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Original Research Article

THE RELATIONSHIP BETWEEN GESTATIONAL DIABETES MELLITUS (GDM) AND VITAMIN D DEFICIENCY IN PREGNANT WOMEN WITH A BMI BELOW 30 KG/M²

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Abstract: *In this study, we aimed to investigate the relationship between vitamin D deficiency and Gestational Diabetes Mellitus (GDM) in women with no significant risk factors for developing GDM. After obtaining approval from the Dubai Scientific Research Ethics Committee, a retrospective cross-sectional study was conducted at the Primary Health Center of the Dubai Health Authority. The electronic medical records system collected data from 200 pregnant women with a BMI of less than 30 kg/m2 who had completed the oral glucose tolerance test (OGTT) and had their vitamin D levels measured between weeks 24 and 28 of gestation. The women were divided into two groups using a random sample procedure. Group A consisted of women with normal serum 25(OH) D concentration (>30.0 ng/mL), while Group B consisted of women with low serum 25(OH) D concentration (<30.0 ng/mL for insufficiency and <10.0 ng/mL for deficiency). The data collected were analyzed using SPSS version 28. Out of the 200 women who met the inclusion criteria, 58 were primigravida (29%), 122 were multigravida 1-3 (61%), 15 were multigravida 4-6 (7.5%), and 5 were multigravida >6 (2.5%). The average age of women in Group A was 24.5±2.4 years, while in Group B, it was 25.0±2.2 years. The average BMI of women in Group A was 26.6±1.5, while in Group B, it was 26.8±2.5. The study's results revealed that 12% of the women in Group A and 20% in Group B developed GDM (p= <0.01). Our data analysis showed a positive correlation between low vitamin D levels and the development of GDM. However, further large-scale randomized controlled studies are required to establish a causal association between low vitamin D levels and GDM.*

Keywords: GDM, Vitamin D Deficiency, Vitamin D Insufficiency, Body Mass Index, Oral Glucose Tolerance Test

Introduction

The term Gestational Diabetes Mellitus (GDM) refers to the first diagnosis of glucose or carbohydrate intolerance during pregnancy, typically occurring after 24 weeks of gestation. Around the world, GDM prevalence ranges from 1% to 28% (Buckley et al., 2012; Kim et al., 2002). It's spreading like a pandemic over the globe. It is turning into a public health issue that affects the mother and foetus both immediately and over time 2,16 (Dabelea et al., 2005). One of the potential modifiable risk factors for the development of temporary insulin resistance has been suggested to be a deficiency of Vitamin D, a ketosteroid produced in the skin (Pu et al., 2015). More research shows that vitamin D influences insulin secretion and reduces insulin resistance, contributing to regulating glucose levels. (Baz-Hecht and Goldfine, 2010; Kim et al., 2020). Even if a systematic review and meta-analysis of observational studies indicate a correlation between low vitamin D levels and GDM, there is still a need to prove a causal association because the available scientific evidence is insufficient and inconsistent. (Jiwani et al., 2012) . Our main goal was to investigate the association between GDM incidence and vitamin D insufficiency in pregnant women with BMIs under 30 kg/m2 in the UAE population.

Methodology

With approval from the Dubai Scientific Research Ethics Committee, the retrospective cross-sectional investigation was carried out at PHC, the women's health unit, DHA Dubai. The Salama Patients Electronic Medical Record served as the source of the data collection. Pregnant women in their second trimester who visited the PHC within the six months following the approval of the study proposal were chosen for the study based on the inclusion criteria, which included doing both serum vitamin D levels and GTT at 24-28 weeks and excluding other risk factors, which had BMI > 30 kg/m2, a history of GDM in a prior pregnancy, pre-existing metabolic diseases, and women with any malabsorptive illness that could affect how diabetes is interpreted (Cushing Syndrome, Acromegaly). SPSS version 28 was used for both data collection and analysis.
For the study, 200 women in all were chosen. Convenient random sampling was used to separate the women into two groups. Pregnant women in Group A had normal vitamin D levels (serum 25(OH) D concentration > 30.0 ng/mL), while pregnant women in Group B had low vitamin D levels (serum 25(OH) D concentration < 30.0 ng/mL and deficiency < 10.0 ng/mL). The findings of the 75-gram oral glucose tolerance test (OGTT), which was performed to screen for gestational diabetes mellitus between weeks 24 and 28, were gathered. The International Association of Diabetes and Pregnancy Study Groups (IADPSG)13–14 recommended diagnostic criteria for GDM were followed. GDM was diagnosed in women who met one or more of the following criteria.
1). Fasting: A blood glucose level of at least 91 mg/dl (5.1 Mmol/L). 2) Blood glucose level at one hour: ≥ 180 mg/dl

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(10 mol/L). 3) Blood glucose level at two hours: less than 153 mg/dL. (8.5Mmol/L)

The incidence of GDM in both groups was used to evaluate the relationship between vitamin D insufficiency and the development of GDM. Data was entered into an Excel sheet after being gathered on pre-made proformas. All information was obtained from the patient's electronic record with prior institutional review board approval.

SPSS version 28 was used for data analysis. The Mean, Frequencies, and Ratios were used to display descriptive statistics such as patient age and parity. The Chi-Square Test was used to show and analyze nominal data, such as BMI, vitamin D, and blood sugar levels. Our main goal was to determine if low vitamin D levels and the onset of GDM were related. The t-test was used to compare the two groups to determine any significance.

A statistically significant result was defined as a p-value of less than 0.05.

Results

Our study involved a review of electronic medical records of 200 women who met specific inclusion criteria. We divided the women into two groups: Group A, consisting of 100 women with normal vitamin D levels, and Group B, comprising 100 women with low vitamin D levels. We observed that 57.5% (115) of women in our sample were aged between 20 and 30, while 42.5% (85) were aged between 31 and 40. The prevalence of gestational diabetes mellitus (GDM) was determined for each group, and the results were compared to determine any significant difference. Our findings showed that 12% of the women in Group A developed GDM as per the ADA criteria, whereas 20% of the women in Group B with low vitamin D levels developed GDM (Figure 1). The distribution of primigravida and multigravida women is presented in Table 2. The average BMI for women in Group A was 26.6±1.5, and for Group B, it was 26.8±2.5 (as shown in Table 3). We found no variation in dietary intake between the two groups; both groups had adequate sun exposure and lived in the **same geographical area.**

Table 1. Age of Women (years)

Age groups	Frequency	Percent
20 to 30	**115**	**57.5**
31 to 40	**85**	**42.5**
Total	**200**	**100.0**

Table 2. No. of Pregnancies

No. of Pregnancies	Frequency	Percent
Primigravida	**58**	**29.0**
1 to 3	**122**	**61.0**
4-6	**15**	**7.5**
>6	**5**	**2.5**
Total	**200**	**100.0**

Table 3. Demographic Statistics

	Age (Yrs.)	BMI
Mean+ Std. Deviation	Group A 24.5±2.4 Group B 25.0±2.5	Group A 26.6±1.5 Group B 26.8±2.5

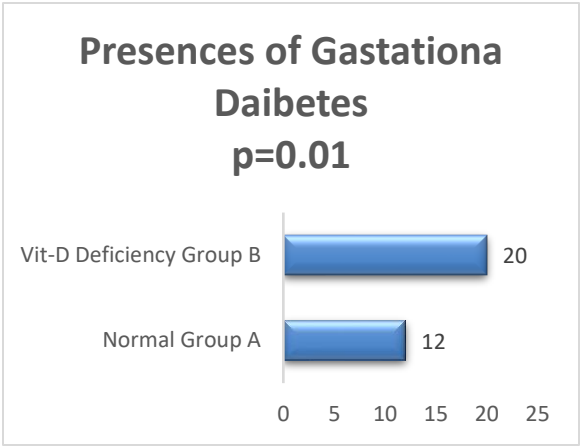

Figure 1 comparision of gastational diabetes in both groups

Table 4. Association of Vitamin D with GDM

		Gestational Diabetes Mellitus		Total	P-value
		Yes	No		
Level of Vitamin D	Normal Group A	12	88	100	P<0.01
	Deficiency Group B	20	80	100	
Total		32	168	200	

Table 5. Correlations between Vitamin D and GDM

		Level of Vitamin D	Gestational Diabetes Mellitus
Level of Vitamin D	Pearson Correlation	1	0.434**
	Sig. (2-tailed)		<0.001
	N	200	200
Gestational Diabetes Mellitus	Pearson Correlation	0.434**	1
	Sig. (2-tailed)	<.001	
	N	200	200
**. Correlation is significant at the 0.01 level (2-tailed).			

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In a sample of 200 individuals, the correlation between the level of Vitamin D and the presence of Gestational Diabetes Mellitus is shown in Table 5. Both variables are being analyzed, and the "Pearson Correlation" value of 0.434** represents the linear relationship's strength and direction. A positive correlation means that as the level of Vitamin D increases, the likelihood of having Gestational Diabetes Mellitus also increases. The "Sig. (2-tailed)" value is the p-value associated with the correlation coefficient, and in this case, it is less than 0.001, indicating that the observed correlation is statistically significant at the 0.01 level (2-tailed). This means that the correlation is unlikely to have occurred by random chance. The sample size for both variables, represented by "N," is 200, the number of data points used to calculate the correlation. In summary, the table shows a statistically significant positive correlation between the level of Vitamin D and the presence of Gestational Diabetes Mellitus in the sample.

Discussion

Finding any correlation between low vitamin D levels and the development of gestational diabetes mellitus (GDM) in women without other significant risk factors was the main goal of the study. It is a well-known fact that vitamin D insufficiency is more common in the UAE among the general population and pregnant women (Lavery et al., 2017). Less sun exposure during severe weather and the prevalence of indoor activities are two variables that contribute to the low levels of vitamin D in the population of the United Arab Emirates. Any level of glucose intolerance during pregnancy that is initially identified, often after 24 weeks of gestation (Muhairi et al., 2013), is referred to as gestational diabetes. Pregnancy-related GDM is a prevalent issue, and its occurrence is rising globally as a result of improved screening techniques, a higher diagnostic bar, and changing patient demographics. Both the mother and the fetus are negatively impacted by maternal hyperglycemia (Metzger et al., 2009; Yogev et al., 2010). Due to the fetus's rapid growth, the need for all nutrients increases during pregnancy, including vitamin D. Similarly, early infancy, childhood, and puberty have higher vitamin D requirements. It has been demonstrated to be connected to numerous skeletal disorders in addition to its traditional function in regulating calcium absorption and bone metabolism (Bikle, 2009).

A vitamin D deficiency is considered a risk factor for GDM development (Association, 2010). Vitamin D supplementation during pregnancy lowers foetal problems in women with vitamin D insufficiency. According to studies, pregnant women who are vitamin D deficient are more likely to experience preeclampsia, caesarean sections, and gestational diabetes mellitus type (Merewood et al., 2009).

Numerous investigations are underway to determine the etiology of GDM development. Researchers have recently become more interested in the potential connection between vitamin D insufficiency and the development of GDM (Association, 2010). There are three possible pathways by which a vitamin D deficit and the onset of GDM might be linked. First, vitamin D directly affects pancreatic beta cells, which are responsible for controlling blood glucose levels in circulation. Second, a local mechanism in the pancreas causes an enzyme known as 1alpha-hydroxylase to become active, which is how Vitamin D is made active in the organ. This dynamic form of vitamin D helps secrete insulin, which lowers blood glucose levels directly through its receptors or indirectly through intracellular calcium regulation (Buckley et al., 2012). Thirdly, Vitamin D raises the sensitivity to insulin by acting on muscle cell receptors, either by making them more sensitive or by increasing their number, and by influencing the extracellular calcium regulation (Schwartz et al., 2004). Ultimately, these impacts contribute to regulating blood glucose levels in circulation.

Conclusion

The study concluded a significant prevalence of upper cross syndrome in female physiotherapists. Variables like working hours posed serious risks for initiating UCS among professionals. Upper Cross Syndrome (UCS) prevalence was 27% in working physiotherapists; however, females and people who work long hours were more likely to develop Upper Cross Syndrome (UCS). It was also discovered that there is a strong correlation between Upper Cross Syndrome and Work-Related Musculoskeletal Disorders (WRMDs.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department Concerned.
Consent for publication
Approved
Funding
Not applicable

Conflict of interest

The authors declared absence of conflict of interest.

References

Association, A. D. (2010). Diagnosis and classification of diabetes mellitus. *Diabetes care* **33**, S62-S69.

Baz-Hecht, M., and Goldfine, A. B. (2010). The impact of vitamin D deficiency on diabetes and cardiovascular risk. *Current Opinion in Endocrinology, Diabetes and Obesity* **17**, 113-119.

Bikle, D. (2009). Nonclassic actions of vitamin D. *The Journal of Clinical Endocrinology & Metabolism* **94**, 26-34.

Buckley, B. S., Harreiter, J., Damm, P., Corcoy, R., Chico, A., Simmons, D., Vellinga, A., Dunne, F., and Group, D. C. I. (2012). Gestational diabetes mellitus in Europe: prevalence, current screening practice and barriers to screening. A review. *Diabetic medicine* **29**, 844-854.

Dabelea, D., Snell-Bergeon, J. K., Hartsfield, C. L., Bischoff, K. J., Hamman, R. F., and McDuffie, R. S. (2005). Increasing prevalence of gestational diabetes mellitus (GDM) over time and by birth cohort: Kaiser Permanente of Colorado GDM Screening Program. *Diabetes care* **28**, 579-584.

Jiwani, A., Marseille, E., Lohse, N., Damm, P., Hod, M., and Kahn, J. G. (2012). Gestational diabetes mellitus: results from

a survey of country prevalence and practices. *The Journal of Maternal-Fetal & Neonatal Medicine* **25**, 600-610.

Kim, C., Newton, K. M., and Knopp, R. H. (2002). Gestational diabetes and the incidence of type 2 diabetes: a systematic review. *Diabetes care* **25**, 1862-1868.

Kim, K.-S., Park, S. W., Cho, Y.-W., and Kim, S.-K. (2020). Vitamin D deficiency at mid-pregnancy is associated with a higher risk of postpartum glucose intolerance in women with gestational diabetes mellitus. *Endocrinology and Metabolism* **35**, 97-105.

Lavery, J. A., Friedman, A. M., Keyes, K. M., Wright, J. D., and Ananth, C. V. (2017). Gestational diabetes in the United States: temporal changes in prevalence rates between 1979 and 2010. *BJOG: An International Journal of Obstetrics & Gynaecology* **124**, 804-813.

Merewood, A., Mehta, S. D., Chen, T. C., Bauchner, H., and Holick, M. F. (2009). Association between vitamin D deficiency and primary cesarean section. *The Journal of Clinical Endocrinology & Metabolism* **94**, 940-945.

Metzger, B. E., Lowe, L. P., Dyer, A. R., Trimble, E. R., Chaovarindr, U., Coustan, D. R., Hadden, D. R., McCance, D. R., Hod, M., and McIntyre, H. D. (2009). Hyperglycemia and adverse pregnancy outcomes. *Obstetric Anesthesia Digest* **29**, 39-40.

Muhairi, S. J., Mehairi, A. E., Khouri, A. A., Naqbi, M. M., Maskari, F. A., Kaabi, J. A., Dhaheri, A. S. A., Nagelkerke, N., and Shah, S. M. (2013). Vitamin D deficiency among healthy adolescents in al ain, united arab emirates. *BMC public health* **13**, 1-7.

Pu, J., Zhao, B., Wang, E. J., Nimbal, V., Osmundson, S., Kunz, L., Popat, R. A., Chung, S., and Palaniappan, L. P. (2015). Racial/ethnic differences in gestational diabetes prevalence and contribution of common risk factors. *Paediatric and perinatal epidemiology* **29**, 436-443.

Schwartz, G. G., Eads, D., Rao, A., Cramer, S. D., Willingham, M. C., Chen, T. C., Jamieson, D. P., Wang, L., Burnstein, K. L., and Holick, M. F. (2004). Pancreatic cancer cells express 25-hydroxyvitamin D-1α-hydroxylase and their proliferation is inhibited by the prohormone 25-hydroxyvitamin D 3. *Carcinogenesis* **25**, 1015-1026.

Yogev, Y., Chen, R., Hod, M., Coustan, D., Oats, J., Metzger, B., Lowe, L., Dyer, A., Trimble, E., and McCance, D. (2010). Hyperglycemia and adverse pregnancy outcome (HAPO) study: preeclampsia. *American journal of obstetrics and gynecology* **202**.

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