

ORIGINAL RESEARCH

Study the Effect of Vitamin D Supplementation on Children with Vitamin D Deficiency and Type 1 Diabetes Mellitus in Derna City

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ABSTRACT:

Vitamin D deficiency has been linked to type 1 diabetes mellitus (T1DM) and its metabolic parameters; however there are conflicting results therefore we aimed to evaluate the effect of Vitamin D deficiency on type1 patients and vitamin D status in patients. In this study 30 children patients who had attended the dar alsalaam medical center, their age around 3-14 years old. All children were classified to 3 groups ; group 1 :type 1 diabetes using insulin injection, group 2: type 1 diabetes using insulin injection and received vitamin D either ergocalciferol or cholecalciferol , through 12-16 weeks, group3: healthy children they don't received any treatment medication through the study period. The parameters were measured in this study are: fasting blood glucose (FBG), fasting lipid (total cholesterol, TC, triglyceride (TAG), low



density lipoprotein (LDL), very low density lipoprotein (VLDL), high density lipoprotein (HDL), glycosylated hemoglobin (Hb A1c), calcium, blood urea, creatinine, blood urea nitrogen (BUN) and Serum 25 hydroxy vitamin D [25(OH)D] were measured. We concluded from our study that vitamin D deficiency was highly prevalent in our patients' groups with T1DM. There were statistically significant differences between patients with T1DM treated with insulin, T1DM treated with insulin and vitamin D and control.

KEYWORDS: Vitamin D Deficiency;; Type 1 Diabetes Mellitus; Healthy Children; Insulin Injection.

INTRODUCTION

Diabetes is a chronic disease that occurs when the pancreas is no longer able to make insulin, or when the body cannot make good use of the insulin, it produces. Insulin is a hormone made by the pancreas that acts like a key to let glucose from the food we eat pass from the blood stream into the cells in the body to produce energy (Ahmed et al., 2020). Diabetes mellitus is a disease of metabolic deregulation, most notably abnormal glucose metabolism, accompanied by characteristic long-term complications. The complications that are specific to diabetes include retinopathy, nephropathy, and neuropathy (Guo, Cheng, Chan, & Yu, 2008).

Patients with all forms of diabetes of sufficient duration, including insulin-dependent diabetes mellitus (IDDM) and non-insulin-dependent diabetes mellitus (NIDDM), are vulnerable to these complications, which cause serious morbidity (Jiménez, Martín-Carmona, & Hernández, 2020). Type 1 diabetes mellitus results from cellular-mediated autoimmune destruction of the beta cells of the pancreas. Serum 25-hydroxyvitamin D (25-OHD) concentrations are largely determined by environmental factors, mainly through vitamin D intake and ultraviolet exposure.

The sun is the primary source of vitamin D, which is synthesized endogenously in skin to produce cholecalciferol (vitamin D3), although a small proportion (<20%) of vitamin D comes through diet from a limited

range of foods (in the form of ergocalciferol [vitamin D2] and vitamin D3). The main marker of vitamin D status is the metabolite 25-OHD, which is synthesized in the liver (Cristelo, Machado, Sarmiento, & Gama, 2021).

A relationship between type 1 diabetes mellitus and vitamin D deficiency has been reported, the prevalence of vitamin D deficiency in patients with type 1 diabetes was 15% to 90.6%. There is evidence that vitamin D is important in the prevention of islet cell death and might be useful in improving the survival of islet cell grafts, and it improves the production of insulin. Low vitamin D levels were shown to have a negative effect on beta-cell function. Regular doses of vitamin D early in life have been shown to reduce the risk of developing type 1 diabetes. Vitamin D treatment has also been shown to improve glycemic control and insulin sensitivity in people with type 1 and type 2 diabetes and in normal individuals. Increasing vitamin D levels from 25 to 75 nmol/L results in a 60% improvement in insulin sensitivity. These effects have been mainly attributed to the immunomodulatory actions of vitamin D (Savastio et al., 2018).

It is still confusing to fully understand the mechanism how vitamin D affects the diabetes mellitus patients' health.

MATERIALS AND METHODS

Study Design

The present study is a case control study .

Target population

The target population is a diabetic patient with type 1.

Setting of the Study

The dar al salaam medical center in Derna city.

Study duration

12-16 weeks

Sample Size

The present study had conducted on 30 children who had attended the dar alsalaam medical center, their age around 3-14 years old.

All children were classified to 3 groups ; group 1 :type 1 diabetes using insulin injection, group 2: type 1 diabetes using insulin injection and received vitamin D either ergocalciferol or cholecalciferol , dose amount 400-4000IU /day through 12-16 weeks, group3: healthy children they don't received any treatment medication through the study period .

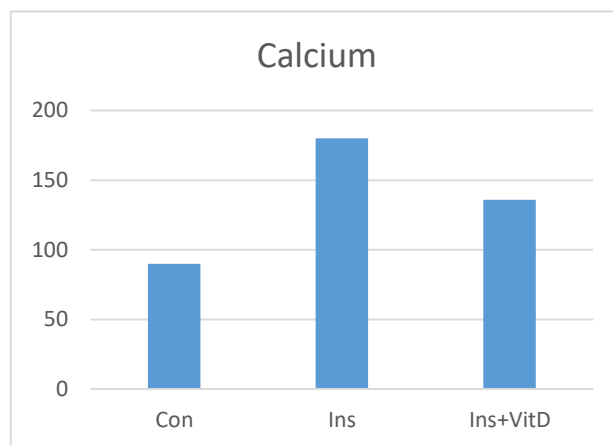
Blood Sampling and Parameters

All blood samples and processing of this study had done by Alrazi medical lab in Derna city. The laboratory investigation in the form of fasting blood glucose (FBG), fasting lipid (total cholesterol), TC, triglyceride (TAG), low density lipoprotein (LDL), very low density lipoprotein (VLDL), high density lipoprotein (LDL), glycosylated hemoglobin (Hb A1c), calcium, blood urea, creatinine, and blood urea nitrogen (BUN) were measured.

Serum 25 hydroxy vitamin D [25(OH)D] was measured by ELISA kit in Alrazi medical lab.

RESULTS AND DISCUSSION

Thirty subjects of ages 3-14 years (female and male) were studied. A group study received only insulin treatment shown decrease in calcium level, and HDL compared to control group for healthy children Figures (1 and 2).



Figur(1). Calcium levels.

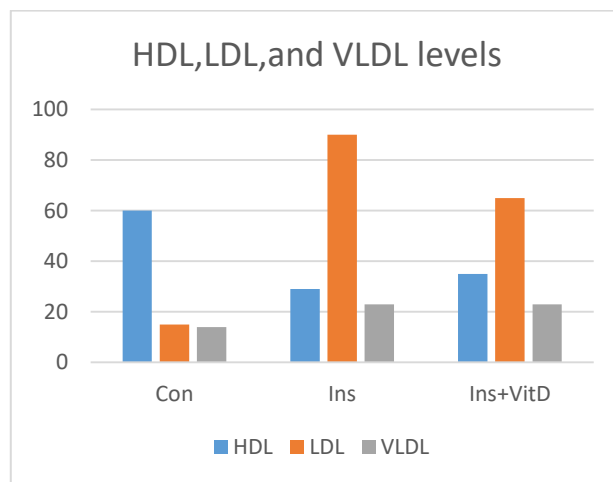


Figure (2). HDL, LDL and VLDL levels.

In addition the LDL, VLDL, FBG, BUN, BU, cholesterol , triglyceride and Hb A1 c% levels ,as shown in table(1) decreases significantly in patients group that received insulin treatment only figure(3,4,5).

Table :(1). Change in biochemical parameters during study.

Variable	Control n=10	Insulin Treatment n=10	Insulin +Vit D n=10
Calcium	10±0.22	8.5±0.23	9±0.04
cholesterol	90±0.44	180±0.54	136±0.22
Triglyceride	40±0.22	155±0.25	119±0.33
HDL	60±0.27	29±0.22	35±0.43
LDL	15±.00	90±0.87	65±0.27
VLDL	14±0.09	23±0.24	23±0.92
Serum creatinine	0.7±.00	0.6±0.42	0.7±0.65
Fasting blood glucose	70±0.82	270±0.32	145±0.02
BUN	6±0.11	7±0.12	7±0.12
Blood Urea	14±0.03	21±0.32	15±0.12
25(OH)D ng/ml	32±0.71	10±0.23	38±0.13

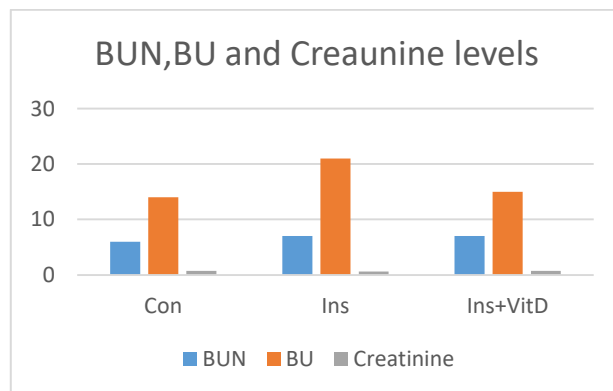


Figure (4). BUN, BU and Creatinine levels

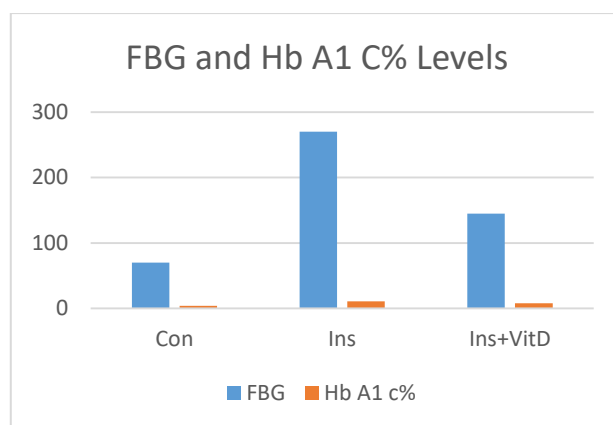


Figure (5). FBG and HbA1 c% Levels

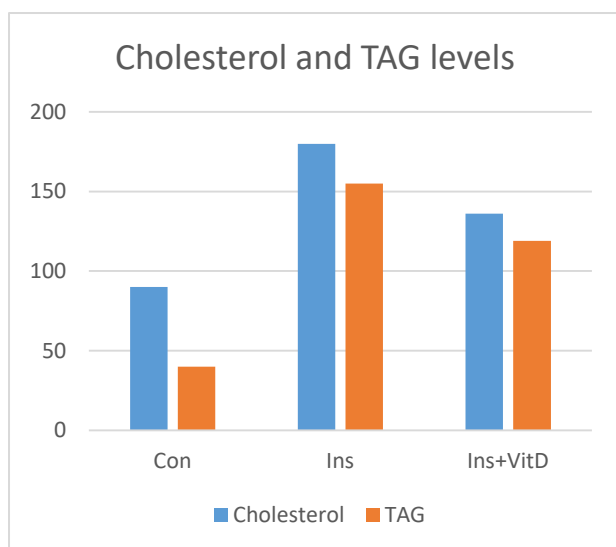


Figure (3). Cholesterol and TAG levels

Also the level of 25 (OH) D decreases during the study period compared to control group Figure 6.

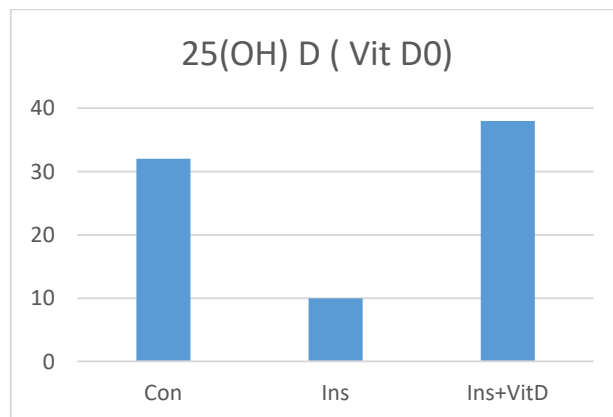


Figure (6). Vitamin D levels.

On the other hand, the patients group received the insulin treatment and the vitamin D supplementation, showing a promising results, such as control the fasting blood glucose level, decrease the cholesterol, triglyceride, and LDL levels compared to control group. The Hb A1 c values for the insulin treatment group that received vitamin D change to be more acceptable as a good control for blood glucose level.

By comparing treatment group with insulin and vitamin D to patients group with insulin only, the level of VLDL and BUN shown no difference between two groups treatment, even with the difference level of 25(OH) D Figure 2 and 4.

This study evaluated the effect of vitamin D supplementation on children diabetic with vitamin D deficiency. A greater portion of subjects with Vitamin D deficiency had a high level of HbA1c and FBG, The relationship between 25(OH)D and glycemic control in patients with T1D is not fully understood. In previous study (Nwosu, Stavre, Maranda, Cullen, & Lee, 2012) found no significant relationship between 25(OH)D and HbA1c in patients with T1D, while this study found a statistically significant, but clinically non-significant increase in HbA1c value following vitamin D supplementation.

These results differ from the conclusions of a study in children, adolescents, and young adults with T1D which found a significant reduction in HbA1c level following a supplementation regimen consisting of both vitamin D and calcium (Østergård et al., 2011). It is possible that vitamin D alone has no significant role on improving glycemic control in patients with T1D.

Evidence from two randomized controlled trials (RCT) suggests that vitamin D supplementation effectively reduces insulin resistance (IR) (Von Hurst, Stonehouse, &

Coad, 2010) (Nagpal, Pande, & Bhartia, 2009). Vitamin D has identified to play an important role on insulin synthesis, secretion and function (Usluogullari et al., 2015). Vitamin D stimulates insulin secretion from the pancreatic β cells through enhancing the intracellular Ca concentration converting the pro-insulin to insulin. Also it increases the sensitivity of cells to insulin by increasing the expression of insulin receptors and by keeping adequate supply of calcium pool, that explain the decrease of calcium level when the vitamin level decreases. Alterations of Ca supply lead to peripheral insulin resistance due to impaired insulin transduction, which decreases GLUT-4 the main player in glucose metabolism, which maintains glucose homeostasis. (Pittas, Lau, Hu, & Dawson-Hughes, 2007).

CONCLUSION

We concluded from our study that vitamin D deficiency was highly prevalent in patients groups with T1DM. There were statistically significant differences between patients with T1DM treated with insulin, T1DM treated with insulin and vitamin G and control.

This study demonstrates that routine vitamin D supplementation in patients with diabetes mellitus is associated with a significant reduction in LDL, cholesterol, triglyceride, Calcium, FBG, blood urea, and Hb A1 c. The changes in these parameters were not associated with the doses of the insulin.

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الملخص

ارتبط نقص فيتامين د ببدء السكري من النوع الأول ومؤشراته الأيضية؛ إلا أن النتائج متضاربة، لذا هدفت هذه الدراسة إلى تقييم تأثير نقص فيتامين د على مرضى السكري من النوع الأول ومستوى فيتامين د لديهم. شملت الدراسة 30 طفلاً مريضاً، تتراوح أعمارهم بين 3 و14 عاماً، ممن راجعوا مركز دار السلام الطبي. تم تصنيف الأطفال إلى ثلاث مجموعات: المجموعة الأولى: مرضى السكري من النوع الأول الذين يتلقون حقن الأنسولين، المجموعة الثانية: مرضى السكري من النوع الأول الذين يتلقون حقن الأنسولين ويتناولون فيتامين د، إما إرغوكالسيفيرول أو كوليالكالسيفيرول، لمدة تتراوح بين 12 و16 أسبوعاً، المجموعة الثالثة: أطفال أصحاء لم يتلقوا أي علاج دوائي خلال فترة الدراسة. شملت المعايير التي تم قياسها في هذه الدراسة: سكر الدم الصائم، والدهون الصائمة (الكوليسترول الكلي، والدهون الثلاثية، والبروتين الدهني منخفض الكثافة، والبروتين الدهني جداً، والبروتين الدهني عالي الكثافة)، والهيموجلوبين السكري (HbA1c)، والكالسيوم، واليوريا في الدم،

والكرياتينين، ونيتروجين اليوريا في الدم، وفيتامين د 25 هيدروكسي [OH)D)25] في المصل. وخلصنا من دراستنا إلى أن نقص فيتامين د كان شائعًا جدًا بين مجموعات مرضى السكري من النوع الأول. كما وُجدت فروق ذات دلالة إحصائية بين مرضى السكري من النوع الأول الذين عولجوا بالأنسولين، ومرضى السكري من النوع الأول الذين عولجوا بالأنسولين وفيتامين د، ومجموعة الضبط.

الكلمات المفتاحية: نقص فيتامين د، داء السكري من النوع الأول، الأطفال الأصحاء؛ حقن الأنسولين.