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Correlation between vitamin D status in mothers and their neonates in an Iranian population

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Abstract

Background and Objective: There has been a resurgence of nutritional rickets in children in many developing countries. Furthermore, Vitamin D deficiency is one of the major health problems and unexpectedly has a high prevalence in sunny countries (e.g. Middle East). In order to find out the association between vitamin D deficiencies in mothers and their neonates, we designed this study.

Methods: In a cross-sectional study, 49 pregnant women were recruited from Ali-Asghar children's hospital in Tehran, in 2015. All blood samples were assayed for 25-hydroxyvitamin D3, calcium, phosphorus, parathyroid hormone, alkaline phosphatase and creatinine. Vitamin D deficiency defined as levels of 25(OH) D< 20 ng/ml for mothers and newborns.

Results: The mean±SD 25OHD levels of the mothers and their neonates were 26.1±8.44 ng/mL and 17.23 ±10.36 ng/Ml, respectively. Serum 25OHD of the mothers and their neonates were significantly correlated (r= 0.446, P< 0.001).

Conclusion: We found a significant correlation between vitamin D deficiency in mothers and their neonates. We think it is necessary to reconsider the recommendation of vitamin D supplementation for women during pregnancy.

Keywords: Vitamin D, Neonate, Mother, Iran

Introduction

Vitamin D (Vit D) is one of the most important contributors to calcium (Ca) homeostasis. It is a fat-soluble vitamin formed mostly in human skin by exposure to sunlight, though a small percentage comes directly from the diet (1,2). 25-hydroxyvitamin D3 [25(OH)D] is the main circulating metabolite of vitamin D, and its concentration in serum reflects the vitamin D stores in human (3).

Materno-fetal vitamin D deficiency (VDD) is still an important cause of morbidity in developing countries. 25(OH)D crossing the placenta during the last months of gestation furnishes the main Vit D requirement of the newborn during the first few months of life (4). The Vit D status of breastfed newborns depends mainly on the Vit D stores acquired during intrauterine life because the human milk content of Vit D is very low (5,6).

In this study, we aimed to find out the Vit D status in mothers and their neonates and the correlation between serum levels of Vit D in mothers and their neonates and add our results to the last evidence about VDD.

Methods

This study included 49 Iranian women and their full-term neonates who were admitted in the NICU of Ali-Asghar children hospital in Tehran, 2015. The neonates who had odd numbers in the NICU were selected by simple random sampling. All blood samplings were done by a specified person and serum 25-hydroxyvitamin D (25OHD) level was determined in the laboratory of Ali-Asghar children hospital by enzyme-linked immunosorbent assay (ELISA) using Euroimmune kit (Germany). In addition, parathyroid hormone (PTH) calcium (Ca), phosphorus (P), alkaline phosphatase (ALP) and creatinine (Cr) were estimated by chemiluminescence, arsenazo lll (color-

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Table 1. Biochemical data of the mothers and their neonates' mean±SD

Mean of values	Mothers	Neonates
Vitamin D (ng/ml)	26.1 (8.44)	17.23 (10.36)
Calcium (mg/dl)	8.63 (0.49)	9.47 (7.58)
Phosphorus (mg/dl)	5.44 (0.81)	5.23 (0.96)
Alkaline phosphatase (IU/L)	228.77 (64.27)	373.28 (177.16)
Creatinine (mg/dl)	0.43 (0.07)	0.45 (0.17)
Parathyroid hormone (pg/ml)	35.1 (7.43)	42.43 (58.4)

Table 2. Percentage distribution of vitamin D level of mothers and their neonates

25-hydrovitamin D (25OHD) (ng/mL)	Mothers	Neonates
Very severe vitamin D deficiency (< 5)	0%	10.20%
Severe vitamin D deficiency (5 – 10)	0%	16.32%
Vitamin D deficiency (10 – 20)	24.48%	44.89%
Suboptimal vitamin D provision (20 – 30)	46.93%	12.24%
Optimal vitamin D level (30 – 50)	28.57%	16.32%

imetry), photometric method, the German societies for clinical chemistry (DGKC) method, and enzymatic colorimetry, respectively.

Exclusion criteria included: 1) immature neonates 2) history of using Vit D or calcium supplements in mothers 3) history of metabolic diseases related to Vit D and calcium homeostasis among mothers and their neonates, and 4) intensive congenital anomalies in neonates.

We classified serum levels of 25(OH)D into five groups for deficiency status (<5 as very severe, 5-10 as severe, 10–20 as deficiency, 20-30 as suboptimal, and ≥30 ng/ml as normal).

Statistical Analysis: The biochemical data of the mothers and the neonates were expressed as mean ± SD. The Student's t-test was used to compare the differences between the means of variables. Pearson correlation was used to investigate correlation between two variables. In all tests, the level of significance was 0.05. Data were analyzed through SPSS software version 21.

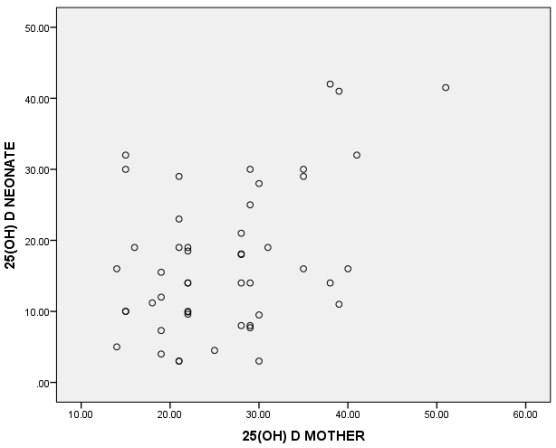


Fig. 1. Correlation between maternal and neonatal 25(OH)D concentrations (ng/mL).

Results

In total, 49 mother-neonate pairs participated in this study. Table 1 presents biochemical data of the mothers and their neonates. The percentage distribution of Vit D level of the mothers and the neonates is presented in Table 2. The mean of calcium, phosphorus, alkaline phosphatase, creatinine, parathyroid hormone levels of the mothers were compared in two groups: 1- the mothers with Vit D deficiency (< 20) 2- the mothers without Vit D deficiency (>20). There were no significant differences between two groups of the mothers. Also, we compared these biochemical levels in two groups of the neonates like their mothers (with and without Vit D deficiency) but there were no significant differences between two groups of the neonates, too. However there was a significant correlation between the newborns' Vit D levels and calcium concentrations (r= 0.345, P< 0.001). Furthermore, a significant correlation was observed between maternal and neonatal 25(OH) D concentrations (r= 0.446, P< 0.001) (Fig. 1).

Discussion

VDD rickets occurs most commonly during infancy, starting in the early months of life (4) Subclinical Vit D deficiency in neonates and their mothers has also been reported (7,8). The prevalence of Vit D deficiency among infants may be as high as 43-70%, depending on the definition of Vit D deficiency and the latitude of the population studied (9-11). Kazemi et al reported a high

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prevalence of physiologically significant hypovitaminosis D among Iranian pregnant women and their newborns (12). Furthermore, there was significant correlation between maternal and cord blood serum concentrations of Vit D in several studies (13-21). Molla et al studied Vit D status of mothers and their neonates in Kuwait and found out that the Vit D of the mothers and neonates are highly correlated ($r = 0.790$, $P< 0.001$) (14). In some other countries of the Middle East, Vit D deficiency rickets causes significant morbidity among the children. It is a preventable condition and the cost for prevention is affordable by most of the countries (22-24).

According to the studies (12,25-27) that have been done in Iran about Vit D status of the Iranian mothers and their newborns, we expected to find a high rate of Vit D deficiency. In this study, 71.41% of the neonates and 24.48% of the mothers had Vit D deficiency. In addition, our findings are consistent with some other studies that have shown significant correlation between maternal and neonatal serum concentrations of Vit D (13-21). In our study, there was a significant correlation between the newborns' Vit D and calcium concentrations in them($r = 0.345$, $P< 0.001$). This finding is consistent with a study that Hashemipour et al conducted (25). Some studies have shown that maternal Vit D status may influence placental calcium transfer and neonatal serum calcium concentration as we found (28,29).

Conclusion

We conclude that vitamin D deficiency is common among mothers and newborns in Iran. Therefore, Vit D supplements have an important role in pregnant women in decreasing the risk of neonatal Vit D deficiency and subsequent complications such as hypocalcemia.

Conflicts of interest: None declared.

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