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Research Article

Vitamin D deficiency/ insufficiency and some of its related factors in a sample of Iraqi pregnant women and their neonates at Al-Elwiya Maternity Teaching Hospital during 2019

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ABSTRACT

Background: Vitamin D deficiency/ insufficiency is common in different age groups in both genders especially among pregnant women and neonates where it is associated with a number of adverse outcomes including preeclampsia and preterm delivery.

Objectives: To assess extent of vitamin D deficiency/ insufficiency among mothers and their neonates and some factors related to it and identify some adverse outcomes of the deficiency/ insufficiency on neonates (preterm birth and low birth weight)

Subjects and Methods: A cross-sectional study was conducted on 88 Iraqi pregnant women and neonates admitted to "Al-Elwiya teaching hospital for maternity" in Baghdad- Al-Rusafah from 1st of June 2019 to 31st of August 2019. Data about maternal age, mode of delivery, sex, weight and gestational age were obtained. Vitamin D levels of mothers and their neonates were measured by Enzyme Linked Immunosorbent Assay (ELISA).

Results: In a total of 88 mothers and neonates, 96.6% of mothers had Vitamin D deficiency/ insufficiency compared to (86.4%) of neonates. There was a statistically significant difference between maternal and neonatal vitamin D levels. Neonatal Vitamin D levels were positively correlated with maternal vitamin D levels. Neonatal weight was positively correlated with maternal Vitamin D levels. The mean of maternal and neonatal vitamin D levels were (12.16 ng/ml ± 7.06) and (20.25 ng/ml ± 10.97) respectively.

Conclusions: Vitamin D deficiency/ insufficiency was prevalent among mothers and neonates; with higher prevalence among mothers. Maternal Vitamin D levels and neonatal weights were associated with neonatal Vitamin D levels.

Introduction

Vitamin D deficiency/ insufficiency is a worldwide health problem. It is estimated that 1 billion people worldwide have vitamin D deficiency or insufficiency (1) and it is a common problem in the Middle East countries including Iraq where in a review conducted by the nutrition working group of the IOF, hypovitaminosis defined as 25 (OH)D level below 30 ng/ml (75 nmol/L) was prevalent in all regions of the world, whereas levels below 10 ng/ml (25 nmol/L) were most common in South Asia and the Middle East (2) and a study conducted in Iraq found that vitamin D deficiency was present in 65% of women of 25-49 years age and in 60% of men of the same age group (3).

Several variables and factors influence Vitamin D level in the human body such as sunlight exposure, skin color, latitude, season, clothing style, diet and Vitamin D supplements (4-7). In comparison to sunlight, diet provides on average less than 10% of the body's vitamin D requirements in the best of circumstances. However, a full body sunlight exposure during summer months for 10–15 min in a lighter pigmented adult individual will generate between 10 000 and 20 000 IU vitamin D3 within 24 h; darker pigmented individuals require up to 10 times more exposure to generate similar levels of vitamin D3. The amount of UV exposure available for the synthesis of vitamin D depends on many factors other than time spent outdoors, such as degree of skin pigmentation, body mass, latitude, season, the extent of air pollution blocking UV light, the amount of skin exposed and type of clothing, and the level of UV protection including sunscreens (7).

Vitamin D deficiency/ insufficiency is associated with a number of adverse health outcomes that affect all age groups in both sexes (8, 9) especially pregnant women and their neonates where several studies have highlighted that women are at high risk for vitamin D deficiency, and this is associated with adverse pregnancy outcomes, including preeclampsia, gestational diabetes and preterm delivery (10-14). A study in China showed that 34.8% of pregnant women were vitamin D deficient and 43.0% were vitamin D insufficient (15). Another study in Switzerland, showed that only 26.77% of pregnant women had a sufficient vitamin D level while the remaining percentage of women have varying degrees of deficiency (10). However, the role of vitamin D supplementation, and the optimal vitamin D dose and status, is a subject of debate (16).

In this study we aimed to assess the extent of vitamin D deficiency/ insufficiency among pregnant women and their neonates admitted to "Al-Elwiya teaching hospital for maternity" in Baghdad- Al-Rusafah from 1st of June 2019 to 31st of August 2019 and some factors related to it and to identify some adverse outcomes of the deficiency/ insufficiency on neonates (preterm birth and low birth weight).

Subjects and Methods

A cross-sectional study was conducted on a convenient sample of 88 pregnant Iraqi women and 88 of their neonates after delivery; those women were pregnant admitted for vaginal delivery or cesarian section at Al-Elwiya Maternity Teaching Hospital in Baghdad/ Al-Rusafa from 1st of June 2019 to 31st of August 2019.

A questionnaire was designed for those women involving data about maternal age, mode of delivery, sex, gestational age and weight of baby and gestational age. We excluded from the study women with diseases and conditions affecting Vitamin D level including renal, bone and gastrointestinal disorders and medications influencing vitamin D metabolism. Consent was taken from all mothers.

Data were obtained from mothers by direct interview as well as from medical records available. Venous blood samples of mothers were already drawn at time of admission for purpose of cross matching of blood, while cord blood samples of babies were drawn after birth. Samples of both mothers and babies were tested for Serum 25-hydroxyvitamin D (25(OH) D) level; testing was done by Enzyme Linked Immunosorbent Assay (ELISA) technique in a private laboratory because the test wasn't available inside the hospital. For the classification and analysis, in our study we divided mothers and babies into groups that defined vitamin D status: deficiency: < 10 ng/ml; insufficiency: 10 ng/ml - < 30 ng/ml; sufficiency: 30 ng/ml - < 100 ng/ ml. The body weight of each baby was measured to the nearest 0.1 kg, using an appropriate digital scale.

Statistical analysis was carried out using the SPSS statistical software package version 25. Data were expressed as mean ± standard deviation (S.D.) or number and percentage of subjects. Comparisons were conducted using unpaired student's two-tailed t-test. Chi-square test was used to compare categorical variables. The bivariate correlation test was used to calculate the correlation coefficient between two continuous variables if there was no third confounding factor, while partial correlation test was used to calculate the correlation coefficient if there was a third confounding factor. In all tests, the level of significance was $P \leq 0.05$.

Ethical approval was obtained from Al Rusafah Health Directorate.

Results

A total of 88 mothers and neonates, 49 males (55.7%) and 39 females (44.3%), Male: Female Ratio= 1.25:1. The mean maternal age in years was (25.32 ±5.4) with minimum age of 17 and maximum age of 37.

The Mean gestational age of neonates in weeks was (35.36 ± 3.014). 39 babies (44.31 %) were full term and 49 (55.68 %) were preterm. The mean gestational age of male babies was (36.02 ±2.385) while that of female babies was (34.54 ± 3.516), there was a statistically significant difference regarding gestational age between male and female babies.

The Mean weight of all neonates in kg was (2.64 ± 0.78), the mean weight of male neonates was (2.7837 ± 0.74) while that of females was (2.47 ± 0.80), there was no statistically significant difference regarding weight between males and females (P value 0.06).

59 babies (67%) had normal birth weight, while the rest 29 babies (33%) had either low or very low birth weight (Table 1).

Table 1: classification of neonatal weights.

		Frequency	Percent
Neonatal weight	Normal	59	67.0
	Low	21	23.9
	Very Low	8	9.1
	Total	88	100.0

Neonatal weights were positively correlated with their gestational age (Figure 1).

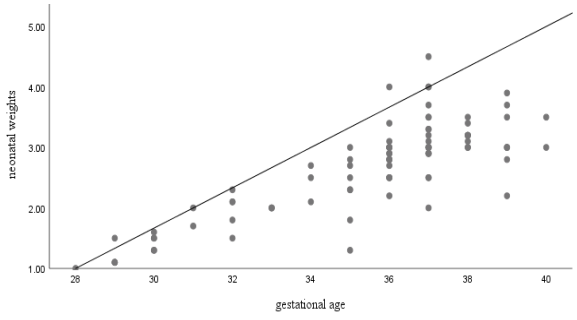

Figure 1: *Correlation between gestational age and neonatal weights (r = 0.827, p value < 0.0001 ((highly significant)).*

Regarding vitamin D levels; the mean of maternal vitamin D level in ng/ml was (12.16 ± 7.06). 42 mothers (47.7%) had Vitamin D deficiency, 43 (48.9%) had insufficiency and 3 (3.4%) had sufficiency (Table 2).

Table 2: Maternal Vitamin D mean, standard deviation and levels.

Maternal vitamin D					
Mean	**S.D.**	**Levels**	**Frequency**	**Percent**	**Total**
12.2685	7.05356	deficiency	42	47.7	47.7
		insufficiency	43	48.9	48.9
		sufficiency	3	3.4	3.4
		Total	88	100.0	100.0

Maternal Vitamin D levels were not correlated with maternal age. The mean of neonatal vitamin D level was (20.25 ± 10.97). 18 babies (20.5%) had Vitamin D deficiency, 58 (65.9%) had insufficiency and 12 (13.6%) had sufficiency (Table 3).

Table 3: Mean of neonatal Vitamin D levels and standard deviation.

Baby vitamin D					
Mean	**S.D.**	**Levels**	**Frequency**	**Percent**	**Total**
20.25181	0.97459	deficiency	18	20.5	20.5
		insufficiency	58	65.9	86.4
		sufficiency	12	13.6	100.0
		Total	88	100.0	100.0

The mean of Vitamin D level among male neonates was (22.29 ± 11.69), while that among females was (17.68±9.52). There was a statistically significant difference in the mean of Vitamin D levels between male and female neonates P value 0.05.
There was a statistically significant difference in vitamin D levels between mothers and neonates (P value = 0.000)
Neonatal Vitamin D levels were positively correlated with maternal vitamin D levels (Figure 2).

There was no significant correlation between neonatal Vitamin D levels and gestational age after controlling the effect of neonatal weights (Figure 3).

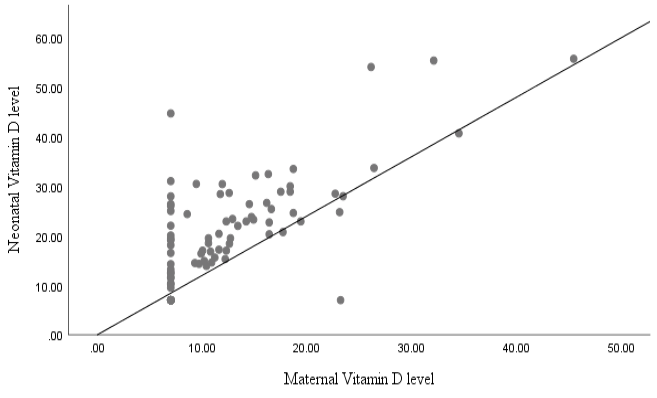

Figure 2*: Correlation between maternal and neonatal Vitamin D levels (r = 0.715, p< 0.0001 ((highly significant)).*

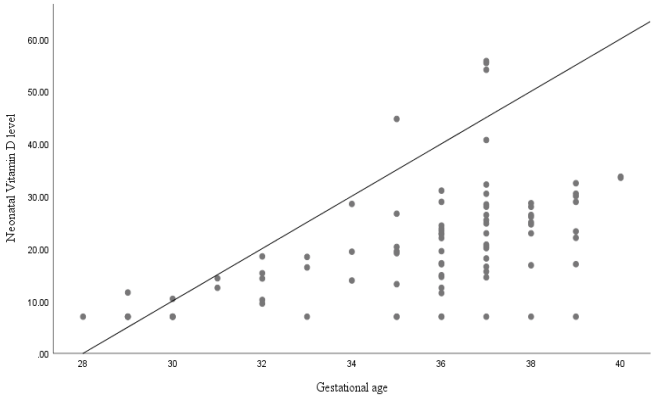

Figure 3*: Correlation between neonatal Vitamin D levels and gestational age (r = 0.106, p = 0.328 ((not significant)).*

The mean of Vitamin D level in full term neonates was (26.18 ± 11.25) and in preterm neonates was (15.53 ± 8.16). There was a statistically significant difference in these means (p value < 0.0001 highly significant). Also, the mean of maternal Vitamin D level in full term pregnancy was (15.12 ± 8.78) and in preterm pregnancy was (9.99 ± 4.14). There was a statistically significant difference in these means (Table 4).

Table 4: Maternal and neonatal Vitamin D mean and standard deviation according to gestational age.

	Gestational age	**No.**	**Mean**	**S.D.**
Baby Vitamin D	Full term	39	26.18	11.25
	preterm	49	15.53	8.16
P value		0.0001		
Maternal Vitamin D	Full term	39	15.12	8.78
	preterm	49	9.99	4.14
P value = 0.001				

There was a significant correlation between neonatal Vitamin D levels and neonatal weights after controlling the effect of gestational age (Figure 4).

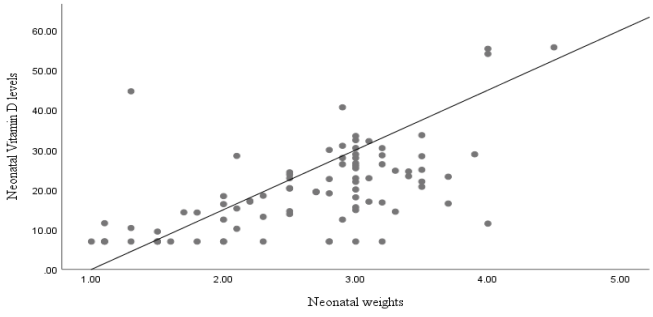

Figure 4: *Correlation between neonatal Vitamin D levels and neonatal weights (r = 0.320, p = 0.002 ((significant)).*

Neonatal weights were positively correlated with maternal Vitamin D levels (Figure 5).

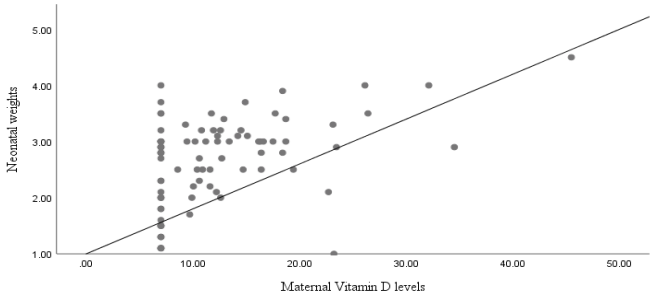

Figure 5*: Correlation between maternal Vitamin D levels and neonatal weights (r = 0.445, p< 0.0001 ((highly significant)).*

Discussion:

In our study, number of male neonates was more than number of females and the mean gestational age of male neonates was more than that of females; this difference in gestational age was significant; and, there was no significant difference in the mean weight of male and female neonates. Neonatal weight was positively correlated with gestational age and this is expected as increase in gestational age gives neonates chance to gain more weight.

Regarding vitamin D levels; majority of mothers (96.6%) were deficient/ insufficient for Vitamin D (only 3.4% had sufficient Vitamin D level). There are nearly similar results regarding maternal Vitamin D deficiency/ insufficiency from studies conducted at international and regional levels (11,17,18,19,20,21), while at national level, most of the studies that we found regarding Vitamin D deficiency/ insufficiency among women concentrated on non-pregnant women (women in childbearing age or postmenopausal women) rather than on pregnant women (22,23,24,3,25). Possible causes of Vitamin D deficiency/ insufficiency among mothers in our study might be tendency of Iraqi people in general to avoid sunlight exposure during summer months due to high temperatures. Also, many Iraqi females are veiled and this will affect Vitamin D production in the skin; although MNAR survey conducted in Iraq showed no difference regarding Vitamin D level between women with different clothing styles (25). Another possible cause is air pollution which is a big problem in Iraq (26-28). Another possible cause is the fact that neonates get their share of Vitamin D during pregnancy from their mothers; hence; mothers get depleted of Vitamin D as they provide it to their babies. The limitations of this study is that the questionnaire didn't include questions about sunlight exposure, dietary habits, Vitamin D supplements, skin color and clothing style.

Extent of Vitamin D deficiency/ insufficiency among neonates was less than that among mothers (86.4%) but it still a large percent of deficiency/ insufficiency despite the significant difference regarding Vitamin D levels between mothers and neonates. Neonatal Vitamin D levels were significantly positively correlated with maternal vitamin D levels and this is consistent with results of other studies worldwide (20, 29, 30). Male neonates had significantly higher mean of Vitamin D level than females (22.29 ng/ml and 17.68 ng/ml respectively).

Neonatal Vitamin D levels were positively correlated with their weights which is logical as more weight of baby usually reflects well-nourished baby. Neonatal weights were significantly positively correlated with maternal Vitamin D levels and 33% of neonates had either low or very low birth weight which is a considerable percent. In addition, the study showed that there was a statistically significant difference in the mean of Vitamin D level of mothers with full term pregnancy and preterm pregnancy. These results about the associations between neonatal and maternal Vitamin D, and neonatal weights and neonatal Vitamin D indicate the role of maternal Vitamin D in the growth of fetus and is consistent with results of many studies (10-14, 31). Vitamin D levels in umbilical cord blood were nearly always higher compared to the levels in maternal blood; this is consistent with results of a study about factors associated with the prevalence of hypovitaminosis D in pregnant women and their neonates, and the high Vitamin D levels found in umbilical cord blood could be due to a positive maternal–foetal gradient or to placental synthesis of vitamin D. This protective mechanism would guarantee adequate vitamin D levels in the fetus and neonate during a period of rapid growth. A plausible explanation is that the total vitamin D levels in cord blood are higher because cord blood contains more vitamin-D binding protein (DBP) (32).

The large extent of Vitamin D deficiency/ insufficiency among pregnant women and their neonates in our study stimulates us to think about importance of Vitamin D level testing and/ or Vitamin D supplementation for pregnant women; however, to date, the National guidelines of Iraqi Ministry of Health and Environment - which in turn are adapted from Guidelines of World Health Organization - doesn't recommend Vitamin D testing or supplementation as a routine procedure for pregnant women (33, 34).

Conclusion:

Vitamin D deficiency/ insufficiency was prevalent among mothers and babies in the study (with higher prevalence among mothers). Maternal Vitamin D level and neonatal weight were the main factors related to neonatal Vitamin D level.

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