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Original Article

Comparison of Vitamin D Level in Preterm and Term Infant–Mother Pairs: A Brief Study

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ABSTRACT

***Background*:** Recent studies have demonstrated the high prevalence of vitamin D deficiency in the general population. Pregnancy and preterm delivery are known as risk factors for vitamin D deficiency. Consequently, vitamin D level in women with preterm deliveries might vary from those with term pregnancies. In this study, we aimed to compare vitamin D level in term and preterm infant–mother pairs.

***Methods*:** This cross-sectional study was conducted in the neonatal intensive care unit of Mahdieh Hospital in Tehran, Iran in 2013. Serum level of 25-hydroxy vitamin D in preterm infant-mother pairs (≤ 32 weeks of gestation and birth weight ≤ 1500 g) was compared with term infant-mother pairs within the first 24 hours after delivery.

***Results*:** In total, 62 infant-mother pairs were recruited in this study, including 33 preterm (53.2%) and 29 term (46.8%) newborns; overall, 32 (51.6%) infants were male. the mean maternal age was 27.3 years in the preterm group and 26.4 years in the term group. The mean serum vitamin D level in preterm infants was 13.91 ng/ml. In the preterm group, vitamin D level was within the range of 4-59 ng/ml in newborns and 8-62 ng/ml in mothers. In the term group, the mean vitamin D level was 13.39 in infants and 13.7 ng/ml in mothers. In total, 48.5% and 65.5% of preterm and term groups had vitamin D deficiency, respectively. Among all newborns, 56% had vitamin D deficiency, although the difference between term and preterm neonates was not statistically significant. Also, there was no significant correlation between the infants' serum vitamin D level and birth weight. Based on the findings, serum vitamin D levels in mothers and newborns were significantly correlated (P<0.001).

Conclusion: According to the present study, there was no significant correlation between gestational age and vitamin D level in infant-mother pairs; however, vitamin D levels in mothers and newborns were significantly correlated.

Keywords: Vitamin D, Neonate, Osteopenia of prematurity, Preterm

Introduction

Preterm birth constitutes 5-18% of all deliveries and very low birth weight infants comprise 4-8% of all live births (1, 2). Significant advances in neonatal care have increased the survival rate of premature infants. However, the associated morbidity continues to affect these infants despite the increased survival rate.

One of the adverse outcomes of prematurity is osteopenia of prematurity and one of the risk factors for this condition is vitamin D deficiency (3). Based on recent studies, a significant percentage of the general population suffers from vitamin D deficiency. The overall prevalence of vitamin D deficiency has been estimated at 41.6% in several studies, with the highest rate reported among black people (82.1%) (4).

In addition, pregnancy is an identified risk factor for vitamin D deficiency. Overall, vitamin D deficiency has been reported among 47.0% and 83.5% of white and black pregnant women, respectively. On the other hand, in a previous study, the prevalence of vitamin D deficiency was estimated at 65.3% among both white and black pregnant women (5). Considering the association between vitamin D deficiency and preterm delivery (6) and the difference in vitamin D level between women with preterm and term deliveries, in this study, we aimed to compare vitamin D level in term and preterm infant-mother pairs.

Methods

This cross-sectional study was conducted in the neonatal intensive care unit (NICU) of Mahdieh Hospital, affiliated to Shahid Beheshti

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University of Medical Sciences in 2013. The 25-hydroxy vitamin D level of preterm infant-mother pairs (≤ 32 weeks of gestation and birth weight ≤ 1500 g) was compared with vitamin D level in term infant-mother pairs within the first 24 hours following birth.

Mothers who received medications such as phenobarbital, isoniazid, carbamazepine, or corticosteroid were excluded from the study. Blood samples of mothers and newborns were stored at -80°C, and vitamin D level was determined, using special kits. Vitamin D level was categorized into three groups: 1) sufficient (> 30 ng/ml); 2) insufficient (10-30 ng/ml); and 3) deficient (< 10 ng/ml). In addition, we considered the guidelines by the American Academy of Pediatrics (AAP), in which vitamin D level lower than 20 ng/ml signifies vitamin D deficiency. Therefore, the obtained results were analyzed according to both classifications (7).

Variables such as gestational age, maternal age, birth weight, neonate's gender, and vitamin D level were analyzed, using SPSS version 19.0. This study was approved by the institutional review board of Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Results

A total of 62 infant-mother pairs were enrolled in this study. Overall, 33 (53.2%) and 29 (46.8%) infants were preterm and term, respectively. Based on the findings, 30 (48.3%) newborns were female and 32 (51.6%) were male.

In the preterm group, the mean gestational age was 29.3 weeks, the mean birth weight was 1221±82 g, and the mean maternal age was 27 years. On the other hand, in the term group, the mean gestational age was 38.7 weeks, the mean birth weight was 3085±86 g, and the mean maternal age was 26 years.

The mean serum vitamin D level in preterm infants was 13.91 ng/ml (range: 4-59 ng/ml). Also, the mean vitamin D level in mothers and term infants was 13.7 and 13.39 ng/ml, respectively (Table 1). According to AAP guidelines, 48.5% (n=16) and 65.5% (n=19) of preterm and term infants had vitamin D deficiency, respectively. Overall, 56% (n=62) of all newborns had vitamin D deficiency, without any significant difference between the two groups (P>0.428). According to our classification, 3 (9.1%) preterm and 3 (10.3%) term neonates had vitamin D levels higher than 30 ng/ml (Table 2).

Table 1. Demographic characteristics of infant-mother pairs

Demographic characteristics (mean)	Preterm group	Term group	P-value
Gestational age (weeks)	29.3	38.72	0.0000
Birth weight (g)	1221	3085	0.0000
Maternal age (years)	27	26	0.428
Infant's vitamin D level (ng/ml)	13.91	13.39	0.850
Mother's vitamin D level (ng/ml)	14.91	13.71	0.158

Table 2. Comparison of variables in terms of vitamin D level

Groups	Vitamin D status N (%)	Gestational age (weeks)	Weight (g)	Maternal Age (years)	Mother's vitamin D level (ng/ml)	Infant's vitamin D level (ng/ml)
Preterm	Vitamin D deficiency: 16 (48.5%)	30.38	1195	27	6.08	7.32
	Vitamin D insufficiency: 14 (42.4%)	28.07	1239	27	18.11	17.36
	Vitamin D sufficiency: 3 (9.1%)	29.33	1283	29	32.84	33.00
	Total: 33 (100%)	29.30	1221	27	18.47	13.92
Term	Vitamin D deficiency: 19 (65.5%)	38.58	3027	27	8.32	6.26
	Vitamin D insufficiency: 7 (24.1%)	38.57	3037	25	19.08	19.20
	Vitamin D sufficiency: 3 (10.3%)	40.00	3570	21	35.38	45.04
	Total: 29 (100%)	38.72	3085	26	13.72	13.30
Total	Vitamin D deficiency: 35 (56.5%)	34.83	2189	27	8.32	6.73
	Vitamin D insufficiency: 21 (33.9%)	31.57	1838	26	19.08	17.98
	Vitamin D sufficiency: 6 (9.7%)	34.67	2426	25	35.38	39.01
	Total: 62 (100%)	33.71	2093	26	13.72	13.68

Table 3. Comparison of variables in preterm infants

	Vitamin D deficiency				P-value
	No		Yes		
	Mean	SD	Mean	SD	
Gestational age (weeks)	28.29	1.36	30.38	1.82	0.65
Weight (g)	1247	476	1195.00	372.86	0.73
Maternal age (years)	27	3.30	27.00	5.84	0.69
Infant's vitamin D level (ng/ml)	20.11	7.04	7.33	2.37	0.000
Mother's vitamin D level (ng/ml)	20.7	7.7	16.80	7.2	0.158

Table 4. Comparison of variables in term infants

	Vitamin D deficiency		
	No	Yes	P-value
Gestational age (w)	39.00	38.58	0.409
Weight (g)	3197	3027	0.357
Maternal age (years)	24	27	0.049
Mother's vitamin D level (ng/ml)	23.96	8.32	0.000

As the findings revealed, there was no significant correlation between serum vitamin D level and birth weight of neonates (r: 0.037, P=0.77). However, the serum vitamin D levels in mothers and newborns were significantly correlated (P<0.001). In term infants with vitamin D deficiency, lower vitamin D levels were detected in mothers, unlike mothers of infants with higher vitamin D levels (8.3±5.3 vs. 23.9±15).

According to the statistical analysis, lower birth weight and gestational age were reported among newborns with vitamin D deficiency (or insufficiency), compared to those with higher vitamin D levels. However, there was no significant association between vitamin D level and gestational age or birth weight (weight: 1195±372g vs. 1247±476 g; vitamin D level: 7.325 vs. 20.117 in cases with and without vitamin D deficiency) (P=0.65 and P=0.73, respectively) (Table 3).

Also, in the term group, gestational age of mothers with vitamin D deficiency was 38.58±1.2 weeks and the normal vitamin D level was 39±1.4 ng/ml; however, no statistically significant difference was observed between term neonates with and without vitamin D deficiency (P=0.409) (Table 4). Also, no significant relationship was observed between maternal age and vitamin D level.

Discussion

In this study, we briefly assessed the serum level of 25-hydroxy vitamin D in mothers and newborns at Mahdieh Hospital of Tehran, Iran. According to recent studies, a significant percentage of the general population has vitamin D deficiency (4). Pregnancy and preterm delivery are regarded as risk factors for vitamin D deficiency (5, 6). Therefore, in this study, we aimed to compare vitamin D level in term and preterm infant–mother pairs.

Based on the present findings, there was no significant difference between term and preterm infant-mother pairs. In our study, mothers in the two groups were matched in terms of age. Consequently, we were unable to compare the level of vitamin D among mothers from different age groups. Also, it should be noted that pregnant women are not provided with vitamin D supplements as part of the routine prenatal care in Iran, and intake of vitamin D is dependent on one's dietary habits.

In consistence with the present study, Mehta in Tanzania in 2009 found no significant association between vitamin D level and preterm delivery, although it should be noted that vitamin D level lower than 80 nmol/ml was considered as vitamin deficiency in the mentioned study (8). Moreover, in a study in England in 2009, there was no significant difference between term and preterm infants (9). Similarly, several studies have reported no significant relationship between preterm birth (< 27 weeks of gestation) and vitamin D level (10-12).

On the other hand, according to a study in the Netherlands, prolonged pregnancy was more common among women with vitamin D levels higher than 50 nmol/L, compared to those with lower vitamin D levels (40.2 vs. 40 weeks; P<0.001) (13). Also, similar results were reported in a large-scale study in Australia (14). It should be noted that the cut-off vitamin D levels in the mentioned studies were 25 and 29 ng/ml, respectively.

Moreover, according to a study by Zhu in China in 2015, women with vitamin D levels lower than 28 nmol/L had a higher risk of pregnancy termination at 0.7 weeks (15). Moreover, unlike

the present research, in a study by Shibata in Japan in 2011, mothers with lower vitamin D levels had more preterm deliveries (16).

In the present study, we found no significant relationship between low birth weight and mothers' vitamin D level, which was in line with some previous studies (17, 18). Also, according to a recent systematic review of five randomized clinical trials, which focused on the role of vitamin D level in pregnancy and neonatal outcomes, the protective effects of supplements on low birth weight of infants were reported in three studies, while two studies did not present such findings.

In general, little information is available on the effects of vitamin D intake during pregnancy on maternal, perinatal, or neonatal health outcomes (19). In an overview of vitamin D status and intake in Europe (20), lower levels of vitamin D were reported in Turkey in comparison with other European countries such as Germany, Spain, and France. Similar to the present study, the mean level of vitamin D was 16.3 ng/ml in the mentioned study. This finding indicates that Middle Eastern countries are at risk of vitamin D deficiency due to various geographical, ethnic, genetic, and nutritional factors. Consequently, more vitamin D supplements are required in these countries, particularly during pregnancy and early childhood.

On the contrary, in studies by Greer (21) and Cooke (22), higher levels of vitamin D at birth were reported in comparison with the present research. In fact, in our study, vitamin D level in mothers was lower than values reported in other countries. Therefore, use of vitamin D supplements during pregnancy seems to be a reasonable solution.

In Iran, use of vitamin D supplements during pregnancy is not incorporated in routine prenatal care and vitamin D is prescribed on an individualized basis. Moreover, the Islamic dress code, in addition to poor diet and inappropriate lifestyle, can contribute to the lower level of vitamin D in mothers. In a previous study in France, the mean vitamin D level was 47.5 nmol/L on the third day of life and 142.6 nmol/L in the third month after birth in preterm infants by the use of 1000 IU/day of vitamin D (23). It should be mentioned that in our study, infants' vitamin D level was only measured within the first 24 hours after birth.

The major limitation of the present study was the small sample size and measurement of vitamin D level only at birth. Since preterm infants are at risk of vitamin D deficiency and osteopenia of prematurity (due to the limited passage of vitamin D through the placenta in the third trimester of pregnancy), they may require higher levels of vitamin D in the first months of life, compared to term neonates. Therefore, it is recommended that these newborns be assessed in terms of vitamin D deficiency.

Conclusion

Based on the findings, there was no significant correlation between gestational age and vitamin D level in infant-mother pairs, whereas vitamin D levels in mothers and infants were significantly correlated. Further research is required to identify the relationship between preterm birth and vitamin D deficiency.

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