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Original Article

Importance of vitamin D in the mother and infant in pediatric follow-up

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Abstract

Aim: Vitamin D is a steroid structured the hormone that regulates the calcium and phosphor metabolism in the body and is required for healthy growth, development, and skeletal structure. Apart from its negative effect on bone structure, vitamin D deficiency may form the basis of many diseases. For infants aged between 0-24 months coming to the hospital for regular follow-up, the objective of this study was to evaluate their retrospective serum 25-hydroxyvitamin D levels, maternal vitamin D usage history and their distributions based on gender, age and seasons.

Materia and Methods: 992 infants who were admitted to the well-child polyclinic in a training and research hospital in Ankara between January 2018 and May 2019 and detected to have serum 25-hydroxyvitamin D levels below normal were included in our study. The patients were separated into four groups according to their chronological ages with a difference of six months between each group and into three groups based on their vitamin D levels. Groups were also formed according to genders and seasons.

Results: Three groups were formed based on serum 25-hydroxyvitamin D values of the infants; values of those below 10.00 ng/mL were classified as the deficiency, those between 10.01-20.00 ng/mL were classified as insufficiency and those between 20.01 and 30.00 ng/mL were classified as an indefinite group. Among 992 infants included in the study, 38 (3.8%) were defined as a deficiency, 380 (38.3%) as insufficiency and 574 (57.9%) as an indefinite group. Lowest 25-hydroxyvitamin D values of the infants were observed in spring and the group aged between 0-6 months.

Conclusion: Vitamin D values were detected significantly low in infants under the age of two and especially in those who are in their first six months. This condition requires the regular follow-up of vitamin D levels of the mothers during pregnancy and adequate and careful use of vitamin D prepares support.

Keywords: Child health monitoring; infant vitamin D level; maternal vitamin D level

INTRODUCTION

Vitamin D is a hormone that regulates the calcium and phosphor metabolism in the body and is required for growth, development and a healthy skeletal structure (1,2). Its half-life is approximately 3-4 weeks. It is measured as 25(OH)D in serum D vitamin measurement (8,9). 25(OH) D, which is the vitamin D storage form, easily crosses the placenta in rats, and possibly placental passage in humans is easy such that the cord blood 25(OH)D vitamin concentration is equal to or 20% lower than the maternal concentration. Other hormones that have potential calcium regulating effects; oestrodiol, prolactin, placental lactogen and calcium regulating parathyroid hormone-related protein (PTHrP) levels increase during pregnancy (9,12). 25- (OH)D vitamin level of maternal serum during pregnancy shows high correlation with dietary intake and sun exposure (9). The mother's vitamin D should be sufficient for the newborn to be born with a normal 25 (OH) vitamin D concentration.

Vitamin D deficiency or insufficiency occurs due to any reason preventing the sun rays from reaching the earth's surface or not being able to adequately benefit from this, any condition preventing its transfer to the skin or presence of structural melanin intensity, increasing need during quick growth and inadequate intake through nutrition (4).

Apart from bone tissue effects, vitamin D deficiency also forms the basis of many diseases (5,6).

In the studies made in recent years, it was emphasized that vitamin D deficiency constitutes an important problem for the mother and the infant due to their biological unity and diagnosis of vitamin D deficiency before and after delivery gained importance. In addition to the fact that vitamin D deficiency during pregnancy may have lifelong effects on the fetus, it was also reported as the most important risk factor for vitamin D deficiency in the neonatal period and infancy (10).

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Within vitamin D support programs in Turkey, all healthy infants are given 400 IU/day from the first day of their lives until they are one year old to prevent vitamin D deficiency. It is also suggested to give 600 IU/day vitamin D support starting from the age of one until adolescence (11).

The objective of our study was to evaluate retrospective serum 25(OH)D vitamin levels of infants between the ages of 0 and 2 who were admitted to Ankara Yıldırım Beyazıt University Yenimahalle Training and Research Hospital well-child polyclinic for follow-ups, vitamin D usage conditions of their mothers during pregnancy and also to evaluate the infants based on months, genders and seasons.

MATERIAL and METHODS

Ethics committee approval of the study was made on 30.04.2019 with the number 2019-44 Ankara Yıldırım Beyazıt University Yenimahalle Education and Training Hospital Clinical Research was taken from the Ethics Committee.

Nine hundreds and ninety-two infants who were admitted to the well-child polyclinic of our hospital between January 2018 and May 2019 were evaluated in our study. The infants were between 0 and 24 months and were separated into four groups for every six months. Age groups formed based on 25(OH) vitamin D levels were separated into groups based on maternal vitamin D use during pregnancy, vitamin D usage history of the infant and also on genders and seasons. Serum 25(OH)D level <10.00 ng/mL was evaluated as deficiency, 10.01-20.00 ng/mL as insufficiency, 20.01-30.00 ng/mL as indefinite group and >30.00 ng/mL as sufficiency. Vitamin D levels were studied according to the suggestions of the manufacturing firm, using Adivia Centeur XPT (Siemens, Erlangen, Germany) immune measurement auto analyzer.

Statistical Analysis

Statistical analysis of the data was performed with SPSS 21.0 (IBM Corp. Released in 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.). The suitability of the data for normal distribution was examined graphically and by the Shapiro-Wilk test. Data were not normally distributed. The median and minimum-maximum values were used for the non-normally distributed numerical data, and the number and percentage were used for the categorical data. The comparison of the groups was performed by Kruskal Wallis test in comparison of three or more groups in non-normally distributed numerical data, Mann-Whitney test in comparison of double groups, and chi-square test in categorical data. p<0.05 was considered statistically significant.

RESULTS

A total of 992 infants were included in the study. 481 (48.5%) of these were female. 321 (32.4%) were infants born in spring. 401 (40.4%) of these were between 6-12 months old. 498 (50.2%) of the mothers of the infants included in the study stated that they didn't take any vitamin D during their pregnancy. And as their mothers stated, 496 (50.0%) of the infants didn't take any vitamin D after they were born. The median serum vitamin D value of the infants was detected as 16.86 (4.2–30) ng/mL. The lowest vitamin D level was 4.20 ng/mL. Statistical significance was accepted as p<0.05 in the statistical evaluation. Descriptive data of the infants included in the study were summarized in Table 1.

Table 1. The Descriptive Values of Infants

		n	%
Gender	Male	481	48.5
	Female	511	51.5
Seasons	Spring	321	32.4
	Summer	230	23.2
	Autumn	235	23.7
	Winter	206	20.8
Baby age (months)	0-6	298	30.0
	6-12	401	40.4
	12-18	188	19.0
	18-24	105	10.6
Mother of Vitamin D Usage Status	Regular	204	20.6
	None	498	50.2
	Sometimes	290	29.2
Infant of Vitamin D Usage Status	Regular	210	21.2
	None	496	50.0
	Sometimes	286	28.8

Table 2. According to Seasons of Birth and Months

			Gender		
			Female	**Male**	**p-value**
Seasons	Spring	n	158	163	**0.688**
		%	32.8	31.9	
	Summer	n	106	124	
		%	22.0	24.3	
	Autumn	n	111	124	
		%	23.1	24.3	
	Winter	n	106	100	
		%	22.0	19.6	
Baby age (months)	0-6	n	147	151	**0.960**
		%	30.6	29.5	
	6-12	n	195	206	
		%	40.5	40.3	
	12-18	n	88	100	
		%	18.3	19.6	
	%	n	51	54	
		%	10.6	10.6	

n:Count , % : percent, p<0.05 statistically significant difference present

When the number of female and male infants were compared based on the birth season and the infant age, no statistically a significant difference was observed among them (p=0.688 and p=0.960 in order) (Table2).

Based on an examination made, no statistically significant difference was detected between the gender, infant age and the season in which the infants were born (p<0.05). No difference was observed in infant vitamin D values between the females who used and didn't use vitamin D during their pregnancy (p=0.218). Again, no significant difference was observed in serum vitamin D values among vitamin D using and not using infants (p=0.494) (Table 3).

Table 3. Comparision of Infant 25 Hydroxy Vitamin D Level by Variables

		İnfants of 25 Hydroxy Vitamin D Level (ng /mL)	p-value
Gender	Female	20.90 (4.20-29.98)	**0.257**
	Male	21.60 (6.17-30.00)	
Baby age (months)	0-6	21.32 (4.20-29.98)	**0.083**
	6-12	22.39 (4.30-30.00)	
	12-18	20.11 (4.30-29.41)	
	18-24	19.80 (9.14-29.60)	
Seasons	Spring	21.10 (4.30-29.94)	**0.631**
	Summer	21.45 (4.20-30.00)	
	Autumn	21.17 (6.58-29.98)	
	Winter	21.55 (4.30-29.60)	
Mother of Vitamin D Usage Status	Regular	22.09 (5.92-29.98)	**0.218**
	None	21.20 (4.20-30.00)	
	Sometimes	20.99 (4.30-29.92	
Infant of Vitamin D Usage Status	Regular	21.65 (4.30-29.98)	**0.494**
	None	21.08 (4.30-29.94)	
	Sometimes	21.41 (4.20-30.00)	

p<0.05 statistically significant difference present

Table 4. Comparison of Serum 25 Hydroxy Vitamin D Values of İnfants

		Infants of 25 Hydroxy Vitamin D Level (ng /mL)						
		Deficiency		Insufficiency		Indefinite		
		n	%	n	%	n	%	p-value
Gender	Female	21	4.4	190	39.5	270	56.1	**0.466**
	Male	17	3.3	190	37.3	303	59.4	
Seasons	Spring	14	4.4	131	40.8	176	54.8	**0.185**
	Summer	9	3.9	71	31.0	149	65.1	
	Autumn	10	4.3	92	39.1	133	56.6	
	Winter	5	2.4	86	41.7	115	55.8	
Baby age (months)	0-6	14	4.7	97	32.6	187	62.8	**0.048***
	6-12	16	4.0	145	36.3	239	59.8	
	12-18	6	3.2	85	45.2	97	51.6	
	18-24	2	1.9	53	50.5	50	47.6	
Mother of Vitamin D Usage Status	Regular	5	2.5	73	35.8	126	61.8	**0.650**
	None	21	4.2	192	38.7	284	57.1	
	Sometimes	12	4.1	115	39.7	163	56.2	
Infant of Vitamin D Usage Status	Regular	6	2.9	79	37.6	125	59.5	**0.731**
	None	23	4.6	192	38.7	281	56.7	
	Sometimes	9	3.2	109	38.2	167	58.6	

***There is a statistically significant difference between 0-6 months group and 18-24 months group (p is corrected value)**

The infants were separated into three groups based on their serum vitamin D values; those below 10.00 ng/mL were classified as the deficiency, those between 10.01-20.00 ng/mL were classified as insufficiency and those between 20.01-30.00 ng/mL were classified as an indefinite group. The deficiency was detected in 38 (3.8%) infants and insufficiency in 380 (38.3%) infants. Five houndreds and seventy-four (57.9%) infants were evaluated as the indefinite group. Vitamin D distribution grouped according to definitive parameters is summarized in Table 4.

A significant difference wasn't observed in infant serum D vitamin levels grouped according to genders and seasons (p>0.05). Again, no difference was detected among vitamin D values grouped according to numbers of mothers and infants using vitamin D (p>0.05).

When the comparison was made based on infant age groups, a significant difference was detected only among 0-6 months and 18-24 months infant groups (p=0.048). Vitamin D deficiency rates were found higher in the 0-6 month group. No difference was observed in other age groups (p>0.05) (Table 4).

DISCUSSION

Studies made in recent years showed that, in addition to providing calcium and phosphate balance, vitamin D has a role in the growth and differentiation of healthy cells and cancer cells in our body and contribute to the innate and acquired immunity development and interacts with the endocrine system (12, 13). Recently, there are many studies on the borders of vitamin D deficiency and insufficiency. It is also claimed to increase the tendency to diabetes, allergic conditions, many infectious diseases, cardiovascular diseases, neuropsychiatric diseases and some cancer types (14).

In the USA, it is reported that vitamin D deficiency or insufficiency has reached 70% in children in the 6-11 age group (15). The global prevalence of vitamin D deficiency is considered to be changing between 30-60% (16). It is quite difficult to determine a normal range for serum 25(OH)D vitamin level. But in the study they published, Barret et al (17) stated that serum 25(OH)D vitamin level should be over 20.00 ng/mL. In our country, there are health authorities defining serum 25(OH)D vitamin level below 10.00 ng/mL as a deficiency and below 25.00 ng/mL as insufficiency (18). Thus, we formed a group in which we defined the infants with a serum D vitamin level between 20.01-30.00 ng/mL as indefinite. There were 574 (57.9%) infants in the group. The ratio was quite high. Thus we think that the serum D vitamin level of the infant age group should be over 30.00 ng/mL.

In a study performed in the USA, it was reported that a high amount of vitamin D intake during pregnancy could decrease recurrent wheezy breathing in early childhood. When the mothers with the highest daily vitamin D intake (median: 724 IU) and lowest vitamin D intake (median: 356 IU) were compared in this study, it was noticed that recurrent wheezy breathing risk in children significantly decreased (19). In another study performed in Scotland, it was demonstrated that vitamin D intake during pregnancy decreased wheezing complaints in early childhood (20). In a meta-analysis evaluating five observational studies on vitamin D support, it was reported that type 1 diabetes occurrence risk significantly decreased in infants taking vitamin D support (21).

In a retrospective a study performed on Pakistani pregnant women (n=75) and their infants to determine the prevalence of vitamin D insufficiency, maternal and neonatal serum 25(OH)D vitamin levels were compared and as a result, vitamin D insufficiency

Serum 25(OH) vitamin D levels <30.00 ng/mL were detected in 89% of these pregnant women. (22)

In another study made on 200 Afro-American and 200 white pregnant women in the USA, 25(OH) vitamin D levels of serum and cord types of blood were measured in the 4-21st weeks of pregnancy and before delivery. More than 90% of pregnant women were taking vitamin D regularly. Serum 25(OH) vitamin D levels of pregnant women and neonatal were classified as deficient (<37.5 nmol/L), insufficient (37.5-80 nmol/L) and sufficient (>80 nmol/L). The deficiency was detected in 29.2% and insufficiency in 54% of the Afro-American mother during delivery and 45.6% deficiency and 46.8% insufficiency were detected in their infants. These ratios were 5.0%, 42.0%, 9.7%, and 56.4% respectively for white females and their infants. According to the study, although the mothers were taking vitamin before pregnancy, these women and their infants still had a high level of vitamin D insufficiency. Thus, it was stated that the risk is high in the early period of pregnancy and infant life and high dose vitamin D supplement is necessary to prevent vitamin D insufficiency (23).

In our study, a significant difference wasn't detected in vitamin D levels of mothers and infants who took and didn't take vitamin D. When season, infant's current age and gender variables and mothers who didn't give vitamin D to their infants were compared, a significant the difference was detected in vitamin D deficiency especially in infants in 0-6 months. Again, interestingly, no significant the difference was noticed in vitamin D levels of the infants of mothers who used and didn't use vitamin D during their pregnancy. Similar to our the study, in the study made by Celep et al on infants aged 01-12 months in 2019, a significant difference wasn't detected in 25(OH) D vitamin levels among the groups according to gender, age and the measurement season (24). Recently, Serum 25(OH)D level was investigated in 112 healthy children aged between 0-36 months who were admitted to the pediatric clinic in Van and insufficiency was detected in 13.3% of these infants although they received vitamin D support. In another study made in our country, 148 infants aged between 02-24 months were examined and among infants regularly taking 400 IU/day vitamin D, serum vitamin D level was found below 15.00 ng/mL in 27.3% of those aged between 2nd and 6th months, 8.3% of those aged between 6th and 12th months and 30% of those aged between 12-24 months (25).

Our study had some limitations. The limitations of the study was the inability to measure vitamin D during pregnancy, inability to regularly and efficiently follow vitamin D levels of mothers in their diets and inability to detect how much they can benefit from the sunlight. Again the inability to measure vitamin D in cord blood of a fetus, inability to detect how much the infant benefits from the sunlight and the tendency of the families to provide wrong answers to a negative situation was the limitations.

Today, it is obvious that there are many unknown issues and variables when the causes of vitamin D deficiency and insufficiency are investigated. These data made us consider that it is necessary to increase the vitamin D supporting dose given to the infants in our country over 400 IU/day and to strengthen the continuing program.

Based on the studies performed in different countries, we observed that vitamin D sufficiency level is changing. Currently, Vitamin D deficiency due to common causes in mothers who recently gave birth and their infants is still a common global problem. According to the suggestions of the World Endocrinology Association, serum vitamin D levels were defined as deficiency below 12.00 ng/mL, insufficiency below 20.00 ng/mL and as to sufficiency over 20.00 ng/mL. But vitamin D deficiency in the pregnancy period of the mothers, afterward and the infants aged between 0-2 years may form the basis of many diseases, mainly bone development disorders.

CONCLUSION

Consequently we think that vitamin D deficiency and insufficiency borders should be examined again for the infants living under the conditions of our country.

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