Journal of Chemical Health Risks

www.jchr.org

JCHR (2026) 16(1), 1584-1590 | ISSN:2251-6727

The Serum Vitamin D Levels Correlation with Gestational Diabetes Mellitus

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(Received: 05 November 2025 Revised: 15 December 2025 Accepted: 23 January 2026)

KEYWORDS:

Calcium, Dyslipidemia, Gestational Diabetes Mellitus, and Vitamin D.

Abstract

Introduction: Recent research has examined the relationship between serum vitamin D levels during various pregnancy trimesters and gestational diabetes mellitus. In order to investigate the correlation between vitamin D levels and gestational diabetes mellitus (GDM) status throughout pregnancy, we carried out this study in a prospective observational cohort of well-characterized healthy pregnant women.

Objective: To investigate the correlation between vitamin D levels and gestational diabetes mellitus (GDM).

Materials and Methods: The study included pregnant women with and without gestational diabetes mellitus who were under 35 years old and visited the Gynaecology & Obstetrics outpatient department. A sociodemographic, anthropometric, and clinical, data was collected from all included subjects.

Results: It has been demonstrated, women with GDM have significant decreased levels of vitamin D and calcium when compared to normal pregnant women. The significant decreased levels of vitamin D negatively associated with gestational diabetes mellitus. Furthermore, these levels were significantly and negatively associated with BMI and dyslipidemia.

Conclusion: Maternal vitamin D insufficiency is linked to a higher incidence of gestational diabetes mellitus in the early stages of pregnancy.

1. Introduction

Gestational diabetes mellitus (GDM) was linked to both insulin resistance and impaired insulin secretion. However, GDM may occur as a result of a decreased reserve of β cells or a maladaptation to increased insulin demands and results elevated maternal risk and fetal problems during pregnancy (1-2). While fetal concerns include but are not limited to macrosomia, respiratory distress syndrome, birth traumas, jaundice, and hypoglycaemia, maternal hazards include increased rates of caesarean sections and premature labour in GDM patients (3). The previous research has shown that children of GDM mothers are more likely to develop diabetes and obesity in later life when compared to children of non-GDM mothers (4). Additionally, it has been shown that moms with GDM have a 25% probability of having full-blown diabetes when the pregnancy is complete (5). Numerous observational, prospective, or nested case-control designs have examined the relationship between gestational diabetes mellitus and serum vitamin D levels in various trimesters of pregnancy and their findings consistent with an

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www.jchr.org
JCHR (2026) 16(1), 1584-1590 | ISSN:2251-6727

increased risk of developing gestational diabetes mellitus (GDM) in pregnant women with a vitamin D deficiency (6-8). According to numerous studies conducted in developing nations, particularly India, the prevalence of vitamin D deficiency among pregnant women is estimated to be between 70 and 100% (9-10). Additionally, there is evidence that vitamin D supplementation has positive effects on fasting plasma glucose and serum insulin levels in patients with gestational diabetes (11).

There is imperative to assess the relationship between GDM and vitamin D insufficiency. In order to investigate the connection between vitamin D levels and GDM status during pregnancy, this study was carried out in a prospective observational cohort of well-characterized, healthy pregnant women.

2. Objectives

To investigate the correlation between vitamin D levels and gestational diabetes mellitus (GDM).

3. Methods and Methods

This cross-sectional study was conducted of total 80 of gestational diabetes mellitus and 40 general pregnant women (group 1) conducted at Akash Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India. The GDM cases were further sub grouped based on their weeks of gestation, 40 GDM with 24-29 weeks considered group 2 and remaining 40 GDM with 30-35 weeks considered group 3. All pregnant women attending the outpatient department of Gynecology & Obstetrics, aged less than 35 years, and who were in their first trimester were included in the study. The study was carried out from Jan 2019 to Feb 2020. All the high-risk pregnancies including those with instrumental delivery, multiple fetuses, hypertension, cardiac disease, thyroid disease and TORCH infections were excluded from the study. The convenient sampling method was used to select the study participants. The two hundred ninety subjects had their venous blood sample collected at the time of inclusion in the study. The Institutional Ethical committee of Akash Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, approved all study procedures. The written informed consent was obtained from all the study subjects after explaining the objectives involved in the study. Socio demographic, anthropometric details, clinical details and vitamin D data was collected. The fasting blood sugars was determined by using GOD – POD method, total cholesterol estimated by CHOD GPO method, triglycerides measured by GPO-PAP method, HDL was analyzed by selective inhibition method, calcium was determined arsenazo method, the VLDL and LDL was calculated by friedewald's formula and vitamin D levels was chemiluminescence immunoassay (CLIA).

Statistical analysis

The continuous data was presented as mean and standard deviation if normally distributed and independent samples t test or $\chi 2$ test was used for categorical variables. The pearson's correlation analysis was done to find the correlation between vitamin D concentration and GDM status, calcium levels. The box plots and scatter plot was constructed between and P values ($P < 0.05$) were considered statistically significant

4. Results

Table 1: Biochemical measurements between controls and gestational diabetes mellitus

The baseline characteristics of the study participants are shown in Table 1. The comparison between those with GDM and controls has been illustrated. The women in GDM group were age, BMI, weeks of gestation, and blood sugars was greater than those in the non GDM group. There was a significant increased level of total cholesterol, triglycerides, VLDL, LDL and decreased levels of HDL in GDM cases than the controls (P=0.001**). Furthermore, the glycated hemoglobin levels significantly increased in GDM patients then controls. Additionally, there was a significantly decreased levels of calcium and vitamin D in GDM cases when compared to controls.

Table 2: Correlation of vitamin D with other parameters of study

Table 2 illustrates the correlation of vitamin D levels with other parameters of the study. There was a significant and negatively correlated with weeks of gestation, BMI, FBS, PPBS, HbA1C, total cholesterol, triglycerides, HDL, VLDL, LDL and

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JCHR (2026) 16(1), 1584-1590 | ISSN:2251-6727

positively correlated with HDL, calcium (P=0.001**).

Figure 1: Box plots between calcium and vitamin D between study subjects

Figure 1 demonstrates the box plots between calcium and vitamin D in between study subjects. There was a significantly decreased levels of calcium and vitamin D shown in GDM patients when compared to controls (P=0.001**).

Figure 2: Scatter plots between vitamin D and glycated hemoglobin, calcium

Figure 2 shows the scatter plots for vitamin D and glycated hemoglobin, calcium in between study subjects. There was a significant negative association between vitamin D and glycated hemoglobin. Additionally, significant positive association between decreased levels of calcium and vitamin D shown in GDM patients when compared to controls (P=0.001**).

5. Discussion

The present study done on a pregnant woman with and without GDM at PES Institute of Medical Sciences and Research in Bangalore, India. The maternal age, history of diabetes mellitus, western food habits, dyslipidemia, obesity, macrosomia and glycosuria were associated with GDM (12-14). In our study, we found that Vitamin D concentrations were lower among those with GDM when compared to without GDM. Approximately 73.8 % of the women with GDM had vitamin D concentrations below 20 nmol/L considered severe deficiency, and 26.2 % of the women in our study had plasma vitamin D concentrations that would be considered insufficient. Based on these findings current research revealed a link between a higher risk of GDM and low maternal plasma vitamin D concentrations in the early stages of pregnancy. The recent studies also observed 60 – 80 % of GDM women had vitamin D insufficiency, these levels were associated positively with poor glycemic control and reported Vitamin D has a beneficial role in reducing the risk of GDM (15-16).

Additionally, we observed there was significant correlation between vitamin D concentration and blood sugar values, glycated hemoglobin, and dyslipidemia. Recent study reports the vitamin D modulates pancreatic β cell function and secretion by binding to its circulating active form of vitamin D with β cell vitamin D receptor and regulating the balance between the extracellular and intracellular β cell calcium pools (17-18). According to a different study, vitamin D can increase insulin sensitivity by boosting insulin responsiveness for glucose transport and promoting the expression of insulin receptors (19-20). There was a low vitamin D levels may result in insufficient intracellular cytosolic calcium, which is necessary for insulin-mediated intracellular activities and glucose regulation because vitamin D is also known to modulate extracellular calcium (21-22). The results of this study will help primary care physicians understand that women with vitamin D deficiency during pregnancy have a higher chance of getting GDM. The investigatory report of vitamin D levels can be used by primary care physicians to determine diet and treatment protocols. This would eventually result in lower maternal and child morbidity and death by lowering the probabilities of GDM in high-risk women.

6. Conclusion

Based on study findings, there is a link between early pregnancy GDM risk and maternal vitamin D deficiency. Determination of vitamin D levels might be useful for early detection of gestational diabetes mellitus.

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JCHR (2026) 16(1), 1584-1590 | ISSN:2251-6727

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Journal of Chemical Health Risks
www.jchr.org
JCHR (2026) 16(1), 1584-1590 | ISSN:2251-6727

Table 1: Biochemical measurements between controls and gestational diabetes mellitus

Parameters	Controls			GDM (25-29 Weeks)			GDM (25-29 Weeks)			P-value
	Mean ± SD			Mean ± SD			Mean ± SD			
Age (Years)	38.90	±	10.30	26.15	±	2.14	26.15	±	2.14	0.001**
Weeks of Gestation	25.50	±	2.111	27.15	±	1.39	32.47	±	1.71	0.001**
BMI	22.	±	1.	22.	±	1.	34.	±	3.	0.00
(kg/m^2)	25		73	77		89	31		82	1**
FBS (mg/dL)	86.82	±	7.886	134.82	±	11.50	153.42	±	15.08	0.001**
PPBS (mg/dL)	276.72	±	49.37	275.63	±	48.94	282.95	±	52.28	0.001**
Hb A1C (%)	4.75	±	0.66	6.60	±	0.53	7.85	±	1.11	0.001**

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Total Cholesterol (mg/dL)	160.98	±	155.24	172.57	±	111.21	272.38	±	21.70	0.001**
Triacylglycerides (mg/dL)	117.27	±	166.42	132.32	±	17.97	199.15	±	21.25	0.001**
HDL (mg/dL)	46.28	±	5.94	35.82	±	4.26	29.58	±	2.53	0.001**
VLDL	23	±	3.	26.	±	3.	40.	±	4.	0.0
(mg/dL)	.23		50	84		57	39		16	01**
LDL (mg/dL)	89.36	±	94.44	108.55	±	11.64	204.46	±	17.25	0.001**
Calcium (mg/dL)	10.07	±	0.82	7.47	±	1.13	5.82	±	1.35	0.001**
Vitamin-D (ng/mL)	45.23	±	3.25	28.00	±	4.37	15.68	±	2.89	0.001

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JCHR (2026) 16(1), 1584-1590 | ISSN:2251-6727

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Table 2: Correlation of vitamin D with other parameters of study

Vitamin-D (ng/mL)		
Parameters	**r**	**P**
Age (Years)	0.531	0.001**
Weeks of Gestation	-0.632	0.001**
BMI (kg/m^2)	-0.638	0.001**
FBS (mg/dL)	-0.767	0.001**
PPBS (mg/dL)	-0.089	0.001**
HbA1C (%)	-0.758	0.001**
Total Cholesterol (mg/dL)	-0.670	0.001**
Triacylglycerides (mg/dL)	-0.660	0.001**
HDL (mg/dL)	0.726	0.001**
VLDL (mg/dL)	-0.682	0.001**
LDL (mg/dL)	-0.711	0.001**
Calcium (mg/dL)	0.824	0.001**

Figure 1: Box plots between calcium and vitamin D between study subjects

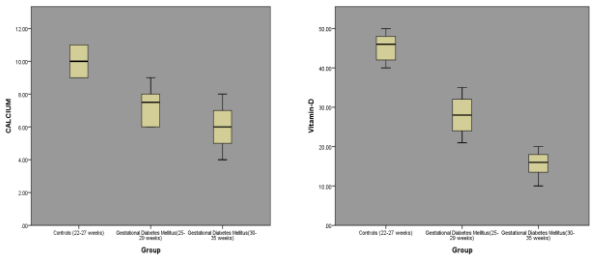

Figure 2: Scatter plots between vitamin D and glycated hemoglobin, calcium