



Original Article

A Comparison of Vitamin D Level among the Patients of Gestational Diabetes Mellitus in a Tertiary Care Hospital in North India

Authors

Dr Meenakshi Srivastava¹, Dr Preeti Bhatnagar²

¹Associate Professor, Department of Obstetrics & Gynaecology, Integral Institute of Medical Sciences & Research, Dasauli Lucknow, Uttar Pradesh

²Associate Professor, Department of Physiology, Heritage Institute of Medical Sciences & Research Varanasi, Uttar Pradesh

Corresponding Author

Dr Preeti Bhatnagar

Associate Professor, Department of Physiology, Heritage Institute of Medical Sciences & Research Varanasi, Uttar Pradesh

Abstract

Objective: To compare vitamin D level among the patients of gestational diabetes mellitus (GDM) with healthy controls in a tertiary care hospital in north India.

Methods: This was a case-control study. The pregnant women aged between 18-40 years, at 24-28 weeks of gestational age and willing to participate in the study were included in the study. Vitamin D level was measured in both cases and controls. GDM was defined as blood sugar level between 140 -199 mg/dl.

Results: More than half of both cases (55%) and controls (56.7%) were between 20-30 years. The percentage of deficiency was observed in 61.7% of cases and in 15% of controls. The deficiency was found to be 15.17 times significantly higher in cases compared to controls (OR=15.17, 95%CI=5.85-39.32, $p=0.0001$). A lower BMI was found in vitamin D deficient patients than insufficiency and sufficient, however, the difference was statistically insignificant ($p>0.05$).

Conclusion: The deficiency of vitamin D was more common among the pregnant women with GDM than without GDM. Informing women of the importance of maintaining adequate vitamin D stores in pregnancy, particularly for those at greatest risk of vitamin D deficiency is required.

Keywords: Pregnant women, Gestational diabetes mellitus, Vitamin D.

Introduction

Diabetes mellitus (DM) is one of the major actual public health issues consisting of chronic hyperglycemia which can damage body organs and systems⁽¹⁾. Gestational diabetes mellitus (GDM) is a common metabolic complication in pregnancy, defined as a glucose intolerance

identifying for the first time during pregnancy⁽²⁾. GDM reveals usually between 24 and 28 weeks of gestation, without particular symptoms, but it should be screened as early as possible to avoid severe short- and long-term complications for mother, fetus or neonate⁽³⁾.

Insulin resistance in peripheral tissues and pancreatic beta-cells inadequacy to secrete insulin represent the double pathways involved in the hyperglycemia. On one side, during normal pregnancy, insulin sensitivity declines, leading to a higher insulin resistance in peripheral tissues, due to placental factors, progesterone and estrogen, having insulin-antagonistic effects⁽²⁾. On the other side, GDM occurs if pancreatic beta-cells are unable to face the increased insulin demand during pregnancy and the elevated glucagon-like peptide 1 (GLP-1) confirms the abnormal insulin secretion⁽²⁾.

Vitamin D, one of the fat-soluble vitamins, is unique in that it is a steroid hormone with endocrine, paracrine and autocrine effects. It has both endogenous production and exogenous sources⁽⁴⁾.

Vitamin D is metabolized in the liver to the form 25-(OH)D, which is used to determine a patient's vitamin D status: 25(OH)D is metabolized in the kidneys to its active form, 1,25-(OH)2D; sterol-cholesterol. The biologic functions of vitamin D are exerted through the interaction of 1,25-(OH)2D with a single vitamin D receptor (VDR) in the cell nucleus. Nagpal and colleagues reported that 1,25(OH)₂D through its transcriptional activity was capable of regulating directly and indirectly 200 genes which control proliferation differentiation, apoptosis and angiogenesis⁽⁵⁾.

Vitamin D deficiency appears to be related to the development of type 2 diabetes mellitus, innate immune responses, multiple sclerosis⁽⁶⁾. Higher plasma vitamin D has been shown to be related with a lower risk for the development of diabetes mellitus in high risk patients⁽⁷⁾. Vitamin D deficiency has been described in the metabolic syndrome. Specific vitamin D receptor gene polymorphisms having been found to be related to components of the metabolic syndrome^(8,9). Moreover, vitamin D seems to affect glucose homeostasis, vitamin D levels having been found to be inversely related to blood glucose levels in gestational diabetes mellitus.

The present study was designed to compare vitamin D level among the patients of gestational diabetes mellitus with healthy controls in a tertiary care hospital in north India.

Material and Methods

The present case-control study was carried out in the Department of obstetrics and Gynaecology, Integral Institute of Medical Sciences. The study was approved by the Ethical Committee of the Institute. The consent was taken from each participant before enrolling in the study. The pregnant women aged between 18-40 years, at 24-28 weeks of gestational age and willing to participate in the study were included in the study. The women known case of diabetes mellitus, hypertension, PIH, history of GDM in previous pregnancy, multiple pregnancy, any significant endocrinal abnormality, history of smoking, BMI >30 and history of vitamin D supplementation were excluded from the study.

Methods

The subjects were enrolled into two groups: Cases with GDM and Controls were healthy pregnant women. Vitamin D level was measured in both the groups. GDM was defined according to DIPSI guideline (10). GDM was defined as blood sugar level between 140 -199 mg/dl. The estimation of Serum Vit D was done by Chemiluminescent immunoassay (CLIA). This is a type of Elisa in which radioisotope iodine is replaced with acridinium ester that makes its own light chemiluminescence.

Statistical analysis

The results are presented in mean±SD and percentages. The Chi-square/Fisher exact test was used to compare the categorical/dichotomous variables between the groups. The one way analysis of variance was used to compare the BMI among various vitamin D deficiency groups. The binary logistic regression analysis was carried out to find the strength of association. The odds ratio (OR) with its 95% confidence interval (CI) was

calculated. The p -value <0.05 was considered significant. All the analysis was carried out on SPSS 16.0 version (Chicago, Inc., USA).

Results

More than half of both cases (55%) and controls (56.7%) were between 20-30 years. Nullipara was also in more than half of cases and controls. One live birth was in 16.7% of cases and 33.3% of controls. Two still births were found to be higher among cases (10%) than controls (3.3%). Abortion was nil in the majority of the cases (76.7%) and controls (80%). None of the cases and controls had history of GDM. Family history of GDM was present in 8.3% of cases and 3.3% of controls. There was no significant ($p>0.05$) association of basic characteristics of patients with groups (Table-1).

The percentage of deficiency was observed in 61.7% of cases and in 15% of controls. The deficiency was found to be 15.17 times significantly higher in cases compared to controls (OR=15.17, 95%CI=5.85-39.32, $p=0.0001$). Insufficiency was found to be 12.30 times significantly higher in cases compared to controls (OR=12.30, 95%CI=2.95-51.34, $p=0.001$) (Table-2).

The percentage of deficiency, insufficiency and sufficient of GDM patients was higher in the age group of 20-30 years, however, the association was statistically insignificant ($p>0.05$) (Table-3).

A lower BMI was found in vitamin D deficient patients than insufficiency and sufficient, however, the difference was statistically insignificant ($p>0.05$) (Table-4).

Table-1: Basic characteristics of GDM patients

Basic characteristics	Cases (n=60)		Controls (n=60)		p-value ¹
	No.	%	No.	%	
Age in years					
<20	6	10.0	5	8.3	0.94
20-30	33	55.0	34	56.7	
>30	21	35.0	21	35.0	
Mean±SD					
Parity					
Nullipara	37	61.7	32	53.3	0.35
Multipara	23	38.3	28	46.7	
Outcome of previous pregnancy					
Live birth					
Nil	33	55.0	29	48.3	0.16
One	10	16.7	20	33.3	
Two	6	10.0	5	8.3	
Three	11	18.3	6	10.0	
Still births					
Nil	44	73.3	51	85.0	0.21
One	10	16.7	7	11.7	
Two	6	10.0	2	3.3	
Abortions					
Nil	46	76.7	48	80.0	0.47
One	12	20.0	8	13.3	
Two	2	3.3	4	6.7	
Previous History of GDM					
Yes	0	0.0	0	0.0	-
No	60	100.0	60	100.0	
Family history of GDM					
Yes	5	8.3	2	3.3	0.24
No	55	91.7	58	96.7	

¹Chi-square test

Table-2: Vitamin D status of GDM patients

Vitamin D status	Cases (n=60)		Controls (n=60)		OR (95%CI)	p-value ¹
	No.	%	No.	%		
Deficiency (<20 ng/dl)	37	61.7	9	15.0	15.17 (5.85-39.32)	0.0001*
Insufficiency (20-30 ng/dl)	10	16.7	3	5.0	12.30 (2.95-51.34)	0.001*
Sufficient (>30 ng/dl)	13	21.7	48	80.0	1.00 (Ref.)	

OR-Odds ratio, CI-Confidence interval, 1Binary logistic regression, *Significant, Ref-Reference

Table-3: Vitamin D status of GDM patients according to age

Age in years	No. of patients	Vitamin D status						p-value ¹
		Deficiency (<20 ng/dl)		Insufficiency (20-30 ng/dl)		Sufficient (>30 ng/dl)		
		No.	%	No.	%	No.	%	
<20	6	5	13.5	1	10.0	0	0.0	0.71
20-30	33	20	54.1	5	50.0	8	61.5	
>30	21	12	32.4	4	40.0	5	38.5	

¹Chi-square test

Table-4: Vitamin D status of GDM patients according to BMI

Vitamin D status	BMI (Mean±SD)
Deficiency (<20 ng/dl)	13.2±6.18
Insufficiency (20-30 ng/dl)	20.99±9.81
Sufficient (>30 ng/dl)	20.74±9.11
p-value ¹	0.17

¹ANOVA

Discussion

Diabetes is one of the most common medical complications of pregnancy. It complicates two to five percent of pregnancies, of which 90% is contributed by gestational diabetes mellitus (GDM)⁽¹¹⁾. The controversy and confusion still exists because of various guidelines for diagnosis of GDM. Vitamin D seems to have several extra skeletal functions including regulation of glucose metabolism through influencing insulin sensitivity, although the mechanisms are not fully understood.

In the present study, more than half of cases (61.7%) and 53.3% of controls were nullipara. There was no statistical significance between cases and controls according to parity (p>0.05). This is in contrast with study by Zuhur et al⁽¹¹⁾ in which the percentage of multipara was 85.9% in women with GDM and 60.7% in controls with significant difference. This difference might be due to difference in the methods used for the diagnosis of GDM.

It has been shown in a study that women with GDM were more likely to have a history of GDM

in previous pregnancies and a history of type 2 DM in first-degree relatives, and were older compared with controls⁽¹¹⁾. In another study, history of previous GDM was 12.8% in women with GDM and was nil in controls. The family history of diabetes was in 78.7% in women with GDM and 17.2% in controls⁽¹²⁾. However, in the study, there was no previous history of GDM in cases and controls. No significant (p>0.05) association was found between family history of GD in cases and controls.

Maghbooli et al⁽¹³⁾ reported the higher prevalence of severe vitamin D deficiency (≤12.5 nmol/L) in GDM than in normoglycaemic pregnancies in 741 Iranian women. Nevertheless, vitamin D levels in Asian population are in general lower than in Caucasian population and criteria used in their study would classify most European women as having optimal vitamin D status. Zuhur et al⁽¹¹⁾ described significantly lower vitamin D levels in 234 Turkish pregnant women with GDM compared to 162 controls. In this study also, insufficiency of vitamin D level was higher than other vitamin D levels. There was no significant (p>0.05) association of vitamin D level among cases with BMI in this study. This finding is in agreement with the other studies^(14, 15).

As vitamin D deficiency is a worldwide public health problem and its severe deficiency during pregnancy may contribute to the development of GDM, the investigation of vitamin D deficiency

during pregnancy and its appropriate replacement, particularly in patients with severely deficient levels, may contribute to the prevention of GDM.

Conclusion

The deficiency of vitamin D was more common among the pregnant women with GDM than without GDM. Informing women of the importance of maintaining adequate vitamin D stores in pregnancy, particularly for those at greatest risk of vitamin D deficiency is required.

Conflict of interest: None

Funding: None

References

1. Karamanou M, Protogerou A, Tsoucalas G, Androutsos G, Poulakou-Rebelakou E. Milestones in the history of diabetes mellitus: The main contributors. *World J Diabetes* 7, 1–7, 2016.
2. Reyes-Lopez R, Perez-Luque E, Malacara JM. Metabolic, hormonal characteristics and genetic variants of TCF7L2 associated with development of gestational diabetes mellitus in Mexican women. *Diabetes Metab Res Rev* 30, 701–706, 2014.
3. Hawryluk J, Grafka A, Geçca T, Lopucki M. Gestational diabetes in the light of current literature. *Pol Merkur Lekarski* 38, 344–347, 2015.
4. *Indian Journal of Endocrinology and Metabolism* 2013; 17 (4): 602.
5. Nagpal S, Na S, Rathachalam R. Non calcemic actions of vitamin D receptor ligands. *Endocr Rev* 2005; 26:662-87.
6. Lee S, Clark SA, Gill RK, Christakos S. 1,25-Dihydroxyvitamin D₃ and pancreatic beta-cell function: vitamin D receptors, gene expression, and insulin secretion. *Endocrinology*. 1994;134(4):1602–1610.
7. Plum LA, DeLuca HF. Vitamin D, disease and therapeutic opportunities. *Nat Rev Drug Discov* 2010; 9: 941–55.
8. Gale CR, Robinson SM, Harvey NC, et al. Maternal vitamin D status during pregnancy and child outcomes. *Eur J Clin Nutr*. 2008; 62(1):68–77.
9. Dawodu A, Saadi HF, Bekdache G, Javed Y, Altaye M, Hollis BW. Randomized controlled trial (RCT) of vitamin D supplementation in pregnancy in a population with endemic vitamin d deficiency. *J Clin Endocrinol Metab*. 2013.
10. Seshiah V., Das A. K., Balaji V., Joshi S. R., Parikh M. N., and Gupta S., “Gestational diabetes mellitus-guidelines. *Journal of Association of Physicians of India* 2006; 54: 622–628.
11. Zuhur SS, Erol RS, Kuzu I, Altuntas Y. The relationship between low maternal serum 25-hydroxyvitamin D levels and gestational diabetes mellitus according to the severity of 25-hydroxyvitamin D deficiency. *Clinics* 2013; 68(5): 658-664.
12. Anna Pleskačová, Vendula Bartáková, Lukáš Pácal, Katarína Kuricová, Jana Bělobrádková, Josef Tomandl, and Kateřina Kaňková. Vitamin D Status in Women with Gestational Diabetes Mellitus during Pregnancy and Postpartum. *BioMed Research International Volume* 2015.
13. Maghbooli Z, Hossein-Nezhad A, Karimi F, Shafaei AR, Larijani B. Correlation between vitamin D₃ deficiency and insulin resistance in pregnancy. *Diabetes Metab Res Rev* 2008; 24: 27–32.
14. Soheilykhah S, Mojibian M, Rashidi M, Rahimi-Saghand S, Jafari F. Maternal Vitamin D Status in Gestational Diabetes Mellitus. *Nutr Clin Pract* 2010;25:524–527.
15. Soheilykhah S, Mojibian M, Rashidi M, Rahimi-Saghand S, Jafari F. Maternal Vitamin D Status in Gestational Diabetes Mellitus. *Nutr Clin Pract* 2010;25:524–527.