ORIGINAL RESEARCH PAPER

Volume-8 | Issue-2 | February-2019 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ASSOCIATION OF VITAMIN D DEFICIENCY AND OXIDATIVE STRESS STATUS IN RELATION TO GLYCEMIC INDEX FLUCTUATIONS IN T2DM PATIENTS.

Biochemistry

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ABSTRACT

Background: VitaminD has been associated with extra-skeletal pathologies through mechanisms involving inflammatory and oxidative stress processes deficiency of Vitamin D has been associated with increase result of developing Type 2 diabetes mellitus (DM) and cardiovascular diseases.

Material and Methods: A total of 276 subjects both males and females, age between 35-65 years were enrolled for this study in which 140 were type 2 diabetic and 136 were without diabetes. Fasting blood sugar (FBS) was measured by glucose oxidase and peroxidase method. Serum MDA was measured by thiobarbituric acid reactive substances method. GlycatedHemoglobin (HbA1c) was measured by ion-exchange resin method. Serum 25(OH)D measurement were performed using a chemiluminescaceimmunoassay analyzer.

Result : The MDA and fasting blood glucose levels were increase in diabetes and were statistically significant. Vitamin D levels were significantly low in patients of type 2 diabetics where compared to controls ($p<0.000$)

Conclusions and Clinical Significance: From this investigation it is reasoned thatlower levels of vitamin D is associated with increased oxidative stress .Therapeutic intervention to increase the vitamin D levels and reduce the oxidative stress should be incorporated as a part of treatment in type 2 diabetics.

KEYWORDS

Diabetes mellitus, Malondialdehyde, Oxidative stress, Vitamin D

Introduction

Diabetes mellitus (DM) is a metabolic disorder characterized by hyperglycemia with derangement of carbohydrate, fat and protein metabolism due to absolute or relative deficiency of insulin secration and action or both. Diabetes mellitus, especially type-2 diabetes is a public health problem which has reached epidemic proportions due to the rapidly increasing rates of this disease worldwide. Target organ complications, secondary to diabetes, are one of the most important medical concerns of the present time.

As per the World Health Organization (WHO) report, India with 32 million diabetic people, at present has the most noteworthy occurrence of diabetes around the world, these numbers are anticipated to increment to 80 million by the 2030. (1)

Hyperglycemia creates receptive oxygen species (ROS), which thusly cause harm to the cells from various perspectives. Damage to the cells at last outcomes in auxiliary difficulties in diabetes mellitus . Increased oxidative stress is a generally acknowledged member in the improvement and movement of diabetes and its complecations.(2) A well connection exists between the advancement of large scale and smaller scale vascular disease in diabetes mellitus.(3)

Vitamin D deficiency has been appeared to modify insulin synthesis and discharge in both human and animal models. It has been repeated that Vitamin D insufficiency may incline to glucose intolerance, modified insulin secretion patients with type 2 diabetes mellitus .Vitamin D recharging upgrades glycaemia and insulin secretion in patients with type 2 diabetes with developed hypovitaminosis D, subsequently recommending a job forVitaminD in the pathogenesis of type 2 diabetes mellitus. The presence of Vitamin D receptor (VDR) and Vitamin D binding proteins (DBP) in pancreatic tissue and the connection between certain allelic varieties in the VDR and DBP gene with glucose resistance and insulin secretion have further supported this hypothesis.(4)

Insufficiency of Vitamin D has been related with increased risk of developing type 2 diabetes mellitus (DM) and cardiovascular diseases(5). Vitamin D inadequacy is very predominant in our nation. About 70% of grown-ups in both rural and urban zones were discovered indicating signs of Vitamin D deficiency.(6, 7)

Therefore,we planned this examination to survey the vitamin D status of the study population by measuring serum 25 (OH)D levels and its relationship with oxidative stress markers intype 2 diabetes mellitus.

AIM:

To evaluate oxidative stress status through measurement of MDA and Vit-D deficiency with respect to fluctuation in glycemic control.

MATERIALAND MATHOD:

Study population:

This is a cross sectional study with Group I (n=140) diagnosed patients of type-2 diabetes mellitus and Group II (n=136) apparently healthy individuals.

Inclusion criteria consists of 35-65 years of patients of both gender, diagnosed with type 2 diabetes mellitus with fasting blood glucose ≥ 126 mg/dl with symptoms of diabetes mellitus- polyuria, polydipsia, fatigue, weight loss. Patients included were attending the diabetic outpatient department of Hind Institute of Medical Sciences, Barabanki, Uttar Pradesh, India.

Material:

Materials used were acetic acid (Product Code A 0060) HCL (Product Code H 0090) and TCA (Product Code T0160), weighing scale, wall-mounted ruler, sphygmomanometer and stethoscope, tourniquet, syringes, plain vials, centrifuge, autoanalyzer (Turbochem-100, model no-4600), ultraviolet-visible double beam spectrophotometer (systronics Model 2710) Chemiluminesecence immunoassay analyzer (Siemens) and kit for 25 (OH) D assay. A glycohemoglobin kit for HbA1c assay and semi autoanalyzer (lab India 2001, Optimas) were also assayed for the study.

Methods:

Fasting blood samples were collected by venipuncture, 5 ml of blood was collected and allowed to clot. Serum was separated and 2 ml of serum was stored in refrigerator to estimate the oxidative stress marker (MDA) and vit-D levels. 2 ml plasma was stored for HbA1c assay.

Serum MDA was measured by the Thiobarbituric acid reactive substances method. The HbA1c was measured by ion exchange resin method. Vitamin D were measured by chemiluminescence immunoassay analyzer(Siemas) using kit for 25(OH) D assay.

Table I: Baseline Characteristics of controls and type 2 diabetics

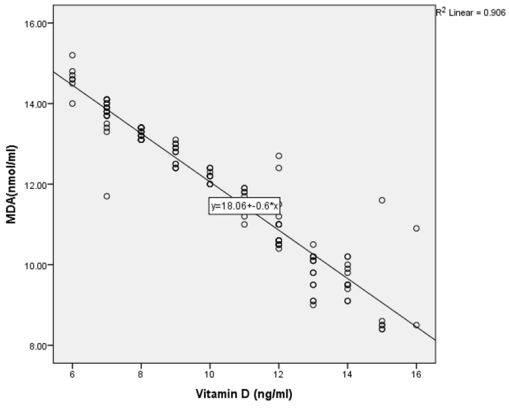
Parameter	Control (n=136) Mean ± SD	Type 2 Diabetes mellitus (n=140)Mean ± SD	p-Value
Age(years)	45.85± 2.729	45.92±2.979	.699

Height (cm)	169.70 ±9.334	169.72±9.192	.972
Weight (kg)	66.74±6.937	70.30±5.819	.000
BMI (kg/m2)	23.1554±1.27477	24.5843±1.27477	.000
Gender (m/f)	92/44	95/45	
SBP (mmhg)	115.54±3.202	128.51±5.621	.000
DBP(mmhg)	79.29±4.101	79.68±4.767	.458
PP(mmhg)	34.76±4.101	43.24±6.281	.000

Table-II: Vitamin D, Fasting blood glucose and Oxidative stress markers of control and type 2 diabetics.

Parameter	Control(n=136) Mean±SD	Type2Diabetes mellitus(n=140) Mean ± SD	p-Value
VITAMIND (ng/ml)	22.27±3.890	10.23±2.749	.000
FBS (mg/dl)	98.26±7.093	138.55±4.687	.000
MDA (nmol/ml)	4.9404±1.02309	11.9338±1.74123	.000

Figure I- Association of vitamin D with MDA in type 2 diabetics ®= -0.952)



Result :

The baseline and anthropometric parameters of controls, type 2 diabetics were given in Table-I. As shown table-I there was no significant difference between age (p<0.699) andhight(p<0.972) of the study participants. Significantly difference in weight (p<0.000), BMI (p<0.000) blood pressure (SBP p<0.000) were seen. Table-II shows the between group comparison of vitamin D and FBG. Vitamin D levels are significantly low in type 2 diabetics when compare to controls(p<0.000), whereas the FBS levels are significantly high in type 2 diabetics when compared to control(p<0.000). The MDA levels are significantly high in type 2 diagnostics when compared to controls(p<0.000).

Correlation analysis showed significant association of vitamin D with oxidative stress markers(figure-I) in type 2 diabetics. The oxidative stress markers MDA was negatively correlated with Vitamin D in type 2diabetics.

DISCUSSION

Vitamin D deficiency is common in metropolitan urban areas of India and worldwide because of flawed way of life. The predominance ofVitamin D inadequacy has immensely expanded in India regardless of the way that it is situated somewhere in the range of 8.40 and 37.60 north latitude and majority of the Indian population expressed to ample sunlight throughout the year(8). Frompublished information with respect toVitamin D inadequacy in India evaluated predominance of Vitamin D insufficiency is 70-100% in grown-up population. Vitamin D may influence glucose homeostasis through expanding insulin resistance and reduced insulin secretion from beta cells of the pancreas. Vitamin D assumes essential job as cancer prevention agent (8).

Vitamin D insufficiency has been appeared to adjust insulin synthesis and secretion in both humans and animal models. It has been accounted for that Vitamin D insufficiency may incline to glucose intolerance altered insulin secretionand type 2 diabetes mellitus. Vitamin D renewal enhances glycaemia and insulin secretion in patients with type 2 diabetes with set up hypovitaminosisD . Natural variables are important in the aetiology of glucose intolerance type 2 diabetes and IHD. The absence of Vitamin D which is important for sufficient insulin secretion, relates demographically to increase risk of myocardial infraction. These disarranges are associated declined vascular disease expanding with glucose intolerance and diabetes and with its hazard factors, comprising syndrome 'X'.(9)

Oxidative stress in diabetes emerges from different pathway, including nonenzymatic, enzymatic and mitochondrial forms. Hyperglycemia alters the redox balance through the polyol pathway (where glucose is lessen to sorbitol, with resulting diminishes in dimension of NADPH and reduced glutathione), initiates oxidases and interferes with the mitochondrial electron transport chain.(10)

Table-II shows the association between MDA levels and glycemic controls. MDA levels are significantly high in diagnose type 2 diabetes when compared to controls (p<0.000). A number of studies have highlighted a direct link between oxidative stress and diabetes through the estimation of markers of oxidative stresseg. Plasma and urinary F2 isoprostans and plasma and tissue levels of nitrotyrosine and superoxide.(11)

In our examination the weight and BMI were significantly high in diagnosed cases of type 2 diabetes. The correlation analysis showed significant association of vitamin D with oxidative stress markers in type 2 diabetics. The level of vitamin D negatively correlate with MDA (r=-0.952; p<0.000) in type 2 diabetics.

Conclusion:

From this investigation it is reasoned thatlower levels of vitamin D is associated with increased oxidative stress .Therapeutic intervention to increase the vitamin D levels and reduce the oxidative stress should be incorporated as a part of treatment in type 2 diabetics.

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