

# Prevalence of Hypovitaminosis D and its Association with Serum Lipids in Patients with Type 2 Diabetes Mellitus

Naval Kishor Yadav<sup>1</sup>, Sarita Dhakal<sup>1</sup>, Hari Prasad Upadhyay<sup>2</sup>

<sup>1</sup>Department of Biochemistry, College of Medical Sciences Teaching Hospital, Bharatpur, Chitwan, Nepal, <sup>2</sup>Department of Statistics, Birendra Multiple Campus, Bharatpur, Chitwan, Nepal.

## ABSTRACT

### Background

Hypovitaminosis D has become worldwide public health concern affecting all age groups and both genders. Its prevalence is very high in South Asia. Many studies reported that vitamin D deficiency is concerned with diabetes mellitus and impaired glucose tolerance. The aim of this research was to find the prevalence of hypovitaminosis D and its association with serum lipids among type 2 diabetic patients.

### Methods

A cross-sectional study, conducted among a total 162 patients with type 2 diabetes mellitus in Manipal Teaching Hospital, Pokhara. The serum level of FBS, PPBS, urea, creatinine, calcium, phosphorus, HbA1c, TG, TC, HDL-C, and vitamin D levels were measured. In the descriptive categorical data were reported in frequency with percentage and numerical data were presented as mean±SD while in inferential statistics to compare the value student t-test were used. p-value<0.05 was considered as statistically significant.

### Results

The mean±SD serum level of vitamin D was 24.48 ± 13.21 ng/mL in patients with type 2 diabetes. The prevalence of hypovitaminosis D was 69.14% (With 95% CI as 62.02 to 76.25%) and sufficient of vitamin D was 30.86% (With 95% CI as 23.74% to 37.97%) among patients with type 2 diabetes. The serum lipids showed statistically insignificant association between hypovitaminosis D with sufficient of vitamin D.

### Conclusions

This research showed that only in one third of the patients had Vitamin D sufficiency. The serum lipids were slightly increased in patients who had hypovitaminosis D.

**Keywords:** Vitamin D; serum lipids; type 2 diabetes mellitus.

## INTRODUCTION

Hypovitaminosis D has become worldwide public health concern affecting all age groups and both genders.<sup>1-3</sup> Its prevalence is very high in South Asia.<sup>4</sup> Vitamin D is involved in bone homeostasis and metabolism.<sup>5</sup> Many studies reported that vitamin D deficiency is concerned with diabetes mellitus and impaired glucose tolerance.<sup>6-8</sup> Vitamin D showed direct and indirect effects on beta cell function, insulin secretion and insulin resistance.<sup>9,10</sup> Vitamin D deficiency may be due to factors like changes in the life style, socio-cultural practice, consumed food that may not contain vitamin D and inadequate sun

exposure.<sup>11</sup> The common cause of mortality in T2DM is cardiovascular diseases. The study of Nemerovskii et al reported that vitamin D play function in control of blood pressure, endothelial function, increased vascular resistance and cardiovascular disease prevention.<sup>12</sup> The aim of this research was to find the prevalence of hypovitaminosis D and its association with serum lipids among type 2 diabetic patients.

## METHODS

A cross-sectional study was conducted among 162 type 2 diabetes patients in Manipal Teaching Hospital,

**Correspondence:** Dr. Naval Kishor Yadav, Department of Biochemistry, College of Medical Sciences Teaching Hospital, Bharatpur, Chitwan, Nepal. Email: naval.rhythm@gmail.com, Phone: +977-9846856696. **Article received:** 2024-07-16. **Article accepted:** 2024-09-05.

from March 2022 to July 2023. Ethical approval was taken from Institutional Review Committee of Manipal College of Medical Sciences, Pokhara (IRC No: MEMG/IRC/378/GA). Informed and written consent was taken from the patients before data collection. Those patients who already been taking vitamin D or calcium supplementation, use of drugs affecting serum lipids and liver or kidney disorders were excluded during data collection. 10 ml of venous blood were collected with aseptic precautions, and then dispensed into gel tube and EDTA tube. The blood of gel tube was allowed to clot and centrifuged at 4000 rpm for 10 minutes to obtain the serum. The tests were performed immediately and in case of delay, stored at -20°C. The serum level of FBS, PPBS, urea, creatinine, calcium, phosphorus, TG, TC and HDL-C were measured in VITROS 4600 dry chemistry analyzer (Ortho Clinical Diagnostics), HbA1c levels were measured using D-10 Biored analyzer and serum vitamin D levels were measured using VITROS 3600 immunodiagnostic analyzer (Ortho Clinical Diagnostics). The normal range for serum vitamin D were 30-100 ng/mL, 10-30 ng/mL indicate insufficient and <10 ng/mL indicate deficiency of vitamin D. The internal quality control was run before running the samples. Data was entered and analyzed by using SPSS 20. Data was analyzed using descriptive and inferential statistical tools. In the descriptive statistics for categorical data were reported in frequency with percentage while continuous data were presented as mean±SD after checking the normality of the data. In inferential statistics to compare Vitamin D level with serum lipid student t-test were used. p-value<0.05 was considered as statistically significant.

## RESULTS

The mean age of study subject was  $52.34 \pm 16.24$  years. The mean of BMI, FBS, PPBS, HbA1c, urea, creatinine, calcium and phosphorus were 28.72, 132.41, 245.57, 7.39, 29.13, 0.56, 9.34 and 4.00 respectively (Table 1).

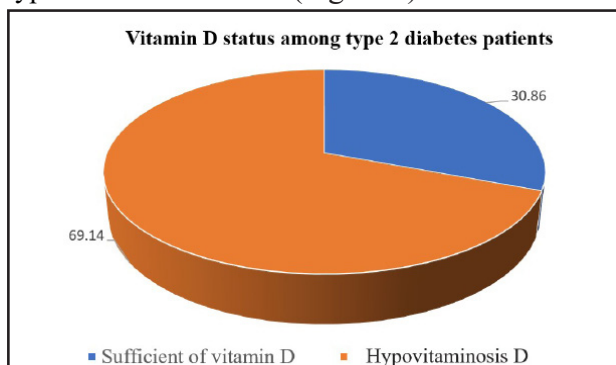
The mean serum level of vitamin D was  $24.48 \pm 13.21$  ng/mL. The Hypovitaminosis D was found in 69.14% (With 95% CI as 62.02 to 76.25%) and

**Table 1. Baseline and biochemical characteristics of study subjects.**

| Variables                | Mean±SD        |
|--------------------------|----------------|
| Age (Yrs)                | 52.34 ± 16.24  |
| BMI (kg/m <sup>2</sup> ) | 28.72 ± 5.35   |
| FBS (mg/dl)              | 132.41 ± 35.23 |
| PPBS (mg/dl)             | 245.57 ± 78.40 |
| HbA1C (%)                | 7.39 ± 1.43    |
| Urea (mg/dl)             | 29.13 ± 6.32   |
| Creatinine (mg/dl)       | 0.56 ± 0.23    |
| Calcium (mg/dl)          | 9.34 ± 0.58    |
| Phosphorus (mg/dl)       | 4.00 ± 0.23    |
| Vitamin D (ng/mL)        | 24.48 ± 13.21  |

BMI (Body Mass Index), FBS (Fasting Blood sugar), PPBS (Post-Prandial Blood Sugar), mg/dl (Milligram per deciliter), ng/mL (Nanogram per Mililiter)

sufficient level of vitamin D was found in 30.86% (With 95% CI as 23.74% to 37.97%) patients with type 2 diabetes mellitus (Figure 1).



**Figure 1. Vitamin D status among type 2 diabetes patients.**

The serum lipids showed statistically insignificant association between hypovitaminosis D with sufficient of vitamin D among the type 2 diabetes patients (Table 2).

## DISCUSSION

The hypovitaminosis D was found in 69.14% and sufficient of vitamin D was in 30.86% patients with type 2 diabetes mellitus. The study conducted in Irain by Saedisomeolia et al reported that the prevalence of vitamin D deficiency was 58.34% and vitamin D sufficiency and insufficiency was 41.66% in patients with type 2 diabetes.<sup>13</sup> Similarly, Elshebiny et al, reported that 67.5% diabetic patients had deficient vitamin D levels, 30.6% had insufficient vitamin D

**Table 2. Serum lipids in study subjects by vitamin D status.**

| Parameters     | Hypovitaminosis D <30 ng/mL | Sufficient of vitamin D >30 ng/mL | p-value |
|----------------|-----------------------------|-----------------------------------|---------|
| TC (mg/dl)     | 174.65 ± 20.88              | 169.71 ± 24.46                    | 0.229   |
| TG (mg/dl)     | 156.36 ± 30.44              | 152.00 ± 33.32                    | 0.443   |
| HDL-C (mg/dl)  | 40.53 ± 3.96                | 41.04 ± 4.69                      | 0.513   |
| LDL-C (mg/dl)  | 102.84 ± 21.42              | 97.52 ± 23.16                     | 0.181   |
| VLDL (mg/dl)   | 31.26 ± 6.07                | 30.38 ± 6.68                      | 0.44    |
| Non-HDL-C      | 134.34 ± 22.32              | 127.91 ± 26.78                    | 0.152   |
| TC/HDL-C ratio | 4.36 ± 0.78                 | 4.22 ± 0.98                       | 0.384   |
| TG/HDL-C ratio | 3.95 ± 1.16                 | 3.83 ± 1.33                       | 0.587   |

TC (Total Cholesterol), TG (Triglyceride), HDL-C (High Density Lipoprotein-Cholesterol), LDL-C (Low density Lipoprotein-Cholesterol), VLDL (Very Low Density Lipoprotein). P-value <0.005 is consider as significant)

levels.<sup>14</sup> The study conducted in Kenya reported that vitamin D deficiency was 38.4%, and insufficiency was 21.9% among T2DM patients.<sup>15</sup> Similarly, a cross-sectional study conducted in Soudi Arabia, reported that 59.8% of vitamin D deficiency, and 38.6% insufficiency among T2DM patients.<sup>16</sup> The another study conducted in Nigeria by Anyanwu et al. reported that 63.2% of type 2 diabetic patients had vitamin D deficiency in relation to the healthy control.<sup>17</sup> In this study, we found that the serum level of lipids were slightly increased except HDL-cholesterol among T2DM patients having hypovitaminosis D in compare to vitamin D adequate patients but the differences were was statistically insignificant. The study of Mohammed et al. reported that there were insignificant differences in mean serum lipids

levels in T2DM patients with vitamin D deficiency in comparison with the control group.<sup>18</sup> Similarly, study conducted among children by Zambrana-Calvi reported that patients with a low level of vitamin D had higher TG levels.<sup>19</sup> Exebio et al found that the level of TC and TG were decreased significantly after supplements of vitamin D for six months.<sup>20</sup> Vitamin D deficiency was found to be associated with impaired  $\beta$ -cell function and insulin resistance, which leads to an increase in TG level and a decrease in HDL-C level.<sup>21</sup>

## CONCLUSIONS

Our study concluded that the hypovitaminosis D was found in more than half of the patients with type 2 diabetes mellitus. The serum lipids were slightly increased in patients who had hypovitaminosis D in relation to patients who had sufficient vitamin D. Therefore, large scale community-based study should be conducted to observe the relationship between vitamin D deficiency and serum lipids in type 2 diabetic patients.

## ACKNOWLEDGEMENT

We were thankful to all the participants, lab staffs, interns and nursing staffs who helped to complete the study.

**Conflict of interest:** None

**Funding:** None

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**Citation:** Yadav NK, Dhakal S, Upadhyay HP. Prevalence of Hypovitaminosis D and its Association with Serum Lipids in Patients with Type 2 Diabetes Mellitus. *JCMS Nepal.* 2024; 20(3): 248-51.