ORIGINAL ARTICLE

A Comprehensive Study on Association of Vitamin D with HDL Cholesterol and HBA1c in Diabetic Patients

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ABSTRACT

Aim: To analyze the role of association of Vitamin D with HDL cholesterol and HBA1c in diabetic patients

Study Design: Cross-sectional study

Place & Duration: Department of Medicine, Shahida Islam Medical College Lodhran from 1st August 2018 to 30th November 2019.

Methods: One hundred diabetic patients from the age range 20 to 60 years were included in this study. After overnight fasting, 10 ml of peripheral blood was withdrawn. Blood samples were centrifuged at 3000 rpm for 10 min and stored at -20°C. Serum levels of 25(OH) D, calcium and fasting serum glucose was measured using Randox kit. Plasma total cholesterol, HDL-C, and triglyceride concentrations were measured in duplicate using enzymatic kits, standardized reagents, and standards.

Results: The mean age range of 57.5 years. 73.4% of the patients were male, 26.6% were female respectively. The mean age of the patients was 57.7±10. The mean HbA1c values of the patients were 9.18±2.52. The mean vitamin D values of the patients were 9.17±3.7. The vitamin D deficiency was in 98.3% of the patients. The collected parameters were compared between good glycemic control patients (HbA1c≤7%) and poor glycemic control patients (HbA1c>7%).

Conclusion: High density lipoprotein correlation was found to be prominent with vitamin D and hence conclusion was validated with respect to HDL. Therefore, the relationship between serum levels of 25(OH) D and lipids may be affected by increased disease duration in these patients.

Keyword: Diabetes, Diagnostic, Vitamin-D, LDL

INTRODUCTION

Vitamin D is a steroid hormone that is initially produced in the skin after exposure to sunlight and is also obtained from dietary sources. Vitamin D deficiency is a common disorder, found in all age groups and in both genders. It is prevalent in various parts of the world including Pakistan with an increased occurrence in high and low latitude countries[1]. Worldwide, the prevalence of vitamin D deficiency is 50% in elderly and within Europe in 2%–30% of adults[2].

Diabetes mellitus (DM) belongs to a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of different organs, especially the eyes, kidneys, nerves, heart, and blood vessels[3]. In 2013, according to the International Diabetes Federation, an estimated 381 million people had diabetes. Its prevalence is increasing rapidly, and by 2030 this number is estimated to almost double[4]. HbA1c is the most important laboratory parameter indicating glycemic control. Clinicians aim to achieve the HbA1ctarget level in diabetes mellitus treatment steps. The general target of HbA1c is ≤7% for glycemic control[5]. HbA1c values over 7% show poor glycemic control. Vitamin D is a steroid hormone that might contribute to prevent type2 diabetes mellitus (DM)[6]. Vitamin D is a crucial factor In development of type 2 DM because it regulates adipogenesis during adipocyte differentiation, stimulates insulin synthesis, protects pancreatic B cells and decreases insulin resistance in muscles[7].

Many cross-sectional and interventional studies have demonstrated that vitamin D deficiency is associated with impaired glucose tolerance and diabetes mellitus[8]. Therefore, serum concentrations of 25(OH) D are lower in T2DM patients compared with healthy controls. There are several mechanisms proposed to explain the inverse relationship between vitamin D and type 2 DM. Vitamin D[9], via both genomic and non-genomic pathways, has direct and indirect effects on insulin secretion, β-cell function, and insulin resistance[10-12].

MATERIALS AND METHODS

This cross sectional study was conducted in Department of Medicine Shahida Islam Medical & Dental college Lodhran during August 2018 to November 2019 with the permission of ethical committee of hospital. There are 100 diabetic patients from the age range 20 to 60 years were included in this study. It included pregnancy, lactation, use of drugs affecting the lipid profile or calcium and bone metabolism, chronic disorders of the liver or kidney, endocrinology disorders such as hypo- or hyperthyroidism and hyperparathyroidism, smoking, insulin injection, use of anticonvulsive drugs, and vitamin D or calcium supplementation. After overnight fasting, 10 ml of peripheral blood was withdrawn. Blood samples were centrifuged at 3000 rpm for 10 min and stored at -20°C.

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Serum levels of 25(OH) D, calcium and fasting serum glucose was measured using Randox kit. The normal range of 25(OH) was 6–54 ng/ml (15-135 nmol/l) using this method. Plasma total cholesterol, HDL-C, and triglyceride concentrations were measured in duplicate using enzymatic kits, standardized reagents, and standards. All continuous values are expressed as mean ± SD and categorical variables are presented as percentage. The Student's *t*-test was employed to compare differences between the means of continuous variables.

RESULTS

The data was collected from 100 diabetic patients with the mean age range of 57.5 years. 73.4% of the patients were male, 26.6% were female respectively. The mean age of the patients was 57.7±10. The mean HbA1c values of the patients were 9.18±2.52. The mean vitamin D values of the patients were 9.17±3.7. The vitamin D deficiency was in 98.3% of the patients. These include blood pressure, HEI, BMI, smoking habits and some other basic things. The collected parameters were compared between good glycemic control patients (HbA1c≤7%) and poor glycemic control patients (HbA1c>7%). Vitamin D was not associated with the glycemic control (*P* value >0.05) [Tables 1-2, Fig. 1).

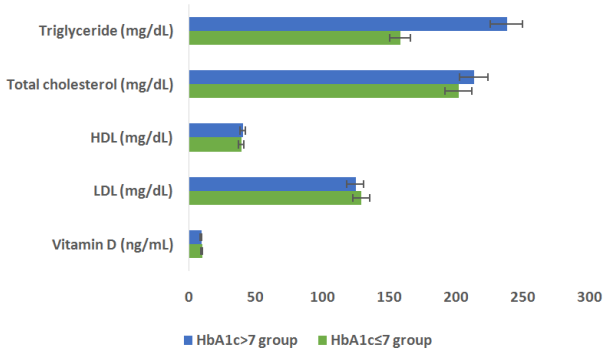
Table 1: Demographic characteristics of the diabetic group

Parameters	HbA1c≤7 group	HbA1c>7 group	All patients
Age	57.5±10.7	57.8±9.7	57.7±10
Gender (Female/ Male)	27 (75%)/ 9 (25%)	67 (72.8%)/ 25 (27.2%)	94 (73.4%)/ 34 (25.6%)
HbA1c	6.3±0.4	10.2±2.1	9.18±2.52
Vitamin D	9.6±3.9	8.9±3.6	8.9±3.6
Vitamin D deficiency (<20 ng/mL), n/%	36 (100)	90 (97.8)	126 (98.4)

Table 2: Association of Vitamin D with HDL cholesterol and HBA1c in diabetic patients

Parameters	HbA1c≤7 group	HbA1c>7 group	*P* value
Vitamin D (ng/mL)	9.67±3.92	8.97±3.6	0.33
LDL (mg/dL)	128.9±29.5	124.6±36.1	0.55
HDL (mg/dL)	39.2±8.3	40.1±9.8	0.66
Total cholesterol (mg/dL)	201.7±36.8	213±53.3	0.26
Triglyceride (mg/dL)	158.1±76.1	237.7±204.7	0.01

Fig. 1: Comparison analysis of Vit-D with HDL cholesterol and HBA1c in diabetic patients



DISCUSSION

In the present study, <20 ng/mL of 25-hydroxyvitamin D was significantly associated with elevated LDL cholesterol and this reiterates the findings of Auwerx et al. from Finland.[13,14] The mechanism of association of hypo vitaminosis D with cholesterol in human is not clearly known. It may be via photo metabolism[15]. In the presence of sunlight, squalene in exposed skin is converted into 7-dehydrocholesterol and vitamin D (and photo metabolites of vitamin D); in the absence of effective sunlight, its metabolic pathway is diverted into the formation of cholesterol[16].

Our study findings indicate that there is a negative, but non-significant, relationship between serum levels of 25(OH) D and that of HDL in diabetic patients. Few studies have been carried out on the relationship between serum levels of vitamin D and lipid profiles[17]. Ford and colleagues, in their NHANES III study, found a negative association between serum levels of 25(OH) D and TG in patients with hypertriglyceridemia. However, this relationship was not observed with regard to HDL cholesterol in healthy subjects. It was suggested that vitamin D has both direct and indirect effects on modifying the lipid profile and that the effect of vitamin D on decreasing serum levels of TG may occur through regulatory action that increases the activity of lipoprotein lipase in adiposity[17]. Several mechanisms are suggested to explain the effect of calcium on lipids, including its reducing role in fatty acid absorption via the formation of insoluble calcium–fatty complexes in the gut. By decreased absorption of fat, particularly saturated fatty acids, it is expected that serum levels of total and LDL cholesterol will be reduced[18].

CONCLUSION

High density lipoprotein correlation was found to be prominent with vitamin D and hence conclusion was validated with respect to HDL. Therefore, the relationship between serum levels of 25(OH) D and lipids may be affected by increased disease duration in these patients. Diminished levels of vitamin D with increased BMI and increased LDL-C aggravates or increases the risk for the diabetic complications and hence may act as predictive markers in diagnosis of diseases in patients.

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