Study of 25 hydroxy Vitamin D levels in type 2 Diabetes Mellitus patients

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ABSTRACT

Introduction: Vitamin D has the effect on insulin release. A type 2 diabetes mellitus (T2DM) patient with the presence of vitamin D deficiency causes impedance in the management of T2DM. Therefore, the present study was undertaken to find the levels of vitamin D in T2DM patients.

Materials and Methods: 80 T2DM patients and 80 age matched controls were studied for their Vitamin D levels along with their fasting glucose, serum calcium and HbA1c levels. Analysis was performed by using student’s t-test to compare the values between T2DM patients and controls. Pearson’s correlation was performed between the parameters in the T2DM patients.

Results: The prevalence of Vitamin D deficiency in T2DM patients and controls was found to be 21.25 % and 11.25 % respectively. Mean ± SD of the Serum Vitamin D (25.0 ± 2.9 ng/L) and serum calcium (7.8 ± 0.6 mg/dl) concentrations were significantly low (p<0.01) in T2DM patients. Vitamin D showed a significant negative correlation with diabetic duration. Vitamin D levels showed an inverse correlation with fasting serum glucose and HbA1c but were not statistically significant.

Conclusion: Vitamin D levels were appeared to be lower in T2DM patients than in the control group and it showed a significant negative correlation with the duration of diabetes.

KEYWORDS: Diabetes mellitus, 25 hydroxy vitamin D deficiency, HbA1c, glucose.

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a metabolic disorder characterized by chronic hyperglycemia predominantly due to insulin resistance with relative insulin deficiency [1]. In India, during the year 2004 there were 37.7 million cases of diabetes, of which 21.4 million were in urban areas and 16.3 million in rural areas [2]. Diabetes mellitus is a risk factor for various micro and macro vascular complications that are accounting for increased morbidity and mortality. Hence it has existed as a major public health problem [3]. Recently, it has been found that Vitamin D deficiency as a co-morbid condition in patients with T2DM [4].

Vitamin D is a fat soluble vitamin that promotes calcium and phospohorus absorption in the gut and kidneys to maintain their adequate levels in serum to enable normal mineralization of bone [5]. Other roles of Vitamin D include modulation of cell growth. The proteins responsible for cell proliferation, differentiation, and apoptosis are modulated in part by vitamin D. [6]

Vitamin D has a role to play in insulin secretion. Therefore, unrecognized Vitamin D deficiency in the presence of T2DM not only worsens the metabolic control but also impede the management of T2DM. Also, studies have suggested that Vitamin D deficiency is a risk factor for cardiovascular disease [7]. Hence, T2DM patients with Vitamin D deficiency are at greater risk for cardiovascular events compared to the patients with only T2DM or Vitamin D deficiency. Therefore, this study intended to estimate Vitamin D levels in T2DM patients attending our hospital. This study also intended to correlate vitamin D values with other parameters to find the association between them.
MATERIALS AND METHODS
This study was undertaken by the Department of Medicine, BGS Global Institute of Medical Sciences, Bangalore after the approval of the institutional research and ethical committee. Diagnosed T2DM patients constituting 80 in number with more than 5 years of duration and without complications like retinopathy, neuropathy and nephropathy were selected. Similar numbers of healthy volunteers were chosen as controls. A total of 160 subjects were studied. Fasting serum samples are collected from diagnosed T2DM patients attending the OPD of the hospital. Fasting serum samples were obtained for testing fasting serum glucose (FSG), 25 hydroxy vitamin D and serum calcium. EDTA samples were obtained for HbA1c estimation. FSG, serum calcium and 25 hydroxy vitamin D were estimated on integrated cobas systems (Roche Diagnostics). FSG was estimated by hexokinase method and serum calcium by O-Cresolphthalin method. HbA1c was estimated by HPLC method.

Serum 25 hydroxy vitamin D form of vitamin D is estimated by electrochemiluminisence method. 25 hydroxy vitamin D is the chosen form as the indicator of vitamin D status. It has a long circulating half-life of 15 days compared to the active form which has a short half-life of 15 hours [8]. There is considerable discussion on the cut points of the serum concentrations of 25 hydroxy vitamin D. Based on its review of data of vitamin D needs, a committee of the Institute of Medicine defined vitamin D deficiency as 25 hydroxy vitamin D ≤ 20 ng/mL, and the same cutoff value was used in this study to identify the vitamin D deficient individuals [9].

Quantitative data was summarized to test the difference in mean values obtained for T2DM patients and controls using student’s t-test, p value < 0.05 is taken as the level of significance. Further, Pearson’s correlation was used to correlate between the various parameters in T2DM patients.

RESULTS
The prevalence of Vitamin D deficiency in T2DM patients was found to be 21.25 % (17, n=80) and in controls the prevalence was 11.25 % (9, n=80). Results are shown in the tables 1 and 2. Table 1 shows the Mean ± SD of the parameters in controls and diabetics with their comparison. Serum Vitamin D (25.0 ± 2.9 ng/L) and serum calcium (7.8 ± 0.6 mg/dl) concentrations were significantly low (p<0.01) in T2DM patients when compared to controls. FSG (158.1 ± 54.2) and HbA1c (6.1 ± 0.5) concentrations were significantly high (p<0.01) in T2DM patients when compared to controls. Table 2 shows the Pearson’s correlation between the vitamin D and other parameters. Vitamin D showed a significant negative correlation with diabetic duration and significant positive correlation with serum calcium. It was found that there was no significant correlation of Vitamin D with FSG and HbA1c.

<table>
<thead>
<tr>
<th>Table 1: Comparison of various parameters between cases and controls</th>
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<table>
<thead>
<tr>
<th>Parameters</th>
<th>Cases</th>
<th>Controls</th>
<th>p value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>59.9 ± 7.8</td>
<td>57.2 ± 9.4</td>
<td>0.02</td>
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<tr>
<td>FBS (mg/dl)</td>
<td>158.1 ± 54.2</td>
<td>85.5 ± 10.0</td>
<td>&lt;0.01</td>
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<tr>
<td>Diabetes Duration (years)</td>
<td>14.9 ± 7.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 hydroxy vitamin D (ng/L)</td>
<td>25.0 ± 2.9</td>
<td>35.1± 2.7</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Serum Calcium (mg/dl)</td>
<td>7.8 ± 0.6</td>
<td>9.3 ± 0.8</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>HbA1c (%)</td>
<td>6.1 ± 0.5</td>
<td>4.8 ± 0.2</td>
<td>&lt;0.01</td>
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*student ‘t’ test

| Table 2: Pearson’s product-moment correlation between 25 hydroxy vitamin D and other parameters in T2DM patients |

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<thead>
<tr>
<th></th>
<th>FSG</th>
<th>Diabetes Duration</th>
<th>Serum Calcium</th>
<th>HbA1c</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 hydroxy vitamin D</td>
<td>r =-0.08</td>
<td>r =-0.23</td>
<td>r = 0.34</td>
<td>r = -0.21</td>
</tr>
<tr>
<td></td>
<td>p= 0.48</td>
<td>p=0.04</td>
<td>p=&lt;0.01</td>
<td>p=0.06</td>
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DISCUSSION
Vitamin D is a fat-soluble vitamin that is naturally present in few foods and produced endogenously. Vitamin D obtained from sun exposure and foods undergo two hydroxylations in the body for activation. The first occurs in the liver and converts vitamin D to 25-hydroxyvitamin D. The second occurs primarily in the kidney and forms the physiologically active 1, 25-dihydroxyvitamin D also known as calcitriol. It is mainly associated with bone metabolism. Recently, vitamin D has sparked widespread interest because of its association with diabetes mellitus.

Present study showed the prevalence of Vitamin D deficiency in T2DM patients as 21.25 % and in controls as 11.25 %. These findings are similar to the findings in other populations. A study on the population of southern region of Saudi Arabia showed that the group with diabetes had more patients with 25 hydroxy vitamin D deficiency than non-diabetic group [10]. A study on Indian population showed the presence of vitamin D deficiency in 91.1% of the subjects with diabetes, and 58.5% of the healthy controls [11].
The Mean ± SD of the Serum Vitamin D and serum calcium concentrations were significantly low in T2DM patients when compared to controls. The results of a large prospective study suggest a potential beneficial role for both vitamin D and calcium intake in reducing the risk of type 2 diabetes [12].

T2DM patients showed a higher FSG and HbA1c concentrations where they showed an inverse correlation with the vitamin D levels though it was not statistically significant. Mohamad MI et al have found that Vitamin D supplementation in T2DM patients improved the glycemic control [13]. This study also showed the existence of significant negative correlation between vitamin D levels and diabetes duration. Therefore patients with long standing diabetes are at risk of vitamin D deficiency.

As reported, vitamin D deficiency inhibits pancreatic secretion and turnover of insulin (but not of other pancreatic hormones), leading to impaired glucose tolerance [14]. Many studies have shown the benefits of supplementation with vitamin D on T2DM management [13]. Therefore, this study emphasizes the need of monitoring of vitamin D levels in the management of T2DM.

CONCLUSION

Vitamin D levels appeared to be lower in T2DM patients than in the control group. Vitamin D showed a significant negative correlation with the duration of diabetes and there was no significant correlation with HbA1c.

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