospital, Motihari, Bihar, India. Total 100 participants were enrolled in the study out of which 50 healthy people were enrolled as case (Group A) and 50 type 2 diabetic patients as controls (Group B). Controls include age and sex matched healthy individuals. Patients younger than 18 years, patients with chronic kidney disease, patients taking calcium supplements or vitamin D supplements within last 3 months, patients suffering from any known chronic illness were excluded from this study.

Results: In patients with controlled diabetes as per HbA1C criteria, the prevalence of sufficient, Insufficient and Deficient Vitamin D was 25%, 60% and 15% respectively, where in patients with uncontrolled diabetes it was 10%, 66.66% and 23.34% respectively. More number of diabetic patients with uncontrolled status (23.34%) was having overt vitamin D deficiency in comparison to controlled status (15%). There is a significant association between the maintenance of euglycemia and severity of Vitamin D level in diabetic patients, as the p value is less than 0.05.

Conclusion: Vitamin D deficiency is highly prevalent in diabetic patients as compared to normal healthy population. All patients with type 2 diabetes mellitus must be screened for vitamin D levels and those found to be having insufficiency or deficiency of vitamin D should be started on vitamin D supplements.

Keywords: Serum vitamin D level, Type 2 diabetes mellitus, Vitamin D deficiency

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Introduction

Diabetes mellitus (DM) is a group of diseases with common feature of hyperglycaemia and associated with disturbance of carbohydrate, fat, and protein metabolism resulting from defects

in insulin secretion, insulin action or both. [1] The worldwide epidemic of diabetes mellitus is a serious current health problem because of the high toll of vascular complications associated with the

condition. It has been estimated that 380 million individuals would be affected with diabetes worldwide by the year 2025. In India alone 41 million individuals are affected, and this is likely to go up to 70 million by the year 2025. [2] Along with Insulin resistance and relative insulin Deficiency, Inflammatory factors, reactive oxygen species and autoimmune reactions have all strongly emerged as the major pathogenic effectors for diabetes. Vitamin D deficiency is also a major health problem worldwide. The prevalence of vitamin D deficiency in India is around 50-90% in normal healthy population. [3] As the major regulator for calcium homeostasis, vitamin D directly and indirectly improves insulin exocytosis via activating calcium-dependent endopeptidases, Hence Vitamin D also improves glucose tolerance. [4]

Immunological defects [5] in addition to neuropathy and vascular abnormality are the prime contributors in the pathogenesis of diabetic foot and subsequent infections. Different studies have shown that deficiency of vitamin D leads to immune cell dysfunction, β cell damage and impaired insulin production. [6-8] Vitamin D is a pleiotropic hormone known to play an immunomodulatory role [9,10], in addition to Ca and bone metabolism. Receptors for its activated form have been identified on pancreatic β cells and immune cells. [8,11]

Few research reported association of that Vitamin D deficiency has been associated with a myriad of metabolic abnormalities, including hypertension, diabetes, dyslipidaemia and obesity. [12] As vitamin D has been showed to have effect on pathophysiology of diabetes and diabetics having very high prevalence of vitamin D

deficiency. This study was carried out with aim to see effect of both high prevalent diseases on each other.

The objectives were to assess the prevalence and severity of vitamin D deficiency in type 2 DM as well as to record the effect of hyperglycaemia on serum vitamin D level.

Methods

The present study was conducted in the Department of Medicine, Sadar Hospital, Motihari, Bihar, India for eight months. Total 100 participants were enrolled in the study out of which 50 healthy people were enrolled as case (Group A) and 50 type 2 diabetic patients as controls (Group B). Controls include age and sex matched healthy individuals. Patients younger than 18 years, patients with chronic kidney disease, patients taking calcium supplements or vitamin D supplements within last 3 months, patients suffering from any known chronic illness were excluded from this study. The patients fulfilling the above mentioned criteria were selected after informed consent. All participants included in this study were subjected to complete history and clinical examination. Routine laboratory Investigations like CBC, FBS, RBS, PP2BS, HbA1C, blood urea, serum creatinine, lipid profile, urine albumin and Vitamin D3 levels were done by standard methods in central laboratory of Hospital. The value of serum vitamin D level was further divided in following category: sufficient = 30-100ng/ml, insufficient=20-29ng/ml, deficiency = less than 20ng/ml. Appropriate statistical methods were used to analyse the results.

Results

Table 1: The association of severity of vitamin D level with the category of diabetes control

Diabetes control	Vitamin D Level			Chi Sq (p value)
	Sufficient	Insufficient	Deficiency	
Controlled Diabetic (N = 20)	5 (25%)	12 (60%)	5 (15%)	2.620 (0.003)

Uncontrolled Diabetic (N= 30)	3 (10%)	20 (66.66%)	7 (23.34%)	
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In patients with controlled diabetes as per HbA1C criteria, the prevalence of sufficient, Insufficient and Deficient Vitamin D was 25%, 60% and 15% respectively, where in patients with uncontrolled diabetes it was 10%, 66.66% and 23.34% respectively. More number of diabetic patients with uncontrolled status

(23.34%) was having overt vitamin D deficiency in comparison to controlled status (15%). There is a significant association between the maintenance of euglycemia and severity of Vitamin D level in diabetic patients, as the p value is less than 0.05.

Table 2: Subgroup analysis- mean vitamin D level in diabetes patients in relation with age, gender and associated co-morbidities

Parameters (Number of patients)	Mean value of vitamin D	p value
Age group	35-60 (35)	24.96±6.04
	>60 (15)	24.46±3.10
Gender	Male (36)	27.73±6.14
	Female (14)	24.36±4.86
HTN	Yes (10)	22.18±3.89
	No (40)	26.44±7.60
IHD	Yes (5)	27.10±4.07
	No (45)	25.66±6.42

These findings suggest that duration of having diabetes has no effect on vitamin D levels. We also compare the mean value of vitamin D deficiency with the duration of Diabetes, but there was no significant relation between duration of diabetes and serum vitamin D deficiency (p value >0.5). Diabetic nephropathy was the most common micro vascular complication seen

in type 2 diabetic patients. It was found that all three important microvascular complications. Diabetic retinopathy, diabetic nephropathy and peripheral neuropathy did not have any significant correlation with serum vitamin D level as p value is greater than 0.05 for all three parameters.

Table 3: Comparison of mean vitamin D level with duration and micro vascular complication of diabetes mellitus

	Parameters		Mean value of vitamin D (ng/dl)	p value
Duration of diabetes	1-5 years		24.56±5.85	0.285
	6-10 years		26±6.04	
	>10 years		25.5±3.68	
Micro-vascular complication	Diabetic Retinopathy	Present	23.27±4.81	0.080
		Absent	25.95±5.78	
	Diabetic Neuropathy	Present	27.63±4.89	0.060
		Absent	24.66±5.90	
	Peripheral neuropathy	Present	24.60±5.10	0.120
		Absent	26.18±6.11	

These findings suggest that duration of having diabetes has no effect on vitamin D levels. We also compare the mean value of vitamin D deficiency with the duration of Diabetes, but there was no significant relation between duration of diabetes and serum vitamin D deficiency (P value

>0.5). Diabetic nephropathy was the most common micro vascular complication seen in type 2 diabetic patients. it was found that all three important microvascular complications: - diabetic retinopathy, diabetic nephropathy and peripheral neuropathy did not have any significant

correlation with serum Vitamin D level as p value is greater than 0.05 for all three parameters.

Discussion

Vitamin D deficiency is a major health problem worldwide. The overall worldwide Vitamin D deficiency prevalence is around 15% according to study done by Pfothnerhauer KM et al. [13] As vitamin D has been showed to have effect on pathophysiology of diabetes and have very high prevalence of vitamin D deficiency, so we have taken up this study to see effect of both high prevalence diseases on each other. Various studies done in different geographical region and cultural background have shown varied range of prevalence of vitamin D deficiency in diabetic group ranging from 67%-98.8%. [3,14] India is already declared as 'Capital of Diabetes'. Diabetes mellitus is accepted as major emerging epidemic in India, as India is having 41 millions of diabetic patients currently and it will go up to 70 million by year 2025. As vitamin D has been showed to have effect on pathophysiology of diabetes and have very high prevalence of vitamin D deficiency, so we have taken up this study to see effect of both high prevalence diseases on each other.

Our study along with Bashir et al and Ifigenia-Kostoglou A et al studies had shown higher prevalence of vitamin D deficiency in diabetes mellitus patients compared to healthy individuals, but two other studies had shown no difference of prevalence between diabetic and healthy population. So, we have compared the mean value of serum vitamin D level in diabetic patients and in healthy population of various study. Various studies including our study had low mean level of vitamin D for diabetic patients in comparison to healthy population. [3,15,16]

In our study, mean vitamin D level is lower in patients with uncontrolled diabetes than patient with controlled

diabetes (p value=0.004 Chi Sq test). Similar results was shown by Mukherjee B et al. Mean level of vitamin D is low in uncontrolled diabetic patients (19.47 ± 4.76) as compared to controlled diabetic patients (23.63 ± 3.71). [16] Modi KD et al found that vitamin D levels in patients with controlled diabetes was 22.4 ± 18.6 while in uncontrolled diabetic patients it was lower, 19.9 ± 18.3 which is statistically significant. [17] Duration of diabetes and presence of micro-vascular complication do not have effect on serum vitamin D level. No effect of increasing age was observed on vitamin D status in diabetic patients and we could not able to find such association in other studies. Female diabetic patients were having lower vitamin D level compared to male counterparts; the reason might be less exposure to sun due to household activity. Hypertension was the most common comorbidity found in diabetic patients (17.14%) in our study. Study by Shalini P et al found that Vitamin D deficiency is more prevalent (80.4%) in hypertensive patients than healthy (67.7%) individuals. [18,19]

Conclusion

Vitamin D deficiency is highly prevalent in diabetic patients as compared to normal healthy population. All patients with type 2 diabetes mellitus must be screened for vitamin D levels and those found to be having insufficiency or deficiency of vitamin D should be started on vitamin D supplements. Also, strict control of diabetic status is mandatory in order to prevent vitamin D deficiency.

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