

# Correlation of 25-Hydroxyvitamin D and Serum Lipid Levels Among Patients with Type 2 Diabetes

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## ABSTRACT

**Objective:** We conducted this study among people with type 2 diabetes to see if 25-Hydroxyvitamin D and serum lipid levels correlate.

**Study Design:** Retrospective/ Cross-sectional study

**Place and Duration:** THQ Hospital Khairpur Tamewali, Bahawalpur. Jun 2021-Dec 2021

**Methods:** In this study, a total of 140 people with type-2 diabetes were examined. The patients ranged in age from 20 to 85 years. Detailed demographics, including age, sex, BMI, literacy, and occupation, were obtained from all patients with signed consent. Blood samples were obtained from each patient and sent to a facility to be analyzed. HbA1c and cholesterol levels were also tested. Serum 25(OH)D levels were determined using an electrochemiluminescence technique. The lipid panel was measured using an automated analyzer utilizing enzymatic techniques. SPSS 24.0 version was used to analyze complete data.

**Results:** There were 80 (57.1%) males and 60 (42.9%) female patients in this study. Mean age of the patients was 49.12±3.61 years with mean BMI 27.11±8.44 kg/m<sup>2</sup>. 65 (46.4%) cases were literate and majority of the patients were job holders in factories 82 (58.6%). Frequency of vitamin D deficiency was found among 100 (71.4%) cases. Frequency of dyslipidemia was found among 108 (77.1%) patients. We found mean cholesterol level was 184.11±6.67 (mg/dl), mean HDL among patients were 45.16±5.53 mg/dl, mean triglyceride was 148.9±4.71 mg/dl, mean LDL among patients was 102.6±7.31 mg/dl and mean vitamin D deficiency among patients was 24.13±9.76 mg/dl.

**Conclusion:** According to the findings of this study, vitamin D deficiency is extremely common among patients with type 2 diabetes. Furthermore, it is possible that vitamin D deficiency has an impact on dyslipidemia in patients with type 2 diabetes.

## INTRODUCTION

Diabetic complications are a major cause of morbidity and mortality all around the world. In patients with diabetes, hyperglycemia can occur if insulin synthesis or action is compromised (DM). [2] Type 2 diabetes affects between 90% and 95% of the population [3, 4]. More than seven million people in Saudi Arabia have diabetes, and an additional three million or more are at risk, according to a recent report from the World Health Organization. (as well as the seventh-highest globally) Saudi Arabia has a prevalence of 32.8 percent for type 2 diabetes. The prevalence is expected to rise to 40.37 percent by 2025 and 45.36 percent by 2030, according to the projections made by the CDC. For those with diabetes mellitus (DM), there's an increased chance of death, in addition to other complications with the heart, blood vessels, and nerves.

Vitamin D deficiency has been linked to cardiovascular disease (CVD) in various epidemiological studies [6,7]. More than a dozen studies have linked circulating 25(OH)D to an elevated risk of cardiovascular disease. Risk of cardiovascular disease (CVD) increases by 1.03 every 25 nmol/L decrease in 25(OH)D vitamin (95 percent CI: 1.00–1.06). Studies show that cardiovascular disease (CVD) and related risk factors are on the rise in Saudi Arabia. Variations in the prevalence of cardiovascular disease across the Middle East and North Africa (MENA) region were discovered. [10].

It is vitamin D's role in bone health that cannot be overstated. There are vitamin D receptors in practically all cell types. There are a variety of important vitamin D-related impacts on the exoskeleton. The metabolism of sugar and fat might be hampered if you don't get enough vitamin D. insulin resistance, hyperinsulinemia, and inflammatory markers such as C-reactive protein were shown to be linked to vitamin D deficiency in this study. [11,12] In overweight and obese people, vitamin D insufficiency has been linked to thyroiditis. [13] Vitamin D treatment improved insulin and glucose homeostasis in animal models deficient in vitamin D. a lack of vitamin [14-16] Low levels of vitamin D increase the risk of hypertension and cardiovascular disease. Diabetics with insulin resistance or insufficiency have

abnormal lipids as a consequence of the disruption of enzymes and metabolic pathways. Having higher-than-normal triglycerides and high LDL or HDL cholesterols suggests you've got diabetes-related dyslipidemia (TG). [17] According to a recent research, people with type 2 diabetes may benefit from taking vitamin D supplements to keep their blood sugar and cholesterol levels in balance (T2DM). Vitamin D supplementation and increased vitamin D levels improve blood sugar management and insulin sensitivity in prediabetics, according to a meta-analysis of 28 randomized clinical studies. [18] Take vitamin D pills if you wish to prevent developing type 2 diabetes.

People with type 2 diabetes (T2DM) are more likely to have dyslipidemia, which raises their risk of heart disease [10]. Dyslipidemia and vitamin D deficiency alone are associated with a wide range of cardiovascular disease risk factors [14-18]. The link between low levels of vitamin D and elevated levels of triglycerides in the blood still needs to be studied further. Taking vitamin D supplements may help lower one's risk of heart disease.

This research intends to determine whether 25-hydroxyvitamin D levels and serum lipid levels are connected in individuals with Type 2 Diabetes Mellitus (T2DM).

## MATERIAL AND METHODS

This retrospective/ cross sectional study was conducted at THQ Hospital Khairpur Tamewali, Bahawalpur and comprised of 140 patients of both genders. Detailed demographics, including age, sex, BMI, literacy, and occupation, were obtained from all patients with signed permission. There were exclusions for patients under the age of 20, patients with diabetes mellitus type 1, vitamin D supplementation, and those with hypothyroidism, renal illness, or hepatic disease.

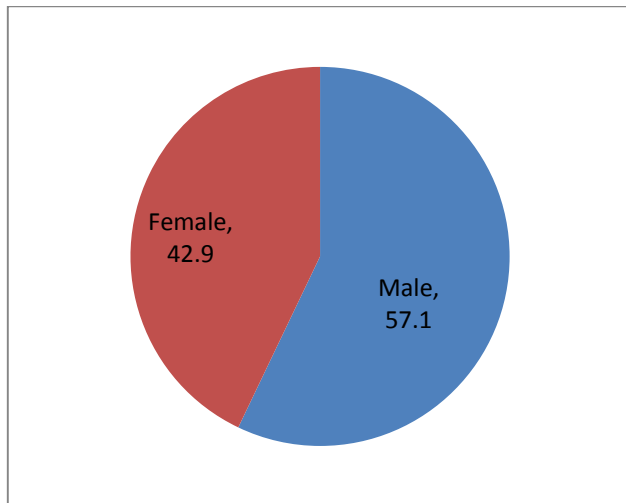
Patients between the ages of 20 and 85 were included in the study. Two separate vials of non-fasting blood were used to obtain the test samples (one with a yellow cap and the other with a purple cap). The patient's venous blood was tested for basic biochemistry (cholesterol, low- and high-density lipoproteins (LDL) and vitamin 25(OH)D). Measurements of 25(OH)D concentrations were made

in both samples. Measurements of 25(OH)D in the blood of study participants were made using an electrochemiluminescence immunoassay (ECLIA). One ELISA was done on two different days, with the identical samples, standards, and controls, and each run had an inter-assay coefficient of variance of 13.1 percent; intra-assay coefficient of variation was determined to be 6.8 percent. Enzymatic approaches were proven to be the best method for measuring total and low density lipoprotein cholesterol, HDL cholesterol, and triglyceride cholesterol levels in the blood. The intra- and inter-assay variability coefficients were each 0.84 and 1.30 for total cholesterol, HDL cholesterol, and TG, whereas they were 2.0 and 0.4 for the other two lipids. Friedewald's equation was used to determine the LDL level.

SPSS 24.0 version was used to analyze complete data. Categorical variables were assessed by frequencies and percentage. Mean standard deviation was used to present data.

**RESULTS**

There were 80 (57.1%) males and 60 (42.9%) female patients in this study.(Fig 1)



Mean age of the patients was 49.12±3.61 years with mean BMI 27.11±8.44 kg/m<sup>2</sup>. 65 (46.4%) cases were literate and majority of the patients were job holders in factories 82 (58.6%). (table 1)

Table 1: Enrolled cases baseline details

Variables	Frequency (140)	Percentage
Mean age (years)	49.12±3.61	
Mean BMI (kg/m <sup>2</sup> )	27.11±8.44	
Education Status		
Yes	65	46.4
No	75	53.6
Occupation		
Job	82	58.6
Business	30	21.4
Retired	28	20

Frequency of vitamin D deficiency was found among 100 (71.4%) cases. Frequency of dyslipidemia was found among 108 (77.1%) patients.(Fig 2)

In current study we found that high cholesterol level was found among 48 (34.3%) cases, higher HDL level was found among 95 (66.9%) cases, high Triglyceride was found in 49 (35%) cases and higher LDL was found in 78 (55.7%) cases.(table 2)

We found abnormal low-density lipoprotein & triglycerides in 5 (3.6%) cases, abnormal cholesterol HDL and triglyceride in 4 (2.9%) cases, abnormal cholesterol and HDL in 3 (2.1%) cases and cholesterol LDL and HDL in 2 (1.4%) patients. (table 3)

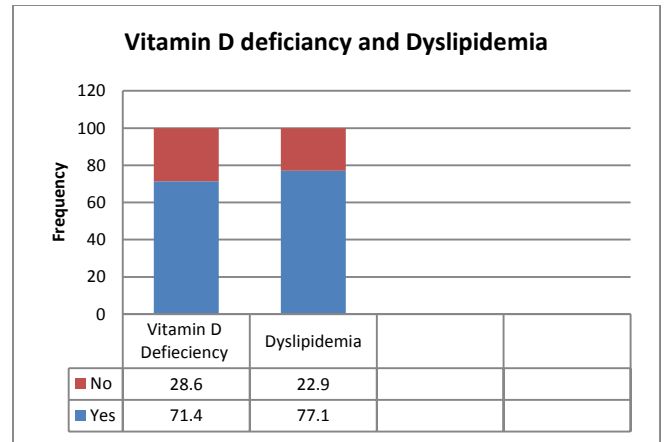


Table 2: Association of lipid profile among enrolled cases

Variables	Frequency	Percentage
High Cholesterol level (mg/dl)		
Yes	48	34.3
No	92	65.7
Higher HDL (mg/dl)		
Yes	95	66.9
No	45	33.1
High Triglyceride (mg/dl)		
Yes	49	35
No	91	65
High LDL (mg/dl)		
Yes	78	55.7
No	62	44.3

Table 3: Association of abnormal lipids among enrolled cases

Abnormal Lipids	Frequency	Percentage
LDL & triglycerides	5	3.6
cholesterol HDL and triglyceride	4	2.9
cholesterol and HDL	3	2.1
cholesterol LDL and HDL	2	1.4

We found mean cholesterol level was 184.11±6.67 (mg/dl), mean HDL among patients were 45.16±5.53 mg/dl, mean triglyceride was 148.9±4.71 mg/dl, mean LDL among patients was 102.6±7.31 mg/dl and mean vitamin D deficiency among patients was 24.13±9.76 mg/dl.(table 4)

Table 4: Association of lipid levels and vitamin D among all cases

Variables	Mean	Standard Deviation
Cholesterol level (mg/dl)	184.11	6.67
HDL (mg/dl)	45.16	5.53
Triglyceride (mg/dl)	148.9	4.71
LDL (mg/dl)	102.6	7.31
vitamin D (ng/ml)	24.13	9.76

**DISCUSSION**

An accurate assessment of vitamin D status may be made by measuring 25(OH)D levels in the blood. 1,25-dihydroxyvitamin D, which binds to the vitamin D receptor and has biological effects, is the most bioactive form of vitamin D. (VDR). [19] Exactly what constitutes vitamin D insufficiency is still a matter of controversy at this time. If your 25(OH)D level is less than 20 ng/mL, you may be suffering from vitamin D insufficiency, as described by the 2011 U.S. guidelines[20] and the 2018 Chinese clinical agreement on vitamin D and its analogs[21]. According to a comprehensive analysis, vitamin D insufficiency is common in China. [22]

In current study 140 patients of type 2 diabetes were included. Majority of the patients were 80 (57.1%) males and 60 (42.9%) female patients in this study. Mean age of the patients was 49.12±3.61 years with mean BMI 27.11±8.44 kg/m<sup>2</sup>. Our findings were comparable to the studies conducted in past.[23,24]

65 (46.4%) cases were literate and majority of the patients were job holders in factories 82 (58.6%).[25] Depression does not appear to be more prevalent in women despite the fact that men make up a larger percentage of those afflicted (57.1 percent) than women (42.9 percent). Participants who were deficient in vitamin D were more likely to cite obesity, smoking, and lack of physical activity as risk factors for cardiovascular disease. This study shows that treating low vitamin D levels in both men and women is critical, despite the fact that the link between these risk factors and low vitamin D is tenuous but nonetheless substantial. Wang et al research [26] suggests [26] Females are more likely to acquire type 2 diabetes at a younger age than men, according to certain research [27]. According to Nordström A et al [28], males are more likely than women to develop type 2 diabetes as they age. In part, this is because males have more visceral fat than women.

Frequency of vitamin D deficiency was found among 100 (71.4%) cases. Frequency of dyslipidemia was found among 108 (77.1%) patients. These results were equivalent to the previous some studies.[23-25] We found that high cholesterol level was found among 48 (34.3%) cases, higher HDL level was found among 95 (66.9%) cases, high Triglyceride was found in 49 (35%) cases and higher LDL was found in 78 (55.7%) cases. We found abnormal low-density lipoprotein & triglycerides in 5 (3.6%) cases, abnormal cholesterol HDL and triglyceride in 4 (2.9%) cases, abnormal cholesterol and HDL in 3 (2.1%) cases and cholesterol LDL and HDL in 2 (1.4%) patients. When Omotoye FE and his colleagues studied 50 diabetic individuals, they found that 35 (70.0 percent) of them had at least one anomaly in their lipid profile. In addition, 34%, 36%, 12%, and 72% of patients had raised LDL-C, TCHOL, TRG, and decreased HDL-C values, respectively. A study by Omotoye FE et al. found that raised LDL and lowered HDL-C were the most prevalent aberrant lipid combinations. There were no statistically significant variations in the mean lipid profiles of males and females. The median ages of males and females, as well as triglyceride and blood glucose levels, were all significantly different (both significantly different, P 0.05). [29] Kayode JA et al. (2010) conducted a second investigation on the lipid profile of Nigerian diabetics. Dyslipidaemia was observed in 50.4% of the population. TC and HDLC was the most common lipid combination in 31.6% of females and 21.1 percent of males, followed by 31.6% of females and 21.1 percent of males. The combined lipid variables showed a statistically significant difference between men and women (P = 0.000). It was revealed that TC (0.000), HDL-C (0.012), and LDL-C (0.001) were statistically significant differences between males and females when lipids were taken into account. [30]

Vitamin D and cholesterol had a significant negative connection (P 0.003) in this research, which is a bridge between the direct and indirect effects of the vitamin on blood triglyceride levels (P 0.002). A negative correlation between vitamin D and triglycerides was found in the regression model (P = 0.002). Patients with type 2 diabetes were tested to determine whether their vitamin D levels were linked to their lipid profiles by researchers from Saedisomeolia A et al. Total cholesterol and triglyceride levels, on the other hand, exhibited no significant inverse connection (P>0.05) with 25(OH)D blood levels. [31]. Vitamin D (25-OH-D) and its effects on lipid metabolism have been related to the development of type 1 diabetes in children and adolescents, according to a recent research by Zambrana-Calv GDR and colleagues. Research in the Zambrana-Calv GDR journal found a relationship between decreased 25-OHD in children and increased levels of total cholesterol, low-density lipoprotein (LDL), and trans fats in adults (TG). Using a standardised method, they found that 25-OH-D (20ng/mL) was related with lower TG levels (P =0.04) and correlation (0.230; P 0.029). [32]

These individuals are more prone to develop type 2 diabetes.

[33-35] Type 2 diabetics with HbA1c levels over 7% were more likely to have elevated triglyceride and LDL levels, according

to a study led by Mulugeta Y and colleagues. Klisic A et al. found an association between a high HbA1c level and abnormal TG, TC, LDL, and HDL levels [36]. In a randomised, placebo-controlled experiment, patients' glycaemic control and other metabolic parameters were improved by vitamin D administration. Type 2 diabetes patients had a significant decrease in total and low density lipoprotein cholesterol (LDL). Atherosclerosis has been related to vitamin D deficiency in persons with type 2 diabetes (T2DM). Finding out if vitamin D deficiency and supplements that might compensate for it are of therapeutic use in diabetics is still an open question.

## CONCLUSION

According to the findings of this study, vitamin D deficiency is extremely common among patients with type 2 diabetes. Furthermore, it is possible that vitamin D deficiency has an impact on dyslipidemia in patients with type 2 diabetes.

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