RESEARCH ARTICLE

PREVALENCE OF VITAMIN D DEFICIENCY IN TYPE 1 DM A CONTROL CROSS SECTIONAL STUDY HELD IN MIDDLE AND WEST REGIONS OF SAUDI ARABIA.

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Abstract

This study compares the prevalence of Vitamin D deficiency in pediatric patients of type 1 diabetes mellitus in the central and western regions of Saudi Arabia with children having no type 1 diabetes mellitus.

Research Methods: A control cross sectional study conducted in Al-YamamahHospital (Central Saudi region) and Hera General Hospital (Western region). New cases or known cases of type 1 diabetes were recruited in the outpatient clinic and measurement of blood Vitamin D level, PTH, Ca, Phosphorous and Alkaline phosphatase were done.

Result: The study showed that among type 1 diabetic patients, 71.1% were severely Vitamin D deficient, 20.6% were moderately Vitamin D deficient, 8.1% were mildly Vitamin D deficient and 0.2% had normal Vitamin D levels. In the control group, 42% were severely Vitamin D deficient, 18.8% were moderately Vitamin D deficient, 8.7% were mildly Vitamin D deficient and 30.4% had normal Vitamin D levels. So overall nearly 100% of the children with Type 1 Diabetes Mellitus were deficient for Vitamin D as compared to 69.5% of the control children.

Conclusion: Vitamin D levels must be done for every child that has proven Type 1 diabetes mellitus (T1DM). This will ensure early detection of Vitamin D deficiency and proper management. This will ultimately yield a better outcome and prognosis.

Introduction:

Diabetes mellitus is a common disease and is especially prevalent (almost as an epidemic) in the Middle Eastern countries. Many researchers have been highlighting the association of Type 1 diabetes and Vitamin D deficiency. Vitamin D is known to regulate the functions of over 200 genes in our body and is essential for growth and development. (1).

Type 1 diabetes mellitus (T1DM) is the most commonly diagnosed type of DM in children and adolescents. It usually presents with symptomatic hyperglycemia and implies the immediate need for exogenous insulin replacement. (2).

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Vitamin D3 is a fat soluble vitamin required for normal growth of all tissues originating from the ectoderm (e.g. bone, teeth, hair and skin). This is especially evident in children. Vitamin D deficiency can result in manifestations of rickets in children and osteomalacia in adults.

The main source of Vitamin D is sun exposure through skin synthesis under the action of ultraviolet irradiation of ergosterol (D1) transferred to a crystalline compound called ergocalciferol (D2) and cholecalciferol (D3) which is formed in our body. Vitamin D is described as “the Sun Vitamin”. It is a steroid with hormone like activity. Minor sources of Vitamin D come from dietary sources such as oily fish, meat and egg. Until 1980, the role of Vitamin D in the functioning of the immune system was unknown.

In recent years an effort has been made to understand possible non-calcemic roles of Vitamin D, including its role in the immune system, particularly on T cell-mediated immunity. Vitamin D receptors are present in significant concentrations in the T lymphocyte and macrophage populations. However, there highest concentration were found in the immature immune cells of the thymus and the mature CD-8 T lymphocytes. The significant role of Vitamin D compounds as selective immune suppressants is illustrated by their ability to either prevent or markedly suppress animal models of autoimmune disease. Results show that 1.25 dihydroxyvitamin D3 can either prevent or markedly suppress experimental autoimmune encephalomyelitis (3, 4).

The incidence of diabetes is increasingly approaching an epidemic population in many countries including Saudi Arabia. There was a study done in 2010 in the Saudi province of Dhahran among a population of children younger than 15 years from the period of 1990-2007. Results showed an increase in the rate of diabetic patient from 18.05 per 100,000/year in the first 9 years to 36.99 per 100,000/year in the next 9 years. (5)

**Research Methodology:**

From a control cross-sectional study of all samples collected from Al Yamamah Hospital OPD as well as Hera General Hospital OPD, we selected a sample of Saudi patient type 1 diabetes to measure their total Vitamin D3 level in the blood. This laboratory investigation was done in two hospitals of different regions in Saudi Arabia, the first one was in Al Yamamah Hospital in Al-Riyadh which is the capital of Saudi Arabia and marked by high temperatures during the day and low temperatures at night. Most of the country follows the pattern of the desert climate with very hot weather especially in Jun, July and Aug reaching temperatures up to 55 degrees Celsius. The second analysis was done in Hera General Hospital in Makkah which is the Islamic capital for Muslims that has a similar climate as Riyadh.

The patients referred to both centers either as newly diagnosed type 1 diabetes based on clinical presentation for the disease, mostly DKA on admission, or rarely presented by hyperglycemia without DKA. Also known cases of T1DM being managed in the two hospitals were included in the study. Diagnosis of T1DM was confirmed by measuring C-peptide.

The data was collected in a period between Jan 2008 to Jun 2015. The sample consisted of 135 patients aged between 1 to 16 years. All patients were Saudi. Family history regarding T1DM or any risk factors for Vitamin D Deficiency (e.g. Sun exposure, nutritional history) were obtained from the parents. Vitamin D3 levels were measured by (Roche diagnostic Gmbh German) 411 Immunoassay analyzer (after the patients recovered from DKA episode). PTH, Ca, Phosphorous and Alkaline Phosphatase were measured as well. Patients then were followed monthly or every 3 months in OPD. Patients started on conventional treatment in the form of NPH and Regular insulin. Patients presented from Al-Riyadh city didn’t like multiple daily injections (50%) but remaining patients (50%) started on multiple daily injections in the form of long acting insulin (Lantus) and rapid acting insulin (novorapid). The results of vitamin D3 levels were categorized according to vitamin D Council (15).

We divided the levels into severe type, which is less than 30 nmol/l, moderate type between 30-50 nmol/l, and mild type between 50-70 nmol/l and normal more than 70 nmol/l which is defined as an adequate vitamin level where there are no symptoms or signs of vitamin D deficiency and the same was used in control group. We selected the control patient referred to OPD with complaint of non-thriving. The control group consisted of 83 patients. There were certain Exclusion criteria:

- Children Younger than 1 year who have signs of rickets
- Other endocrinial gland disease like (Hypo or Hyperaldosteronism)
- Chronic disease (lungs, gastrointestinal disease)
Research sample:
There were a total of 135 patients included in the study having type 1 DM. The mean age was 8.0356 years old (range from 1 to 16 years old) with BMI mean 15.832 (11-25) P-value <0.005. There were 62 (45.9%) males and 73 (54.07%) females. The mean vitamin D3 level for all patients was 22.993 nmol/l (4-89 nmol/l) P-value <0.005. Mean HbA1c for all patients was 10.887 (1-17.5) P-value <0.005.

Discussion:
There have been a lot of studies carried out showing the prevalence of vitamin D deficiency in type 1 diabetes compared with a control group. One of these studies is the north Indian study (6) which showed a Vitamin D deficiency in 91.1% of the subjects with diabetes, and in 58.5% of the healthy controls, (60%) of the cases had severe Vitamin D deficiency compared to 8.3% in the control group. Another study done in Qatar revealed that Vitamin D deficiency was considerably higher in T1DM children (90.6%) compared to non-diabetic children (85.3%). (7)

There was a significant difference found in the mean value of Vitamin D between T1DM and non-diabetic children in Egypt, among diabetic cases, 55% were Vitamin D deficient; meanwhile 45% of cases had normal Vitamin D levels (P < 0.01). (8)

In the T1DM children of Bin Abbas group, 64% were mildly Vitamin D deficient, 16% were moderately Vitamin D deficient, and 4% were severely Vitamin D deficient as compared with 52% (mildly), 6% (moderately), and 1% (severely) in the control group. Overall, 84% of the T1DM children, and 59% of the healthy children were Vitamin D deficient (9).
Also in another study of 129 Swiss children and adolescents with type 1 diabetes, 78 (60.5%) were Vitamin D deficient. In this study, Vitamin D deficiency was defined as a 25-hydroxy-Vitamin-D level below 50 nmol/L. During the winter this number rose to 84.1%. 25-hydroxy-Vitamin-D levels showed marked seasonal fluctuations. There was no correlation with diabetes control, despite the high prevalence of Vitamin D deficiency (10).

Prevalence of Vitamin D deficiency was 60.5% in a Swiss study (11), 43% in an Australian study (12), approximately 25% in an Italian study (13). In a cross-sectional study performed in Jeddah on 510 child ranged between 4-15 years, 13.7% had a normal Vitamin D level, 58.8% had relative deficiency, 27.4% had severe deficiency. Saudi and Yemeni patients were more affected than Egyptian and other nationalities but all children which were included in the sample were not diabetic (14).

In our study, almost 100% of the children of type 1 diabetes had insufficient level of Vitamin D in comparison with (69.5%) in control group. Severe deficiency was 71.1% in T1DM group and 42% in control group. Moderate deficiency 20.6% vs 18.8%, mild deficiency 8.1% vs 8.7% and only 0.2% had sufficient Vitamin D levels vs 30.5%.

Figure 2: Summary for VD3 in type one diabetes.

This diagram shows the level of Vitamin D in nmol/l vs the number of T1DM patients. It is obvious that most of the patients lay in the insufficient area and they are mostly present with severe deficiency.

Conclusion:
Vitamin D level should be a routine test for pediatric patients with Type 1 DM during diagnosis and follow up. Early detection of Vitamin D deficiency and appropriate management will lead to better prognosis and better quality of life, especially the effect on improving glycated hemoglobin (HA1c). This area is an evolving field of research and our knowledge regarding Vitamin D role in T1DM outcomes is not yet complete.

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