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Research Article

Vitamin D Status in Premature Infants and their Mothers with High Stress Levels Due to Military Actions

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Abstract

This article presents data on the study of vitamin D levels in 52 mothers who gave birth to premature infants and were treated in a neonatal unit.

Purpose. To analyze the serum levels of vitamin D in premature infants and their mothers, with high stress levels.

Materials and Methods. A prospective, single-center, cohort study was conducted among 52 women and their preterm infants within the first days postpartum (before any vitamin D correction).

Results .Despite the summer season, the vitamin D level in maternal blood serum was unexpectedly low, averaging 25.15 ± 1.85 [16.3; 32.0] ng/mL. The mean serum 25 (OH)D level in infants was also low: 23.91 ± 2.70 [18.1; 27.5] ng/mL. Only 8 (15.4%) of the infants had sufficient levels of 25 (OH)D. Children are at increased risk of developing sepsis and intestinal problems. Mothers had changed their dietary habits due to chronic wartime stress.

Conclusions. Given the high prevalence of deficiency in pregnant women and newborns, preventive supplementation should be provided year-round. With chronic stress, which is during the period of military operations, it is especially important to monitor the health of pregnant women and monitor their vitamin D level.

Keywords: Premature Infants; Vitamin D; Maternal Nutrition; Complications of Vitamin D Deficiency; Stress by Military Actions

Introduction

Despite ongoing support programs aimed at monitoring vitamin D status among pregnant women, vitamin D deficiency in both mothers and their infants remains a pressing medical and social issue. A meta-analysis involving pregnant women and their newborns from various WHO regions showed that over half of the mothers at the end of pregnancy and their infants-had vitamin D deficiency [1,2].

It has been proven that limited in utero supply of vitamin D may impair development and cause skeletal deformities, congenital cataracts, delayed brain development, and an increased risk of bronchopulmonary dysplasia [3]. Antenatal vitamin D deficiency leads to disrupted fetal bone mineralization. A correlation has been established between maternal vitamin D levels and neonatal bone development indicators such as femur length and bone mineral composition [4].

Purpose

To analyze the serum levels of vitamin D in premature infants and their mothers, with high stress levels due to military actions.

Materials and Methods

A prospective, single-center, cohort study was conducted among 52 women and their preterm infants within the first days postpartum (before any vitamin D correction). The study was

conducted from July to September 2024 in a neonatal intensive care unit. In addition to standard clinical laboratory methods, serum 25-hydroxyvitamin D (25 (OH)D) levels were measured using enzyme immunoassay. Vitamin D status was assessed according to global guidelines: sufficient ≥30 ng/mL, insufficient 20–29.9 ng/mL, and deficient <19.9 ng/mL [5].

The study adhered to safeguarding participant rights and dignity, bioethical standards for working with patients, especially regarding children. No risk was posed to participants. Legal guardians were fully informed of the study's goals, methods, and expected benefits. All diagnostic methods used are standard and permitted; no human experimentation was conducted.

Results and Discussion

The average age of mothers was 23.97 ± 1.32 [19.0; 29.0] years, and mean gestation period was 32.03 ± 0.41 [30.0; 34.0] weeks. Mean birth weight was 1874.3 ± 71.48 [1700.0; 2150] grams.

Despite the summer season, the maternal serum vitamin D level averaged only 25.15 ± 1.85 [16.3; 32.0] ng/mL. Infant serum levels averaged 23.91 ± 2.70 [18.1; 27.5] ng/mL, with only 8 (15.4%) infants having sufficient 25 (OH)D levels (Table 1).

Indicator	Infants with sufficient 25(OH)D (n = 8)	Infants with deficient 25(OH)D (n = 44)
Maternal age (years) Mean ± SD; Me [25; 75]	31,43 ± 2,80 29,0 [25,0; 40,0]	21,70 ± 1,16* 21,0 [18,0; 24,0]
Maternal 25(OH)D (ng/mL) Mean ± SD; Me [25; 75]	25,49 ± 5,57 25,0 [12,0; 36,8]	22,43 ± 1,79* 21,7 [16,4; 25,6]

Table 1: Maternal characteristics by infant 25(OH)D levels.

Note: * - $p < 0.05$

In the analysis of children by 25 (OH)D level, the following data were obtained (Table 2). The level of 25 (OH)D affected body weight at birth, had a tendency to affect growth, which confirmed the data of Nguyen, T. P. H., *et al.* [6] and was slightly associated with gender (Table 2). These children more often developed gastrointestinal disorders and were at risk of developing sepsis.

Additionally, a questionnaire was conducted among all mothers. A survey revealed that 57.7% of mothers had tested for 25 (OH)D during pregnancy and were aware of their low levels, yet hoped that summer sun and fruit consumption would suffice. Of those who took 25 (OH)D supplements (21.1%), daily intake ranged from 1000 IU, and their infants had significantly higher 25 (OH) D levels ($p < 0.05$). Most mothers with sufficient levels were first-time pregnant. 25 (OH)D was taken by 61.5% upon doctor's recommendation, and 36.8% self-prescribed.

The frequency of complaints among respondents who had D deficiency during pregnancy was significantly higher compared to the subgroup of women with normal vitamin levels ($p < 0.05$). Mothers with deficiency more frequently reported fatigue (76.9%), reduced performance (65.3%), hair loss and brittle nails (38.4%), and back pain (67.3%).

Since the full-scale russian invasion, the mental health of Ukrainians, especially pregnant women, has worsened. Chronic stress elevates cortisol levels, increases cravings for sugary and high-fat foods, and impairs metabolism. At the same time, chronically elevated cortisol levels slow down metabolism and reduce the body's ability to burn calories, even with an active lifestyle. Pregnant women noted that they consumed more sweets, sweet fruits, and light carbohydrates - 88.4% of those surveyed. Common foods included eggs and dairy products (67.3%).

Vitamin D3 deficiency also affects the level of the "happiness hormone" serotonin, which provides us with a good mood and the ability to resist stress. A vicious cycle of hormone deficiency (predominance of cortisol) - stress - vitamin D3 deficiency - depression is formed. During the war-related stress, there is a lack of time to prepare healthy meals, and the low quality of products, which affects the vitamin content in them [7].

Indicator	Sufficient ≥30 ng/mL (n = 8)	Insufficient 21–29 ng/mL (n = 14)	Deficient ≤20 ng/mL (n = 30)	p-value
Male Female	6 (75%) 2 (25%)	8 (57,1%) 6(42,9%)	20 (66,7%) 10(33,3%)	χ^2_{1-2} = 1,71, p = 0,190 χ^2_{1-3} = 2,86, p = 0,091
Birth weight M ± m Me [25; 75]	2069,0 ± 83,03 2011,0 [1900,0; 2250,0]	1858,93 ± 112,67 1865,0 [1600,0; 2150,0]	1746,78 ± 140,94 1720,0 [1500,0; 2150,0]	p_{1-2} = 0,24 p_{1-3} = 0,09
Body length (cm)M ± m Me [25; 75]	43,86 ± 1,22 44,0 [41,0; 45,0]	44,07 ± 0,84 44,0 [42,0; 47,0]	43,67 ± 1,23 43,0 [42,0; 44,0]	p_{1-2} = 0,89 p_{1-3} = 0,92
Gestation weeks M ± m Me [25; 75]	31,29 ± 0,61 31,0 [30,0; 32,0]	32,43 ± 0,67 32,0 [30,0; 35,0]	32,0 ± 0,78 32,0 [30,0; 34,0]	p_{1-2} = 0,29 p_{1-3} = 0,50
Maternal age (years) M ± m;Me [25; 75]	31,43 ± 2,80 29,0 [25,0; 40,0]	20,71 ± 1,20 21,0 [17,0; 24,0]	23,22 ± 2,32 21,0 [19,0; 27,0]	p_{1-2} = 0,006 p_{1-3} = 0,04
Sepsis	3 (42,86 %)	6 (42,86 %)	7 (77,78 %)	χ^2_{1-2} = 0,0, p = 1,0 χ^2_{1-3} = 2,05, p = 0,152
Gastrointestinal disorders	5 (71,43 %)	10 (71,43 %)	8 (88,89 %)	p_{1-2} = 0,006 p_{1-3} = 0,04

Table 2: Infant group characteristics by 25 (OH) D level.

Chronic infection signs were present in 32.7% of women. Vitamin D deficiency or insufficiency affected 82.5%. Similar trends were reported by Kwon K.-W., *et al.* [4], attributing findings to vitamin D's immunotropic effects.

Sepsis occurred significantly more often in infants with deficiency (56.5% vs. 42.9%, $p < 0.05$). Preterm birth itself may result from bacterial infection, and newborn immunity is low, compounding infection risk when vitamin D is lacking. Sepsis and bacterial complications are frequent companions of premature infants in intensive care units. This is primarily due to the fact that premature birth itself can be caused by bacterial infection [5,8]. Second, the immune reactivity of newborns is reduced and in this situation, vitamin D deficiency increases the risk of infection.

Conclusions

Fetal development, newborn health, are closely linked to maternal vitamin D status. Given the high prevalence of deficiency in pregnant women and newborns, preventive supplementation should be provided year-round. With chronic stress, which is during the period of military operations, it is especially important to monitor the health of pregnant women and monitor their vitamin D level.

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Conflict of Interest

None declared.

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