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Vitamin D deficiency and insulin resistance in normal and type 2 diabetes subjects

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Abstract

Hypovitaminosis D is invented to be related with diabetes mellitus and metabolic syndrome. Deficiencies in pancreatic β cell function and/or insulin compassion are frequently present, to develop glucose intolerance or type 2 diabetes mellitus. There are adding evidence that vitamin D may influence these mechanisms.

The study has planned in, Shri Ramkrishna Institute of Medical Sciences & Sanaka Hospitals. The 20 Diabetic patients and 20 controlled normal patients were enrolled in to the study. The age group of the patients are from 30-70 years. Thereare very inadequate studies reported of vitamins D3 association with insulin resistance. The aim of present study is to compare levels of the Vitamin D3 in normal and diabetes patients.

The data from the normal study group suggests that the mean 25(OH)D levels are found low in the diabetes patients as compared to the normal patients. Also the levels of than the 20 ng/ml showed the deficiency. Hence in the enrolled study group showed the vitamin D3 deficiency.

Hence form the current study determines that the mean 25(OH)D levels in type 2 diabetes subjects is lower than normal individuals.

Keywords: diabetes mellitus, type 2, insulin, vitamin D

Introduction

Diabetes mellitus (DM), normally mentioned to as diabetes, is a set of metabolic diseases in which there are high blood sugar levels over a prolonged period [1]. Symptoms of high blood sugar include frequent urination, increased thirst, and increased hunger. If left untreated, diabetes can cause many complications. [2] Acute complications include diabetic ketoacidosis and nonketotic hyperosmolar coma. [3] Serious long-term complications include cardiovascular disease, stroke, chronic kidney failure, foot ulcers, and damage to the eyes [4].

Diabetes is due to either the pancreas not producing enough insulin or the cells of the body not responding properly to the insulin produced. [4] There are three main types of diabetes mellitus:

Type 1 DM results from the pancreas's failure to produce enough insulin. This form was previously referred to as "insulin-dependent diabetes mellitus" (IDDM) or "juvenile diabetes". The cause is unknown [2].

Type 2 DM begins with insulin resistance, a condition in which cells fail to respond to insulin properly [2]. As the disease progresses a lack of insulin may also develop [5].This form was previously referred to as "non-insulin-dependent diabetes mellitus" (NIDDM) or "adult-onset diabetes". The primary cause is excessive body weight and not enough exercise [2].

Glycosylated haemoglobin (HbA1c) is the most vital target of glycaemic control. The desirable value for HbA1c is values below 7.00 5-7. HbA1c is important standard in analysis of patients' status that indicates the average blood glucose during the past three months which is essential to ensure the optimal care of diabetic patients. The research has revealed that with each one percent reduction in the value of HbA1c, the risk of microvascular complications is reduced by 40 percent.

Vitamin D deficiency, or hypovitaminosis D, can result from inadequate nutritional intake of vitamin D, inadequate sunlight exposure (in particular sunlight with adequate ultraviolet B rays), disorders limiting vitamin D absorption, and conditions impairing vitamin D conversion into active metabolites—including certain liver, kidney, and hereditary disorders [1]. Deficiency impairs bone mineralization, leading to bone softening diseases as rickets in children and osteomalacia and osteoporosis in adults [5].

Type 2 Diabetes Mellitus (T2DM) is the commonly seen endocrine disorder characterized by hyperglycemia. The International Diabetes Federation (IDF) estimates around 61.3 million diabetic individuals (2011) in India that is further set to increase to 101.2 million with a global estimate of 552 million by the year 2030. There are several factors that seem to play a role in its development including genetic, lifestyle, environmental and nutritional conditions. Amongst nutritional factors, vitamin D is likely to have an important role either in glycemic control or in attenuating diabetic complications. The probable mechanisms indicating the role of vitamin D in glucose homeostasis is likely to be through beta cell dysfunction and insulin resistance in cases with vitamin D deficiency. A negative correlation between serum glucose and insulin levels with 25OHD and a positive correlation with insulin sensitivity has been observed in several human and animal model studies [6]. There are very limited study reported of vitamins D3 association with insulin resistance.The aim of present study is to compare levels of the Vitamin D3 in normal and diabetes patients.

Methodology

The study has planned in, Shri Ramkrishna Institute of Medical Sciences & Sanaka Hospitals. The 20 Diabetic patients and 20 controlled normal patients were enrolled in to the study. The age group of the patients are from 30-70 years. The patients visited to Out Patient Department (OPD) and in-patient department (IPD) of a tertiary care hospital in North India were considered in the study. All the patients are informed consents. All the patient's clinical history were collected. The approval of the institutional ethical committee is taken for the planned study.

Inclusion Criteria

- Diabetic patients
- Both sex: male & females

Exclusion Criteria

- Patients on Vitamin D3 supplement
- Patients with Hepatic, Renal & heart diseases
- Thyroid patients
- Females subjects having polycystic ovarian disease

Group I: Normal patients having 25(OH)Dless than 20 ng/ml

Group II: Diabetic patients having 25(OH)Dmore than 20 ng/ml

Results & Discussion

The data from the both the study group patient were collected and presented as below.

Table 1

Study Parameters	Group I	Group II
Age	40 – 52 yearrs	55 – 57 years
Sex	Male: 12	Male: 09
	Female: 08	Female: 11
Fasting Blood Sugar	152.5 ± 12.3 mg/dl	158.6 ± 9.5 mg/dl
Post Prandial Blood Sugar	230.1 ± 18.6 mg/dl	250.1 ± 12.9 mg/dl
Alkaline Phosphatase	285.4 ± 5.5 U/L	290.8 ± 8.3 U/L
High Density Lipids	52.1 ±3.2 mg/dl	46.8 ± 2.9 mg/dl
Triglycerides	159.8 ± 11.5 mg/dl	162.6±6.8 mg/dl
Insulin	26.3±2.9 mU/L	14.5±1.9
Calcium	7.6±0.3 mg/dl	8.1±0.2 mg/dl
Albumin	3.1±0.1 g/dl	3.9±0.1 g/dl
25(OH)D	22.6±1.3 ng/dl	20.09±2.3 ng/dl

The data from the normal study group suggests that the mean 25(OH)D levels are found low in the diabetes patients as compared to the normal patients. Also the levels of than the 20 ng/ml showed the deficiency. Hence in the enrolled study group showed the vitamin D3 deficiency.

The same observations were reported by the Goswami *et al.* [7]. These findings explain that the insufficient vitamin D level is mainly due to the use of sun protective creams which decrease the penetration of UVB rays into the skin thus preventing the vitamin synthesis. The foods are not fortified with vitamin D and only a very few sea foods are rich sources, modern lifestyle habits limiting to indoor activity, are some of the reasons for deficient/ insufficient vitamin D levels.

The recent data from Australian diabetes, obesity and lifestyle study suggests that the 25(OH)D levels were low in diabetes subjects and there was inverse association between 25(OH)D and type 2 diabetes risk in their population [8]. From our case-control study, we observed decreased 25(OH)D levels in type 2 diabetes. The effects of vitamin D on glucose metabolism are mainly due to the distribution of its receptors (VDR) on pancreatic b cells, skeletal muscle and adipose tissue. Presence of 1a hydroxylase in b cells, the presence of vitamin D response element in the human insulin receptor gene promoter also influence the insulin sensitivity.

The calcitriol directly activates the transcription of human insulin receptor gene, activates peroxisome proliferator activator receptor d (PPAR). Vitamin D stimulates the expression of insulin receptor and enhances insulin mediated glucose transport in vitro [9].Certain allelic variations in vitamin D receptor gene and vitamin D binding protein might influence glucose tolerance and insulin secretion. Thus contributing to the genetic risk for type 2 diabetes [10].

Conclusion

Hence form the current study determines that the mean 25(OH) D levels in type 2 diabetes subjects is lower than normal individuals. The Low 25(OH) D levels in diabetic patients can contribute to higher risk.

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