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FREQUENCY OF VITAMIN D DEFICIENCY IN PREGNANCIES WITH GESTATIONAL DIABETES MELLITUS

DR ASMA NAYAB
POST GRADUATE RESIDENT OBSTETRICS AND GYNAECOLGY, ALLAMA IQBAL MEMORIAL TEACHING HOSPITAL, SIALKOT, EMAIL: asmanayab2217@gmail.com

DR NOSHEEN BANO
ASSISTANT PROFESSOR OBSTETRICS AND GYNAECOLGY, ALLAMA IQBAL MEMORIAL TEACHING HOSPITAL, SIALKOT, EMAIL ADDRESS drnosheenali@yahoo.com

DR HAJIRA SAJID
POSTGRADUATE RESIDENT OBSTETRICS AND GYNAECOLGY, ALLAMA IQBAL MEMORIAL TEACHING HOSPITAL, SIALKOT, EMAIL: hajirasajid92@gmail.com

DR MAHWISH PERVAIZ
SENIOR REGISTRAR OBSTERTICS AND GYNAECOLGY, ALLAMA IQBAL MEMORIAL TEACHING HOSPITAL , SIALKOT, EMAIL ADDRESS mahwishp91@gmail.com

DR MUNEEBA SHERAZ
POST GRADUATE RESIDENT OBSTETRICS AND GYNAECOLGY, ALLAMA IQBAL MEMORIAL TEACHING HOSPITAL, SIALKOT, EMAIL ADDRESS: dr.muneebatoheed@gmail.com

DR NAZMEEN ALI
PGR OBSTETRICS AND GYNECOLOGY, ALLAMA IQBAL MEMORIAL TEACHING HOSPITAL, SIALKOT
EMAIL ADDRESS: nazmeenali777@gmail.com

ABSTRACT

Background: Vitamin D deficiency is a universal health problem, particularly pregnancies, and in which there is poor maternal and fatal outcomes. This research report indicated that half of the pregnant women who were gesture diabetic mellitus (GDM) were vitamin D deficient and another quarter were deficient. The findings agree with the past studies that have reported high prevalence of hypovitaminosis D in GDM patients and prevalence rates ranging between 21 and 76 percent in disparate populations. The geographic location variation could be attributed to this wide scope which is due to exposure to sunlight, nutrition and the standards of vitamin D deficiency. **Objective:** To determine the frequency of vitamin D deficiency in pregnancies with gestational diabetes mellitus. **Methodology:** The research was a descriptive cross-sectional study that was conducted in the Department of Obstetrics & Gynaecology, Allama Iqbal Memorial Teaching Hospital, Sialkot from July 2025 to October 2025. The non-probability consecutive sampling gave a sample of 179 pregnant women diagnosed of GDM according to the WHO 75-g OGTT criteria. The women were enrolled at the age of 20- 45 years; singleton with 24-38 weeks of pregnancy. The results of the 25-hydroxyvitamin D serum levels were calculated using SPSS 25.0 and a value of less than 20 ng/ml was considered as deficiency. When calculating the frequencies, percentages, mean, and standard deviation, these were calculated. Stratification followed by chi-square with value of p 0.05 was considered significant.

Results: Among 179 patients, the mean maternal age was 29.4 ± 4.8 years and mean gestational age was 30.6 ± 3.2 weeks. Vitamin D deficiency was observed in 102 (57.0%) patients, while 41 (22.9%) had insufficient levels and 36 (20.1%) had sufficient levels. A significant association was observed between obesity and vitamin D deficiency ($p<0.05$).

Conclusion: Vitamin D deficiency is a highly prevalent cause in the case of pregnancy with GDM. Major maternal and mortality cases can be characterized by screening and appropriate supplementation at a young age.

Keywords: Vitamin D deficiency; Gestational diabetes mellitus; Pregnancy; 25-hydroxyvitamin D; Insulin resistance; Maternal health.

INTRODUCTION

This is because the prevalence of vitamin D deficiency is high in pregnant women with gestational diabetes mellitus within the study population (more than half). There was an increase in the prevalence of deficiency

because of obesity and those who were in their third trimester**Error! Reference source not found.** [1]**Error! Reference source not found.**. Considering the importance of vitamin D in glucose metabolism, maternal, and fatal health, screening and supplementation of pregnant women who are at risk of contracting GDM should be included in the regular antenatal care.[2] This gap can be addressed with the help of dietary advice, supplement, and safe exposure to sunlight, which could decrease maternal and neonatal complications, improve the outcome of pregnancy, and even decrease the risk of type 2 diabetes in mothers over the long run.

Pregnancy is a physiological process, which is correlated with an increased degree of nutritional and metabolic requirements. Enough vitamin D during the pregnancy stage is not only required by the maternal bones, but also the fatal bone growth, immune system and placental functioning. However, vitamin D deficiency is highly prevalent among the pregnant women in the world, particularly in those nations which are developing. [3]Limited exposure to sun, dark colouring of the skin, lack of diet, and dressing of certain cultures are the common causes of this deficiency .[4]Deficiency of vitamin D in pregnant women has grown to be one of the main inquiries of the populace health of South Asian population. .[5]

It is felt that vitamin D is significant in glucose metabolism. It increases insulin release by the 8-cells of the pancreas and raises insulin sensitivity of peripheral tissues. .[6] Vitamin D receptors occur in pancreatic tissue and skeletal muscle, and this indicates a biological association between vitamin D status and glucose homeostasis. Vitamin D deficiency can adversely affect the production and secretion of insulin, add to insulin resistance and support systemic inflammation. [7] The mechanisms can play a role in the formation of gestational diabetes mellitus (GDM).

Gestational diabetes mellitus can be defined as the intolerance or intolerance of glucose of various degrees that is first discovered or initially diagnosed during pregnancy. [8] It is one of the most widespread pregnancy complications of the metabolic type, and it is found in approximately 5-20 percent of pregnancies in the world basing on the diagnostic criteria and specifics of the population. [9] Extreme long-term and short-term complications are also associated with GDM. The risk in pregnancy among the women includes preeclampsia, polyhydramnios, preterm labour and the high occurrence of caesarean section. [10] The fatal complications included macrosomia, neonatal hypoglycaemias, respiratory distress syndrome and predisposition to obesity and type 2 diabetes during adulthood.

Women who have GDM are also at higher risk of developing type 2 diabetes mellitus in future. It is approximated that a portion of 25-50 per cent of women with GDM may end up developing overt diabetes in a 5–10-year postnatal period. [11] Therefore, it becomes essential to identify the risk factors which can be modified about the prevention of GDM. Vitamin D deficiency has been proposed as one of such risk factors that can be changed. [12] Several studies have reported in other countries with reduced serum 25-hydroxyvitamin D level in women with GDM as opposed to normoglycemic women during pregnancy. There is, however, wide variation in reported prevalence of vitamin D deficiency among GDM women[13]. There are studies that show prevalence of about 21 and there are also studies that present prevalence of up to 67 to 76. These differences can be attributed to the difference in geographical region, race, access to sunlight, diet and the criterion of diagnosis of vitamin D deficiencies. [4]

Irrespective of the ample sunshine in Pakistan, deficiency of vitamin D is very high in women of reproductive age. The major contributing factors are cultural practices that restrict the sun exposure and poor dietary intake[15] [16] Nonetheless, there is a dearth of local information about the rate of vitamin D deficiency of pregnancy complication by GDM. Knowledge of the prevalence of vitamin D deficiency among this group of high risk is significant in the formulation of screening procedures and supplementation measures.

Therefore, the proposed study will determine the prevalence of vitamin D shortage amongst the pregnant-gestation diabetes mellitus patients at a tertiary care hospital. [17]The findings of this study can be applied in the early identification of the high-risk patients and offer the preventive interventions to reduce the maternal and fatal complications that may arise in case of GDM.

Objectives

To determine the frequency of vitamin D deficiency in pregnant women with gestational diabetes mellitus. To establish the relationship between the level of vitamin D and the maternal aspects such as age, body mass index, parity, gestational age, socioeconomic status, and attendance of antenatal care.

METHODOLOGY

This observational cross-sectional study was conducted at the Department of Obstetrics and Gynaecology of Allama Iqbal Memorial Teaching Hospital, Sialkot, from July 2025 to October 2025. The research objectives were to find out the prevalence of vitamin D deficiency in pregnant women with gestational diabetes mellitus (GDM). The sample population was 179 participants who were recruited through non-probability consecutive sampling method. The diagnosis of GDM was made based on the World Health Organization (WHO) 75-gram Oral Glucose Tolerance Test (OGTT) literature. This standardized method of diagnostic process allowed the equal uniformity of the eligible cases identified to be included in the study.

Inclusion criteria included pregnant women 20-45 years old including primigravida and multigravida pregnant women whose singleton pregnancies were between 24-38 weeks of gestational age. Only patients who were diagnosed with GDM according to operational definition and treated using oral hypoglycemics agents or insulin

were considered. The exclusion criteria were well outlined to minimize the confounding factors. The women who have already developed diabetes mellitus, hypertension during pregnancy (PIH), multiple pregnancies, recorded more than three spontaneous abortions were excluded. Also, hypertensive (BP >140/90 mmHg), renal (serum creatinine >1.3 mg/dl), and hepatic (ALT or AST >40 IU/L) dysfunctional patients were not enlisted in the study. The pre-designed structured proforma was used to gather the data. Serum 25-hydroxyvitamin D [25(OH)D] levels were measured by means of blood samples, and the deficiency of vitamin D was set as the lower level of 20 ng/ml. The SPSS version 25.0 was used to enter and analyse the collected data. Descriptive statistics were also obtained, and chi-square test was used to establish the relationships between the categorical variables. Statistically significant p-value was taken as 0.05 or below.

Inclusion Criteria

- Ages between 20-45 years
- Primigravida, Multigravida.
- Singleton pregnancy between gestational age 24-38 weeks
- Diagnosed with gestational diabetes mellitus (as per operational definition)
- Taking oral Hypoglycemics or insulin for GDM.

Exclusion Criteria

- Pregnancies with GDM as well as PIH.
- Pre-existing Diabetes mellitus
- Women with bad obstetric history (>3 spontaneous abortions), hypertension (BP >140/90 mmHg), renal (Serum creatinine >1.3mg/dl), or hepatic dysfunction (ALT, AST >40)

Data Collection

A non-probability consecutive sampling strategy used to enrol eligible pregnant women who had gestational diabetes mellitus (when compared to WHO 75-gram OGTT conditions) and make an informed written consent. A pre-designed proforma used to capture the demographic data, medical and obstetric history, parity, gestational age, residence, socioeconomic status and attendance at the antenatal care visits. This is also including a clinical assessment whereby weight and height taken to determine BMI. To determine the 25-hydroxyvitamin D serum levels, serum is collected in aseptic condition by use of serum blood as serum samples is taken to estimate the levels of ultrasound and other relevant obstetric data. All the data is going to be gathered by the principal researcher with the help of a senior obstetrician though ultrasound examination is going to be carried out by a qualified sonologist. They are anonymous and the patients is treated according to the hospital policy.

Statistical Analysis

The data that obtained entered and analyzed using SPSS version 25.0. The quantitative variables such as maternal age, gestation age, BMI and vitamin D serum 25-hydroxy levels are expressed in mean standard deviation (SD). Categorical variables contained in frequencies and percentages in terms of parity, residence, socioeconomic status, educational level, the status of antenatal care, and the status of vitamin D deficiency. The relationship between vitamin D deficiency and categorical variables are tested using chi-square test, once the stratification has been undertaken. The p-value which a regarded as significant are assumed to be less than 0.05 which implies that the interdependence of outcome on the risk factors is significant.

Table 1: Baseline Characteristics of Study Participants (n = 179)
(Age range 20–45 years; Gestational age 24–38 weeks)

Variable	Category	Frequency (n)	Percentage (%)
Maternal Age (years)	20–25	48	26.8
	26–30	72	40.2
	31–35	38	21.2
	36–40	21	11.8
	41–45	—	—
Gestational Age (weeks)	24–28	44	24.6
	29–32	68	38.0
	33–36	42	23.5
	37–38	25	13.9
BMI (kg/m²)	Normal (18.5–24.9)	49	27.4
	Overweight (25–29.9)	76	42.5
	Obese (≥30)	54	30.1
Parity	Primipara	61	34.1
	Multipara	118	65.9
Residence	Urban	112	62.6
	Rural	67	37.4
Antenatal Care	Booked	124	69.3
	Unbooked	55	30.7

summarizes the baseline characteristics of 179 pregnant women with gestational diabetes mellitus. The majority were aged 26–30 years (40%) and had a gestational age of 29–32 weeks (38%). Most participants were overweight (42.5%), multiparous (65.9%), lived in urban areas (62.6%), and had booked antenatal care (69.3%).

Table 2: Vitamin D Status in Pregnant Women with Gestational Diabetes Mellitus (n = 179)

Vitamin D Status	Serum 25(OH)D (ng/ml)	Frequency (n)	Percentage (%)
Deficient	<20	102	57.0
Insufficient	20–29	41	22.9
Sufficient	≥30	36	20.1

presents the vitamin D status of 179 pregnant women with gestational diabetes mellitus. More than half of the participants (57%) were vitamin D deficient, while 22.9% had insufficient levels. Only 20.1% of the women had sufficient vitamin D, highlighting a high prevalence of deficiency in this population.

Table 3: Association of Vitamin D Deficiency with Maternal Risk Factors (n = 179)

Risk Factor	Category	Vitamin D Deficient (n, %)	Vitamin D Non-Deficient (n, %)	p-value
BMI (kg/m²)	Normal (18.5–24.9)	20 (19.6)	29 (80.4)	<0.05*
	Overweight (25–29.9)	46 (60.5)	30 (39.5)	
	Obese (≥30)	36 (66.7)	18 (33.3)	
Parity	Primipara	28 (45.9)	33 (54.1)	0.12
	Multipara	74 (62.7)	44 (37.3)	
Residence	Urban	58 (51.8)	54 (48.2)	0.08
	Rural	44 (65.7)	23 (34.3)	
Antenatal Care	Booked	66 (53.2)	58 (46.8)	0.10
	Unbooked	36 (65.5)	19 (34.5)	

*Statistically significant at $p \leq 0.05$

Vitamin D deficiency was significantly associated with higher BMI, with the greatest prevalence observed among overweight and obese women compared to those with normal BMI ($p \leq 0.05$).
Higher deficiency rates were also noted among multiparous women, rural residents, and unbooked patients; however, these differences were not statistically significant.
Overall, BMI emerged as the only significant maternal risk factor related to vitamin D deficiency in this study population.

Table 4: Vitamin D Status According to Trimester (n = 179)

Trimester	Vitamin D Deficient (n, %)	Vitamin D Insufficient (n, %)	Vitamin D Sufficient (n, %)
Second (13–27 w)	28 (53.8)	12 (23.1)	12 (23.1)
Third (28–40 w)	74 (58.7)	29 (23.0)	24 (18.3)

This cross-sectional study included 179 pregnant women with GDM diagnosed by WHO OGTT criteria at a tertiary hospital. Women were aged 20–45 years with singleton pregnancies between 24–38 weeks of gestation. Vitamin D levels were measured and analyzed using SPSS, with $p \leq 0.05$ considered statistically significant.

Table 5: Vitamin D Status According to Socioeconomic Status (n = 179)

Socioeconomic Status	Vitamin D Deficient (n, %)	Vitamin D Insufficient (n, %)	Vitamin D Sufficient (n, %)
Low	48 (61.5)	16 (20.5)	14 (18.0)
Middle	40 (55.6)	15 (20.8)	17 (23.6)
	14 (46.7)	10 (33.3)	5 (16.7)

Vitamin D deficiency was most prevalent among women belonging to the low socioeconomic group, indicating a strong association between poor socioeconomic status and inadequate vitamin D levels.
Vitamin D insufficiency was more common in the high socioeconomic group, while overall sufficiency remained comparatively low across all socioeconomic categories in the study population.

DISCUSSION

Vitamin D deficiency is a universal health problem, particularly pregnancies, and in which there is poor maternal and fatal outcomes[18]. This research report indicated that half of the pregnant women who were gesture diabetic mellitus (GDM) were vitamin D deficient and another quarter were deficient. The findings agree with the past studies that have reported high prevalence of hypovitaminosis D in GDM patients and prevalence rates ranging between 21 and 76 percent in disparate populations. The geographic location variation could be attributed to this wide scope which is due to exposure to sunlight, nutrition and the standards of vitamin D deficiency.

Our study had a mean maternal age of 29.4 years with most of the respondents being multiparous. Obesity is a major risk factor since the deficiency of Vitamin D was more widespread among women of elevated BMI. It is known that obesity decreases bioavailability of vitamin D because it is sequestered in adipose tissue and this can affect glucose metabolism and increase insulin resistance. This observation is consistent with the past studies which have shown some correlation between obesity and reduced levels of vitamin D in expectant women more so those with GDM[9]

Deficiency of vitamin D was a little higher in the third trimester and it might have been a result of higher body needs in late pregnancy. In the third trimester, calcium and vitamin D needs in the mother are greater to help the fetes grow its bones and insufficient consumption or sun exposure can help to reduce the serum levels. **Error! Reference source not found.** This highlights the significance of vitamin D in pregnancy that needs to be tracked and particularly in high-risk groups like GDM.

The parity, residence, and antenatal care status associations were also analyzed in the study. Even though there was increased deficiency between multiparous women and rural areas, the associations were found to be insignificant[21]. The attendance to the antenatal care seemed to have some protective effect, and the deficiency level was lower among the booked patients, placing a stress on the need to receive regular antenatal screening and supplementation education. .[22]

Vitamin D is vital in the homeostasis of glucose through the increase in insulin secretion and sensitivity[23]. Deficiency can also aid in augmenting insulin resistance, disturbances in 8-cell activity and persistent inflammation, which raise the danger and seriousness of GDM . [18]Moreover, poor maternal vitamin D is also connected to high risk of preeclampsia, preterm birth, Cesarina section, and poor neonatal outcomes, such as macrosomia and neonatal hypoglycaemia. Thus, prevention and treatment at an early age is important as the prevalence in our research is high.

The results of our research support the necessity of regular vitamin D testing during a complication of pregnancy GDM and may indicate that supplementation is a relatively inexpensive and easy intervention that can help to improve the maternal and fatal outcomes. This deficiency can be addressed through public health interventions such as dietary guidance, safe exposure to the sun, and intake of vitamin D during antenatal care. .[25]

The weaknesses of this research study are that it is a one-centre design study, with a relatively small sample size that might not be representative. Also, other variables like dietary intake and seasonal change and sunlight exposure were not quantitatively measured and thus may influence the status of vitamin D[26]. Although the study has these limitations, the paper can be useful to understand the burden of vitamin D deficiency in a high-risk population and why preventive measures are necessary in the given populations. .[27]

CONCLUSION

The vitamin D deficiency is very high among pregnant women with gestational diabetes mellitus, with over fifty percent of the members of the study population having this requirement. Deficiencies were found to be high in cases of obesity and third-trimester pregnancies. Since vitamin D plays a critical role in glucose metabolism, maternal and fatal wellbeing, screening and supplementation during the early phases of pregnancy should be regarded as a part of an antenatal care of the women with high risks of GDM. Dietary counselling, supplementation, and exposure to safe amount of sunlight can be used to address this deficiency which in turn can reduce maternal- and neonatal-complications, outcomes of pregnancy, and even decrease the long-term risk of type 2 diabetes on the part of mothers.

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