JKBMS, Vol.3, No.1, P.19-25, 2017 https://doi.org/10.56056/amj.2017.19

Vitamin D status in type 1 diabetic children in Erbil city: a case-control study

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Abstract

Background and objectives: Worldwide clinical studies suggest a relationship between vitamin D deficiency in early life and the later onset of type 1 diabetes mellitus. The aim of the study was to find out the association between vitamin D and type one diabetes mellitus. **Methods:** A case-control study carried out in Erbil city-Kurdistan region over a period from January-June 2016. It included 50 cases of type 1 diabetes mellitus aged less than 16 years collected in Layla Qasim center of diabetes in Erbil and 50 non-diabetic children whom attended pediatrics hospital with their relatives. The study matched the age, gender and ethnicity of both groups. Their health status was assessed by BMI, school performance and investigating for vitamin D, alkaline phosphatase, HbA1C, Calcium and parathyroid hormone. **Results:** our study found that there is a highly significant difference between type 1 diabetic and healthy subjects regarding the level of vitamin D3 ($P < 0.001$). The mean age of diabetic patients and the control group were (9.48±4.4) years and (8±3.36) years consecutively. Most of the diabetic patients (62%) had vitamin D deficiency, (38%) were insufficient. While only (12%) of the control had vitamin D deficiency and (88%) were insufficient. Among diabetics also, there was highly significant, moderately negative correlation between age and the vitamin D level (r^o= -0.369&P<0.008) as well as a similar significant, moderately negative correlation was evident between BMI and vitamin D level (r^o= -0.347&P<0.014). A non-significant, mildly negative correlation is found between glycemic control and the level of vitamin D (r^o= -0.104&P<0.474). The last significant mildly negative correlation was between vitamin D and PTH as (r^o=- 0.285&P<0.045). **Conclusions:** the present study revealed markedly decreased level of vitamin D among T1DM patients compared to healthy children.

Keyword: Type 1 diabetes mellitus; Vitamin D3; PTH

Introduction

Type 1 diabetes mellitus is an auto immune disease in which the pancreas is un-able to respond to secretagogue stimulation with appropriate insulin secretion. Hyperglycemia develops when more than 70-90% of the insulin-producing beta cells are destroyed. An auto-immune destructive process, which plays a central role in the development of type 1 diabetes mellitus, is facilitated by subject's own genetic susceptibility and the non-genetic factors. Non-genetic factors include viral infections, toxic chemicals and others. Vitamin D deficiency is a non-genetic factor that appears to be associated with an increased risk of developing type 1 diabetes mellitus[1].The major source of vitamin D for children and adults is exposure to natural sunlight[2-6]. A major cause of vitamin D deficiency is inadequate exposure to sunlight[3, 7-9]. Wearing a sunscreen with a sun protection factor of 30 reduces vitamin D synthesis in the skin by more than 95% 10. People with a naturally dark skin tone have natural sun protection and require at least three to five times longer exposure to make the same amount of vitamin D as a person with a white skin tone[11-12]. There is an inverse association of serum 25(OH) D and body mass index (BMI) greater than 30 kg/m^2, and thus, obesity is associated with vitamin D deficiency[13]. There is strong epidemiological data showing that the population in countries with high prevalence of type 1 diabetes mellitus is commonly vitamin D deficient. Vitamin D supplementation during pregnancy decreased the risk of development of type 1 diabetes mellitus for offspring[14]. Supplementation of vitamin D at an early age also decreases the risk of developing diabetes mellitus type 1.Children with suspected rickets had a 3 fold increased risk of developing insulin-dependent diabetes mellitus[15]. Vitamin People with a naturally dark skin tone have natural sun protection and require at least three to five times longer exposure to make the same amount of vitamin D as a person with

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Materials and Methods

This is a case-control study between two groups, fifty patients having type one diabetes mellitus collected from Layla Qasim center of diabetes in Erbil (group one, cases) and other fifty healthy children who attended Raparin pediatric hospital with their relatives (group two, control) over a period from January till June 2016. Regarding the control group, children less than one year of age; more than 16 years old and those who already were on vitamin D therapy, patients with renal insufficiency, those with chronic liver disease, those with history of epilepsy and on phenytoin therapy, and those with chronic malabsorption all are excluded in this study. The diabetic patients were on their center guideline insulin regimen and follow up. Face-to-face interviews with the parents were based on a well-prepared questionnaire that included all related factors including socio-demographic information, exposure to sunlight, onset of diabetes, dietary habits. Health status is assessed in both groups by measuring body mass index, school performance, vitamin D3 level, alkaline phosphatase level, HbA1C level, Calcium and parathyroid hormone. All investigations were done in Raparin hospital, and the maximum time between sample collection and theanalysis was one hour. After labeling each sample tube, serum is separated and processed by using (cobas e 411) of Roche company for the detection of Vitamin D3, parathyroid hormone. Serum vitamin D3 level is sub-divided into three categories, deficient (10 ng/ml), insufficient (10-20 ng/ml), and sufficient if (20 ng/ml)[17]. Serum calcium level (9.5-10.6 mg/dl)[18], serum alkaline phosphatase (30-130U/L)[19], parathyroid hormone (15-65 pg. /dl)[20], HbA1c in the meaning of diabetic control (7-9) % and the target level of 7.5% or less[21].Data were processed and analyzed using the statistical package for social sciences (SPSS, version20). Chi-square test for association was used to compare between proportions. Student's t-test was used to compare between two means. Pearson correlation coefficient was used to measure the strength of correlation between numerical variables. P-value of less than 0.05 was considered as statistically significant.

Results

Our study revealed that there is a highly significant difference between type 1 diabetic patients and healthy children regarding the level of vitamin D3 ($P < 0.001$). Table 1 illustrates that the mean level of vitamin D in the diabetic group was nearly half its mean level in the control group.

Table (1): Vitamin D status in Diabetic group versus control group

Study group	Number of patients	Mean ± SD	P. Value
Control group	50	20.3 ±8.2	<0.001
Diabetic group	50	10.6 ±8.3	

Also the study showed that there is a negative correlation between vitamin D level and the advance in age in both healthy & diabetic children respectively. It revealed that both groups exhibit lower levels of vitamin D in older children & adolescents than younger children. But the nadir level of vitamin D in young age children is much lower in the diabetic group than that of healthy group as shown in Figure 1 and 2 below.

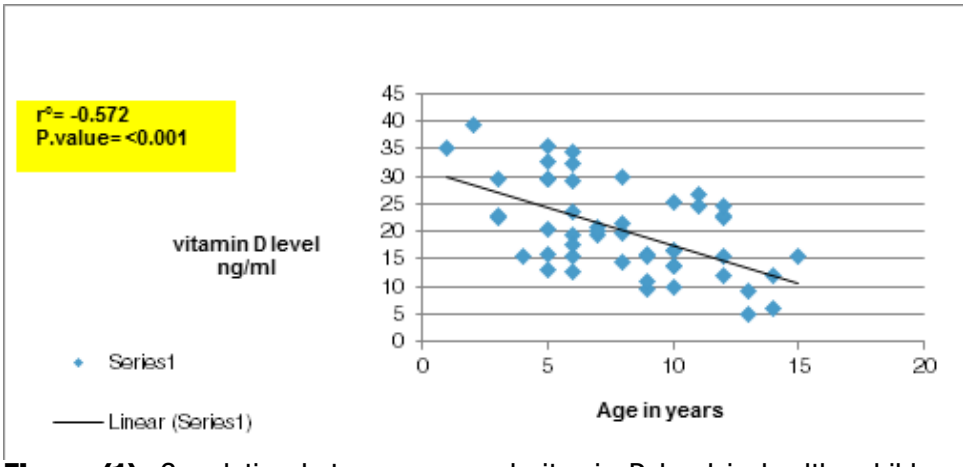

Figure (1): Correlation between age and vitamin D level in healthy children.

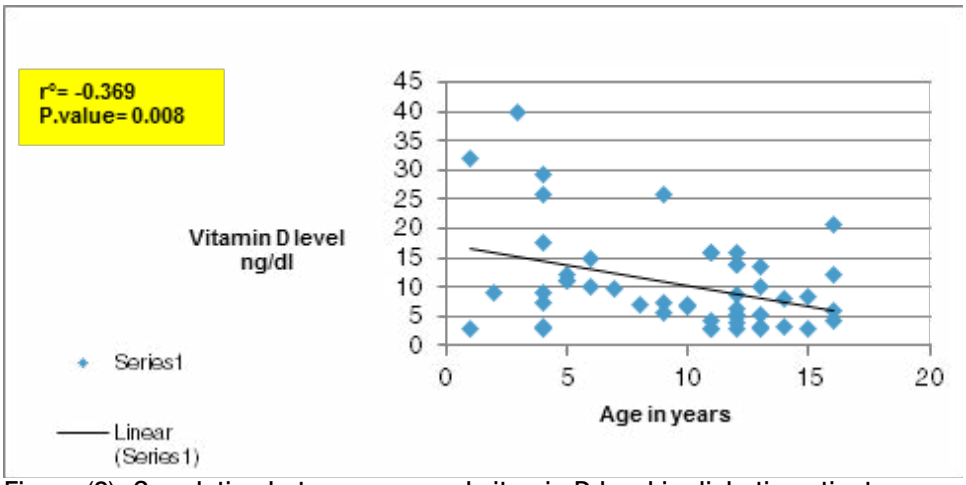

Figure (2): Correlation between age and vitamin D level in diabetic patients.

Remarkable variation is observed between the two groups regarding how much percent had deficient or insufficient vitamin D3 Figure 3.

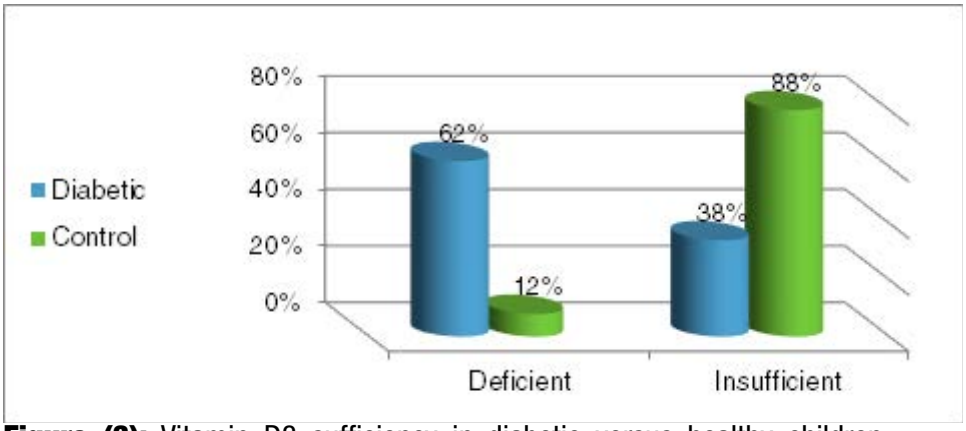

Figure (3): Vitamin D3 sufficiency in diabetic versus healthy children

Also in this study, both diabetic and the healthy groups showed a negative correlation between the level of vitamin D3 & body mass index. But this negative correlation was weaker and non-significant in the healthy children compared to the diabetic patients. These correlations are illustrated respectively in figure 4 and Figure 5 below.

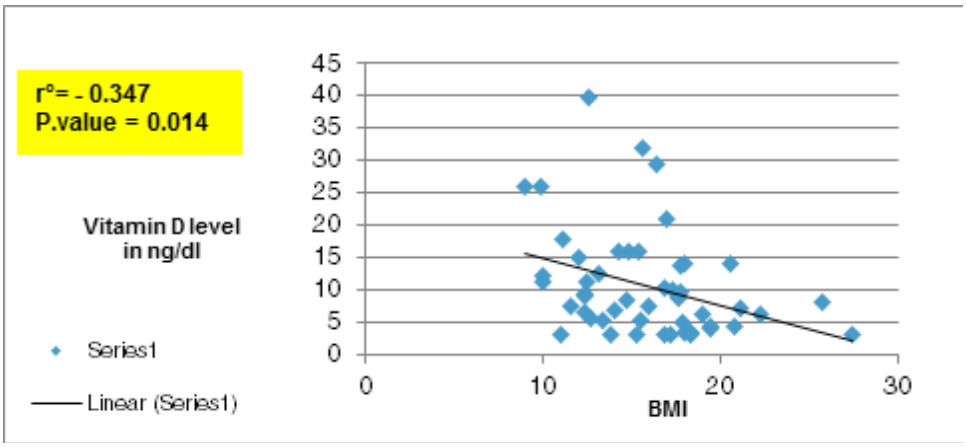

Figure (4): Correlation between BMI & vitamin D level in diabetic patients.

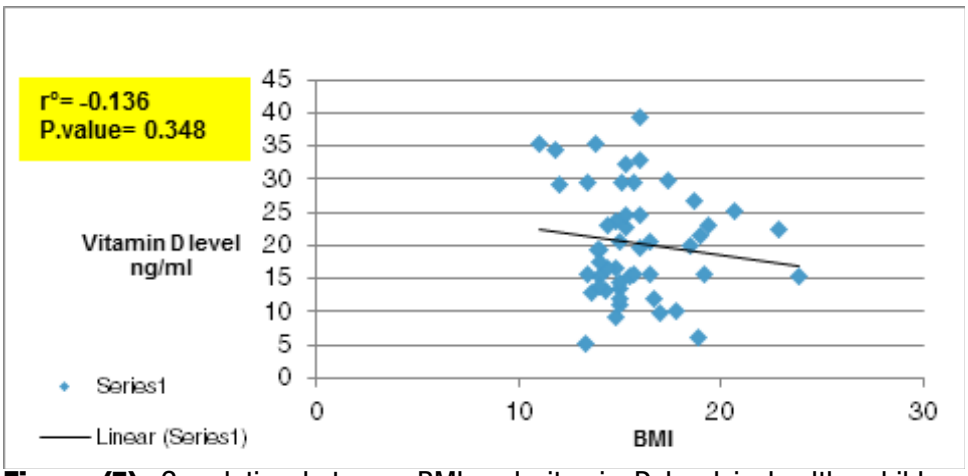

Figure (5): Correlation between BMI and vitamin D level in healthy children

In our study there was non-significant relationship between HbA1C & vitamin D3 level within the Diabetic group (p=0.349) as demonstrated in Figure 6.

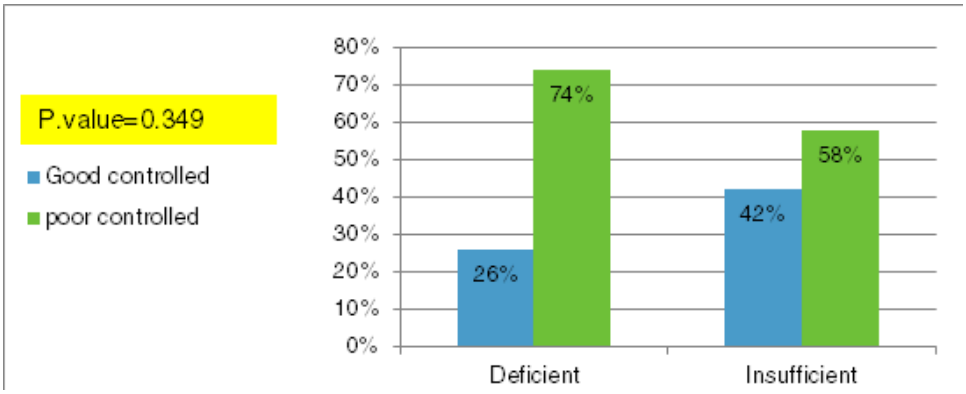

Figure (6): Glycemic control and its relationship with vitamin D sufficient

Discussion

Study showed that serum vitamin D3 is significantly lower in children with T1DM than in healthy children with a P value of <0.001, this is agreed with previous worldwide studies[22-23]. Moreover, another factor that makes this relation stronger is that the diabetic patients has lower levels of vitamin D during the years after diagnosis of Diabetes and bone density is lower in type one diabetic patients than in normal populations[24-25]. Another possible mechanism is that vitamin D may have direct effects on B-cells, including improving insulin secretion, enhancing expression of vitamin D receptors and improving islet morphology[26]. Our study also agrees with Littorin ET al[27].who found that[25]-hydroxyvitamin D was lower in patients with type one diabetes mellitus compared with control group whether they are recently diagnosed or after years of diagnosis. This finding may support the idea that vitamin D deficiency may be an important factor behind the development of type one diabetes, perhaps with an immunological background[14, 28-31] Also, it was lower after years of diagnosis of type one diabetes and this was in agreement with Svoren et al[32], and Bin-Abbas et al[33]. This study showed that 34 % of type one diabetic patients were 25-hydroxy vit.D insufficient and 66 % were deficient. In comparison to our results, Bener et al[34].found that 90.6 % of diabetics versus 85.3 % of nondiabetics are vitamin D deficient and in northeastern US, it had been found that 15 % of type one diabetes were 25-hydroxyvitD deficient versus 61 % insufficient[35].Furthermore, Janner et al[36].found 60.5 % of diabetic children were vitamin D deficient. Both of our studied groups showed a negative correlation between (age and vitamin D_3 level) also (BMI and vitamin D_3 level). However, this correlation was more significant and further negative among the diabetic group than among the healthy children. These results disagreed with Mao et al[37].Lastly. In our study there was a non-significant corelation between 25-hydroxyvit D sufficiency and HbA1C (p=0.349); this findings agreed with Littorin et al[27].who found that there was non-significant correlation between 25-hydroxy vitamin D levels and HbA1C, this indicates that the diabetic state per say is a reason for low 25hydroxyvitD levels and is not secondary to any hyperglycemic or insulin-resistant state.

Conclusions

Considering the findings in the study, we can say that vitamin D_3 in type 1 diabetic patients is considerably lower than the healthy group. Thus, it is reasonable to think that vitamin D_3 deficiency probably been a remarkable trigger factor to develop type one diabetes mellitus.

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