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Original Research Article

# Vitamin D Deficiency in Newly Diagnosed Type II Diabetes Mellitus Patients: A Case Control Study

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**Abstract**

**Aim:** The aim of the present study was to assess the prevalence of Vitamin D deficiency in newly diagnosed type II diabetes Mellitus patients at a tertiary health care centre.

**Material & Methods:** A comparative study carried out at Department of General Medicine. Study population was newly diagnosed patients of type II diabetes Mellitus and their healthy controls. Total 100 cases were enrolled and their healthy controls were 100. Controls were subjects without diabetes mellitus and matched for age and gender.

**Results:** Mean age of the cases was 50.5±2.5 years and mean age of the control group was 51.7±3.2 years. The age difference in both the group was statistically not significant (p= 0.32). Thus both the groups were comparable. Cases were having significantly higher weight as compared to controls (p=0.001). The difference in the mean height of both the groups was statistically not significant (p=0.75). BMI of the cases was significantly higher than control group (p=0.001). As the cases were diabetic, blood sugar level was higher in that group. Mean HbA1C in cases was 8.4±1.8 and control was 6.4±0.9. The difference was statistically significant (p=0.0001). Mean systolic blood pressure in cases and controls were 130.8±15.5 mm of Hg and 128.2±12.4 mm of Hg respectively. Mean diastolic blood pressure in cases was 79.1±8.04 mm of Hg and 78.2±5.6 mm of Hg respectively. There were 103 (51.50%) females and 97 (48.50%) males in the cases (new onset Type 2 Diabetes Mellitus), whereas 62 (51.67%) females and 58 (48.33%) males in controls (without Type 2 Diabetes Mellitus). Maximum patients were above 55 years of age in cases and controls.

**Conclusion:** Vit D concentration in diabetic patients was significantly lower in comparison to non-diabetic individuals.

**Keywords:** Vitamin D Deficiency, Newly Diagnosed Type II Diabetes, Prevalence.



## Introduction

Vitamin D is a fat- soluble vitamin. Normal body function is regulated by vitamin D. Vitamin D is produced endogenously when exposed to ultraviolet rays. For activation vitamin undergoes hydroxylation in body. There are two major forms of vitamin D, vitamin D2 (ergocalciferol) and vitamin D3 (cholecalciferol). [1] Vitamin D acts on vitamin D receptors that are found in many different tissues in the body, and plays an important role in glucose regulation, cardiovascular system, bone mineral density and many other biological functions. [2,3] Vitamin D deficiency is major nutritional health problem in adults across the world. Vitamin D has an important role in glucose metabolism. It regulates insulin secretion and it increases the insulin sensitivity of the tissue. [4]

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder, the prevalence of which is increasing steadily all over the world. It has been estimated that, by 2030, the global population of diabetes would have been 562 million. [5] Although the number of people with T2DM is increasing in every country, its major contribution is from developing countries, where it is fast becoming an epidemic.

Type 2 Diabetes Mellitus is a metabolic disorder characterized by hyperglycaemia which arises due to inability of the body to use insulin properly. Type 2 Diabetes Mellitus can increase the burden of chronic microvascular and macrovascular conditions like retinopathy, nephropathy, neuropathy and cardiovascular disease (CVD). [6]

Type II diabetes may range from predominantly insulin resistance with relative insulin deficiency to a predominantly insulin secretory defect with insulin resistance. [7] Vitamin D affects these activities in diabetic patients. Vitamin D is likely to indirectly affect insulin secretion and insulin sensitivity through beta cells and environmental tissues that are the targets of insulin. [8] Replacement of vitamin D reduces the resistance to insulin and improves the glucose metabolism in diabetic patients. [9] Researches have shown low vitamin D status to be associated with the development of type-2 diabetes as well as metabolic syndrome. [10] It has lead to the hypothesis that vitamin D insufficiency correlates positively with insulin resistance and cardiovascular risk in obese adolescents and that 25-OH vitamin D supplementation improves insulin resistance and cardiovascular risk factors in this population. [11]

Hence present study was conducted to see the vitamin D level in patients of newly diagnosed type II diabetic patients.

## Material & Methods

A comparative study carried out at Department of General Medicine, AIIMS, Patna, Bihar, India for 9 months. Study population was newly diagnosed patients of type II diabetes Mellitus and their healthy controls. Total 100 cases were enrolled and their healthy controls were 100. Controls were subjects without diabetes mellitus and matched for age and gender.

### Inclusion Criteria:

1. Patients diagnosed with type II diabetes mellitus within 1 year and on antidiabetic treatment with medicines.
2. Patients not taking Vitamin D or other drugs like corticosteroids, anticonvulsants, and contraceptives).
3. Non-alcoholic and non-smokers.

### Exclusion Criteria:

1. Patients with diabetes for more than 1 year.
2. Type I diabetes mellitus.
3. Patients suffering from severe complications of diabetes (nephropathy, retinopathy etc), and HbA1C >11%.
4. Females who have attended menopause.
5. Pregnant females.
6. Patients with history of angina, myocardial infarction.
7. Patients with chronic diseases of kidney, liver or thyroid.
8. Patients taking any treatment in form of calcium supplements.

### Methodology

Data was collected with pre tested questionnaire. Data included demographic data, clinical history (duration of disease, symptoms). A through clinical examination was done. Examination of the patients included recording of height, weight, body mass index (BMI), waist and hip circumference, and measurement of waist-to-hip ratio. BMI was calculated by the formula: body weight in kg/ height in $m^2$ Blood sugar was measured by fasting and post prandial blood sugar. HbA1C was done. After overnight fasting 10 ml of blood was taken from the patients for measuring fasting blood sugar, lipid profile and serum vitamin D level. HbA1c was measured with high performance liquid chromatography (HPLC) standardized for the DCCT assay (reference range, 4-6%). The serum level of vitamin D was measured by using the enzyme-linked immunosorbent assay (ELISA) method and applying the kit. Serum vitamin D level was considered as normal if it was 30-100 ng/mL. If vitamin D level was 20- 30 ng/mL it was considered as inadequacy of vitamin D. levels < 20 ng/mL were considered as deficiency of vitamin D. [12]

### Statistical Analysis

Data was entered in the excel sheet. Data was compared among both the groups (cases and controls). Data was analysed with SPSS version 20.

## Results

**Table 1: Comparison Of age and Anthropometric Parameters in Cases and Controls**

| Parameters | Cases | Controls | P value |
|---|---|---|---|
| Age (years) | 50.5±2.5 | 51.7±3.2 | 0.32 |
| Weight (kg) | 74.6±6.4 | 72.4±5.9 | 0.0001 |
| Height (cm) | 165.5±8.2 | 162.8±7.3 | 0.75 |
| BMI (Kg/m2) | 25.5±3.3 | 26.4±2.2 | 0.0001 |

Mean age of the cases was 50.5±2.5 years and mean age of the control group was 51.7±3.2 years. The age difference in both the group was statistically not significant (p= 0.32). Thus both the groups were comparable. The mean weight of cases group was 74.6±6.4 kg and control group was 72.4±5.9 kg. Cases were having significantly higher weight as compared to controls (p=0.001). Mean height of the cases and controls were 165.5±8.2 cm and 162.8±7.3 cm respectively. The difference in the mean height of both the groups was statistically not significant (p=0.75) Body Mass Index is used to assess the obesity of the person. BMI of cases group was 25.5±3.3 kg/m2

and of control group was 26.4±2.2 Kg/m2. BMI of the cases was significantly higher than control group (p=0.001).

**Table 2: Comparison Of investigative Parameters in Cases and Controls**

| Parameters | Cases | Controls | P value |
|---|---|---|---|
| Fasting BSL | 164.6±36.4 | 102.4±20.2 | 0.0001 |
| HbA1C | 8.4±1.8 | 6.4±0.9 | 0.0001 |
| Systolic BP | 130.8±15.5 | 128.2±12.4 | 0.12 |
| Diastolic BP | 79.1±8.04 | 78.2±5.6 | 0.48 |

Mean fasting blood sugar in cases group was 164.6±36.4 mg/dl and in control group it was 102.4±20.2 mg/dl. As the cases were diabetic, blood sugar level was higher in that group. Mean HbA1C in cases was 8.4±1.8 and control was 6.4±0.9. The difference was statistically significant (p=0.0001). We measured systolic and diastolic blood pressure of both the groups. Mean systolic blood pressure in cases and controls were 130.8±15.5 mm of Hg and 128.2±12.4 mm of Hg respectively. Mean diastolic blood pressure in cases was 79.1±8.04 mm of Hg and 78.2±5.6 mm of Hg respectively.

**Table 3: Gender distribution of the study group**

| | Case | | Control | | P Value |
|---|---|---|---|---|---|
| **Gender** | **NO.** | **%** | **NO.** | **%** | |
| Male | 48 | 48 | 49 | 49 | |
| Female | 52 | 52 | 51 | 51 | 0.260 |
| Total | 100 | 100 | 100 | 100 | |
| **Age in years** | | | | | |
| 40-44 | 18 | 18 | 15 | 15 | |
| 45-49 | 12 | 12 | 22 | 22 | |
| 50-54 | 34 | 34 | 25 | 25 | 0.850 |
| ≥55 | 36 | 36 | 38 | 38 | |
| TOTAL | 100 | 100 | 38 | 100 | |

There were 103 (51.50%) females and 97 (48.50%) males in the cases (new onset Type 2 Diabetes Mellitus), whereas 62 (51.67%) females and 58 (48.33%) males in controls (without Type 2 Diabetes Mellitus). Maximum patients were above 55 years of age in cases and controls.

**Table 4: Distribution of serum 25-Hydroxy Vitamin D level of the study group**

| | Case | | | Control | | |
|---|---|---|---|---|---|---|
| | **Male** | **Female** | **Total** | **Male** | **Female** | **Total** |
| Normal (≥30 ng/ml) | 14 | 20 | 34 | 28 | 21 | 49 |
| Low (<30 ng/ml) | 34 | 32 | 66 | 21 | 30 | 51 |
| Total | 48 | 52 | 100 | 49 | 51 | 100 |

Among the Cases, 25-Hydroxy Vitamin D was normal in 34% (34) out of which 20 were females while 14 were males while among the Controls, 25-Hydroxy Vitamin D was normal in 49% (49) out of which 21 were females while 28 were males. 25-Hydroxy Vitamin D was low in 66% (66) of the cases out of which 32 were females while 34 were males while among the controls 25-Hydroxy Vitamin D was low in 51% (51) out of which 30 were females while 21 were males.

## Discussion

Diabetes mellitus is a chronic metabolic disease caused by inherited and/or acquired deficiency in the production of insulin, or by the ineffectiveness of the insulin produced by the pancreas. [13] Type II diabetes may range from predominantly insulin resistance with relative insulin deficiency to a predominantly insulin secretory defect with insulin resistance. [14] Approximately 1 billion people in the world suffer from vitamin D deficiency, which possibly results from limited exposure to sunlight, long-term wearing of covering clothes, use of sunscreen, as well as low consumption of food containing ergocalciferol, and also malabsorption syndrome. The link of vitamin D with insulin insensitivity or abnormal glucose metabolism gained much more scientific attention in the last 10 years. While the exact mechanisms of how the underlying multiple effects of vitamin D on different tissues are not fully understood currently, one unique factor is the expression of vitamin D receptors (VDRs) in >30 tissues, including pancreatic islet cells. There is some evidence that polymorphisms in the VDR gene maybe associated with insulin resistance, insulin secretion, and fasting glucose concentrations suggesting that vitamin D is likely to contribute to glucose metabolism. [15]

Mean age of the cases was 50.5±2.5 years and mean age of the control group was 51.7±3.2 years. The age difference in both the group was statistically not significant (p= 0.32). Thus both the groups were comparable. The mean weight of cases group was 74.6±6.4 kg and control group was 72.4±5.9 kg. Cases were having significantly higher weight as compared to controls (p=0.001). Mean height of the cases and controls were 165.5±8.2 cm and 162.8±7.3 cm respectively. The difference in the mean height of both the groups was statistically not significant (p=0.75) Body Mass Index is used to assess the obesity of the person. BMI of cases group was 25.5±3.3 kg/m2 and of control group was 26.4±2.2 Kg/m2. BMI of the cases was significantly higher than control group (p=0.001). Mean fasting blood sugar in cases group was 164.6±36.4 mg/dl and in control group it was 102.4±20.2 mg/dl. As the cases were diabetic, blood sugar level was higher in that group. Mean HbA1C in cases was 8.4±1.8 and control was 6.4±0.9. The difference was statistically significant (p=0.0001). Mean systolic blood pressure in cases and controls were 130.8±15.5 mm of Hg and 128.2±12.4 mm of Hg respectively. Mean diastolic blood pressure in cases was 79.1±8.04 mm of Hg and 78.2±5.6 mm of Hg respectively. Lee et al... found that 89% of their study individuals suffered from deficiency of vitamin D. They also found that the mean concentration of vit D in their patients was 26.11±13.6 this is higher than our findings in the diabetic patients. [16] There were 103 (51.50%) females and 97 (48.50%) males in the cases (new onset Type 2 Diabetes Mellitus), whereas 62 (51.67%) females and 58 (48.33%) males in controls (without Type 2 Diabetes Mellitus). Maximum patients were above 55 years of age in cases and controls. As per the Diabetes Atlas 2019, the prevalence of Diabetes in India is 8.9%. The prevalence of Diabetes Mellitus in India ranges from 5–17%, with higher levels found in the southern parts of the country and in urban areas. [17,18]

Among the Cases, 25-Hydroxy Vitamin D was normal in 34% (34) out of which 20 were females while 14 were males while among the Controls, 25-Hydroxy Vitamin D was normal in 49% (49) out of which 21 were females while 28 were males. 25-Hydroxy Vitamin D was low in 66% (66) of the cases out of which 32 were females while 34 were males while among the controls 25-Hydroxy Vitamin D was low in 51% (51) out of which 30 were females while 21 were males. In a study by Daga et al [19], 91.1% of diabetic patients had vit D insufficiency. In their study vit-D concentration in diabetic patients was 7.88±1.2, however, in non-diabetic individuals, it was 16.64±7.83. Similar to our study, Gagnon et al [20] found that the mean serum concentration of vit D in diabetic patients was lower than the non-diabetic individuals. Taheri et al [21] also showed that mean serum concentration of vit D in diabetic patients was 20.6±11.4 and in non-diabetic individuals was 22.22±16.03.

However, there are studies on the contrary which reveal that low 25-Hydroxy Vitamin D levels are not associated with the risk for Type 2 Diabetes Mellitus [22] and that the association between 25-Hydroxy Vitamin D concentrations and Type 2 Diabetes Mellitus is not causal. [23] According to a recent meta-analysis vitamin D supplementation administered for glycaemic control and insulin resistance in patients with diabetes is not recommended, although doses of vitamin D supplementation may have been suboptimal; almost all trials included in the meta-analysis used vitamin D doses of at least 2000 IU/d. [24] Results from other studies also concluded that vitamin D supplementation at doses of 400 to 800 IU/d, with or without calcium, does not prevent new-onset Type 2 Diabetes Mellitus. [25,26]

## Conclusion

Vit D concentration in diabetic patients was significantly lower in comparison to non-diabetic individuals.

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