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Vitamin D Effects on Glycated Hemoglobin (HbA1c) Level, And Their Correlation between Diabetic and Non Diabetic in Adults

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Abstract: **Background: There are several factors that seem to play a role in diabetes development including genetic, lifestyle, environmental and nutritional conditions. Amongst nutritional factors, vitamin D is likely to have an important role either in glycemic control or in attenuating diabetic complications. The probable mechanisms indicating the role of vitamin D in glucose homeostasis is likely to be through beta cell dysfunction and insulin resistance in cases with vitamin D deficiency. Objectives: the aim of this study was to determine the correlation between HbA1c and 25(OH) D and the involving of diabetic and non diabetic patients in these changes. This paper is attends to investigate the effect of Vitamin D on Glycated Hemoglobin (HbA1c) level. Method: We performed cross-sectional study that examined the effect of vitamin D on Glycated Hemoglobin (HbA1c) level in 184 Adult participants from diabetic and non diabetic patients attending King Fahad hospital in Jeddah during the years 2015. The average age was 42 years. The relation between diabetic and non diabetic patients effected by Vitamin D on Glycated Hemoglobin (HbA1c) level was modeled by statistical SPSS multiple linear regression analyses. Results: the rate of Vitamin D Deficiency among patients included in this study a very high percentage which is 82% of them have Deficiency amount of Vitamin D in this body which meant that they are under big risk of getting diabetes type 2. And the other shocking result is that only 2.2% which means 4 patients out of 184 having sufficient amount of Vitamin D, sadly this shows that our population is under risk of other skeletal disorders than diabetes. Conclusion: accumulating the evidence from several studies, vitamin D is likely to have a role in Diabetic and non diabetic patients and Hb-glycation. However, the relationship between serum 25OHD with hemoglobin glycation (HbA1c) and insulin resistance in Diabetes has not been extensively studied before, but we could not see any correlation in our study.**

Keywords: **vitamin D, glucose homeostasis, non diabetic, Glycated Hemoglobin (HbA1c), Diabetic.**

1. INTRODUCTION

Vitamin D is a fundamental micronutrient with significant ramifications for human wellbeing. Its deficiency has been accounted for to be an entirely basic finding in sort 2 diabetic patients (Holick MF et al, 2011). Human and creature thinks about have demonstrated a negative relationship between's serum levels of vitamin D and both serum glucose and insulin levels, though the connection with insulin affectability was positive (Palomer X et al, 2008). In diabetic and non diabetic subjects, a critical opposite relationship between glycated hemoglobin (A1C) and serum 25(OH) D levels has been watched (Hutchinson MS et al, 2011.)Vitamin D may improve glucose-stimulated insulin discharge in pancreatic β-cells, upgrade glucose and lipid digestion system in skeletal muscle (Rajakumar K et al, 2012), and enhance systemic irritation. HbA1 itself comprises of three distinctive glycations, the HbA1c subgroup being the most helpful, normally measured by isoelectric centering or electrophoresis. The glycation of hemoglobin happens at a variable (non-direct rate) after some time, amid the entire lifespan of the red platelet (RBC), which is ordinarily 120 days. This implies the relative extent of glycated hemoglobin at any one time depends on the mean glucose level over the previous 120 days (Reynolds TM et al, 2006). Plasma Haemoglobin A1c (HbA1c) reflects ambient mean glycaemia over a 2-3 months period. Reports indicate that patients, with and without diabetes, with an elevated HbA1c have an increased risk of adverse outcome following surgical intervention (O'Sullivan CJ et al, 2006). Although HbA1c testing is mainly used for monitoring blood sugar control in patients with diabetes, the World Health Organization (WHO) now recommends that HbA1c can be used as a diagnostic test for diabetes, provided that stringent quality assurance tests are in place and assays are standardised to

criteria aligned to the international reference values. An HbA1c of 48 mmol/mol (6.5%) is recommended as the cut-off point for diagnosing diabetes. A value less than 48 mmol/mol (6.5%) does not exclude diabetes diagnosed using glucose tests. One advantage of using HbA1c for diagnosis is that the test does not require a fasting blood sample (World Health Organization, 2011).

2. OBJECTIVES

A correlation between glucose control (HbA1c) and 25 (OH) Vitamin D metabolism has been suggested by previous studies. However, this correlation has not yet been evaluated considering the impact of chronic complications on diabetic and non diabetic patients; Thus, the aim of this study was to determine the correlation between HbA1c and 25(OH) D and the involving of diabetic and non diabetic patients in these changes. This paper is attends to investigate the effect of Vitamin D on Glycated Hemoglobin (HbA1c) level.

3. METHODS AND MATERIALS

An observational cross-section study including 184 all patients were adults to elderly visiting King Fahad hospital in Jeddah in the year of 2015 All participants performed the baseline test to show the vitamin D level and HbA1c. Authors divided those patients into two groups, diabetic and non diabetic patients.

Finally SPSS 16.0 (SPSS version 16.0, SPSS Inc. Chicago, IL, USA) package was used in statistical analysis of collected data. For the better assessment through SPSS, must put the data into groups as following HbA1c into categories that include good glycemic control (HbA1c ≤ 7 %), moderate glycemic control (HbA1c 7.1 - 9 %), poor glycemic control (HbA1c > 9%). and this study has divided the participants into three groups too according to their vitamin D levels in their bodies. and these groups are first (Vitamin D deficiency), who is their level of vitamin D less than 30 nmol/L,. second group (insufficient Vitamin D level), those who is having the level of vitamin D between the ranges of 30-49 nmol/L, Patients, who had the level of vitamin D ≥50 nmol/L, were included in third group sufficient (Vitamin D level in blood).

4. RESULTS

This study was cross sectional observation of 184 patients more than 66% of those patients were above the age of 30 years old 32% of them already above 50 years old as it shows in Table1.

Table1.

Age Group

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	elderly	60	32.6	32.6	32.6
	Mature Adults	61	33.2	33.2	65.8
	Adolescent	9	4.9	4.9	70.7
	Young Adults	54	29.3	29.3	100.0
	Total	184	100.0	100.0	

From the result showing the rate of Vitamin D Deficiency among patients included in this study a very high percentage which is 82% of them have Deficiency amount of Vitamin D in this body which meant that they are under big risk of getting diabetes type 2. And the other shocking result is that only 2.2% which means 4 patients out of 184 having sufficient amount of Vitamin D, sadly this shows that our population is under risk of other skeletal disorders than diabetes, Table 2.

Table2.

Vitamin D Level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Deficiency	152	82.6	82.6	82.6
	Insufficient	28	15.2	15.2	97.8
	Sufficient	4	2.2	2.2	100.0
	Total	184	100.0	100.0	

HbA1c can be used as a diagnostic test for diabetes, provided that stringent quality assurance tests are in place and assays are standardized to criteria aligned to the international reference values, and there are no conditions present which preclude its accurate measurement. An HbA1c of 7% is recommended as the cut point for diagnosing diabetes. A value less than 7% does not exclude diabetes diagnosed using glucose tests. The expert group in WHO concluded that there is currently insufficient evidence to make any formal recommendation on the interpretation of HbA1c levels below 7%. And as we can see in Table3, more than 80% are between the ranges of 7% to 9% which is a good glycimic control, and only 4.3% are in a very poor control, which may give a sign that they are diabetic excluded.Table3.

Table3.

HbA1c

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	good control	148	80.4	80.4	80.4
	moderate	28	15.2	15.2	95.7
	poor	8	4.3	4.3	100.0
	Total	184	100.0	100.0	

In the present study we confirmed a significant inverse correlation between HbA1c and serum 25(OH) D levels, a good indicator of vitamin D status. We also reported that this significant inverse relation persisted in the multivariate analyses: HbA1c was a significant predictor of serum 25(OH) D levels independently of age, as we could have observe in this study that 30 out of 184 patients from the elderly group aged above 50 years old, having HbA1c in good control range (7% - 9%) in the deficiency level of vitamin D amount in the body. so without considering the age of patients there are 120 patients of the 184, in a good control of HbA1c and in the Deficiency amount of Vitamin D, which give us a very high avoidance about the effect of Vitamin D level in the body to the Hba1c level and that could give us the conclusion that these two parameters are in a big correlation with the diabetes incident Table 4.

Table4.

HbA1c , Vitamin D Level , Age Group (Correlation)

			Vitamin D Level			
Age Group			Deficiency	Insufficient	Sufficient	Total
Elderly	HbA1c	good control	30	10	2	42
		moderate	10	0	1	11
		poor	7	0	0	7
	Total		47	10	3	60
Mature Adults	HbA1c	good control	40	8	1	49
		moderate	10	1	0	11
		poor	1	0	0	1
	Total		51	9	1	61
Adolescents	HbA1c	good control	8			8
		moderate	1			1
	Total		9			9
Young Adults	HbA1c	good control	42	7		49
		moderate	3	2		5
	Total		45	9		54
Total	HbA1c	good control	120	25	3	148
		moderate	24	3	1	28
		poor	8	0	0	8
	Total		152	28	4	184

Diabetes and lesser forms of glucose intolerance, impaired glucose tolerance (IGT) and impaired fasting glucose (IFG), can now be found in almost every population in the world and epidemiological evidence suggests that, without effective prevention and control programmes, the burden of diabetes is likely to continue to increase globally.

5. DISCUSSION

WHO has published several guidelines for the diagnosis of diabetes since 1965. Both diagnosis and classification were reviewed in 1999 and were published as the guidelines for the Definition, Diagnosis and Classification of Diabetes Mellitus (World Health Organization, 1999). The potential utility of HbA1c in diabetes care is first mentioned in the 1985 WHO report. The relationship between HbA1c and prevalent retinopathy is similar to that of plasma glucose, whether glucose and HbA1c are plotted in deciles. This relationship was originally reported in the Pima Indians and has also been observed in several other populations including Egyptians, the NHANES study in the USA in Japanes. Overall, the performance of HbA1c has been similar to that of fasting or 2-h plasma glucose. For all three measures of glycaemia, the value above which the prevalence of retinopathy begins to rise rapidly has differed to some extent between studies. Although HbA1c gives equal or almost equal sensitivity and specificity to glucose measurement as a predictor of prevalent retinopathy, it is not available in many parts of the world and in general, it is not known which is the better for predicting microvascular complications. The increasing incidence of T2DM is taking a great toll of health resources. This has laid a number of research studies related to life style, environmental and nutritional factors in an attempt to ameliorate its burden, the diverse effect of vitamin D on glucose and calcium homeostasis (Luo C et al, 2009), recently observed a transient improvement in glycemia in T2DM with oral D3 supplementation without change in either HbA1c or beta cell function and concluded that high dose D3 has a little or no therapeutic benefit. A similar study from UAE (A Sadiya A et al, 2014) has also reported no significant change in HbA1c levels after six month of supplementation with vitamin D3 in vitamin D-deficient obese Diabetes patients of Emirati population.

6. CONCLUSION

Though vitamin D deficiency is prevalent in Diabetes Mellitus and non- diabetic control subjects, its relationship in glycation control or insulin resistance in DM subjects could not be confirmed in this study population. but it's a very important aspect of life to demonstrating that improvement in vitamin D status is not the only factor responsible for better health of the individuals but lifestyle and dietary changes seem to play a role which will improve the overall health including hemoglobin glycation and insulin resistance along with vitamin D levels.

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