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Original Research

Evaluation Of Vitamin D Level In Gestational Diabetes Mellitus

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ABSTRACT

Background: It has long been believed that a lack of vitamin D increases the likelihood of developing glucose intolerance. During pregnancy, pregnant women with gestational diabetes mellitus (GDM), impaired glucose tolerance (IGT), and non-GDM control participants were all compared for their serum levels of 25-hydroxy vitamin D3.

Methods: In this case-control study, 111 non-GDM control women were compared to 54 women with diagnosed GDM, 39 women with IGT (1 abnormal oral glucose tolerance test), and 54 women without GDM. In terms of gestational age, age, and body mass index, controls and the IGT and GDM groups were matched.

Results: When compared to non-GDM controls, the maternal blood 25-hydroxy vitamin D3 concentration in the GDM and IGT groups at 24-28 weeks of gestation was considerably lower (P =.001). Plasma 25-hydroxy vitamin D3 concentrations were consistent with a diagnosis of vitamin D insufficiency in 83.3% of GDM and 71.2% of the control group (P =.03). When compared to the control group, women with GDM had a 2.66-fold higher probability of being deficient (25-hydroxy vitamin D3 15 ng/mL).

Conclusions: According to these findings, vitamin D deficiency is more common in women with IGT/GDM, and more research is needed to determine how vitamin D status affects a woman's ability to tolerate glucose during pregnancy.

Keywords: Vitamin D deficiency; gestational diabetes mellitus; glucose intolerance

INTRODUCTION

Due to its beginning or initial detection during pregnancy, gestational diabetes mellitus (GDM) is often referred to as glucose intolerance. [1,2] By influencing insulin sensitivity or beta-cell activity, vitamin D may contribute to the aetiology of type 2 diabetes, according to the findings of several research. [3-5] A vitamin D deficit, for instance, has been linked to insulin resistance and reduced insulin production, according to research conducted on both humans and animals [6]. Vitamin D supplementation was also able to reverse this impact. [7] Additionally, several investigations found particular vitamin D receptors in pancreatic cells, pointing to a function for 1, 25-dihydroxy vitamin D in the control of insulin secretion. [8]

Additional research has demonstrated that pregnant women frequently lack vitamin D. There was a significant positive correlation (P< 0.0001) between serum 25-hydroxy vitamin D concentrations (a marker of vitamin D status) and insulin sensitivity in a study of 126 healthy volunteers with normal glucose tolerance, as well as a significant negative correlation (P

.0001) between serum 25-hydroxy vitamin D and indicators of pancreatic beta-cell function. The prevalence of the metabolic syndrome's components was higher in people with subnormal serum concentrations of 25-hydroxy vitamin D than in those with normal levels (30% vs. 11%, P <0.01). [3] We want to study the connection between vitamin D concentrations and GDM because the data on the association between GDM and vitamin D deficiency are insufficient.

MATERIALS AND METHODS

A case-control study was performed at a Hospital from June 2021 to December 2022. Exclusion criteria included, women with pregestational diabetes, multiple pregnancies, fetal abnormality, chronic disease, hypertension, and history of consumption of anticonvulsant drugs. All subjects gave written informed consent for participation in the study, which was approved by the local ethics committee.

At 24-28 weeks of pregnancy, pregnant women underwent a 50-g oral glucose challenge test to check for GDM (OGCT; Carpenter and Coustan criteria). [1] However, the OGCT was performed at the 14th and 18th week of gestation when risk factors like a positive family history of diabetes, age higher than 30, obesity (body mass index [BMI] >30 kg/m2), prior history of GDM, and history of macrosomia were present.

A typical 100-g, 3-hour oral glucose tolerance test was performed on patients who had an aberrant response (postload glucose readings of 130 mg/dL or greater) (OGTT). A woman was deemed to have GDM if at least two of the four diagnostic criteria (fasting plasma glucose 95 mg/dL, and plasma glucose levels of 180 mg/dL, 155 mg/dL, and 140 mg/dL, respectively) were satisfied. [9,10] We included 111 healthy pregnant women with normal serum GTT levels as the control group and 54 women with GDM who had one abnormal OGTT value on the 3-hour OGTT (impaired glucose tolerance test) according to American Diabetes Association guidelines (ADA 2004). We gathered general data from the participants' medical records, such as mother age, height, pre-pregnancy weight, reproductive and medical histories, and pre-pregnancy BMI (kg/m2). These data were included as covariates in the data analysis. The BMI of the mother was also determined at the time of sample collection. Normative expectant women were matched with the GDM and IGT group based on their pre-pregnancy BMI, age, and gestational age.

In 10-mL vacutainer tubes, samples of maternal fasting plasma were collected and stored frozen at 80°C. A human ELISA kit (Immuno Diagnostic System, UK) was used to evaluate 25-hydroxy vitamin D3, with an interassay coefficient of variation (CV) of 2.6% and an intraassay CV of 2.3%. Serum glucose was determined using an enzymatic in vitro test.

SPSS for Windows, version 11.50, was used to conduct all statistical analyses. Due to the non-normal distribution of vitamin D3 levels, data for continuous variables were reported as medians rather than mean and standard deviation (interquartile range). The Kruskal-Wallis test was used to compare the three groups' serum 25-hydroxy vitamin D3 levels. For deficient status, serum levels of 25-hydroxy vitamin D3 were divided into 3 groups (30 ng/mL was considered sufficient).

RESULTS

A total of 204 expectant women took part in this study (54 GDM, 39 IGT, 111 normal GTT). Participants' average gestational ages were 22.03 8.54 weeks, and the average maternal age across the three groups was 27.39 5.08 years. The three groups under investigation had significantly different amounts of vitamin D3 as can be seen in Table 1 (P =.001). Additionally, there was a difference between the GDM and control group and the IGT and control group (P =.0001). 11.3% of all the women in the study had a 25-hydroxy vitamin D3 deficiency (30 ng/mL), and this risk was 2.66 times higher in women with GDM (95% CI,

1.26-5.6). (Table 2). There was no significant association between the serum levels of 25-hydroxy vitamin D3 and age (r = 0.05, P =.6), parity (r = 0.07, P =.2), BMI (r = 0.08, P =.24), or fasting blood glucose level (r = 0.06, P =.4).

Table 1: Levels of Maternal Biochemical Markers in 3 Groups Studied

	GDM	IGT	Control	P Value
Fasting serum glucose level, mg/dL	98.79 ± 14.78	97.07 ± 7.29	82.05 ± 6.67	.001
Level of serum 25-hydroxy vitamin D3, ng/mL	9.62 (8.26)	6.6 (9.36)	12.9 (14.32)	.001

Table 2: Frequency (and Group Percentage) of Different Serum Levels of 25-Hydroxy Vitamin D3 According to Their Groups

Vitamin D3 Level, ng/mL	GDM	Non- GDM	IGT	Total	P Value
<20	45 (83.3)	79 (71.2)	36 (92.3)	160 (78.4)	.007
20-29	1 (1.9)	17 (15.3)	3 (7.7)	21 (10.3)	
>30	8 (14.8)	15 (13.5)	0	23 (11.3)	

DISCUSSION

In addition, women with GDM had a 2.66-fold higher probability of deficient status (25-hydroxy vitamin D3 level 15 ng/mL) compared to the control group. Our results showed serum levels of 25-hydroxy vitamin D3 were considerably lower in the GDM and IGT groups compared with the control group. The secretion of insulin and perhaps its function are thought to be affected by vitamin D. [11] The link between vitamin D insufficiency and the risk of GDM has some hypothesised mechanisms. By binding its circulating active form, 1,25-hydroxyvitamin D, to a vitamin D receptor on a cell, as well as by controlling the equilibrium between the external and intracellular calcium pools, vitamin D may directly or indirectly control -cell function and secretion. [12,13] Furthermore, vitamin D can improve insulin sensitivity by promoting insulin receptor expression and raising the insulin response to glucose transport. [14]

The connection between GDM and a vitamin D deficiency has not been adequately studied. Our results are consistent with those of Maghbooli et al. [15], who found that at 24-28 weeks of pregnancy, blood concentrations of 25-hydroxy vitamin D levels were considerably lower in GDM women than in groups with normal levels of vitamin D. [15] Maternal blood 25-hydroxy vitamin D concentrations were significantly and negatively correlated with fasting serum glucose levels, according to Clifton Bligh et al. [16]. However, some investigations failed to find a link between GDM and hypovitaminosis D. According to research by Farrant et al. [17] in the United Kingdom, 31% of women had serum 25-hydroxy vitamin D levels below 28 nmol/L, and 66% of women had hypovitaminosis D overall (serum 25-hydroxy vitamin D concentrations 50 nmol/L). GDM was not significantly correlated with maternal serum vitamin D levels. [17] Another Indian study also found no link between serum 25-hydroxy vitamin D concentrations at 30 weeks' gestation and the likelihood of developing gestational diabetes. [18]

After adjusting for the variables (such as BMI, maternal age, race/ethnicity, and first-degree family history of type 2 diabetes), a large cohort research discovered that blood vitamin D deficiency was linked to a 2.66-fold (OR, 2.66; 95% CI, 1.01-7.02) increase in the risk of GDM. [18] Additionally, according to our research, women with GDM were 2.02 times more likely to have a vitamin D deficiency (low serum levels of 25-hydroxyvitamin D3).

Our research has some flaws. First, only once in 24-28 weeks of gestation did we evaluate the serum 25-hydroxy vitamin D3 levels. Second, as our research was cross-sectional, we require additional cohort studies that include repeated measurements of blood 25-hydroxyvitamin D3 concentrations during the first trimester and assess the risk of gestational diabetes mellitus (GDM) in women with vitamin D deficiency.

CONCLUSION

Our findings indicated that rates of vitamin D deficiency are higher among women with IGT/GDM, and further research is required to determine the link between vitamin D status and glucose tolerance during pregnancy.

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