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Research Article

Prevalence of Vitamin D Associated Gestational Diabetes Mellitus among Mothers in Third Trimester

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ABSTRACT
OBJECTIVE: This study was aimed to evaluate the association between Vit D deficiency and risk of developing GDM during pregnancy at a tertiary care Hospital.
BACKGROUND: In the United States, Gestational diabetes mellitus (GDM) results in complication of 7–14% of gravidities. Another common side effect of pregnancy is vitamin D deficiency. It is unknown, nevertheless, if taking vitamin D supplements can stop GDM. According to recent studies, vitamin D supplementation can improve glucose and insulin tolerance. There is conflicting evidence from observational studies about association between GDM and low serum 25(OH) D levels.
METHODOLOGY: A case control study was carried out at the department of Obstetrics & Gynecology, Jinnah Hospital, Lahore from 01-07-2022 to 31-12-2022. Using consecutive sampling method. 122 pregnant females were inducted in the study. All the females aged between 20 to 40 years and parity less than five who presented with gestational age of more than 24 weeks by dating scan were made part of the study. The SPSS version 21 program was used to enter and analyze the data. To test for significance, post-stratification adjusted OR was calculated, with OR>1 being considered significant.
RESULTS: In this study, out of 122 cases (61 in each group), 78.68% (n=48) in cases and 77.05 %(n=47) in controls were aged between 20-30 years, whereas 21.32 %(n=13) in cases and 22.95 %(n=14) in controls were aged between 31-40. Vitamin D deficiency in cases was 29.51 %(n=18) in cases and in controls 9.84 %(n=6) whereas. The odds ratio was 3.90 and p value was 0.007.
CONCLUSION: This study reached to the conclusion that the risk of gestational diabetes mellitus is greatly increased by vitamin D during the third trimester of pregnancy.

KEYWORDS: Vitamin D deficiency, Association, gestational diabetes, 3rd trimester.

INTRODUCTION

GDM, (gestational diabetes mellitus) can be defined as a varying degree of glucose intolerance that begins or are first observed during pregnancy [1]. The prevalence of GDM is increasing globally specially in Asian countries [2]. According to estimates, the prevalence of GDM is almost 15-20% overall in comparison with 9.9% observed earlier [3]. Females having GDM have higher risk to develop delivery problems and type 2 DM after pregnancy [4]. Infants born to diabetic mothers have higher incidence of macrosomia, birth trauma, hypoglycemia, respiratory distress at birth and are more prone to develop obesity and type 2 DM later in life [5, 6]

Vit D deficiency is common during pregnancy [7]. The role of vit D in calcium homeostatsis and bone mineralisation is well established. In addition to its classical actions, recent evidence has shown that vit D is also involved in glucose homeostatsis. Vit D is important for routine manufacture and secretion of insulin as well as for normal insulin sensitivity [8]

There is a strong evidence that vit D deficiency during first 1/3rd of gestation is linked with increased risk of GDM in third trimester of pregnancy [3]. Recent study by Parlea L et al [9] also detected a significant association between GDM and vit D deficiency. Mother with gestational diabetes had significantly lower serum vitamin D compared with control subjects (56.3 vs. 62.0 nmol/l, P = 0.018). Another study showed that among women with GDM, Pregnant women were divided into four categories: 64 (15.9%) had severe vitamin D

deficiency, 79 (19.7%) had deficiency, 196 (48.8%) had insufficient, and 63 (15.7%) had sufficient levels [7]. A similar study conducted by Zang C et al depicted that Vit D concentrations in GDM cases were around 33%, compared to 14% in controls (P< 0.001), and were compatible with a diagnosis of vitamin D deficiency[10].

Although there is rising scientific evidence connecting vitamin D insufficiency to diabetes, the results examining the link between GDM and vitamin D levels is unpredictable and conflicting.[3] Research carried out by Makgoba et al demonstrated no statistically significant differences in Vit D levels between those who subsequently developed GDM and those who remained normoglycemic (P = 0.874)[11] . A study conducted by Baker AM et al concluded that Women eventually diagnosed with GDM and healthy controls both had low rates of first-trimester maternal vitamin D insufficiency (8.3% vs 6.7%, respectively; p = 0.90)[12].

In this study was aimed to determine the relationship between vit D defeciency and risk of developing GDM during pregnancy given its topicality and potential for clinical impact. It will also address the controversy observed in above studies. Moreover there is not enough research done locally on the subject till present. By conducting this study, we aim to establish the connection between these two common conditions which would then help us updating the local guidelines in future.

MATERIALS & METHODS

A case control study was carried out at the department of Obstetrics & Gynecology, Jinnah Hospital, Lahore from July 2022 to December 2022. Using consecutive sampling method. 122 pregnant females were inducted in the study. All the females aged between 20 to 40 years and parity less than five presenting at gestational age of $\geq$24 weeks by dating scan were made part of the study. They were divided into two groups. Group A were the cases who had GDM (gestational diabetes mellitus) while group B were the controls who didn't have GDM. Each group consisted of 61 females. Mothers having multiple gestation (on ultrasound), previously diagnosed DM, anemia, imbalanced LFTs, RFTs, Females at high risk (including chronic or pregnancy induced hypertension (bp$\geq$140/90mmhg)), patients with history of GDM in previous pregnancy and the females already taking vitamin d supplementation (diagnosed in first trimester of pregnancy) were excluded from the study.

In the study, 122 females who met the eligibility requirements were enrolled from the Obstetrics and Gynaecology Outpatient Department at Jinnah Hospital in Lahore. Every woman gave her informed permission. Additionally we recorded the socio-demographic data. Participants were split into two groups based on whether they were GDM cases or GDM-free controls. After that, a blood sample was collected using a 5cc disposable syringe under aseptic conditions, and it was delivered to the hospital laboratory for vitamin D levels testing. Biochemical analysis led to the identification of vitamin D insufficiency (as per the operational definition).

The SPSS version 21 programme was used to enter and analyse the data. For quantitative variables like age and gestational age, mean and SD were computed. For qualitative characteristics such a vitamin D deficiency, frequency and proportion were provided. To evaluate the relationship between vitamin D insufficiency and GDM, odds ratios were constructed. The significance level was set at OR>1. Frequency was described as parity. Age, parity, gestational age, and BMI were used to stratify the data. To test for significance, post-stratification adjusted OR was calculated, with OR>1 being considered significant.

RESULTS

Out of 122 cases (61 in each group), 78.68 %(n=48) and 77.05 %(n=47) were aged between 20-30 years, whereas 21.32% (n=13) and 22.95% (n=14) were aged between 31-40 years, with mean and SD 28.09$\pm$2.62 and 28.36$\pm$2.57, in cases and controls respectively (Table No. I).

Gestational age shows that 65.57 %(n=40) and 63.93%(n=39) were between 25-32 weeks of gestational age in cases and controls respectively. Whereas 34.43%(n=21) and 36.07%(n=22) had >32 weeks of gestation, with the mean$\pm$SD 30.97$\pm$3.03 and 31.23$\pm$2.93 weeks in cases and controls respectively. (Table No. I)

Parity distribution shows that 52.46%(n=32) in cases and 55.74%(n=34) in controls were between 1-2 parity whereas 47.54%(n=29) in cases and 44.26%(n=27) in controls were between 3-4 parity, mean$\pm$SD was calculated as 2.66$\pm$0.93 parity in cases and 2.59$\pm$0.90 parity in controls.

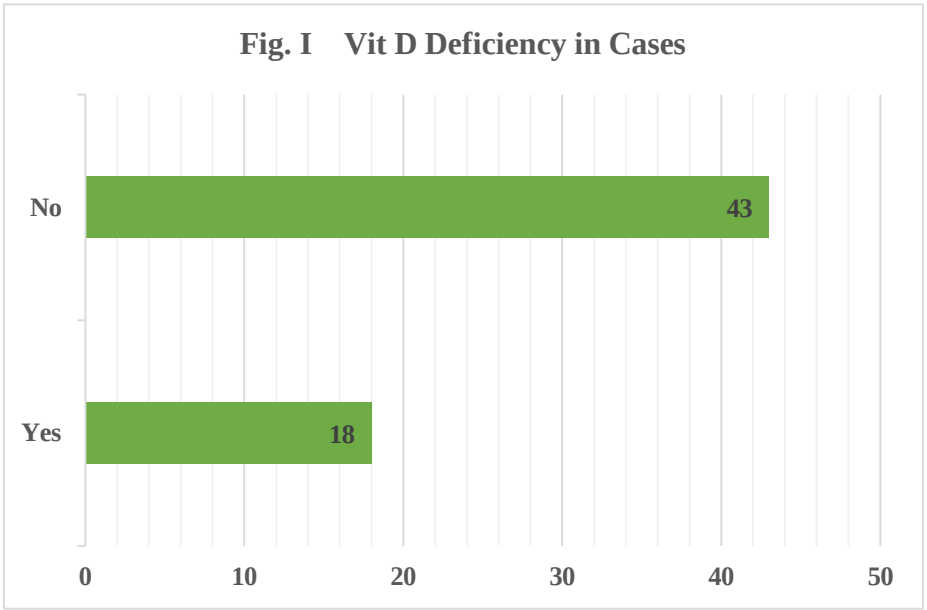
The vitamin D deficiency in cases was 29.51 %(n=18) and 9.84 %(n=6) in cases and in controls respectively, the odds ratio was 3.90 and p value was 0.007.

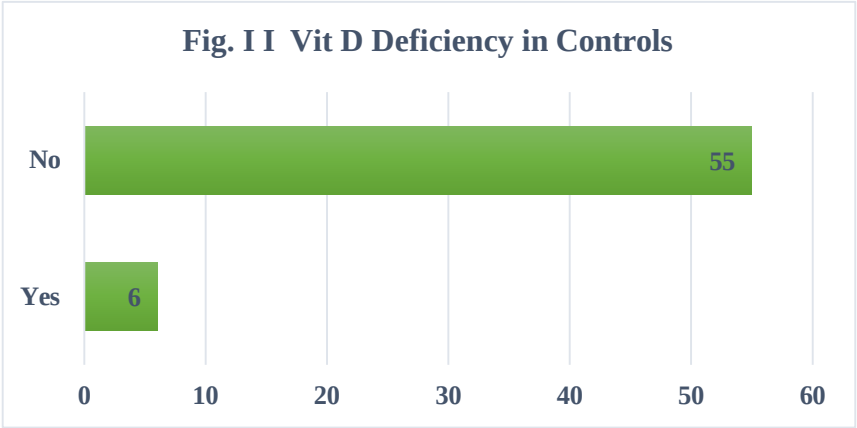
Table No. I

Table I Sociodemographic Factors of the Cases and Controls in the Study

Study Variables		Cases (n=61)		Controls (n=61)	
		n	%	n	%
Age(years)	20-30	48	78.68	47	77.05
	31-40	13	21.32	14	22.95
	Mean±SD	28.09±2.62		28.36±2.57	
Gestational Age	25-32	40	65.57	39	63.93
	>32	21	34.43	22	36.07
	Mean±SD	30.97±3.02		31.23±2.93	
Parity	2-Jan	32	52.46	34	55.74
	4-Mar	29	47.54	27	44.26
	Mean±SD	2.66±0.93		2.59±0.90	
Vit D Deficiency	Yes	18	29.51	6	9.84
	No	43	70.49	55	90.16

Relationship between vitamin D deficiency and risk of gestational diabetes mellitus during 3rd trimester of pregnancy shows that vitamin D deficiency in cases was 29.51 %(n=18) in cases and in controls 9.84 %(n=6) whereas remaining 70.49 %(n=43) in cases and 90.16 %(n=55) in controls had no vitamin D deficiency, odds ratio was 3.90 and p value was 0.007. (Figure I and II)





The data was stratified for age, parity, gestational age and BMI. Post-stratification adjusted OR was calculated to check the significance with OR>1 as significant.

Table No. II

Study Variables	Vit. D Deficiency		P value	Odds Ratio
	Yes	No		
Age 20-30 Years				
Cases	14	34	0.004	9.26
Controls	2	45		
Age 30-40				
Cases	4	9	0.9	1.11
Controls	4	10		
G. Age: 25-32 weeks				
Cases	13	27	0.01	5.77
Controls	3	36		
G. Age: >32 weeks				
Cases	5	16	0.93	0.92
Controls	3	9		
Parity 1-2				
Cases	10	22	0.06	3.4
Controls	4	30		
Parity 3-5				
Cases	8	21	0.06	4.76
Controls	2	25		
BMI: up to 31				
Cases	15	25	0.004	5.7
Controls	4	38		
BMI: >31				
Cases	3	18	0.72	1.42
Controls	2	17		

DISCUSSION

In this study, out of 122 cases (61 in each group), 78.68 %(n=48) and 77.05 %(n=47) were aged between 20-30 years, whereas 21.32% (n=13) and 22.95% (n=14) were aged between 31-40 years, with mean and SD 28.09±2.62 and 28.36±2.57, in cases and controls respectively. The vitamin D deficiency in cases was 29.51 %(n=18) and 9.84 %(n=6) in cases and in controls respectively, the odds ratio was 3.90 and p value was 0.007.

A statistically significant correlation between GDM and vitamin D deficiency was shown by Parlea L et al [9] and other researchers. However, in the control group, the serum vitamin D levels of the GDM women were considerably lower (56.3 vs. 62.0 nmol/l, P = 0.018). Another study found that among pregnant women with GDM, 64 (15.9%) had severe vitamin D deficiency, 79 (19.7%) had deficiency, 196 (48.8%) had insufficient vitamin D, and 63 (15.7%) had sufficient vitamin D.[7] According to a comparable study by Zang C et al, Vit D values were compatible with a diagnosis of vitamin D deficiency in about 33% of GDM cases in contrast to 14% of controls (P 0.001).[10] Our results agree with the research mentioned above.

In a similar study, Heather H. Burris and colleagues [13] reported that 4.0% mothers with normal glucose tolerance, 5.7% mothers with impaired glucose tolerance and 13.2% and 25(OH) D levels were less than 25 nmol/L, concluding that the mothers with 25(OH) D levels below 25 nmol/L might be at higher risk to develop GDM. [13]

Several research have been carried out to look into the potential role of vitamin D insufficiency in a variety of pregnancy diseases, including GDM [14-16]. Low vitamin D levels have been linked to preeclampsia or gestational diabetes in observational studies [17]. Pregnancy vitamin D deficiency has been linked to an increased risk of GDM, and women with GDM had considerably lower serum 25(OH) D levels than women with adequate glucose tolerance [18-22]. However, it remains unknown whether this link is activated by anything [23]. Several research [24-29] have discovered an inverse relationship between 25(OH)D and fasting plasma glucose (FPG), oral glucose tolerance test (oGTT) plasma glucose one hour after load, and glycated haemoglobin.

CONCLUSION

This study reached to the conclusion that the risk of gestational diabetes mellitus is greatly increased by vitamin D during the third trimester of pregnancy.

REFERENCES

1. Judith G.M. Jelsma, Karen M.vanLeeuwen, Nicolette Oostdam, Christopher Bunn, David Simmons, GernotDesoy, Rosa Carcoy et al. Beliefs, barriers and preferences of European overweight women to adopt a healthier lifestyle in pregnancy to minimize risk of developing Gestational Diabetes Mellitus;an explorative study. Journal of pregnancy 2016;2016:11.
2. Kim SY, England L, Sappenfield W, Wilson HG, Bish CL, Salihu HM, Sharma AJ. Racial/ethnic differences in the percentage of gestational diabetes mellitus cases attributable to overweight and obesity, Florida, 2004-2007. Prev Chronic Dis 2012;9:110249.
3. Meng-Xi Zhang, Guo-Tao Pan, Jian-Fen Guo, Bing-Yan Li 2, Li-Qiang Qin 2 and Zeng-Li Zhang 1. Vitamin D Deficiency Increases the Risk of Gestational Diabetes Mellitus: A Meta-Analysis of Observational Studies, Department of Labor Hygiene and Environmental Health, School of Public Health of Soochow University,China. Nutrients 2015; 7:8366–754.
4. Parildar H, Dogruk Unal A, Aksan Desteli G, Cigerli O, Guvener Demirag N. Frequency of Vitamin D deficiency in pregnant diabetics at Baskent University Hospital, Istanbul. Pak J Med Sci 2013;29(1):15-20.
5. Donald R.Coustan. Gestational Diabetes Mellitus. Clinical Chemistry. 2013;5:1310-21.
6. Mimouni FB, Mimouni G, Bental YA. Neonatal management of the infant of diabetic mother. Pediatrics & therapeutics. 2013;4(1):4.
7. 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):658-64.
8. Farrant HJ, Krishnaveni GV, Hill JC, Boucher BJ, Fisher DJ, Noonan K, et al. Vitamin D insufficiency is common in Indian mothers but is not associated with gestational diabetes or variation in newborn size. Eur J Clin Nutr 2009 May;63(5):646-5.

9. Parlea L, Bromberg IL, Feig DS, Vieth R, Merman E, Lipscombe LL. Association between serum 25-hydroxyvitamin D in early pregnancy and risk of gestational diabetes mellitus. Diabet Med 2012;29(7):e25-32.
10. Zhang C, Qiu C, Hu FB. Maternal plasma 25-hydroxyvitamin D concentrations and the risk for gestational diabetes mellitus. PLoS ONE 2008;3:e3753
11. Makgoba M, Nelson SM, Savvidou M, Messow C-M, Nicolaides K, Sattar N. First-Trimester Circulating 25-Hydroxyvitamin D Levels and Development of Gestational Diabetes Mellitus. Diabetes care 2011;34(5):1091-3.
12. Baker AM,HHaeri S, Camargo CA Jr,Stuebe AM, Boggess KA.First trimester maternal vitamin D status and risk for gestational diabetes(GDM).Diabetes Metab Res Rev 2012;28:164-8.
13. Burris HH, Rifas-Shiman SL, Kleinman K. Vitamin D deficiency in pregnancy and gestational diabetes mellitus. Am J Obstet Gynecol. 2012;207(3):182.e1-8.
14. Hirani V, Mosdøl A, Mishra G. "Predictors of 25-hydroxyvitamin D status among adults in two British national surveys," British Journal of Nutrition 2009;101:760–4.
15. Javaid MK, Crozier SR, Harvey NC. "Maternal vitamin D status during pregnancy and childhood bone mass at age 9 years: a longitudinal study," The Lancet 2006;367:36–43.
16. Holmes VA, Barnes MS, Alexander HD, McFaul P, Wallace JMW. "Vitamin D deficiency and insufficiency in pregnant women: a longitudinal study," British Journal of Nutrition 2009;102:876–81.
17. Boyle V. "Vitamin D and pregnancy," Obstetrics, Gynaecology & Reproductive Medicine 2014;24:315–6.
18. Alzaim M, Wood RJ. "Vitamin D and gestational diabetes mellitus," Nutrition Reviews 2013;71:158–67.
19. Maghbooli Z, Hossein-Nezhad A, Karimi F, Shafaei AR, Larijani B. "Correlation between vitamin D3 deficiency and insulin resistance in pregnancy," Diabetes/Metabolism Research and Reviews 2008;24:27–32
20. Burris HH, Rifas-Shiman SL, Kleinman K. Vitamin D deficiency in pregnancy and gestational diabetes mellitus. American Journal of Obstetrics and Gynecology 2012;207:182.e1–182.e8
21. Aghajafari A, Nagulesapillai T, Ronksley PE, Tough SC, O'Beirne M. "Association between maternal serum 25-hydroxyvitamin D level and pregnancy and neonatal outcomes: systematic review and meta-analysis of observational Studies. British Medical Journal 2013;346: Article ID f1169
22. Soheilykhah S, Mojibian M, Rashidi M, Rahimi-Saghand S, Jafari F. Maternal vitamin D status in gestational diabetes mellitus," Nutrition in Clinical Practice 2010;25:524–7
23. Poel YHM, Hummel P, Lips P, Stam F, van der Ploeg T, Simsek S. Vitamin D and gestational diabetes: a systematic review and meta-analysis. European Journal of Internal Medicine 2012;23:465–9
24. Clifton-Bligh RJ, McElduff P, McElduff A. Maternal vitamin D deficiency, ethnicity and gestational diabetes. Diabetic Medicine 2008;25:678–84
25. Lau SL, Gunton JE, Athayde NP, Byth K, Cheung WN. Serum 25-hydroxyvitamin D and glycated haemoglobin levels in women with gestational diabetes mellitus. Medical Journal of Australia 2011;194:334–7
26. Khalid A, Aman S, Jhatial I, Talreja W, Hussain W, Wadho S, Shahani MP. Factors Affecting Non Compliance with Exclusive Breastfeeding Among Mothers: A Survey at District Hospital Dadu. Pakistan Journal of Medical & Health Sciences. 2023 Mar 25;17(02):380-.
27. Wadho S, Panhwar AD, Gurbakhshani R, Humayun A, Malik E, Safder Z, Shahani MP. SELF-BREAST EXAMINATION PRACTICES AMONG SCHOOL TEACHERS: A CROSS SECTIONAL STUDY.
28. Talreja W, Jhatial IA, Panhwar M, Siyal MA, Shahani MP, Khoso AA, Aijaz K. FREQUENCY OF HEPATOTROPHS (A, B & C VIRUSES) IN HEPATIC ENCEPHALOPATHY AND THEIR OUTCOME IN CHILDREN.
29. Bhutto AA, Rehman SU, Abro HA, Shahani MP, Ali F, Qazi A. FREQUENCY OF CARDIAC ABNORMALITIES IN PATIENTS PRESENTING WITH SYSTEMIC LUPUS ERYTHEMATOSUS AT TERTIARY CARE HOSPITAL, KARACHI.