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Association of Serum Vitamin D Levels with Glycated Hemoglobin in Patients with Gestational Diabetes Mellitus

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KEYWORDS:

Dyslipidemia, Gestational Diabetes Mellitus, Vitamin D

ABSTRACT:

Background: Insufficient levels of Vitamin D associated with an increased risk of gestational diabetes mellitus (GDM), and its complications. Present study designed to assess the role of vitamin D in gestational diabetes mellitus.

Objective: Present study designed to assess the role of vitamin D in gestational diabetes mellitus.

Methodology: This case control study included 60 pregnant women with gestational diabetes mellitus and 30 normal pregnant women without any illness. The blood sample were collected for measurement of biochemical and serum vitamin D levels. The complete statistical analysis done by using SPSS statistical software.

Results: The serum vitamin D levels significantly decreased in pregnant women with gestational diabetes mellitus when compared to normal pregnant women. The insufficient levels of vitamin D significant and negatively associated with indexes of gestational diabetes mellitus, BMI and dyslipidemia.

Conclusion: Based on study findings, insufficient levels of vitamin D significantly associated with the pregnant women with gestational diabetes mellitus when compared to normal pregnant women. Monitoring of vitamin D levels might be useful for early diagnosis of gestational diabetes mellitus and its complications.

1. Introduction

Gestational Diabetes Mellitus (GDM)

Gestational diabetes mellitus (GDM) is a metabolic condition abnormality in glucose tolerance as defined by the American Diabetes Association (ADA) as diabetes diagnosed in the second or third trimester of pregnancy (1-2). The global incidence of GDM varies significantly, with prevalence rates ranging from 1% to 25%, depending on demographic factors, screening methods, and diagnostic criteria (3-4). The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) studies reported, it carries the risk of unfavourable maternal, fetal, neonatal outcomes, including increased birth weight above the 90th percentile and a higher incidence of neonatal hypoglycaemia and primary caesarean section (5-7). Advanced maternal age, obesity, ethnicity, a family history of diabetes, and a prior history of impaired glucose metabolism and polycystic ovarian syndrome are recognized risk factors in the development of GDM (8-9). The presence of GDM was not shown to be directly correlated with parity per vitamin D was recently found to be a possible factor in its prevalence (10-11).

vitamin D is a fat-soluble vitamin and involve synthesis, secretion, and functions of insulin, enhances pancreatic

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function and insulin sensitivity results and act against to diabetes mellitus. vitamin D functions as a possible immunosuppressant in gestational diabetes mellitus by suppressing the expression of pro-inflammatory markers such TNF-α and IL-2 (12-13). Low maternal blood vitamin D levels have been linked to GDM in numerous observational studies. Recently, attention has turned to the potential role of vitamin D in glucose metabolism and its possible involvement in the pathogenesis of GDM (14-15). vitamin D, beyond its well-known functions in calcium absorption and bone metabolism, has been implicated in various non skeletal conditions, including diabetes. While the skeletal benefits of vitamin D are well established, its role in non-skeletal conditions, particularly diabetes, is an area of increasing interest (16). vitamin D receptors have been found in a variety of tissues, including those in volved in glucose metabolism, such as muscle and pancreatic beta cells. This study seeks to investigate the correlation between maternal vitamin D deficiency in early pregnancy and the likelihood of developing gestational diabetes mellitus.

2. Objectives

Present study designed to assess the role of vitamin D in gestational diabetes mellitus.

3. Methods

This case-control study was conducted at Akash Institute of Medical Sciences and Research Centre, Bangalore, India between January 2019 to February 2020, involving 60 pregnant women with GDM and 30 normal pregnant women without GDM. This study clinical protocol and all relevant documents were reviewed and approved by the Akash Institute of Medical Sciences and Research Centre. Informed consent form obtained from all the study participants.

Criteria of the study

Pregnant women diagnosed GDM as per International Association of Diabetes and Pregnancy Study Groups (IADPSG) criteria (17) and normal pregnant women considered as controls. The pregnant women have history of instrumental delivery, multiple fetuses, hypertension, cardiac disease, thyroid disease and TORCH infections were excluded from the study.

Sample collection

Five milliliters(5mL) of fasting and post prandial venous blood sample collected from all the included subjects. The collected blood sample 1 mL transferred into grey tube; 1 mL transferred into EDTA tube and remaining 3 mL transferred blood sample red tube. The samples were separated by centrifugation process, plasma and serum transferred to properly labelled aliquots. The samples stored into -500c until analysis.

Methods

The blood sugars were estimated by glucose oxidase peroxidase method, total cholesterol measured by cholesterol oxidase peroxidase, triglycerides determined by glycerol phosphate oxidase peroxidase method, high density lipoprotein by selective inhibition method, glycated hemoglobin was measured by latex immunoturbidimetry method, and vitamin D analyzed by chemiluminescence immunoassay. The very low-density lipoprotein and low-density lipoprotein calculated by friedewald's formula.

Statistical analysis

The normal distributed data was represented by mean ± standard deviation (SD). The comparison between the parameters by analysis of variance and correlation between parameters by pearson's correlation analysis. The boxplots and scatter plots constructed for clinical and experimental parameters. The P value is <0.005 considered as significant.

3. Results

Table 1: Base line characteristics of controls and GDM cases

Table 1 illustrates the baseline characteristics of the normal pregnant women and pregnant women with GDM cases. The significant age and BMI levels in GDM pregnant women have higher than normal pregnant women (P=0.001**). The blood sugars, total cholesterol, triacylglycerides, VLDL, LDL, glycated hemoglobin significantly enhanced levels in GDM pregnant women have higher than normal pregnant women (P=0.001**). There was a significant reduced levels of HDL in GDM pregnant women have higher than normal pregnant women (P=0.001**). Furthermore, there was a significantly decreased levels of calcium and vitamin D in GDM cases when compared to controls.

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Table 2: Correlation of vitamin D with other GDM indices

Table 2 shows the correlation between vitamin D and gestational diabetes mellitus indices of the study. The insufficient vitamin D levels significant and negatively associated with weeks of gestation, BMI, FBS, total cholesterol, triacylglycerides, VLDL, LDL, glycated hemoglobin and positively associated with HDL (P=0.001**).

Figure 1: Comparison of serum vitamin D levels in between controls and gestational diabetes mellitus

The figure 1 represents the comparison of glycated hemoglobin and vitamin D levels between the study subjects. There was a significant increased levels of glycated hemoglobin in gestational diabetes mellitus when compared to controls. Additionally, the gestational diabetes mellitus patients show significantly very low levels of vitamin D when compared to controls (P=0.001**).

Figure 2: Scatter plots between vitamin D and glycated hemoglobin, fasting blood sugars

The figure 2 indicates the scatter plots between vitamin D and glycated hemoglobin and fasting blood sugars between the study subjects. There was a significant and negative association between insufficient vitamin D and glycated hemoglobin, fasting blood sugars (P=0.001**).

4. Discussion

The GDM is linked to a number of unfavorable outcomes for both the mother and the fetus, such as higher birthweight, hypoglycemia in the newborn, a higher risk of primary caesarean sections, preeclampsia, dystocia, and an increased risk of obesity, type 2 diabetes, and the metabolic syndrome (18). Pregnant women with GDM were shown to have a considerably higher mean age and a history of GDM, both of which are known risk factors for GDM. Although parity in and of itself has not been demonstrated to be a risk factor for its development, increased parity was also observed in the GDM group (19).

The circulating vitamin D used for assessing bone health and also used for various metabolic diseases particularly diabetes mellitus. Significantly decreased levels of vitamin D levels negatively associated with blood sugars and dyslipidemia in pregnant women with GDM when compared to normal pregnant women (P=0.001**). Additionally, recent studies also reported vitamin D levels are an independent predictor of GDM. This finding is consistent with many existing studies, suggesting that a low vitamin D status may be an important risk factor for gestational diabetes (20-22). Pregnant women's normal vitamin D levels are still not defined by a cutoff. Vitamin D sufficiency has been defined using a number of ranges, however these were established based on the ideal levels to preserve skeletal health in the general population. Determining the typical range for expectant mothers is still necessary (23-24).

The fact that the women in this study were already taking vitamin D supplements as part of regular prenatal care is also noteworthy, even though it cannot be quantified. Low vitamin D levels were still very common, though. Numerous recent investigations have shown a probable connection between GDM and low maternal serum vitamin D levels (25-26). This study demonstrates that vitamin D levels are closely associated with the occurrence of GDM, pregnancy complications, and neonatal outcomes.

6. Conclusion

Based on the study findings, significantly decreased levels are associated with high risk of GDM and its complications. The monitoring of vitamin D status during pregnancy to potentially reduce the risk of GDM and improve maternal and neonatal outcomes.

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Table 1: Base line characteristics of controls and GDM cases

Parameters	Controls			GDM			P-value
	Mean ± SD			Mean ± SD			
Age (Years)	36.36	±	12.30	26.15	±	2.50	0.001**
Weeks of Gestation	27.52	±	3.12	34.47	±	1.80	0.001**
BMI (kg/m^2)	20.25	±	1.76	36.31	±	2.82	0.001**
FBS (mg/dL)	84.82	±	5.86	151.42	±	17.08	0.001**
PPBS (mg/dL)	266.72	±	47.57	280.95	±	54.28	0.001**
HbA1C (%)	5.75	±	0.76	5.85	±	1.36	0.001**
Total Cholesterol (mg/dL)	162.98	±	17.24	274.38	±	22.70	0.001**
Triacylglycerides (mg/dL)	115.27	±	14.42	197.15	±	20.25	0.001**
HDL (mg/dL)	48.28	±	7.94	30.58	±	1.53	0.001**
VLDL (mg/dL)	25.23	±	3.55	42.39	±	3.16	0.001**
LDL (mg/dL)	91.36	±	10.44	202.46	±	15.25	0.001**
Vitamin-D (ng/mL)	43.23	±	4.25	17.68	±	2.90	0.001**

Table 2: Correlation of vitamin D with other GDM indices

Vitamin-D		
Parameters	**R**	**P**
Age (Years)	0.533	0.001**
Weeks of Gestation	-0.630	0.001**
BMI (kg/m^2)	-0.636	0.001**
FBS (mg/dL)	-0.765	0.001**
PPBS (mg/dL)	-0.087	0.001**
HbA1C (%)	-0.756	0.001**
Total Cholesterol (mg/dL)	-0.672	0.001**
Triacylglycerides (mg/dL)	-0.662	0.001**
HDL (mg/dL)	0.728	0.001**
VLDL (mg/dL)	-0.684	0.001**
LDL (mg/dL)	-0.713	0.001**

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Figure 1: Comparison of serum vitamin D levels in between controls and gestational diabetes mellitus

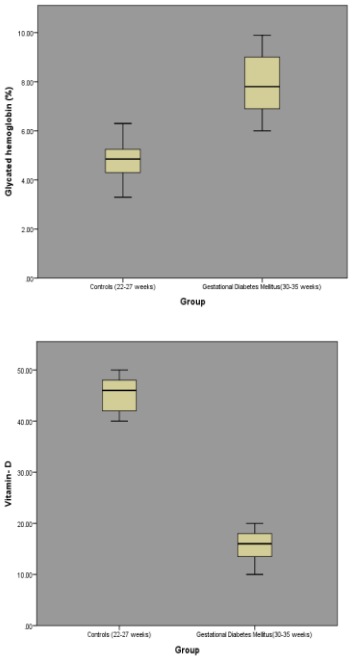

Figure 2: Scatter plots between vitamin D and glycated hemoglobin, fasting blood sugars