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RELATIONSHIP OF VITAMIN D LEVELS AND GLYCEMIC CONTROL IN PATIENTS WITH TYPE 2 DIABETES MELLITUS.

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ABSTRACT

OBJECTIVE: To find out relationship between vitamin D levels and glycemic control in patients with type-2 diabetes mellitus (T2DM) **STUDY DESIGN:** Cross-sectional study. **PLACE AND DURATION OF THE STUDY:** The department of medicine at PMCH from January 2021 to December 2021. **MATERIAL AND METHODS:** A total of 195 T2DM patients of both genders aged 18 to 70 years were enrolled. All these patients were evaluated for their HbA1c levels along with 25 (OH)D levels. Demographical data along with clinical characteristics were recorded at the time of enrollment. All the patients were further divided in 2 groups as good glycemic control (GGC) as HbA1c below 7.0% or poor glycemic control (PGC) as HbA1c above or equal to 7.0% and compared in terms of demographic and laboratory parameters. **RESULTS:** Out of a total of 195 patients, there were 112 (57.4%) male. Overall mean age was noted to be 47.82±7.0 years. There were 138 (70.8%) patients having PGC while 57 (29.2%) had GGC. The 25 (OH)D was significantly low among patients with PGC versus GGC ($p<0.0001$). Significantly more patients with GGC had sufficient levels of 25 (OH)D in comparison to PGC (54.4% vs. 20.3%, $p<0.00001$). **CONCLUSION:** Poor glycemic control was found to have linkage with vitamin D deficiency while inverse relationship was seen between levels of HbA1c and vitamin D among patient having T2DM.

KEYWORDS: Glycemic Control, Type-2 Diabetes Mellitus, Vitamin D.

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INTRODUCTION

Vitamin D is linked to skeletal integrity while recently, the extra-skeletal role of vitamin D is raising attention among researchers around the world as vitamin D is known to have many other functions.[1,2] Commonest reasons behind vitamin D deficiency (VDD) include reduction in exposure to sunlight which is known to ignite the synthesis of vitamin D via skin. Globally, more than 1 billion are estimated to have VDD[3] while community data from Pakistan estimated VDD to be present among 54%.[4]

Decline in vitamin D level in serum has been found to enhance insulin resistance as well as development of type-2 diabetes mellitus (T2DM).[5] Higher levels of plasma vitamin D have been associated with reduction in risk for the development of T2DM. The VDD has also been described among patients of metabolic syndrome while some studies have shown vitamin D levels to be inversely linked with HbA1c among women having gestational diabetes.[6] A meta-analysis done in 2017 revealed vitamin D supplementation to be

related to decline in fasting blood sugar as well as HbA1c levels in T2DM patients with VDD.[7] Scarcity of data exists about role of VDD among T2DM patients but a recent local study from Karachi described linkage between VDD and increased levels of HbA1c.[8] This study was planned to find out relationship between vitamin D levels and glycemic control in patients with T2DM. The findings of this study were thought to enlighten us about the possible linkage between poor glycemic control (PGC) and lower levels of vitamin D which could further help us planning strategies to handle these T2DM patients in a better way.

MATERIAL AND METHODS

The department of medicine at PMCH from January 2021 to December 2021.

Endorsement from institutional moral council was procured for this review. All of the people who participated in this study gave their written permission. Using p=54 percent, 4 z=1.96, a confidence level of 95 percent, and an e (margin of error) of 7 percent, the estimated sample size was 195. The study included 195 T2DM patients of both sexes, aged 18 to 70, who visited the outpatient department of medicine Fasting serum glucose levels for all patients were greater than or equal to 126 mg/dl. The 25 (OH)D levels and HbA1c levels of all these patients were assessed. Patients with history of vitamin D supplementation in the past 6 months were excluded. Patients having chronic ailments like chronic liver disease, uremia, and any kinds of cancer or lung disease were also not enrolled.

Demographical data along with clinical characteristics of all the patients were noted at the time of enrollment. A total of 10ml blood with a minimum period of 4 hours fasting was obtained and sent for analysis of 25(OH)D, parathyroid hormone (PTH), alanine aminotransferases (ALT) and creatinine using kit methods. All the patients were further divided in 2 groups as good glycemic controls (GGC) as HbA1c below 7.0% or PGC as HbA1c above or equal to 7.0% as described by American Diabetes Association.[9]

SPSS rendition 26.0 was utilized for information examination. The frequency and percentages of qualitative variables like gender, residence area, and daily sunlight exposure (more than or less than 2 hours per day) were used. Mean and standard deviation (SD) were displayed as quantitative variables. The chi-square test was used to compare qualitative data, and the independent sample t-test was used to compare quantitative variables, with a p-value of 0.05 considered significant.

RESULTS

Out of a total of 195 patients, there were 112 (57.4%) male. Mean age was 47.82±7.0 years. Table 1 is showing characteristics of patients. There were 138 (70.8%) patients who had PGC while 57 (29.2%) had GGC.

Table 1: Characteristics of Patients (n=195)

Characteristics	Number (%) / Mean±SD	
Gender	Male	112 (57.4%)
	Female	43 (42.6%)
Age (years)	47.82±7.0	
`Age at the Time of Diagnosis of T2DM	42.46±6.5	
Area of Residence	Rural	121 (62.1%)
	Urban	74 (37.9%)
Sunlight Exposure as more than 2 hours per day	Yes	77(39.5%)
	No	118 (60.5%)
BMI (kg/m^2)	27.8±5.4	
Waist Circumference (cm)	96.8±8.2	
25 (OH)D (ng/ml)	23.5±9.2	
Creatinine (mg/dl)	0.88±0.2	
Glycemic Control	Poor	138 (70.8%)
	Good	57 (29.2%)

Table 2 is showing comparison of demographic and laboratory parameters among those who had GGC and PGC. No statistically significant difference was noted in between patients of both groups ($p>0.05$) except 25 (OH)D was significantly low among patients with PGC ($p<0.0001$).

Significantly more patients with GGC had sufficient levels of 25 (OH)D in comparison to PGC (54.4% vs. 20.3%) while overall p value turned out to be less than 0.00001 (Table 3).

DISCUSSION

Some researchers have proposed vitamin D to have major role in immune system as sufficient levels of vitamin D are linked with immune tolerance[10] while its deficiency can contribute to autoimmune disorders like multiple sclerosis[11], rheumatoid arthritis[12] and diabetes mellitus.[13]

Table 2: Comparison of Demographic and laboratory characteristics between patients having GGC and PGC

Characteristics	GGC (n=57)	PGC (n=138)	P-Value	
	Number (%) / Mean±SD			
Gender	Male	38	74	0.2357
	Female	19	24	
Age (years)	46.18±6.8	48.24±7.4	0.0720	
`Age at the Time of Diagnosis of T2DM	41.27±5.8	42.82±6.9	0.1374	
Area of Residence	Rural	38	83	0.3933
	Urban	19	55	
Sunlight Exposure as more than 2 hours per day	22	55	0.8701	
BMI (kg/m^2)	27.2±5.1	28.1±5.7	0.900	
Waist Circumference (cm)	96.1±7.8	97.0±8.3	0.4844	
25 (OH)D (ng/ml)	28.2+7.4	19.6±9.9	<0.0001	
Creatinine (mg/dl)	0.87±0.1	0.88±0.2	0.7200	

"GGC = Good glycemic control"
"PGC = Poor glycemic control"

Table 3: Comparison of Status of Vitamin D Levels with respect to Glycemic Control Among Patients having T2DM

25 (OH)D as ng/ml	GGC (n=57)	PGC (n=138)	P-Value
Deficient (<20.0)	12 (21.1%)	65 (47.1%)	<0.00001
Insufficient (20.0-29.9)	14 (24.6%)	45 (32.6%)	
Sufficient (≥30.0)	31 (54.4%)	28 (20.3%)	

"GGC = Good glycemic control"
"PGC = Poor glycemic control"

We noted significantly lower 25(OH)D levels in T2DM patients with PGC in comparison to those with GGC. It was also seen that inverse relationship was present between levels of HbA1c and 25(OH)D as rising levels of HbA1c meant that those patients were having lower levels of 25(OH)D and vice versa. Likewise, it was also noted that significantly more patients with PGC had VDD and insufficiency versus those with GGC. A study from Greece found vitamin D levels to be significantly lower among T2DM patients when compared to controls ($p<0.01$) while inverse association was seen in terms of HbA1c levels and vitamin D levels among patients with T2DM.[14] These results further reiterate the role and linkage of vitamin D with glucose metabolism and normal metabolic functions. A local study from Agha Khan University Pakistan revealed that there was linkage between VDD and abnormal HbA1c levels among T2DM patients and the researchers proposed that these individuals can be benefited by vitamin D supplementation.[8] Khan DM et al from Lahore in another local study revealed vitamin D administration to assist in lowering HbA1c in T2DM.[15] The possible mechanism behind the impact of vitamin D to influence glucose metabolism among T2DM patients could be due to its role in improving insulin sensitivity and beta cell survival while vitamin D is also known to increase insulin secretion from pancreatic beta cells along with regulating calcium flux from normalization of glucose tolerance.[16,17]

Like in the present study, inverse relationship between levels of HbA1c and vitamin have been reported by many authors from different parts of the world[14,18,19] while there are very few studies conducted on the same subject in Asian population. On the contrary, some researchers found no benefits in glycemic control with vitamin D supplementation[20] which warrants further research.

Our study had some limitations as well. As this was a single center cross sectional study so findings of our study cannot be generalized. We were also unable to assess the role of different oral hypoglycemic agents or insulin on vitamin D levels among present set of patients. Further studies enrolling large sets of patients with multiple study centers will further evaluate the findings of the present study.

CONCLUSION

Poor glycemic control was found to have linkage with VDD while inverse relationship was seen between levels of HbA1c and vitamin D among patient having T2DM.

ETHICS APPROVAL: The ERC gave ethical review approval. **CONSENT TO PARTICIPATE:** written and verbal consent was taken from subjects and next of kin. **FUNDING:** The work was not financially supported by any organization. The entire expense was taken by the authors.

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CONFLICT OF INTEREST: No competing interest declared

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