

Impact of Vitamin D Levels on HbA1C in Diabetic Obese Patients Hyderabad Sindh Based Study

Impact of
Vitamin D Levels
on HbA1C in
Diabetic Obese

Fatima Sohail, Imran Ali Shaikh, Naila Masood, Fouzia A Sheikh, Kamran Ali Qureshi and Tariq Shaikh

ABSTRACT

Objective: To assess the impact of Vitamin D deficiency in patients having raised hemoglobin A1C (HbA1c) with obesity.

Study Design: Descriptive / Cross sectional study

Place and Duration of Study: This study was conducted at the Department of Medicine, Liaquat University Hospital, Hyderabad for six months from July 2016 to Jan 2017.

Materials and Methods: This study included 143 patients. All the patients who fulfilled the inclusion criteria were evaluated for the deficiency of vitamin D level by taking 2cc venous blood sample in a disposable syringe and send to laboratory for analysis. A written proforma was filled by all the patients for participation in the study. The deficiency of vitamin D was labeled when $<20\text{ng/ml}$.

Results: In our study, out of 143 cases with raised HbA1c and obesity 13.29 % (n=19) were between 30-45 years of age, while 86.71% (n=124) were between 46-60 years of age $\pm 53.58 \pm 5.37$ years, Males were 46.85 % (n=67) and 53.15% (n=76) were females, mean Vitamin D level was 29.30 ± 7.33 . Frequency of vitamin D deficiency in diabetic patients having raised hemoglobin A1C (HbA1C) with obesity shown 21.68% (n=31) and p value was insignificant $p > 0.68$.

Conclusion: It has concluded that the impact of Vitamin D deficiency in patients having raised hemoglobin A1c (HbA1c) with obesity is higher and needs attention to address this issue in our population.

Key Words: Diabetes mellitus, raised hemoglobin A1C, Obesity, vitamin D deficiency

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INTRODUCTION

Vitamin D has crucial role in calcium/phosphorus homeostasis and bone physiology, several indications suggest that vitamin D status may also have a momentous role in glucose homeostasis and on preventing progression of metabolic syndrome and Type 2 diabetes.¹ Low level of vitamin D adversely effects on HbA1C.¹ Vitamin D has an amendable role in managing type 2 diabetes which has global prevalence of around 285 million currently and 438 million by the year 2030.²

Diabetes is a group of metabolic disorder in which chronic hyperglycemia occur which is associated with several complications affecting kidneys, eyes, nerves,

heart and blood vessels, this occur due to the defect in insulin secretion and insulin action.³ Vitamin D deficiency has been identified in patients with type 2 diabetes and is essential for glucose homeostasis because it releases normal insulin.⁴ There is inverse relation between serum level of Vitamin D and serum glucose levels but have a favorable relation with insulin levels and sensitivity.⁵ Besides glucose homeostasis it has important role in calcium and phosphorus maintenance and bone mineralization, it also have favorable impact on non-skeletal outcomes which includes neuro muscular function.⁶ Vitamin D impact on diabetes is measured through HbA1c, is the hemoglobin component that comprises glycohemoglobin formed by the non-enzymatic glycation of the N-terminal valine on the beta chain of Hb.⁷ The relationship between HbA1C and Plasma glucose; which is directly related to diabetes is complex. HbA1C is a standard measurable tool of plasma glucose over the preceding weeks to months and can increase or decrease relatively quickly with large changes in plasma glucose.⁸ The correlation analysis showed a relatively weak but significant association between HbA1C and vitamin D impact and the National Health and Nutrition Examination Survey (NHANES) III study demonstrated the relation between low levels of 25(OH)D and diabetes prevalence.⁸⁻⁹ The vitamin D

Department of Medicine, Liaquat University of Medical and Health Sciences, Jamshoro, Sindh.

Correspondence: Dr. Imran Ali Shaikh, Professor of Medicine, Liaquat University of Medical and Health Sciences, Jamshoro, Sindh.

Contact No: 0333-2662415

Email: imran2naila@yahoo.com

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level is inversely proportional to raised HbA1C (uncontrolled diabetes), while the reported prevalence for vitamin D deficiency in patients having raised HbA1c (uncontrolled diabetes) with obesity is 16%.¹⁰ There were few studies on vitamin D deficiency in type 2 diabetes mellitus without any link to glycemic status but there was no any study conducted on Vitamin D deficiency in relation to raised HbA1c (controlled diabetes) with obesity. Therefore, the literature regarding the vitamin D deficiency having raised HbA1c in our population still has been scarce and needs to be studied because there are variations in race and dietary habits, low socioeconomic status and deficiency of awareness in our population as compared to western world. The results may share to various health care providers and community health oriented programs and it may also supportive for physicians should consider vitamin D level in subjects having raised HbA1c with obesity as early screening can evaluate the deficiency so that proper effective measures can be planned on priority basis.

MATERIALS AND METHODS

This Cross sectional descriptive study was carried out for six months from 31st July to 31st Jan 2017 at Department of Medicine, Liaquat University Hospital, Hyderabad Sind. The sample size was 143 patients having raised hemoglobin with obesity was taken, the prevalence of vitamin D deficiency with raised HbA1c and obesity was 16%,¹⁰ and the sample technique was Non-probability consecutive.

These patients were excluded from multiple disorders by clinical history, previous hospitalization and inquiring the existence of previous record and diagnoses. Postmenopausal women and the patients already on vitamin D supplements and phenytoin therapy also confirmed and excluded.

Inclusion criteria:

- Patients with raised HbA1c and obesity for more than 03 months duration, age 30-60 year and either gender

Exclusion criteria:

- Hypo/hyper parathyroidism, osteoporosis
- Chronic liver, kidney and lung disease
- Malignancy

These patients were recruited from medicine department of Liaquat University Hospital Hyderabad. All the patients who fulfilled the inclusion criteria were evaluated for the deficiency of vitamin D level by taking 2 cc venous blood sample in a disposable syringe and send to diagnostic & Research laboratory LUMHS for analysis. The deficiency of vitamin D was considered less than 20ng/ml¹¹

The data was collected on pre-designed proforma. The entire expenses of tests were bear by authors.

The data of all patients was analyzed in SPSS version 16.00. The frequency and percentage (%) was

calculated for deficiency of vitamin D in patients having raised HbA1c with obesity, gender distribution, residence (urban/rural), dyslipidemia, and hypertension. The mean and standard deviation (SD) was calculated for age, duration of diabetes, BMI, HbA1c and vitamin D level. The stratification was done for age, gender, duration of raised HbA1c and obesity, dyslipidemia, hypertension, rural and urban to see the effect on outcome and to control the effect modifiers. The post-stratification chi-square test was applied to see the effect of these outcomes at 95% confidence interval and the p-value ≤ 0.05 was considered as statistically significant.

RESULTS

A total of 143 cases fulfilling the inclusion/exclusion criteria were enrolled to determine the frequency of Vitamin D deficiency in patients having raised hemoglobin A1c (HbA1c) with obesity.

Table No.1: General characteristics 143 patients

Characteristics		Number	%age	Mean	SD
Age (in years)	30-45	19	13.29	53.58	±5.37
	46-60	124	86.71		
Gender	Male	67	46.85		
	Female	76	53.15		
Residential status	Urban	73	51.05		
	Rural	70	48.95		
Dyslipidemia		99	69.23		
Hypertension		86	60.14		
Body mass index				8.32	0.59
Duration of diabetes				4.57	1.71

Table No.2: Vitamin D Parameters in 143 Patients

Vitamin D characteristics	No. of patients	Mean	SD	%age
Vitamin d level	143	29.30	7.33	
vitamin D deficiency	31	15	4.3	21.68
Normal vitamin D levels	112	23.3	4.1	78.32
Duration of diabetes with vitamin d status				
< 5 years	111			
Deficiency	26			
normal	85			
> 5 years	32			
Deficiency	5			
normal	27			0.34 (p value)

Age distribution of the patients was done, it shows that 13.29 % (n=19) were between 30-45 years of age, while 86.71 % (n=124) were between 46-60 years of age, mean±sd was calculated as 53.58±5.37 years.

Table No. 3: Deficiency with regards to HbA1C in 143 patients

Hba1c	Vitamin D deficiency		P value
	Yes	No	
6.6-8	8	34	0.62
> 8	23	78	

Gender distribution shows that 46.85 % (n=67) were male and 53.15% (n=76) were females. Residential status of the patients was recorded which shows that 51.05% (73) were urban and 48.95% (n=70) belongs to rural area. Frequency of Co-morbidities shows that 69.23 % (n=99) had dyslipidemia, while 60.14% (n=86) had hypertension. Mean duration of diabetes mellitus was 4.57±1.71 years. Body mass index of the patients was recorded as 8.32±0.59. (Table 1)

Vitamin D level of the patients was recorded as 29.30±7.33.

Frequency of vitamin D deficiency in patients having raised hemoglobin A1C (HbA1C) without obesity shows that 21.68 % (n=31) had vitamin D deficiency while 78.32% (n=112) had no vitamin D deficiency. (Table 2)

The stratification was done for age, gender, duration of raised HbA1c and obesity, dyslipidemia, hypertension, rural and urban to see the effect on outcome and to control the effect modifiers. The post-stratification chi-square test was applied to see the effect of these outcomes at 95% confidence interval and the p-value ≤0.05 was considered as statistically significant. (Table 3).

DISCUSSION

A growing literature suggests that vitamin D homeostasis may play a role in the etiology of type 2 diabetes. Vitamin D also affects insulin resistance by stimulating the expression of insulin receptors, or indirectly by regulating calcium homeostasis. Despite proposed biological mechanisms, observational studies and clinical trials in humans did not provide consistent evidence regarding the association between vitamin D status and diabetes. There are few studies on vitamin D deficiency in type 2 diabetes mellitus without any link to glycemic status but there was no any study conducted on Vitamin D deficiency in relation to raised HbA1c (controlled diabetes) without obesity. There, the literature regarding the vitamin D deficiency having raised HbA1c in our population still has been scarce and needs to be studied because there are variations in race and dietary habits, low socioeconomic status and deficiency of awareness in our population as compared to western world.

In our study, out of 143 cases with raised HbA1c with obesity 13.29% (n=19) were between 30-45 years of age, while 86.71% (n=124) were between 46-60 years of age, mean and standard deviation was calculated as 53.58±5.37 years, 46.85% (n=67) were male and 53.15% (n=76) were females, mean Vitamin D level of the patients was recorded as 29.30±7.33. Frequency of vitamin D deficiency in patients having raised hemoglobin A1C without obesity shows that 21.68% (n=31) had vitamin D deficiency.

The findings of our study are in agreement with a study showing that the vitamin D level is inversely proportional to raised HbA1 while the reported prevalence for vitamin D deficiency in patients having raised HbA1C with obesity was 16%.^{11,12}

A robust study showed young female high BMI¹⁴ that vitamin D less than 15 ng/mL represented negative effect on insulin resistance. While NHANES III declared low levels of vitamin D levels were more likely to have elevated blood glucose levels.

A study¹³ of more than five hundreds individuals, non diabetic from both sex in between 40-69 year measured for serum vitamin D, IGF-1, oral glucose tolerance, lipids, insulin, anthropometry, blood pressure of followed up for a decade. It has been resulted negative correlation between vitamin D, dysglycemia and insulin resistance.

These findings also supported by another cohort showed significant inverse association between serum vitamin D and risk hyperglycemia¹⁴.

Nwosuet al¹⁵ showed inverse relationship in between HbA1c and vitamin D supplements, concluded that there was a clinically significant decrease in HbA1c 1 to 1.5% after correction of vitamin d deficiency.

Prakashet al.¹⁶ resulted same that correction of vitamin d kept Hba1C under normal levels. This actually supported that vitamin d is associated with HbA1c directly.

In our study obese diabetics had vitamin d deficiency in about 22% while Iqbal et al¹⁷ found vitamin D deficiency in 30.6% patients of diabetes with good control and in 58.7% patients with poor control.

It has been shown in another study there was significant reduction in HbA1c levels after replacement of vitamin D in diabetic patients.¹⁸

CONCLUSION

We concluded that the frequency of Vitamin D deficiency in patients having raised hemoglobin A1c (HbA1c) with obesity is higher and needs attention to address this issue in our population.

Author's Contribution:

Concept & Design of Study: Fatima Sohail
 Drafting: Imran Ali Shaikh, Naila Masood
 Data Analysis: Fouzia A sheikh,

Kamran Ali Qureshi,
Tariq Shaikh
Revisiting Critically: Fatima Sohail, Imran Ali
Shaikh
Final Approval of version: Fatima Sohail

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REFERENCES

1. Kajbaf F, Mentaverri R, Diouf M, et al. The association between 25-hydroxyvitamin D and hemoglobin A1c levels in patients with type 2 diabetes and stage 1-5 chronic kidney disease. *Int J Endocrinol* 2014;1424-9.
2. Nigil-Haroon N, Anton A, John J, Mittal M. Effect of vitamin D supplementation on glycemic control in patients with type 2 diabetes: a systematic review of interventional studies. *J Diabetes Metabdisord* 2015;14:3-9.
3. American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabetes Care* 2012;35:S64-71.
4. Krul-PoelyH, Westra S, Ten, et al. Effect of vitamin D supplementation of glycemic control in patients with type 2 diabetes (SUNNY Trial): a randomized placebo-controlled trial. *Diabetes Care* 2015;38:1420-6.
5. Heshmat R, Tabatabaei-Malazy O, Abbaszadeh-Ahranjan, et al. Effect of vitamin D on insulin resistance and anthropometric parameters in type 2 diabetes; a randomized double-blind clinical trial. *Daru* 2012;20:10-7.
6. Pittas AG, Lau J, Hu FB, Dawson-Hughes B. The role of vitamin D and calcium in type 2 diabetes. A systematic review and meta-analysis. *J Clin Endocrinol Metab* 2007;92:2017-29.
7. Gallagher EJ, Le Roith D, Bloomgarden Z. Review of hemoglobin A(1c) in the management of diabetes. *J Diabetes* 2009;1:9-17.
8. Rohlfing CL, Wiedmeyer HM, Little RR, et al. Defining the relationship between plasma glucose and HbA(1c): analysis of glucose profiles and HbA(1c) in the Diabetes Control and Complications Trial. *Diabetes Care* 2002;25:275-8.
9. Manickam B, Neagu V, Kukreja S, Barenglots E. Relationship between HbA1c and circulating 25-hydroxyvitamin D concentration in African American and Caucasian American men. *Endocr Pract* 2013;19:73-80.
10. Zoppini G, Galletti A, Targher G, Brangani C, Pichiri I, et al. Glycatedhaemoglobin is inversely related to serum vitamin D levels in type 2 diabetic patients. *PLoS One* 2013;8:25-31
11. Holick MF, Binkley NC, Bischoff-Ferrari HA, et al. Evaluation, treatment and prevention of vitamin D deficiency: an Endocrine Society clinical practice guideline. *J Clin Endocrinol Metab* 2011;96:1911-30.
12. Kayaniyil S, Vieth R, Retnakaran R, Knight JA, et al. Association of vitamin D with insulin resistance and beta-cell dysfunction in subjects at risk for type 2 diabetes. *Diabetes Care* 2010;33(6):1379-81.
13. Forouhi NG, Luan J, Cooper A, Boucher BJ, et al. Baseline serum 25-hydroxyvitamin D is predictive of future glycemic status and insulin resistance: the Medical Research Council Ely Prospective Study 1990-2000. *Diabetes* 2008;57(10):2619-25.
14. Magge SN, Prasad D, Zemel BS, et al. *J Clin Transl Endocrinol* 2018;12:1-7.
15. Nwosu BU, Maranda L. The Effects of Vitamin D Supplementation on Hepatic Dysfunction, Vitamin D Status, and Glycemic Control in Children and Adolescents with Vitamin D Deficiency and Either Type 1 or Type 2 Diabetes Mellitus. *PLoS ONE* 2014;9(6):e99646.
16. Prakash P, Bansal MK, Gautam A, Raj A, et al. Effects of Vitamin-D Supplementation in Vitamin-D Deficient, near normal HbA1c diabetic patients. *Ann Applied Bio-Sci* 2016;3(2):A214-A217
17. Iqbal K, Islam N, Mehboobali N, Asghar A, Iqbal MP. Association of vitamin D deficiency with poor glycaemic control in diabetic patients. *J Pak Med Assoc* 2016;66(12):1562-5.
18. Green RT, Gambhir KK, et al. Maintenance of long-term adequate levels of vitamin d lowers HbA1c in African American patients with type 2 diabetes. *Ethn Dis* 2014;24(3):335-341.