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Original Research Article

VITAMIN D2 LEVELS IN TYPE-2 DIABETES MELLITUS PATIENTS IN ANDAMAN AND NICOBAR ISLANDS

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ABSTRACT

Background and Objective: Vitamin D deficiency has been recently linked to diabetes, biochemical tests are restricted to traditional monitoring of glucose. Therefore, introducing vitamin D test in Andaman and Nicobar Islands hospitals may help in the management of the disease.

Materials and methods: This case-control study comprised 30 type 2 diabetic patients (19 males and 11 females) and 30 healthy controls (18 males and 12 females) were included in the study. Serum vitamin D2, serum glucose, Glycated hemoglobin (HbA1c) was measured. Data were computer analyzed using Excl spared sheet and SPSS version 18.0.

Results: The mean ages of cases and controls were 39.9±6.84 and 37.7±9.95 years, p=0.32 respectively. The levels of blood HbA1c, Fasting blood glucose and Post Prandial Blood Glucose levels were significantly increased in cases compared to controls (9.04±1.34 vs. 5.95±0.14%, P=0.00; 178.27±32.13 vs. 91.67±13.61mg/dl, P=0.00; and 287.03±42.66 vs 124.23±8.01mg/dl, p=0.00 respectively). Vitamin D2 level were cases 9.71-±1.82 ng/ml, and controls 34.47±3.06 ng/ml were also statistically significantly decreased (p=0.00) in type -2 diabetic patients when compared with healthy controls. Vitamin D2 levels were negatively correlating with age, FBS, PPBS, and HbA1c (r=-0.284, p=0.128; r=-0.064, p=0.738; r=-0.059, p=0.757; and r= -0.077, p=0.685 respectively) in cases.

Conclusions: Serum vitamin D2 was significantly lower in type 2 diabetic patients compared to controls in Andaman and Nicobar Islands. Serum vitamin D2 was negatively correlated with Age, FBS, PPBS, and HbA1c. It's accepted that vitamin D treatment improves insulin resistance. Therefore, supplementation of vitamin D to type 2 diabetic patients in the Andaman and Nicobar Islands hospitals and clinics may be useful in the disease management.

KEY WORDS: Type 2 diabetic patients, HbA1c, Serum vitamin D2, Andaman and Nicobar Islands.

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BACKGROUND

The more prevalent form, type 2 diabetes, accounts for more than 90% of cases [1]. Type 2 diabetes usually begins as insulin resistance, a disorder in which the cells do not use insulin properly. As the need for insulin rises, the pancreas gradually loses its ability to produce it [2]. Lack of insulin action and/or secretion in type 2 diabetes induces hepatic glucose output by inhibiting glycogen synthesis and stimulating glycogenolysis and gluconeogenesis then

increased rates of hepatic glucose production result in development of overt hyperglycemia, especially fasting hyperglycemia [3-5]. In such conditions, lipolysis in adipose tissue is promoted leading to elevated circulating levels of free fatty acids. In addition, excess fatty acids in serum of diabetics are converted into phospholipids and cholesterol in liver. These two substances along with excess triglycerides formed at the same time in liver may be discharged into blood in the form of lipoproteins [6]. In addition, disturbance in liver and kidney functions was also reported in type 2 diabetes [7- 9].

Fat soluble vitamin-D is plays an essential role in calcium homeostasis and the maintenance of normal function in multiple tissues. Vitamin-D either directly from the diet or through exposure to solar ultraviolet B radiation obtains [10,11]. In addition to its well-recognized effects on skeletal health, vitamin D has suggested to have a potential role in other disease states and health conditions including cardiovascular disease, type 2 diabetes, autoimmune disorders and cancer [12-16].

Numerous studies have found that patients with type 2 diabetes or impaired glucose tolerance are significantly more likely to have a lower serum vitamin D concentration compared to those without diabetes [17,18]. In addition, recent studies reported a significant inverse association of serum vitamin D with insulin resistance [19,20] as well as a positive association between vitamin D and β-cell function [21,23]. However, no previous study linked vitamin D to diabetes mellitus in Andaman. Therefore, the present study is the first to assess serum vitamin D level in type 2 diabetic patients from Andaman and Nicobar Islands.

MATERIALS AND METHODS

This case control study was conducted at General Medicine department with collaboration with Biochemistry department. We included A total of 60 (30 type–2 diabetic patients, and 30 healthy controls) age and sex matched subjects were participated in the study by giving informed consent form from Amrita Health center, Port Blair. Patients with chronic renal failure, glomerular nephritis, arthritis, bone disorders, pregnant women, and vitamin-D supplementing patients, Patients who take hormone replacement therapy or corticosteroid therapy were excluded from the study.

Limitation of the study

1. Sample collection was relatively difficult as many patients refuse to participate in the study.

2. The number of patients who frequently visiting the diabetic clinics was relatively low.

Sample collection and analysis: After an overnight fast of 12 to 14 hrs, 5 ml blood was collected by veni puncture. 3ml of blood was collected in anticoagulant (EDTA and fluoride) vacutainer. The remaining 2ml is taken into another bottle and allowed to clot. Serum and plasma were separated. The blood sugar by GOD-POD method and Glycated Hemoglobin by Micro column method on RA-50 instrument, and Serum Vitamin D2 estimated by enzyme linked immunoassay (ELISA) is designed by Calbiotech, Inc for the quantitation of total 25-OH Vitamin D in human serum and plasma were estimated on the same day on.

Statistical analysis: All values obtained will be expressed as Mean (± SEM). Unpaired two-tailed student *t*-test will be performed to compare the difference in the means between controls and study group. A 'P' value <0.05 will be considered as statistically significant. Statistical Analysis will be done by using Microsoft excel spread sheets. SPSS program version 18.0 was also used for correlation.

RESULTS

A total number of 60 subjects, 30 healthy controls (Males: 18, & Females: 12) and 30 cases (type-2 Diabetic subjects: Males: 19, and Females: 11) were include in the study.

Graph 1: Shows age distribution in cases and controls.

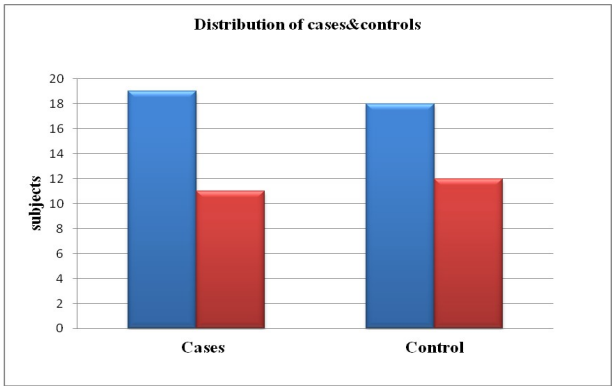


Table 1: Shows compression between cases and controls.

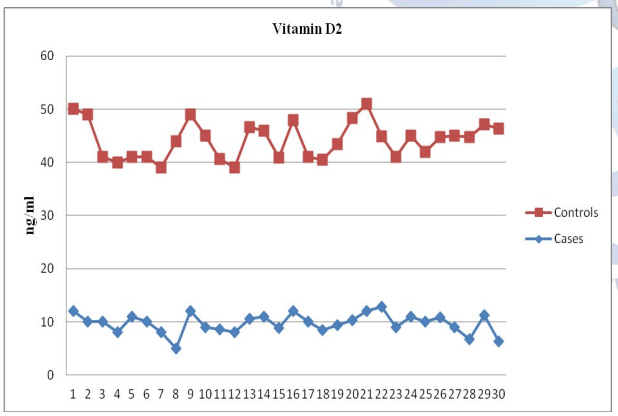
	Cases		Controls		
	Mean	SD	Mean	SD	p-value
Age	39.9	6.84	37.7	9.95	0.32
FBS	216.43	26.6	91.67	13.61	0.00*
PPBS	317.4	66.69	124.23	8.01	0.00*
HbA1C	9.47	1.03	5.95	0.14	0.00*
Vitamin-D2	9.71	1.82	34.47	3.06	0.00*

*<0.005 is Statistically Significant

Table 2: shows Vitamin D2 and HbA1c correlation with age, FBS, PPBS, HbA1c and Vitamin-D2 in cases.

		Age	FBS	PPBS	HbA1c	VitD2
Age	r		-0.055	-0.064	0.096	-0.284
	p		0.773	0.735	0.613	0.128
FBS	r	-0.055		0.677**	0.742**	-0.064
	p	0.773		0	0	0.738
PPBS	r	-0.064	.677**		.726**	-0.059
	p	0.735	0		0	0.757
HbA1c	r	0.096	0.742**	0.726**		-0.077
	p	0.613	0	0		0.685
VitD2	r	-0.284	-0.064	-0.059	-0.077	
	p	0.128	0.738	0.757	0.685	

Graph 2: Shows the Vitamin- D2 levels in both cases and controls.



DISCUSSION

Diabetes mellitus is a metabolic disorder characterized by impairment of carbohydrate, lipid and protein metabolism. Its global prevalence rate is alarming. The total number of people with diabetes worldwide is projected to rise from 108 million in 1980 to 422 million in 2014 [24]. The global prevalence of diabetes among adults over 18 years of age has risen from 4.7% in 1980 to 8.5% in 2014 [24]. This has been rising more rapidly in middle- and low-income countries, its major cause of blindness, kidney failure, heart attacks, stroke and lower limb amputation. In 2015, an estimated 1.6 million deaths were directly caused by diabetes. WHO projects that diabetes will be the seventh leading cause of death in 2030 [24] making it one of the most important public health challenges. Despite that, there are under-diagnosis and under-reporting of the disease in the Andaman and Nicobar Islands. Type 2 diabetes (non-insulin-dependent, or adult-onset) results from the body's ineffective use of insulin. Type 2 diabetes comprises the majority of people with diabetes around the world, and is largely the result of excess body weight and physical inactivity. Symptoms may be similar to those of type 1 diabetes, but are often less marked. As a result, the disease may be diagnosed several years after onset, once complications have already arisen. Until recently, this type of diabetes was seen only in adults but it is now also occurring increasingly frequently in children. Healthy diet, regular physical activity, maintaining a normal body weight and avoiding tobacco use are ways to prevent or delay the onset of type 2-diabetes. Diabetes can be treated and its consequences avoided or delayed with diet, physical activity, medication and regular screening and treatment for complications.

In the present study, A total number of 60 subjects, 30 healthy controls (Males: 18, & Females: 12) and 30 cases (type-2 Diabetic subjects: Males: 19, and Females: 11) were include in the study and the mean age group of cases vs controls 39.9±6.84 vs 37.7± 9.95 respectively and there is no statistically significance was found (p=0.32). FBS, PPBS, HbA1c, and Vitamin D2 levels were studied in both groups. The mean and SD of fasting blood sugar level were cases 216.43-±26.6 mg/dl, controls 91.67±13.61 mg/dl, post prandial blood sugar level were cases 317.40-±66.69 mg/dl, controls 124.23±8.01 mg/dl, and Glycated haemoglobin level in cases 9.470±1.03% and in the controls 5.95 ± 0.14% were also statistically significantly increased (p=0.00, 0.00, and 0.00 respectively) in type -2 diabetic patients when compared with healthy controls. In type-2 diabetes cases the HbA1c was significantly positively correlating with the FBS and PPBS.

As indicated in the present study, the mean blood HbA1c and serum glucose level were significantly higher in cases compared to controls. Similar results were obtained [8, 25-28].

In diabetes, prolonged hyperglycemia super drives nonenzymatic protein glycation, which forms reversible Schiff bases and Amadori compounds. A series of further complex molecular rearrangements then yield irreversible advanced glycosylated end-products (AGEs). AGEs accumulate in the circulating blood and in various tissues [29, 8]. It is reported that the levels of HbA1c in the blood reflect the glucose levels to which the erythrocyte has been exposed during its lifespan [30]. Therefore, the HbA1c test is attractive as it measures chronic glycaemia, rather than instantaneous blood glucose levels. HbA1c has been used as an objective marker of average glycaemic control for many years, has an accepted place in the monitoring of patients with diabetes, and is relied on for significant management decisions, such as initiation of insulin therapy [31].

Vitamin D is a multifunctional hormone that can affect many essential biological functions, ranging from immune regulation to mineral ion metabolism. Although the major function of vitamin D is to maintain calcium and phosphate homeostasis and to promote bone mineralization, many extra skeletal roles for vitamin D have been identified [32]. Recently found that vitamin D inadequacy is associated with significant coronary artery stenosis in a community-based elderly cohort [33]. Other investigators have shown that low vitamin D status is associated with an increased risk of various diseases, such as cancer, hypertension, and cardiovascular disease [32].

In the present study vitamin D2 level were cases 9.71-±1.82 ng/ml, and controls 34.47±3.06 ng/ml were also statistically significantly decreased (p=0.00) in type -2 diabetic patients when compared with healthy controls. Vitamin D2 levels were negatively correlating with age, FBS, PPBS, and HbA1c (r=-0.284, p=0.128; r=-0.064, p=0.738; r=-0.059, p=0.757; and r= -0.077, p=0.685 respectively). The present results revealed that the number of cases having vitamin D deficiency and insufficiency were significantly higher than that of controls. Vitamin D deficiency and insufficiency were found to be prevalent among type 2 diabetic patients [34-36].

When compared with controls, cases showed significant decrease in the mean level of serum vitamin D. This means that deficiency in vitamin D levels are linked to type 2 diabetes. Such finding is in agreement with that demonstrated by Subramanian et al., [34] and Yu et al., [37]. In addition, Nikooyeh et al., [38]; Afsaneh et al., [20] and Nasri et al., [39] concluded that supplementation of vitamin D is associated with a lower risk of type 2 diabetes.

The role of vitamin D in the pathophysiology of type 2 diabetes is a subject of debate in the scientific community. Some mechanisms are proposed to explain how vitamin D deficiency promotes type 2 diabetes. The vitamin D receptors (VDRs) are widely expressed in adipose, pancreatic, and possibly muscle cells [40].

In the β -pancreatic cells, vitamin D appears to modulate directly insulin synthesis via the nuclear VDR, since there are VDR elements in the insulin promoter genes [41]. Vitamin D may also promote morphological improvement in pancreatic islet cells, decrease apoptosis, and have nongenomic effects mediated by messenger VDR [42]. Vitamin D can also act indirectly on the control of diabetes by acting on osteoblast to activate the synthesis of osteocalcin hormone. The high increase in osteocalcin synthesis appears to improve glucose tolerance by stimulating insulin synthesis in the pancreas [43]. It's accepted that vitamin D treatment improves insulin resistance [20].

CONCLUSION

Similar to the present study in other Asian countries, which indicated that up to 70% of the general population had vitamin D insufficiency, defined as 30 ng/mL 25(OH)D [14]. This may represent a public health problem, considering the numerous complications and diseases associated with vitamin D deficiency [45].

Biochemical tests of the disease are restricted to monitoring blood glucose level when the patient visits the clinic. This necessitated further assessment of other biochemical features in blood such as vitamin D, its deficiency was recently linked to type-2 diabetes [46, 36]. Therefore, supplementation of vitamin D to type 2 diabetic patients in the Andaman and Nicobar Islands hospitals and clinics may be useful in the disease management. The present study isthe first to assess serum vitamin D level in type 2 diabetic patients from Andaman and Nicobar Islands.

CONCLUSION

The levels of Fasting blood glucose, Post Prandial Blood Glucose, and blood HbA1c levels were significantly increased in type -2 diabetic cases compared to healthy controls, and the HbA1c is significantly positively correlating with FBS, PPBS. Vitamin D2 levels were statistically significantly decreased in type -2 diabetic patients when compared with healthy controls. Vitamin D2 levels were negatively correlating with age, FBS, PPBS, and HbA1c in cases. Vitamin D may also promote morphological improvement in pancreatic islet cells, decrease apoptosis, and have nongenomic effects mediated by messenger VDR. Vitamin D can also act indirectly on the control of diabetes by acting on osteoblast to activate the synthesis of osteocalcin hormone. The high increase in osteocalcin synthesis appears to improve glucose tolerance by stimulating insulin synthesis in the pancreas. It's accepted that vitamin D treatment improves insulin resistance. Therefore, supplementation of vitamin D to type 2 diabetic patients in the Andaman and Nicobar Islands hospitals and clinics may be useful in the disease management.

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