Insulin resistance related to Vitamin D deficiency in gestational diabetes mellitus

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Abstract

Introduction: Beta cells in the pancreas secrete insulin, C-Peptide. C-Peptide is marked as an indicator of insulin secretion. Dysregulation of insulin - mediated metabolic pathways has emerged as an underlying malfunction through which vitamin D deficiency in gestational diabetes may be linked. Vitamin D deficiency is also associated with resistance and pancreatic beta cell dysfunction. Vitamin D activity increases insulin release and insulin secretion from pancreatic islet bet cells. C – Peptide hormone is an indicator of insulin secretion and is a connecting peptide. It is removed when insulin is released and secreted in the first and second phases of insulin secretion. Optimal vitamin D homeostasis may be essential for both insulin secretion and action, two fundamental features in the pathogenesis of insulin resistance and diabetes. The present study was designed to demonstrate the relationship between 25 – Hydroxyl Vitamin D (25 (OH)D) Levels and Insulin Resistance (IR) in normal pregnancy and Gestational Diabetes Mellitus (GDM). The study included 150 pregnant women classified into two main groups normal present (n=100) and GDM (n=50). Further classification for each group was carried out based on 25(OH)D, Fasting Blood Glucose (FBG), Fasting Insulin (FI) C – Peptide and Insulin Resistance (IR) markers were calculated including Glucose / Insulin ration (G/I). Results indicated significantly increased FBG, FI, C-Peptide compared to control group, no significant correlations were obtained between 25(OH)D and any tested parameters, however, in GDM 25(OH)D showed significant corrections with FBG. Thus this indicating that 25(OH)D way be associated with elevated IR that accompanying GDM.

Keywords: Gestational diabetes mellitus, Vitamin D, Insulin resistance, C – Peptide.

Introduction

Dysregulation of insulin – mediated metabolic pathways has emerged as an underlying mechanism through which vitamin D deficiency and diabetes may be linked. Vitamin D deficiency is associated with insulin resistance[1,2] and pancreatic beta cell dysfunction. Vitamin D activity increase insulin release (Phase - I) and insulin secretion (Phase - 2) from Pancreatic islet bêta cells.[3] C-Peptide is an indicator of insulin secretion.[4] C-Peptide, a connecting protein to insulin, is removed when insulin is released.[5] Vitamin D homeostasis may be essential for both insulin secretion and action, two fundamental features in the pathogenesis of insulin resistance and diabetes.[6]

Gestational Diabetes Mellitus (GDM) is a carbohydrate intolerance of variable degree of severity, which starts and first recognize during pregnancy. The prevalence ranges of GDM from 1 to 15% of all pregnancies. The pathogenesis of gestational diabetes mellitus as in Type 2 DM, involves the combination of relative insulin deficiency and insulin resistance.[7] The aim of the current study was to investigate the relationship between vitamin D levels and markers of insulin release, secretion (C- Peptide) resistance in normal pregnancy and pregnant women complicated with GDM.[8]

Materials and Methods

This cross – sectional study was conducted at the diabetes out patients clinic of the Owaisi Hospital (a teaching hospital to Deccan College of Medical Sciences, Hyderabad, Telangana State, India). A total number of 150 consecutive pregnant women referred to our owaisi Hospital & Research Center where 100 present women were treated as normal (n = 100) and 50 pregnancy women were treated for Gestational Diabetes Mellitus. Both the normal pregnant women and Gestational Diabetic Mellitus (GDM) women ages ranged from 21 – 40 years. According to the correlation between normal pregnant women and Gestational Diabetic Mellitus (GDM) pregnant women there is significant difference is found among C – peptide, insulin and 25 Hydroxy vitamin D. After overnight fasting, whole blood was collected from each patient. Blood sample was divided into two parts. First part for blood glucose measurement and the second part for serum collection. Serum was kept at -20°C for the determination of fasting C – peptide, insulin and 25(OH)D

Blood Glucose (BG)

Blood glucose (BG) was determined using kit provided by Cobas

Serum C- Peptide

Serum C- Peptide levels were determined using Enzyme Linked Fluorescent Assay (ELISA) technique. The lower detection limit of the employed kit was 0.003 nmol/L (0.01 ng/ml)

Serum Insulin

Fasting insulin (FI) was determined using Enzyme Linked Fluorescent Assay (ELISA) technique. The lower detection limit of the employed kit was 0.2 µl/ ml (0.01 ng/ml)

Glucose/Insulin Ratio

The Glucose / Insulin Ratio (G/I ratio) was calculated by dividing results obtained from FG (mmol/L) FI (µU/ml)

Table 1: Subjects Characteristics in Normal Pregnancy and in Gestational Diabetes Mellitus

Parameter	Normal Pregnancy (n=100)	Gestational Diabetes Mellitus(n=50)
Maternal Age (MA)(Years)	24.90 ± 0.40	28.65 ± 0.25 (p=0.001)
Gestational Age (GA)(Week)	25.00 ± 0.45	25.75 ± 0.33
Body Mass Index (BMI)(kg/m^2)	25.80 ± 0.21	28.25 ± 0.43 (p=0.001)

Table 2: Fasting Blood Glucose and Markers of Insulin Resistance in Normal Pregnancy and in Gestation Diabetes Mellitus

Parameter	Normal Pregnancy (n=100)	Gestational Diabetes Mellitus (n=50)
FBS (mmol/L)	4.00 ± 0.10	6.00 ± 0.22 (p=0.001)
FI (µU/ml)	10.75 ± 1.12	28.55 ± 5.54 (p=0.02)
C-Peptide (nmol/L)	0.32 ± 1.10	0.76 ± 0.06 (p=0.001)
25(OH)D	< 10 ± 0.10	< 0.5 ± 0.01 (p<0.001)
G/I	0.38 ± 0.	0.52 ± 0.06 (p=0.001)
FIRI1	82 ± 0.15	7.35 ± 1.35 (p=0.001)

FBS= Fasting Blood Sugar FI= Fasting Insulin G/I= Glucose/Insulin ratio FIRI= Fasting Insulin resistance Index

Vitamin D

Serum Vitamin D was measured by Enzyme Linked Fluorescent Assay (ELIZA) employing a kit from Minividas Biomerax. The lower detection limit of the employed kit was < 10 ng/ml.

Results

Results obtained from classification based on pregnancy station. Results showed this pregnancies complication with GDM had significantly higher maternal age and were presented with increased BMI compared to normal pregnancy women GDM women had elevated fasting blood glucose and markers of insulin resistant (Fasting insulin, C – peptide, Fasting Insulin resistant). In pregnancies complicated with GDM, 25(OH)D was significantly correlated with FBG (p=0.01). Results also correlated that is GDM women with deficient Vitamin D. Significant increase in the mean values of FBG, FI, C-peptide.

Discussion

Gestational Diabetes Mellitus (GDM) is a most common complication of pregnancy, characterized by insulin resistance (IR). The imbalance between IR and insulin and C-Peptide secretion led to maternal hyperglycemia. The present study showed significantly higher FBG and Serum C-Peptide is GDM pregnancies compared to normal pregnancies. The elevated IR was apparent in GDM. Pregnancies as manifested by elevated fasting insulin levels, basal fasting insulin resistance index. In this study, both normal and GDM pregnancies were complicated with GDM were presented with significantly higher mean value for BMI. In normal pregnancy BMI was significantly correlated with FBG and most common markers of IR, including FI, G/I and FIRI. In GDM 25(OH)D showed significantly lower mean value than normoglycemic controls (p<0.001).

Long – term Consideration

Women with Gestational Diabetes Mellitus (GDM) are at high risk for the development of diabetes, usually type 2, after pregnancy. There are several factors that promote insulin resistance which appear to enhance the risk of type 2 diabetes after GDM. 7% GDM women carry long- term consideration for the type S 2 diabetes mellitus.

Conflict of Interest: None.

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