

A STUDY ON THE ASSOCIATION BETWEEN 25(OH) VITAMIN D AND GLYCOSYLATED HEMOGLOBIN (HbA1c) LEVEL IN TYPE II DIABETIC PATIENTS ATTENDING A TERTIARY CARE HOSPITAL IN WESTERN UTTAR PRADESH

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Abstract

Background: Diabetes is a serious health condition that poses significant challenges to development, particularly in the context of modern lifestyle changes and urbanization, which greatly elevate an individual's risk of developing the disease. In recent years, there has been growing interest in Vitamin D, often referred to as the "Sunshine Vitamin," due to its potential links to various health issues, including hypertension, cardiovascular diseases, diabetes, and cancer. A substantial body of research suggests that a deficiency in Vitamin D may play a crucial role in the development of micro & macrovascular complications of Type 2 diabetes. **Material & Methods:** A total of 110 subjects of diagnosed Type II diabetes mellitus in the age group of 20 to 70 years not on vitamin D supplements were included in this study. Subjects with chronic kidney & liver diseases and pregnant women were excluded. **Result:** There was negative non-significant correlation between the serum level of Vitamin D and HbA1c level in these subjects. **Conclusion:** Monitoring the serum level of vitamin D in diabetic patients and providing supplements if necessary would be useful, as vitamin D is essential for the human body and helpful in preventing the complications of diabetes mellitus. Longitudinal studies with larger population size may help in addressing the correlation and mechanism of association between Vitamin D levels & HbA1c in Type 2 DM.

Keywords: Vitamin D, Type 2 Diabetes Mellitus, HbA1c.

INTRODUCTION

Diabetes is a debilitating condition that disrupts the normal functioning of metabolism. The combined impact of lifestyle and urban development significantly increases the probability of developing diabetes. The COVID-19 pandemic has a greater impact on young people in nations with little resources, leading to a significant number of illnesses and deaths among this age group. The effect on employed workers is especially noticeable, presenting a substantial risk to the economic advancement of these countries. Given the rising life expectancy and progress of nations, it is certain that this disease will increase unless effective measures for treatment and prevention are put in place ¹. Vitamin D, also referred to as the 'Sunshine Vitamin', has attracted much attention in recent decades due to its correlation with several conditions including hypertension, heart disease, diabetes, and cancer ². Multiple research investigations repeatedly demonstrate that vitamin D is highly efficacious in developing and maintaining good health. The following diseases have been extensively studied

and found to be strongly associated with a lack of vitamin D: hypertension, obesity, dyslipidemia, type 1 and type 2 diabetes mellitus, coronary artery heart disease, stroke, pulmonary tuberculosis, osteoporosis, cancer, rheumatoid arthritis, multiple sclerosis, Alzheimer's disease, depression, infections, seasonal affective disorder, and overall morbidity and mortality³. There is abundant evidence suggesting that vitamin D inadequacy may contribute to the development of both type 1 and type 2 diabetes. The pancreas contains beta-cells that play a crucial role in the secretion of insulin. The beta-cells possess the enzyme alpha 1 hydroxylase and receptors for vitamin D (VDR)⁴. Several interventional studies have shown that administering vitamin D improves insulin resistance and glucose tolerance^{5 6}. Vitamin D deficiency immediately leads to a reduction in insulin synthesis. It is probable that it indirectly influences the production of insulin by altering the movement of calcium through the membranes of beta cells, hence diminishing calcium's influence on the release of insulin. In peripheral tissues, it enhances the efficacy of insulin by increasing the expression of insulin receptors, improving insulin's sensitivity to glucose transport, and reducing systemic inflammation by mitigating the effects of various cytokines⁷. Research conducted across India constantly shows a prevalent frequency of vitamin D inadequacy in our country, despite its tropical setting. Studies have shown that people of all age groups, including those living in both urban and rural areas, have a lack of vitamin D.⁸ Hypertension and diabetes are the fastest growing non-communicable diseases worldwide. Currently, the prevalence of diabetes in India is extremely high. Assuming this trend persists, Indians will surpass all other countries in terms of the highest number of instances of this illness worldwide by the year 2030. The decrease in glycaemic control during winter months is due to the simultaneous decline in active vitamin D levels during this season⁹. Vitamin D3 is cost-effective and readily available. Thus, by supplementing with it, we can achieve adequate regulation of blood sugar levels, thereby reducing the potential adverse effects linked to diabetes in the long term. In persons with diabetes, the occurrence of common co-morbidities such as hypertension, cardiovascular disorders and infections can be greatly diminished¹⁰.

MATERIALS AND METHOD

The study was conducted in the Department of Medicine & Biochemistry at the School of Medical Science and Research, Sharda University, Greater Noida, after obtaining the approval from the Institutional Ethics Committee. Patients who indicated their readiness by signing the pre-designed informed consent form were included in this study. Diabetes patients attending the outpatient and inpatient departments of the General Medicine were included. The present study covered a total of 110 patients who meet the inclusion criteria. The inclusion criteria for this study are individuals who have been diagnosed with Type II diabetes mellitus, in the age group of 20 to 70 years. Exclusion criteria include patients with preexisting chronic kidney disease, chronic liver disease, on glucocorticoid therapy, anti-seizure medicines, pregnant women, and on vitamin D supplements. The history of duration of diabetes mellitus, the drugs currently being taken by the patients, and any other associated disorders such as systemic hypertension and coronary artery disease were recorded and excluded from the study. Blood samples were collected to determine the levels of total vitamin D and HbA1c. Vitamin D levels were determined using a competitive immunological assay (C.I.A). The HbA1c value was determined with the use of High-Performance Liquid Chromatography (HPLC).

RESULT

The patients' vitamin D levels were evaluated using the health-based reference values. The levels of sufficiency are considered to be greater than 30 ng/ml, while levels between 20-30 ng/ml are considered insufficient. Levels below 20 ng/ml are classified as deficient. The patients' HbA1c levels were classified as within the reference range of 5.7-6.4 %. Values above 6.5 are considered to be high ¹¹. Statistical analysis was conducted by entering all the data into a proforma and analyzing it using SPSS version 21 software on a Windows 10 operating system. The descriptive analysis employed to summarize data using measures such as Mean, Std. Error of Mean, Standard Deviation, and Skewness, Std. Error of Skewness, Percentage, and Proportion as shown in table no. 1.

Pearson's correlation used to evaluate correlation between vitamin D and HbA1c. A p-value below 0.05 is considered as statistically significant.

Table 1

		Age	HbA1c	Vit D Level	Weight	Height
N	Valid	110	110	110	110	110
	Missing	0	0	0	0	0
Mean		49.23	7.9382	24.3666	64.41	163.77
Std. Error of Mean		1.199	0.16125	1.24873	0.675	0.383
Std. Deviation		12.573	1.69115	13.09681	7.077	4.015
Variance		158.085	2.86	171.527	50.079	16.122
Skewness		-0.134	1.396	1.332	0.384	-0.104
Std. Error of Skewness		0.23	0.23	0.23	0.23	0.23
Range		47	6.1	60.5	29	18
Minimum		23	6.6	8	53	154
Maximum		70	12.7	68.5	82	172
Percentiles	25	40	6.8	15.3	58	160
	50	49	7.1	20.95	64	164
	75	62	8.725	29.55	69	167.25

Table 2

Correlations			
		HbA1c	Vit D Level
HbA1c	Pearson Correlation	1	-0.171
	Sig. (2-tailed)		0.074
	N	110	110
Vit D Level	Pearson Correlation	-0.171	1
	Sig. (2-tailed)	0.074	
	N	110	110

DISCUSSION

Type 2 Diabetes Mellitus (T2DM) is a persistent metabolic condition characterised by high level of glucose in the blood. It is linked to a substantial rise in mortality and morbidity, expensive healthcare expenses, and is quickly becoming a widespread problem of global magnitude. According to the World Health Organisation, the global diabetic population is projected to surpass 370 million by the year 2030. Vitamin D is an essential nutrient necessary for the health and welfare of persons, and it can be acquired from external sources or produced inside the body. The main source of vitamin D is the production within the skin by the action of UV radiation. This study

aims to establish the relationship between the concentration of serum 25(OH) vitamin D3 and the levels of glycosylated hemoglobin (HbA1c) in patients who have been diagnosed with type II Diabetes mellitus. Enhancing glycemic management can effectively mitigate the complications associated with diabetes. This study enrolled a total of 110 patients who meet the criteria for inclusion. The study comprised patients diagnosed with Type II diabetes mellitus, aged between 20 and 70 years, who were not using vitamin D supplements. The patient with concurrent chronic kidney and liver illness, as well as pregnant women, were excluded in the study. The average age of the participants in the study was 49.23 ± 12.57 years. Out of the total of 110 patients in this study, 71 were females while the remaining patients were males. The average HbA1c level was 7.94 ± 1.69 indicating non glycemic control. The average vitamin D level was 24.37 ± 13.1 U/dL, 51 were found to have a deficiency in vitamin D, while 32 had inadequate levels of vitamin D. Negative non –significant correlation with p-value = 0.07 are observed between the serum vitamin D level and the HbA1C. The study conducted by Danaei and colleagues in 2014 revealed a significant inverse correlation between the serum concentration of vitamin D and HbA1C level.¹². Due to the significant occurrence of vitamin D insufficiency in individuals with diabetes, it is advisable to use specific strategies to address this deficiency in diabetic patients. The supply of vitamin D to the human body is facilitated through the ingestion of food, the intake of vitamin D supplements, and exposure to sunlight.^{13,14,15}. Monitoring the serum level of vitamin D in diabetic patients and providing supplements if necessary would be useful, as vitamin D is essential for the human body and helpful in preventing the complications of diabetes mellitus. Longitudinal studies with larger population size may help in addressing the correlation and mechanism of association between Vit D levels & HbA1c in Type 2 DM.

CONCLUSION

This study demonstrates a correlation between low serum levels of vitamin D and type 2 diabetic patients. Furthermore, there was non- significant correlation observed between the serum concentration of vitamin D and HbA1C levels in these patients. Diabetic individuals have a very high occurrence of vitamin D insufficiency. It is advisable to implement specific treatment to address this deficit in these patients. To arrive at a definite conclusion, longitudinal studies with larger sample size would be useful to address the association between Diabetes Mellitus and Vit D. Using other parameters like Fasting Blood Glucose, Random Blood Glucose with HbA1c may be helpful for this association.

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