Original research article

A STUDY ON EFFECT OF SERUM 25-HYDROXY CHOLECALCIFEROL ON GLYCEMIC STATUS AND LIPID PROFILE IN TYPE 2 DIABETES MELLITUS

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Abstract

Introduction: In diabetes mellitus, a metabolic disorder abnormalities in insulin production or insulin action cause disturbances in carbohydrate, protein, and lipid metabolism, which in turn cause chronic hyperglycemia. The research set out to determine the correlation between vitamin D levels and the incidence of vitamin D deficiency in people with type 2 diabetes mellitus.

Method: This study was a comparative cross-sectional investigation carried out at the Department of Biochemistry, Guntur Medical College, Guntur, Andhra Pradesh, India. This survey was done from December 2022 to November 2023. A total of 100 patients were included in this investigation.

Results: Based on this investigation, the participants' vitamin D levels were divided into three distinct groups. There was a correlation between the vitamin D level and HbAlc, blood sugar, and lipid profile. This study demonstrates the association between Vitamin D and the development of type 2 diabetes mellitus, as well as its impact on glycemic control and lipid profile in individuals with type 2 diabetes mellitus. There is a high occurrence of vitamin D deficiency in individuals with type 2 diabetes mellitus. This deficiency, together with other risk factors, can significantly contribute to the development of complications associated with diabetes mellitus.

Conclusion: It is evident that vitamin D plays a role in the development of type 2 diabetes mellitus and impacts both the ability to control blood sugar levels and the lipid profile of people with this condition. Type 2 diabetes mellitus is associated with hypovitaminosis D, which, in addition to other risk factors, may be a strong independent predictor of diabetes complications.

Keywords: Glucose, lipid profiles, type 2 diabetics, serum 25-hydroxy cholecalciferol

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Introduction

In diabetes mellitus, a metabolic disorder that does not spread from person to person, abnormalities in insulin production or insulin action cause disturbances in carbohydrate, protein, and lipid metabolism, which in turn cause chronic hyperglycemia. One of the most pressing issues in public health today is diabetes [1, 2]. Diabetes mellitus is on the rise both domestically and internationally. Worldwide, about 380 million people will have diabetes during the next decade, with 41 million of them people living in India. This is going to add up to around 15% of the global load. As a result, we need to find modifiable risk factors and develop effective preventative strategies. New research links vitamin D-1, 25-dihydroxycholecalciferol to an increased risk of type 2 diabetes [3, 4].

The skin produces 25-hydroxy cholecalciferol (vitamin D), a hormone, when it comes into contact with sunlight. Diseases including osteomalacia in adults, osteoporosis in youngsters, and rickets in children are linked to its shortage because of its primary function in maintaining bone integrity. Diabetes, high blood pressure, metabolic syndrome, atherosclerosis, heart attacks, and stroke are some of its non-skeletal complications. A lack of vitamin D is among the most prevalent health problems affecting people of all ages. Worldwide, hypovitaminosis D is a growing problem that needs urgent attention. Twenty to thirty percent of persons suffer from vitamin D insufficiency [5-7].

The main pathogenic effects of diabetes include inflammatory factors, reactive oxygen species, and autoimmune reactions. The significance of vitamin D in insulin resistance and the development of diabetes has recently attracted a lot of attention. Vitamin D insufficiency and type 2 diabetes share many risk factors, including a lack of physical exercise, being overweight, becoming older, and being of a certain race [8, 9].

Glycated haemoglobin is a worldwide indicator of glycemic control and a common diagnostic tool for diabetes mellitus. Glycated haemoglobin is a measure of the average blood glucose levels during the last three to four months. It is a crucial tool for gauging the efficacy of diabetes care, tracking patients' long-term glucose control, and predicting the likelihood of diabetic complications [10, 11].

Diabetes causes dyslipidemia due to insulin insufficiency, which causes the body to mobilise free fatty acids excessively while chylomicrons and VLDL are underutilised. Decreased cholesterol bile acid conversion leads to an elevated cholesterol level. Researchers examined vitamin D levels in people with diabetes mellitus in relation to their fasting and postprandial blood sugar, glycated haemoglobin, and lipid profiles [12, 13].

The purpose of this research was to examine the correlation between vitamin D levels and glycemic status and lipid profiles in patients visiting the diabetic outpatient department, as well as to determine the incidence of vitamin D deficiency in people with type 2 diabetes mellitus. The research set out to quantify 25-hydroxycholecalciferol, a form of vitamin D, in people with type 2 diabetes.

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Materials and Methods

This study was a comparative cross-sectional investigation carried out at Department of Biochemistry, Guntur Medical College, Guntur, Andhra Pradesh, India. This survey was done from December 2022 to November 2023. A total of 100 patients were included in this investigation.

Sample Selection

Patients with type 2 diabetes mellitus, ranging in age from 30 to 60, who were told about the study in their native language and gave their written consent, were included if they were using an oral hypoglycemic medication for less than three months. Based on the recommendations of the American Association of Clinical Endocrinologists for Vitamin D, the participants were divided into three categories after their vitamin D levels were estimated.

Inclusion Criteria

- Recently diagnosed type 2 Diabetes patients aged 30-60.
- Both gender.
- Taking oral hypoglycemic medications for less than three months.

Exclusion Criteria

- Type I diabetes mellitus.
- Patients with cancer.
- Women with gestational diabetes mellitus.
- Patients with hypertension.

Results

One hundred patients with type 2 diabetes are included in the current investigation. The individuals were divided into three subgroups based on their vitamin D status. Vitamin D levels in Group 1 are less than 20 ng/ml, in Group 2 they are between 20 and 30 ng/ml, and in Group 3 they are greater than 30 ng/ml. The master table displays all of the research, including that on vitamin D. The study's master table was created by adding together the results of the tests that were taken by each research subject. Version 20.0 of the SPSS software was used to conduct the statistical analysis. The mean ± standard deviation was used to express the results. Via analysis of variance, the parameters between the groups were compared. The study employed Pearson's correlation analysis to establish a relationship between the parameters.

Table 1: Gender wise distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	50	50.0	50.0	50.0
	Female	50	50.0	50.0	100.0
	Total	100	100.0	100.0	

Table 1 presents the distribution of genders, with 50% being male and the other 50% being female.

Table 2: Age wise distribution

		Frequency	Percent	Valid Percent
Valid	Below 20	42	42.00	42.0
	20-30	10	10.00	10.0
	Above 30	48	48.00	48.0
	Total	100	100.0	100.0

Table 2 displays the age distribution of the patients, with 42 individuals below the age of 20, 10 patients between the ages of 20-30, and 48 patients above the age of 30 out of a total of 100 patients.

Table 3: Chi-square test for fasting blood sugar

	Value	DF	Asymp. Sig. (2-sided)
Pearson Chi-Square	32.124	1	0.00
Likelihood Ratio	38.357	1	0.00
Linear-by-Linear Association	30.912	2	0.00
N of Valid Cases	100		

Table 4: Comparison of research groups by age

	N	Mean	Std.Deviation
Below 20	42	40.12	4.167
20-30	10	10.00	4.368
Above 30	48	47.32	4.258
Total	100	50.64	4.264

Table 4 presents the age distribution among the study groups of the patients.

Discussion

The purpose of this research was to examine vitamin D's potential impact on type 2 diabetes mellitus. A total of one hundred diabetic participants were divided into three groups based on their vitamin D levels; each group had its biochemical parameters evaluated. In terms of the variables there was a statistically significant difference between the groups for fasting blood sugar, PPBS, HbA1c, total cholesterol, TGL, and LDL, and a statistically significant difference for HDL [11-13].

Our study found that 61% of newly diagnosed diabetics who visited the had vitamin D

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insufficiency. Among diabetics, just 39% had adequate vitamin D levels. Vitamin D, which is known as the "sunshine vitamin," is most often insufficient when people do not get enough time in the sun. The amount of time people spend outdoors has diminished due to modernization, which results in insufficient exposure to the sun. Sunscreen use and a dark complexion are two other factors.
The newly diagnosed cases of diabetes had a noticeably reduced serum vitamin D concentration. Researchers found that low serum vitamin D content was associated with an increased prevalence of diabetes. Diabetes was associated with lower levels of 25(OH)D and 1,25(OH)2D, even after controlling for confounding variables such as sex, geography, physical activity, body mass index (BMI), vitamin D intake, and calcium, according to a 2011 cross-sectional [14-16].
The results demonstrated that compared to the control group, diabetic patients had much lower 25 (OH) D levels, and the prevalence of 25 (OH) D insufficiency was much greater in diabetic patients [17, 18].
Vitamin D concentrations in people with diabetes compared to those without the disease. Vit D concentrations were lower in diabetes patients when compared to the control group. The 25-hydroxyvitamin D concentrations of newly diagnosed juvenile-onset diabetics and healthy individuals who do not have diabetes are compared. In participants with diabetes, the mean ± standard deviation of 25 (OH) D was 7.88±1.20 ng/ml, which was substantially lower than the controls' 16.64 ± 7.83 ng/ml. Low vitamin D status was associated with a higher frequency of type 2 diabetes, and this association was rather stable. Vitamin D insufficiency was found in 46% of men and 54% of females in our study [19, 20]. People in the 46-55 age bracket had higher vitamin D levels than those in the 35-45 and 55+ age brackets.
Clinical and epidemiological evidence suggests that vitamin D's beneficial effects on fasting blood sugar levels above 125 mg/dl are due, first and foremost, to its function in insulin secretion or both, and, secondarily, to its role in inflammation [21, 22].VitaminD's impact on type 2 diabetes mellitus can be explained by its ability to improve beta cell function. This can happen either through an increase in intracellular ionised calcium, which leads to enhanced insulin release, or by vitamins D direct effect on pancreatic beta cells, activating their 1 alpha hydroxylase. Inhibition of cytotoxic cytogene expression by VDR transcription factors leads to an increase in insulin sensitivity, which in turn increases glucose utilisation and inhibits beta cell death through calcium dependent pathways in target cells. People with certain genetic variations in vitamin D metabolism genes, like DBP and VDR, may have an increased risk of developing type 2 diabetes [23, 24]. When vitamin D concentrations are high, its effects extend beyond the skeleton; when concentrations are low, they remain localised to the skeletal and muscular systems. At 40-60 ng/ml, there is a noticeable concentration. In addition to suppressing the renin gene, 25(OH) D enhances transcription of the insulin receptor gene. Insulin sensitivity is influenced by vitamin D's impact on peroxisome proliferative activated receptor regulation.
Our research showed that blood vitamin D and HbA1c were significantly inversely correlated. In our study, Group 1 people whose vitamin D levels were below 20 ng/dl had an average HbA1C of 7.48±1.16. Group 2 people whose vitamin D levels were between 20 and 30 ng/dl had an average HbA1C of 6.02±0.31 [24-26]. And Group 3

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people whose vitamin D levels were above 30 ng/dl had an average HbA1C of 5.86±0.196. Which is really significant. This could be because, as mentioned before, vitamin D plays a role in insulin secretion and sensitivity. Low levels of HDL cholesterol are associated with hypertriglyceridemia and hypercholesterolemia in diabetics. High triglyceride levels are the most typical abnormality. Vitamin D enhances calcium absorption in the intestines, which may reduce hepatic triglyceride synthesis and release through cholesterol complex formation. Because insoluble calcium fatty acid complexes may form in the gut, an increase in intestinal calcium levels may decrease the absorption of fatty acids from the intestines [26-28]. Reducing the absorption of fat, especially saturated fatty acids, might lower serum LDL-C. A low blood cholesterol level is a result of a combination of factors, including the fact that calcium aids in the breakdown of cholesterol into bile acids and the fact that a diet rich in vitamin D inhibits parathyroid hormone, which in turn lowers triglyceride levels through enhanced peripheral elimination. Insulin resistance and beta cell activity are both reduced by adequate vitamin D levels. This changes the metabolism of lipoproteins, which raises triglyceride levels and lowers HDL levels. Vitamin D controls TGL metabolism by regulating the expression of VLDL cholesterol receptors in certain cell types. Vitamin D insufficiency increases insulin resistance, which in turn raises levels of bad cholesterol (LDL) and good cholesterol (TGL) [28-30].

Conclusion

Vitamin D deficiency was seen in individuals with a high glycemic index in this investigation. This could be a factor that puts you at higher risk of developing diabetes. Therefore, vitamin D estimate in diabetic individuals is a feasible addition. According to the study, a lower vitamin D level is linked to higher fasting PP blood sugar. Low vitamin D levels were also linked to an altered lipid profile in diabetic patients, according to the study. Because of its effects on glycemic status and lipid profile, vitamin D may influence the precipitating risk factors for the beginning of prognosis of diabetic complications, and it also acts as a risk factor for the development of type 2 diabetes mellitus. Therefore, lowering blood vitamin D levels can halt or postpone the onset of diabetes mellitus and its complications. Modifying one's lifestyle may help one reach this objective.

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None.

Conflict of Interest

None.

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