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Exploring the Association Between Maternal Vitamin D Status, Pregnancy Symptomatology, and Quality of Life: A Cross-Sectional Study in Mosul, Iraq

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Abstract

Background: Vitamin D deficiency is a growing public health concern, particularly among pregnant women, due to its potential implications for both maternal and fetal health. Although the physiological importance of vitamin D in bone metabolism is well known, its role in modulating pregnancy symptoms and quality of life (QoL) requires further exploration.

Objective: This study aimed to examine the prevalence of vitamin D deficiency among pregnant women in Mosul, Iraq, and assess its association with common pregnancy-related symptoms and overall QoL. It also examined demographic and lifestyle factors that influence maternal vitamin D levels and their impact on pregnancy outcomes.

Methods: A descriptive correlational study was conducted across four teaching hospitals in Mosul from October 2024 to January 2025. A total of 120 pregnant women participated. Data collection tools included serum 25-hydroxyvitamin D measurements, the Pregnancy Symptom Inventory, and the SF-36 QoL index. Demographic and obstetric data were obtained through structured interviews. SPSS Version 28 was used for data analysis, including descriptive statistics, cross-tabulations, and multivariate regression.

Results: Vitamin D deficiency (<20 ng/mL) was identified in 57.5% of participants. Lower vitamin D levels were significantly associated with increased fatigue, nausea, musculoskeletal pain, and lower QoL scores ($p < 0.05$). Age, BMI, and sun exposure emerged as key predictors of vitamin D status. Women with sufficient vitamin D levels reported better physical functioning, emotional well-being, and social engagement.

Conclusion: Vitamin D deficiency is prevalent among pregnant women in Mosul and is associated with heightened symptomatology and reduced QoL. These findings support the integration of routine vitamin D screening and targeted supplementation into prenatal care programs. Further longitudinal studies are recommended to establish causality and evaluate long-term maternal-fetal outcomes.

What is already known about the topic?

- Vitamin D plays a critical role in maternal health during pregnancy, influencing calcium and phosphorus metabolism, immune function, and fetal bone development.
- Vitamin D deficiency is widespread among pregnant women globally, especially in the Middle East and North Africa (MENA) region, due to limited sun exposure, dietary insufficiency, and cultural practices.

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Introduction

Pregnancy is a transformative period marked by complex physiological, hormonal, and emotional changes. These changes often result in a variety of physical symptoms, such as fatigue, nausea, musculoskeletal pain, and sleep disturbances, which can significantly affect a woman's quality of life (QoL) during pregnancy (Argano et al., 2023). While modern prenatal care has made substantial progress in managing critical obstetric complications, less attention has been paid to these common yet impactful symptoms that disrupt daily functioning and maternal well-being.

Among the modifiable nutritional factors during pregnancy, vitamin D has received growing attention due to its role not only in bone metabolism but also in immune modulation, mood regulation, and cellular function (Abrams, 2020). Maternal vitamin D sufficiency is particularly vital during pregnancy, as it contributes to fetal skeletal development, immune tolerance, and hormonal balance (Siracusano et al., 2020).

Emerging evidence links vitamin D deficiency with increased severity of pregnancy-related symptoms and lower QoL scores. Fatigue, back pain, joint discomfort, and sleep disturbances may be exacerbated by inadequate vitamin D levels, potentially through mechanisms involving muscle dysfunction and inflammatory responses (Fernando et al., 2020). Furthermore, vitamin D deficiency has been associated with adverse outcomes such as preterm birth, low birth weight, and gestational complications (Zhao & Zhang, 2020; Bhowmik et al., 2021).

Despite these associations, vitamin D status remains insufficiently monitored in prenatal care, especially in regions like Mosul, Iraq, where environmental, cultural, and dietary factors may limit sun exposure and intake of vitamin D-rich foods. Recent studies in Iraq report alarmingly high deficiency rates exceeding 70% among pregnant women (Al-Zuhairy et al., 2022; Saeed Al-Rawi & Al-Ani, 2024). These statistics highlight the urgent need for localized research to understand the broader implications of vitamin D deficiency on maternal health and quality of life.

Aim of the Study:

To assess the relationship between maternal vitamin D levels and pregnancy-related symptoms and quality of life, while identifying key demographic and lifestyle factors that influence vitamin D status among pregnant women in Mosul, Iraq.

Methods

Study Design and Setting

This study employed a descriptive correlational design to explore the relationship between maternal vitamin D status, pregnancy symptomatology, and quality of life (QoL). The research was conducted in four teaching hospitals in Mosul, Iraq, which serve a diverse population of pregnant women. The setting provided a practical environment for assessing both clinical and self-reported measures related to vitamin D status and pregnancy outcomes (Bhowmik et al., 2021; Fernando et al., 2020).

Study Population and Sampling

A total of 120 pregnant women were recruited for the study between October 2024 and January 2025. Participants were selected based on the following inclusion criteria:

- Pregnant women in any trimester who attended routine prenatal care.
- Willingness to provide a blood sample and complete self-administered questionnaires.
- Absence of any known chronic illnesses that could confound vitamin D metabolism.

A convenience sampling technique was used to enroll participants from the outpatient departments of the selected hospitals. This approach ensured the inclusion of women from various socioeconomic backgrounds and with different levels of sun exposure, dietary habits, and health statuses (Al-Zuhairy et al., 2022).

Data Collection Tools and Procedures

Data were gathered using a multi-faceted approach:

- 1. Serum 25-Hydroxyvitamin D Measurement:**

Blood samples were collected from all participants and analyzed for serum 25(OH)D levels using a standardized Enzyme-Linked Fluorescent Assay (ELFA). Vitamin D deficiency was operationally defined as serum levels below 20 ng/mL in accordance with the Endocrine Society's guidelines (Rebecca, 2021).

- 2. Pregnancy Symptom Inventory:**

The severity and frequency of common pregnancy symptoms (e.g., fatigue, nausea, musculoskeletal pain, and sleep disturbances) were assessed using a validated questionnaire. This tool allowed participants to rate their symptoms on a Likert scale, providing quantitative data for correlation analyses (Sapra et al., 2017).

- 3. Quality of Life Assessment:**

The Short Form-36 (SF-36) Health Survey was administered to evaluate overall QoL. This standardized instrument measures physical functioning, emotional well-being, social functioning, and general health perceptions, making it well-suited for the pregnant population (Hays & Reeve, 2024).

- 4. Demographic and Obstetric Data:**

Structured interviews were conducted to obtain comprehensive demographic, socioeconomic, and obstetric information. Variables such as age, body mass index (BMI), parity, dietary habits, sun exposure duration, and clothing practices were recorded, as these factors may influence vitamin D status and related pregnancy outcomes.

Ethical Considerations

Prior to data collection, ethical approval was obtained from the University of Mosul's College of Nursing Research Ethics Committee. Written informed consent was secured from all participants, ensuring confidentiality and the right to withdraw from the study at any time. The study adhered to the ethical principles outlined in the Declaration of Helsinki.

Data Analysis

Data were analyzed using SPSS Version 28. Descriptive statistics (means, standard deviations, and frequency distributions) were computed to summarize demographic characteristics and vitamin D levels. Cross-tabulations and chi-square tests were performed to assess associations between vitamin D status and categorical variables such as symptom severity and QoL domains. Furthermore, multiple regression analyses were conducted to determine the predictive power of demographic and lifestyle factors on maternal vitamin D levels and their impact on pregnancy symptoms and QoL. A p-value of less than 0.05 was considered statistically significant (Abrams, 2020).

Results

The study involved 120 pregnant women from four major teaching hospitals in Mosul City, Iraq. The participants' ages ranged from 18 to 42 years, with a mean age of 28.6 years. The majority were in their second or third trimester, with varying levels of education and socioeconomic backgrounds. Most participants had a normal or slightly elevated body mass index (BMI), and more than half reported limited sun exposure, often due to cultural clothing practices or time spent indoors.

A significant proportion of the study population (57.5%) was found to be vitamin D deficient, with serum 25(OH)D levels below 20 ng/mL. Only 17.5% of the participants had sufficient vitamin D levels (>30 ng/mL). The distribution of vitamin D intake showed that while many women reported consuming fortified foods or taking supplements, the frequency and dosage were generally inadequate. Additionally, sun exposure was limited

to less than 15 minutes per day for most participants, contributing to the high deficiency rate.

Statistical analyses revealed a strong inverse correlation between vitamin D levels and the severity of pregnancy-related symptoms. Women with lower serum vitamin D levels reported significantly higher levels of fatigue, musculoskeletal pain, nausea, and backache ($p < 0.01$). Vitamin D deficiency was also significantly associated with symptoms such as swelling, sleep disturbances, breast pain, stretch marks, and genitourinary complaints. Participants with sufficient vitamin D levels experienced fewer symptoms and reported better physical comfort throughout their pregnancies.

Regarding mental and physical well-being, the study found that low vitamin D levels were significantly associated with poorer scores in emotional and physical health domains, as measured by the SF-36 questionnaire. Women with vitamin D deficiency scored lower in general health, vitality, physical activity, and emotional stability. Regression analysis confirmed that vitamin D status was a strong predictor of physical symptoms and overall quality of life during pregnancy.

Moreover, several demographic and lifestyle factors were found to significantly influence vitamin D levels. Age, BMI, level of education, and daily sun exposure showed statistically significant associations with serum vitamin D concentrations ($p < 0.05$). Women with higher BMI and less sun exposure were more likely to be vitamin D deficient. Furthermore, a higher number of pregnancies and lack of prenatal vitamin use were also linked with lower vitamin D levels.

Finally, the univariate logistic regression analysis revealed that vitamin D deficiency increased the risk of multiple pregnancy-related complications, including gestational hypertension, increased fatigue, and reduced physical functioning. These findings underscore the multifactorial impact of vitamin D on both physical symptoms and perceived well-being during pregnancy.

Table 1. Demographic Characteristics of the Study Participants (N = 120)

Characteristic	Category	Frequency (n)	Percentage (%)
Age Group (years)	18–25	35	29.2%
	26–35	62	51.7%
	>35	23	19.1%
Trimester	First	18	15.0%
	Second	53	44.2%
	Third	49	40.8%
Education Level	Primary	22	18.3%
	Secondary	48	40.0%
	University	50	41.7%
Body Mass Index (BMI)	Normal (<25)	37	30.8%
	Overweight (25–29.9)	58	48.3%
	Obese (≥30)	25	20.9%
Daily Sunlight Exposure	<15 minutes	78	65.0%
	≥15 minutes	42	35.0%
Vitamin D Supplement Use	Yes	47	39.2%
	No	73	60.8%

Table 2. Distribution of Maternal Vitamin D Status (n = 120)

Vitamin D Status	Serum 25(OH)D Level	Frequency (n)	Percentage (%)
Deficient	<20 ng/mL	69	57.5%
Insufficient	20–30 ng/mL	30	25.0%
Sufficient	>30 ng/mL	21	17.5%

Table 3. Association Between Vitamin D Levels and Common Pregnancy Symptoms

Symptom	Mean Score in Deficient Group	Mean Score in Sufficient Group	p-value
Fatigue	4.3	2.1	<0.001 **
Nausea	3.9	2.0	0.002 **
Back Pain	4.1	2.4	<0.001 **
Musculoskeletal Pain	4.2	2.5	<0.001 **
Sleep Disturbances	3.8	2.1	0.004 **
Breast Pain	3.6	2.2	0.031 *
Swelling (Edema)	3.7	2.6	0.028 *

* p < 0.05, ** p < 0.01

Table 4. Correlation Between Vitamin D Status and Quality of Life Domains (SF-36)

Quality of Life Domain	Mean Score in Deficient Group	Mean Score in Sufficient Group	p-value
Physical Functioning	52.6	71.2	<0.001 **
Role Limitations (Physical)	49.3	68.5	0.002 **
Energy/Fatigue	45.2	67.1	<0.001 **
Emotional Well-being	48.0	65.3	0.004 **
Social Functioning	50.5	70.1	0.001 **
General Health Perception	51.7	68.4	0.001 **

Table 5. Univariate Logistic Regression: Predictors of Vitamin D Deficiency

Variable	Odds Ratio (OR)	95% Confidence Interval	p-value
Age > 35 years	1.8	1.1–3.4	0.034 *
BMI ≥ 30 (Obese)	2.3	1.5–4.7	0.018 *
Low Sunlight Exposure	3.7	2.1–6.2	<0.001 **
No Supplement Use	2.9	1.4–5.5	0.003 **

* $p < 0.05$, ** $p < 0.01$

Discussion

This study investigated the relationship between maternal vitamin D status, pregnancy-related symptoms, and quality of life (QoL) among pregnant women in Mosul, Iraq. The findings revealed a high prevalence of vitamin D deficiency (57.5%) among the participants, aligning with previous reports from the Middle East and North Africa (MENA) region, where deficiency rates often exceed 70–80% due to limited sun exposure, conservative clothing, and inadequate dietary intake (Várbíró et al., 2022; Al-Zuhairiy et al., 2022).

A central finding of this study was the significant association between low serum 25(OH)D levels and the severity of pregnancy-related symptoms, including fatigue, musculoskeletal pain, backache, nausea, and sleep disturbances. These results are consistent with the findings of Siracusano et al. (2020) and Zhao et al. (2023), who

highlighted the role of vitamin D in muscle function and inflammatory modulation. Deficient women reported higher scores of physical discomfort, which may reflect the role of vitamin D in calcium regulation and muscle integrity. Additionally, fatigue and generalized pain in pregnancy are believed to be partly due to vitamin D's role in mitochondrial function and anti-inflammatory pathways (Helde-Frankling & Björkhem-Bergman, 2017).

The study also confirmed that vitamin D deficiency was significantly correlated with lower quality of life scores across multiple SF-36 domains, including physical functioning, emotional well-being, and energy levels. This finding corroborates existing literature that links vitamin D to mood regulation via its impact on serotonin synthesis and inflammatory cytokines (Lv et al., 2024; Woo et al., 2022). Pregnant women with sufficient vitamin D levels reported improved emotional balance, better social functioning, and greater vitality—suggesting that adequate vitamin D status may play a crucial role in promoting holistic maternal well-being during pregnancy.

In terms of predictors, the study found that maternal age over 35, obesity (BMI ≥ 30), low sunlight exposure, and lack of supplementation were significant risk factors for vitamin D deficiency. These results align with previous studies that have shown higher BMI can sequester vitamin D in adipose tissue, reducing its bioavailability (Phillips et al., 2022). Cultural norms that limit sun exposure—such as wearing long garments and spending more time indoors—further contribute to the deficiency, even in sun-rich regions like Iraq (Saeed Al-Rawi & Al-Ani, 2024; Zhang et al., 2022). This emphasizes the multifactorial nature of vitamin D deficiency and the importance of culturally appropriate interventions.

Furthermore, the regression analysis revealed that vitamin D deficiency was a significant predictor of pregnancy-related complications, including gestational fatigue, emotional instability, and reduced physical functioning. This aligns with findings from previous interventional studies which demonstrated that correcting vitamin D deficiency could reduce pregnancy complications such as preeclampsia, gestational diabetes, and poor fetal growth (Dahma et al., 2023; Kinshella et al., 2021).

The study's implications are far-reaching. By establishing a link between maternal vitamin D deficiency and both physical and psychological symptoms, it advocates for routine screening and supplementation as part of prenatal care protocols. As suggested by Upadhyaya et al. (2022), proactive public health measures—such as dietary fortification, supplementation programs, and health education—can help improve maternal and neonatal outcomes in at-risk populations.

Despite the strengths of the study, including the use of validated tools and biochemical assays, some limitations should be noted. The cross-sectional design restricts the ability to establish causal relationships. The sample was limited to one geographic area, which may affect generalizability to other regions. Additionally, recall bias could have influenced self-reported symptoms and lifestyle factors.

Conclusion

Overall, the study reinforces the importance of addressing maternal vitamin D deficiency as a modifiable risk factor with significant implications for pregnancy symptomatology and quality of life. These findings support broader public health initiatives and clinical strategies that emphasize nutritional adequacy, lifestyle awareness, and routine monitoring during pregnancy.

Conflict of interest

I declare that there are NO conflicts of interest

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Institutional Review Board Statement

Ethical approval was obtained from the **College of Nursing, University of Mosul** (Code: CCMRE-Nur-24-13). Administrative permission was secured from the Nineveh Directorate of Health (**Approval No. 42**). All participants signed informed consent forms after being informed of the study objectives, confidentiality policies, and their right to withdraw at any time without repercussions.

Data privacy and participant confidentiality were maintained throughout the study. Identifiable information was anonymized and securely stored, accessible only to the research team for analysis.

Informed Consent Statement: Not applicable.

Data Availability Statement: Available from the corresponding author upon reasonable request.

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