

Original Article

Vitamin D, calcium and phosphorus status of Pregnant Women and their Newborns in West Iran.

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Abstract

Objective: To determine the prevalence of Hypovitaminosis D in pregnant women and in cord blood of their newborns.

Methods: Serum calcium, phosphorus and 25(OH) Vit D, were measured in 193 pregnant subjects between 16-45 years of age in third trimester admitted in Be'sat hospital. Same were measured in the cord blood of 193 newborns belonging to them.

Results: Mean maternal serum 25(OH) Vit D was 16.5 ± 14.2 ng/mL, and cord blood was 12 ± 0.2 ng/mL. Fifty-seven percent of pregnant women had 25(OH) Vit D values below the cutoff level. Seventy six percent of newborns had 25(OH) VitD values below the cutoff level. Maternal serum 25(OH) Vit D correlated positively with cord 25(OH) Vit D ($r=0.77$, $P<0.05$). Mean maternal serum calcium was 8.89 ± 0.73 mg/mL and mean newborn serum calcium was 9.46 ± 0.93 . Mean maternal serum calcium correlated with mean newborn serum calcium ($r=0.38$, $P<0.05$). Twenty six percent of women and 37.8% of newborns had hypocalcemia.

Conclusion: There was a high prevalence of significant hypovitaminosis D among pregnant women and their newborns. Our study emphasize the need of majority of pregnant women and their newborns to supplemental vitamin D and has significant public health implications. (Rawal Med J 2007;32:18-21)

Key Words: 25(OH) Vit D, pregnancy, newborn, calcium, phosphorus.

INTRODUCTION

Vitamin D deficiency is prevalent in the Middle East, especially Iran.¹ Vitamin D deficiency during pregnancy has important implications for the newborn and infant. Mild hypovitaminosis D might induce secondary hyperparathyroidism that results in resorption of bone.² According to Islamic Ideas, females after puberty

are expected to cover themselves except their face and hand in public³ and development of urbanization results in poor outdoor activity.² Furthermore, milk, the primary source of calcium, is so expensive and had a limited amount of production and poor system of distribution in some areas of Iran. All of these factors may induce the decrease of auto production of vit D in the body. Deficient calcium intake has been shown to be the cause in a large proportion of childhood rickets in other countries⁴⁻⁶ and to contribute to adolescent osteomalacia.⁴ Dietary calcium deficiency has caused secondary vitamin D deficiency and calcium replenishment improved serum 25(OH) vit D concentrations.⁷ Hypovitaminosis D during pregnancy has important consequences for the newborn, including fetal hypovitaminosis D, neonatal rickets and tetany, and infantile rickets.^{8,9} As few data on serum 25(OH)D concentration and the prevalence of Hypovitaminosis D among pregnant women from Iran are present,¹⁰ this study was undertaken to determine the prevalence of maternal and fetal Hypovitaminosis D among western Iranian women.

MATERIAL AND METHODS

Pregnant women were recruited from Be'sat Hospital, Kurdistan Medical University, which caters to urban and rural peoples. All women with a full-term live pregnancy who presented to the hospital in a 1-mo period from February to March 2005 and their newborns were recruited. Those with history of treatment with antitubercular, antiepileptic drugs and heparin, or renal disease, malabsorption, Hypercortisonism, diabetic mellitus and preterm labor (labor before 37 week of pregnancy) were excluded from the study. We registered 220 women with term live newborns but 27 subjects were excluded from study, thus a total of 193 pregnant women entered the study.

Maternal blood was collected before labor by venous sampling and Newborn samples from cord blood. Serum total calcium, phosphorus and 25(OH) Vit D were measured in standard technique. The normal range of cord blood 25(OH) D was >14 ng/ml.¹¹ Hypovitaminosis D was divided into three stages: mild (10–14 ng/ml), moderate (5-10 ng/ml) and severe (0-5 ng/ml). The normal range of serum calcium in mother and neonate was 8.4-10.2, and 9-11.5 respectively and normal range of serum phosphorus in mother and neonate was 2.7-4.7 and 4.8-8.2 respectively.¹¹ Albumin, magnesium and alkaline phosphatase (ALP) of maternal sera and cord samples belong to 57 women and neonates with hypocalcemia or hypophosphatemia and severe and moderate Hypovitaminosis D were also measured.

Statistical Analysis

Statistical analysis was conducted by using SPSS version 9.0. Group means were compared by using Student's *t* test. Correlations were studied by using Pearson's correlation coefficient. A linear regression analysis was performed. All complete pairs of values were used to derive a cutoff of 25(OH) vit D. Significance at $P \leq 0.05$ was taken for two-sided tests. Data are presented as mean (\pm SD).

RESULTS

Age of 177 of women (91.7%) was in range of 20-40 years, 11 were 20 years and 5 women were older than 40 years. Four or lower pregnancies were in 166 (74%) women. Maternal serum 25(OH) vit D was >15 ng/ml in 83 (43.1 %) women. Cord blood 25(OH) vit D had values >15 ng/mL in 46 (23.8 %) newborns (table 1).

Table 1. Levels of maternal serum and cord blood 25(OH) vit D.

Value	Frequency	percent	Frequency	percent
	Maternal blood 25(OH)D	Maternal blood	Cord blood	Cord blood
5 and lower (ng/ml)	28	14.5	50	25.9
5.1 -10 ng/ml	51	26.4	77	39.9
10.1-14ng/ml	31	16	20	10.4
14.1 and greater	83	43.1	46	23.8
Total	193	100	193	100

Maternal serum calcium, between 8.4-10.2 mg/dL (normal) was found in 138 women (71.5%), 51 women (26.4%) had values lower than 8.4mg/dl (Hypocalcemia) and 4 women (2.1%) had values higher than 10.2 mg/dL (hypercalcemia). Cord blood calcium between 9-11.5 mg/dL (normal) was found in 120 newborns (62.2%), 73 newborns (37.8%) had values lower than 9 mg/dl (Hypocalcemia). Maternal serum phosphorus, between 2.7-4.7 mg/dL (normal) was found in 133 women (68.9%), 28 women (14.5%) had values lower than 2.7 mg/dl (Hypophosphatemia) and 32 women (16.6%) had values higher than 4.7 mg/dL (hyperphosphatemia). Cord blood phosphorus between 4.8-8.2 mg/dL (normal) was found in 126 newborns (65.3%), 66 newborns (34.2%) had values lower than 4.8 mg/dl (Hypophosphatemia) and 1 newborn (0.5%) had values higher than 8.2 mg/dl (Hyperphosphatemia). Mean values of maternal and cord blood are shown in table 2.

Table 2. Mean values of maternal and cord blood 25(OH) vit D, calcium and phosphorus.

Measurement	Maternal blood			Cord blood		
	Mean	SD	Normal Range	Mean	SD	Normal Range
25(OH) vit D ng/ml	16.5	14.2	> 14	12	12.2	>14
Calcium mg/ml	8.9	0.73	8.4-10.2	9.5	0.94	9-11.5
Phosphorus mg/ml	3.75	1.05	2.7-4.7	5.4	1.25	4.8-8.2

Out of 28 pregnant women with severe hypovitaminosis D, 24 newborns (85.7%) belonging to them had severe deficiency (table 3).

Table 3. Frequency of newborns belonging to women with vit D deficiency

Frequency		Newborns vit. D status belonging to women with Vit D deficiency.			
Level of Maternal vit D deficiency		Newborns with sever deficiency	Newborns with moderate deficiency	Newborns with mild deficiency	Newborns with normal range
Severe	28	24	3	1	0
Moderate	51	14	31	2	4
Mild deficiency	31	8	15	5	3
Total	110	46	52	8	7

Maternal serum 25(OH) vit D showed a positive correlation with cord blood 25(OH) vit D ($r=0.778$, $P<0.05$). Maternal serum 25(OH) vit D showed weak correlation with cord calcium level ($r=0.168$, $p<0.05$). Maternal serum 25(OH) D showed weak correlation with cord phosphorus level ($r=0.156$, $p<0.05$). Maternal 25(OH) vit D show weak correlation with maternal serum calcium level ($r=0.171$, $p<0.05$). Maternal serum calcium showed a positive correlation with cord blood calcium ($r=0.36$, $p<0.05$). Maternal serum phosphorus showed a positive correlation with cord blood phosphorus ($r=0.36$, $p<0.05$).

DISCUSSION

The most important finding in our study is high prevalence of hypovitaminosis D among pregnant women (57%) and their neonates (76.2%). The mean maternal 25(OH) vit D was 16.5 ± 14.2 (ng/ml) and the mean cord vit (OH) D was 12 ± 12.2 (ng/ml). 93.6% of neonates belonging to women with hypovitaminosis D had vit D deficiency. The physiologic relevance of the finding is substantiated by the positive correlation with cord blood 25(OH)D. Vitamin D deficiency has also been noted in pregnant women in tropical countries, but all studies were in Muslim populations, in whom the practice of their dressing might have played an important role.^{12,13} Serum 25(OH) vit D concentrations in pregnant Muslim women living in Denmark showed the mean concentration during summer in 25 women was 18.84 ± 1.84 ng/mL that similar with our study.¹⁴ A study from south Tehran showed the mean maternal vit (OH) D was 6.7 ± 1.5 ng/ml and the mean cord vit(OH) D was 3 ± 6.3 ng/ml that was lower than our study and this could have been induced by air pollution and low socioeconomic level of people in south of Tehran.¹⁵ A severe deficiency was found in 55% of non-European women compared to 5% of Dutch/West-European women.¹⁶

Cord blood 25(OH) vit D strongly correlated with maternal values. In our study, 14 (24%) of the mothers with hypocalcemia or hypophosphatemia with hypovitaminosis D had elevated ALP (indicating biochemical osteomalacia), as did 10 (17.5%) of the newborns. Rab and Baseer from Pakistan reported elevated total ALP in 26% of pregnant women.¹² Daily

vitamin D intake was low (88 ± 14 IU/d) in their subjects, as 51 women (26.4%) had values lower than 8.4mg/dl (Hypocalcemia) and 73 newborns (37.8%) had values lower than 9 mg/dl (Hypocalcemia). In our study, pregnant women with Hypocalcemia, 24% had hypoalbuminemia, 20.6% had hypomagnesemia and 6.8% had hypoparathyroidism. Thus only 48.6% of women with hypocalcemia related directly to vit D deficiency. Maternal serum calcium and phosphorus had positive correlation with cord blood calcium and phosphorus which is similar to the same study in Libya and Norway.¹⁷ At present, vitamin D supplementation is not a part of antenatal care programs in Iran. The US National Academy of Sciences recommends 400 IU as the dietary intake for vitamin D during pregnancy. In conclusion, our data suggests a high prevalence of significant hypovitaminosis D among pregnant women and their newborns in this part of Iran.

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