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Research Article

EFFECT OF VITAMIN D3 SUPPLEMENT IN GLYCOSATED HEMOGLOBIN OF PEDIATRICS WITH TYPE 1 DIABETES MELLITUS IN TOBRUK MEDICAL CENTER LIBYA

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Abstract

Type1 diabetes mellitus is accounting for around 10% of all cases of diabetes mellitus. Insulin production is hampered by vitamin D insufficiency, which leads to glucose intolerance. The goal of the trial was to see if vitamin D intake had an effect on HbA1c in children with type 1 diabetes and vitamin D deficiency. In 56 patients with type 1 diabetes mellitus, a prospective non-blind, non-randomized clinical investigation was done. Between January 2021 and June 2021, these patients were recruited through Tobruck Medical Center's Diabetes Clinic. We assessed blood Vit D, Ca, and HbA1c in diabetic children with type I DM who had not previously received vitamin D, and then measured it again after 12 weeks of vitamin D delivery. We divided the youngsters into two groups: baseline before vitamin D administration and follow-up after 12 weeks of vitamin D administration. After 12 weeks of vitamin D administration, we noticed a significant improvement in HbA1c. As a result, with a p-value of ‹0.005, there is a significant strong association between vitamin D supplementation and HbA1c level in type I diabetic children. After vitamin D administration, we saw dramatic control and a decrease in HbA1c.

Keywords: Type I diabetes mellitus, vitamin D, HbA1c, blood sugar, pediatrics.

INTRODUCTION

Diabetes mellitus (DM) is a set of metabolic illnesses marked by hyperglycemia caused by a deficiency in insulin secretion, action, or both. Diabetes-related chronic hyperglycemia is linked to long-term damage, dysfunction, and failure of various organs, particularly the eyes, kidneys, nerves, heart, and blood vessels (ADA, 2012). Apart from its established involvement in bone mineralization and calcium homeostasis, there is now significant data supporting vitamin D's activities in immunity and inflammation, as well as immune cells' production of nuclear vitamin D receptors (VDR) and hydroxyls enzymes. (Hughes and Nortas, 2009).This discovery has prompted a surge of study on the role of vitamin D in maintaining immunological homeostasis and preventing the onset of auto-immune diseases such as diabetic mellulitis (Hughes and Nortas, 2009). In humans, vitamin D deficiency increases the risk of type 1 diabetes by impairing insulin production and causing glucose intolerance. Vitamin D supplementation, on the other hand, has been demonstrated to minimize the incidence of type 1 diabetes and its consequences by halting the decline of pancreatic function and improving c-peptide levels (Mathieu *et al.,* 2005). Deficiency in vitamin D inhibits insulin secretion and leads to glucose intolerance. Vitamin D [25OH)2 D3 and its analogues reduce IL-1 or (IFN-)-induced suppression of Beta-cell function (insulin production and secretion) in vitro (Bouillon *et al.,* 2008). Vitamin D deficiency has been linked to hyperglycemia, elevated HbAIc, insulin resistance, diabetes development, hypertension, and cardiovascular disease, according to research (Penckofer *et al.,* 2008). Vitamin D treatment reduces autoimmunity, improves tolerance, and encourages islet beta cell regeneration (Seshadria *et al.,* 2011).

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This encouraged us to look into the effect of vitamin D intake on HbA1c and glycemic control in type 1 diabetes patients with vitamin D insufficiency in the pediatric age group, which had never been done before on Libyan diabetic children.

METHODS

A prospective, non-blinded, and non-randomized clinical controlled trial was done to see if vitamin D treatment could help individuals with type 1 diabetes control their blood sugar levels. A total of 56 patients with type 1 diabetes mellitus were studied out of a total of 68. Between January 2021 and June 2021, these patients were recruited through the Tobruk Medical Center's Diabetes Clinic. Patients with type 1 diabetes mellitus were enrolled in the study, as were children with vitamin D deficiency (25OHD< 50 nmol/lit) who were given a single injection of 300,000 units of intramuscular vitamin D3. Children with sufficient vitamin D are given an orally preventive dose according on their age because they do not get enough sun exposure. After the vitamin D injection, a calcium supplement (40mg/kg/day) was given orally to avoid hungry bones .The levels of glycosylated hemoglobin and 25-hydroxyvitamin D were tested at the start and after 12 weeks. Eligible patients were aged from 1- 16 years old, had type 1 diabetes mellitus. Type II diabetes, secondary diabetes, hepatic or renal disease, metabolic bone disease, malabsorption, malignancy, and children with any cause other than TIDM that can affect serum vitamin D levels were excluded from the study. Twelve children were excluded from a total of 68 due to a lack of compliance and follow-up. Prior to their inclusion, all youngsters and their parents gave their verbal agreement. We employed a well-designed questionnaire that was completed entirely by the author. The questionnaire contained demographic information about the children, such as their age, gender, nationality, and place of residence, as well as anthropometric measurements such as weight, height, and body mass index (BMI), which is computed as weight (kilograms) divided by height squared (square meters). WHO uses BMI, which classifies people as overweight or obese if their BMI is between 85 and 95 percentiles (Bogin, 2009).We assessed serum vitamin D, calcium (Ca), and HbA1c in diabetic children with type I DM who had not previously received vitamin D, and then evaluated it again after 12 weeks of vitamin D delivery. As a result, we divided the youngsters into two groups: baseline before vitamin D administration and follow-up after 12 weeks of vitamin D administration. We further split the patients into two groups (<25 & ≥ 25) based on their vitamin D levels, and three groups (<7.8, ≥7.8-9.9, and >9.9) based on their glycosated hemoglobin levels. A competitive protein binding assay was used to determine the serum level of 25(OH)D. Vitamin D deficiency was defined as serum 25-OHD levels less than 50 nmol/L, whereas severe vitamin D deficiency was defined as values less than 25 nmol/L(Holick MF, 2007&Aljabri KS, 2010).The amount of glycosylated hemoglobin in the blood was determined using high-performance liquid chromatography. Calcium levels in the blood were determined using standard laboratory chemistry.

Statistical Analysis

Chi square (X2) test were used for categorical data comparison. For the correlations between HbA1c and vitamin D level. All statistical analyses were performed using SPSS Version 17.0. The difference between groups was considered significant when $p < 0.05$.

Limitation: The study's limitations included the limited sample size and the fact that it was conducted in only one clinic; also, some patients were lost due to a lack of compliance and the number was 12 patients lost in follow up.

RESULTS

Age of studied children range (1-16 years old) with mean 9.56± 3.56 SD, BMI (12.30- 32.20) with mean 18.21±4.50 and WT range (8.5-59 kgs) with mean 30.78 ± 12.44. Gender nearly equal with 29 females (51.8%) and 27 males (48.2%), most of children were Libyan 95%, 68% from Tobruk city and the rest from outside Tobruk.

Table 1. Demographic data of children

Variables	Categories / Mean+-SD	Number/ Range	Percentage %	Total
Age	18.21± 4.50	1-16yr		
Weight	30.78 ± 12.44	8.5-59 kg		
BMI	18.21± 4.50	12.30- 32.20		
Gender	Female	29	51.8	56
	Male	27	48.2	
Nationality	Libyan	53	94.6	56
	Non Libyan	3	5.4	
Residence	Tobruk	38	67.9	56
	outside Tobruk	18	32.1	

We note when divided the children into two groups sever vitamin D deficient ≤25nmol/L and deficient > 25 &<50 nmol/L, most of studied children in this study were sever deficient 43 with vitamin D mean 15.45 nmol/L, only 11 child classified as deficient with mean 34.18 nmol/L and two child sufficient but after vitamin D supplementation only one child become severely deficient.

Table 2. Distribution of basal data of studied children

Results of Vitamin D Level groups			
Parameters	≤25	>25	P-value
No	43	13	
Male/female ratio	(18/25)	(9/4)	.000
Age	10.27	7.25	.006
BMI	18.5272	17.1462	.167
Ca	8.5395	8.6538	.486
HbA1c	11.5674	10.4692	.075

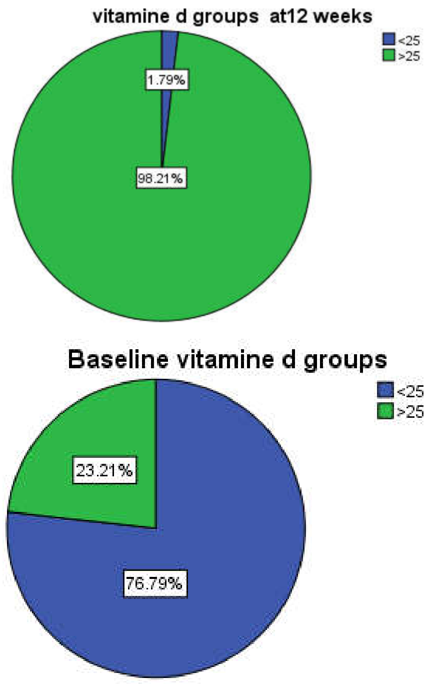

Figure 1. classification of children according to Vit D level (sever deficient ≤25nmol/L& deficient> 25 but <50nmol/L)

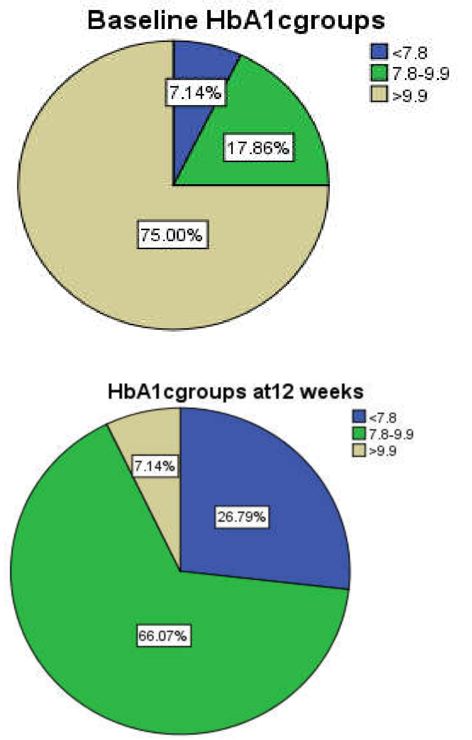

Figure 2. HbA1c before and after vitamin D supplementation

Table 3. Laboratory data of children with type IDM

Variables		N	Minimum	Maximum	Mean	Std. Deviation
Baseline	Vitamin D	56	5.00	51.50	19.80	10.17
	HbA1c	56	7.10	15.00	11.31	1.95
	Ca	56	7.00	9.40	8.57	0.51
	Mean Vit D ≤25	43	5.00	24.60	15.45	5.50
	Mean Vit D >25	13	25.70	51.50	34.18	8.73
Follow up (at 12 weeks	Vitamin at 12 weeks	56	23.00	66.00	46.95	8.59
	Ca at 12 weeks	56	5.20	10.30	8.45	1.26
	HbA1c at 12 weeks	56	7.00	9.10	7.87	0.37
	Mean Vit D≤25	1	23.00	23.00	23.00	-
	Mean Vit D >25	55	27.40	66.00	47.39	8.02

As figured in figure (2) 75% of children at presentation with high HbA1c > 9.9%, while after Vit D supplementation only 7% with HbA1c > 9.9% and most of children with HbA1c < 9.9.

Table 4. Correlation betweenvitamin D andHbA1c at 12 weeks

Correlations at 12 weeks		
		Vitamin d at 12 weeks
HbA1c at 12 weeks	Pearson Correlation	.006
	Sig. (2-tailed)	.964
	N	56

We found there is significance correlation between vitamin D level and HbA1c in type I diabetic children with p-value: 0.006.

Table 5. Correlation between vitamin D, HbA1c before and after vitamin D administration

Parameters	Baseline		After 12 weeks		P-value
No	56		56		
	Mean	Std Deviation	Mean	Std Deviation	
VIT D	19.7964	10.17155	46.9536	8.58741	0.000
Hba1c	11.3125	1.95272	8.4500	1.25785	0.000

We found there is marked improving in HbA1c after 12 weeks of vitamin D supplementation and increasing in serum level of vitamin D in studied children with type I DM. So there is significance strong correlation between vitamin D supplementation and level and HbA1c level in type I diabetic children with p-value: 0.000

DISCUSSION

The goal of this study is to see how vitamin D intake affects HbA1c and glycemic control in children with type 1 diabetes. And our first observation was a significant improvement in HbA1c following 12 weeks of vitamin D treatment, as well as an increase in vitamin D serum levels in the children we evaluated. So, with a p-value of ‹0.005, there is a significant strong association between vitamin D supplementation and HbA1c level in type I diabetic children. This is completely in agreement with (Sakineh Mohammadi1 *et al.,* 2015) and (Aljabri, 2010).

Vibhor (2010) found a similar result when he tested serum vitamin D levels in diabetic patients (T1DM) and found that diabetics had considerably lower serum vitamin D levels than control people. Treatment with vitamin D3 improves glycemic control in patients with type 1 diabetes mellitus, according to this study. Furthermore, vitamin D3 supplementation improves HbA1C levels. The addition of vitamin D3 to insulin therapy improves glycemic control significantly, according to a study. This benefit on glycemic control lasted for 12 weeks, but we don't know if it would last longer. According to the Aljabri study, higher levels of 25OHD were associated with improved glycemic control (Aljabri KS, 2010). When vitamin D levels are boosted from 25 to 75 nmol/L, insulin sensitivity improves by as much as 60%, according to (Pittas, 2007) Glycemic control was observed to deteriorate in three Asian patients following vitamin D administration in one trial, however these patients were given vitamin D2 rather than vitamin D3. Certain vitamin D receptor genotypes are important drivers of insulin secretory capability in distinct ethnic groups, and vitamin D2 has multiple unknown metabolites with unknown effects (Ogunkolade, 2002; Scragg, 2004). It's worth noting that we only had 56 children with type 1 diabetes, whereas Aljabri's study included 88 children and adults. The effect of vitamin D on glycemic management was not affected by age or gender in Aljabri's study. While in our study, we discovered that males have a higher level of vitamin D deficiency than females, with a p value of 0.00, and that the effect of vitamin D on glycemic control varies by age.

- The study's limitations included the limited sample size and the fact that it was conducted in only one clinic. Additionally, some patients were lost owing to a lack of follow-up and a short follow-up period, and our study did not take into account the children's sun exposure time or food history.We urge that future studies have a high sample size and involve multicenter research. And suggest that a similar study be conducted on type 2 diabetes .Also, all diabetic children with type I DM should have their vitamin D3 levels checked on a regular basis.

Conclusion

In conclusion, our research found that; the majority of children with type I diabetes had a statistically significant lower mean serum vitamin D level. Dramatic control and drop in HbA1c after vitamin D supplementation and improved vitamin D level. Finally, diabetes is one of the world's fastest-growing chronic diseases. Vitamin D insufficiency is prevalent, and supplementation may help type 1 diabetes patients maintain better glycemic control.

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