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The State of Vitamin D Supplement Use and Knowledge Levels of Mothers With 0-12 Month-Old Infants

0-12 Aylık Bebeği Olan Annelerin D Vitamini Takviyesi Kullanım Durumu ve Bilgi Düzeyleri

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ABSTRACT

Aim: *This study aimed to understand the knowledge and awareness of mothers about vitamin D and to observe their practices regarding the use of vitamin D for themselves during pregnancy and for their infants after birth.*

Material and Method: *This descriptive study was conducted between July and November 2021 with a total of 818 mothers between the ages of 18 and 48 with 0-12 months old infants via a web-based survey.*

Results: *The majority of mothers were between the ages of 25 and 29 and had a university degree (40.2% and 52.3%, respectively). 65.6% of the mothers stated that they used vitamin D supplements during pregnancy. Most of the infants were given vitamin D supplementation immediately or within 15 days after birth. 91.9% were still using vitamin D supplements daily (3.3 ± 1.30 drops). The majority of mothers had sufficient knowledge about the functions of vitamin D and the diseases that can occur in its deficiency.*

Conclusion: *This study shows that most mothers comply with the time and amount of vitamin D use recommended for themselves and their infants in "Vitamin D Supplementation Programs", and that they are well-informed about vitamin D supplementation.*

Keywords: *Vitamin D, Vitamin D supplementation, Knowledge*

ÖZET

Amaç: *Bu calışmanın amacı, annelerin D vitamini hakkındaki bilgi ve farkındalıklarını anlamak, hamilelikte kendileri ve doğumdan sonra bebekleri için D vitamini kullanımına ilişkin uygulamalarını gözlemlemektir.*

Gereç ve Yöntem: *Tanımlayıcı tipteki bu çalışma, Temmuz-Kasım 2021 tarihleri arasında, 0-12 aylık bebeği olan 18-48 yaş arası toplam 818 anneye web tabanlı anket uygulanarak yapılmıştır.*

Bulgular: *Annelerin çoğunluğu 25-29 yaşları arasında olup üniversite mezunudur (sırasıyla %40.2 ve %52.3). Annelerin %65.6'sı gebelikte D vitamini takviyesi kullandığını belirtmiştir. Bebeklerin çoğuna doğumdan hemen sonra veya doğumdan sonraki 15 gün içinde D vitamini desteği verilmiştir. Bebeklerin %91.9'u halen günlük D vitamini takviyesi kullanmaktadır (3.3 ± 1.30 damla). Annelerin çoğunluğu D vitamininin işlevleri ve eksikliğinde oluşabilecek hastalıklar hakkında yeterli bilgiye sahiptir.*

Sonuç: *Bu çalışma, çoğu annenin "D Vitamini Destek Programları"nda kendileri ve bebekleri için önerilen D vitamini kullanım süre ve miktarına uyduklarını ve D vitamini takviyesi konusunda bilgili olduklarını göstermektedir.*

Anahtar Kelimeler: *D vitamini, D vitamini takviyesi, Bilgi*

INTRODUCTION

Vitamin D, which consists of a group of sterol structures involved in the synthesis of hormones and hormone precursors in a favorable biological environment, is the fat-soluble vitamin whose effects on human metabolism have been most studied in recent years (Marino & Misra, 2019). The role of 1,25-dihydroxy-cholecalciferol, the active form of vitamin D, in bone mineralization in providing calcium and phosphorus balance in the bone and skeletal system is well known. Over the last years, in the literature, the regulatory role of vitamin D in hormone secretion, proliferation, and differentiation of cells and its effects on the immune system has been associated with autoimmune diseases such as inflammatory bowel disease, diabetes, cardiovascular diseases, cancer, asthma, multiple sclerosis, and respiratory tract infections (Marino & Misra, 2019; Seremet Kürklü & Ayaz, 2015).

As the need for vitamin D increases during pregnancy and lactation, the risk of vitamin D deficiency in pregnant and lactating mothers also increases (Rasheed, 2017). The most common cause of vitamin D deficiency or insufficiency in infants is the scarcity of vitamin D reserves in mothers. Considering the effects of vitamin D during pregnancy, especially outside the bone and skeletal system, the effects of its deficiency on the fetus may continue throughout life (T.C. Sağlık Bakanlığı Halk Sağlığı Genel Müdürlüğü, 2011). The low level of vitamin D in the mother during pregnancy causes the newborn to have low 25-hydroxy vitamin D levels (Çiçek, Kalkan & Bilgen Sivri, 2016). Vitamin D deficiency during pregnancy is associated with an increased risk of certain diseases such as preeclampsia and gestational diabetes in mothers, and with low birth weight, cesarean delivery, neonatal hypocalcemia, decreased bone density, bone malformations (rickets), seizures, and respiratory problems in newborns and infancy (Seremet Kürklü & Ayaz, 2015; T.C. Sağlık Bakanlığı Halk Sağlığı Genel Müdürlüğü, 2011). It is recommended that the mothers should have adequate serum vitamin D levels to maintain a healthy pregnancy and lactation period and for the newborns to be healthy. Neonatal vitamin D levels depend on maternal vitamin D levels at birth and breast milk in the first months after birth. Breast milk is a poor source of vitamin D. Therefore, exposure to sunlight and dietary supplements are becoming critical sources of vitamin D (Çiçek et al., 2016; Rasheed, 2017). Rickets is a disease that is frequently observed in infants aged 3-24 months in case of vitamin D deficiency and manifests itself as deformities due to insufficient calcium storage in the bone and skeletal system. Due to rickets, infants may display symptoms such as convulsions, delay in walking and teething, softness and deformity in skull bones, frequent infections, and head sweating (T.C. Sağlık Bakanlığı Halk Sağlığı Genel Müdürlüğü Çocuk ve Ergen Sağlığı Dairesi Başkanlığı, 2017).

Turkey is located between 36th and 42nd latitudes in the northern hemisphere and can benefit from the sunlight optimally. While vitamin D insufficiency or deficiency is expected to be less common in our country, studies on vitamin D insufficiency suggest that vitamin D deficiency/insufficiency is, in fact, a serious public health issue (Şenkal, Ünüvar, Seren, Canan & Durankuş, 2018). According to Turkey Nutrition and Health Survey-2019 data, 47.2% of pregnant women had vitamin D insufficiency and 24.3% had vitamin D deficiency. Since 2005, the "Prevention of vitamin D deficiency and protection of bone health" project has been implemented in an effort to prevent vitamin D deficiency and insufficiency in Turkey, and 400 IU (3 drops) of oral vitamin D supplementation has been provided daily for newborns, starting after birth and during infancy, regardless of their nutritional habits (Hatun, Özkan & Bereket, 2011; T.C. Sağlık Bakanlığı Halk Sağlığı Genel Müdürlüğü Çocuk ve Ergen Sağlığı Dairesi Başkanlığı, 2017). According to the data of the General Directorate of Public Health, Department of Child and Adolescent Health, 80% of mothers and 40% of infants have vitamin D deficiency. To date, vitamin D supplementation has been provided for nearly 15 million infants in Turkey, thanks to the vitamin D deficiency prevention and control program (T.C. Sağlık Bakanlığı Halk Sağlığı Genel Müdürlüğü Çocuk ve Ergen Sağlığı Dairesi Başkanlığı, 2017). Within the scope of the "Vitamin D for Pregnant Women Program" initiated in 2011 by the General Directorate of Maternal and Child Health and Family Planning of the Turkish Ministry of Health, it is planned to reduce maternal vitamin D deficiency by providing vitamin D to all pregnant women in 1200 IU (9 drops) once a day from the second trimester (12th week of pregnancy) until six months after delivery, for 12 months in total (T.C. Sağlık Bakanlığı Halk Sağlığı Genel Müdürlüğü,

2011). A study conducted in Turkey in 2018 suggested that the cases of nutritional rickets applying to the pediatric endocrine outpatient clinic were increasing, which may be due to disruptions in the execution of the public health project on vitamin D prophylaxis (Çamtosun, Akıncı, Çelik & Dündar, 2020).

Mothers' knowledge and awareness of the effects of vitamin D supplementation on their own and their infants' health are among the factors that positively affect the regular use of vitamin D supplementation. Public health programs can only be successful by informing mothers about the subject, increasing awareness, and encouraging favorable attitudes/behaviours (Şolt & Dolgun, 2018). From this point of view, this study aims to understand the knowledge and awareness of mothers about vitamin D and to observe their practices regarding the use of vitamin D for themselves during pregnancy and for their infants after birth.

MATERIAL and METHOD

Research Type

This descriptive study was conducted between July and November 2021 via a web-based survey in order to determine the knowledge, awareness, and practices of mothers in living Turkey about vitamin D.

Study Population

The target population of the study consists of mothers with 0-12 month old infants. The sample of the study was determined using G-power analysis. The sample size was calculated as 484 with an error rate was 0.05 and a power of 95%. Total of 818 mothers between the ages of 18 and 48 with 0-12 months old infants were included in this study.

Data Collection Tools

A questionnaire created via Google Forms was applied to the mothers. General information such as their age, educational background, employment status, and use of vitamin D during pregnancy and at the time of the study was questioned. In addition, data were collected about the baby's age, birth weight, birth length, current body weight and length, breastfeeding status, duration of breastfeeding, initiation and duration of complementary feeding, vitamin D use, initiation time, frequency, and duration of administration according to mothers' declarations. Questions about mothers' knowledge about vitamin D sources, use of vitamin D and its effects on health, and their behaviours about the use of vitamin D supplements were designed and questioned by researchers.

Ethics Consideration

The study was conducted according to the guidelines laid down in the Declaration of Helsinki. Necessary permissions for the study were obtained from the Akdeniz University Clinical Research Ethics Committee (Date: 07.07.2021 and No: KAEK 513).

Data analysis

SPSS (Statistical Package for Social Sciences) version 25.0 (Inc., Chicago, IL, USA) packaged software was used for all statistical analyses. Numeric and percentage values were used in the evaluation of qualitative data and mean and standard deviation values in that of the quantitative data.

RESULTS

Table 1 shows the general characteristics of the mothers participating in the study and their use of vitamin D during pregnancy. The majority of mothers were between the ages of 25 and 29 and had a university degree (40.2% and 52.3%, respectively). 65.6% of the mothers stated that they used vitamin D supplements during pregnancy. The mean time to start vitamin D supplementation of mothers who used vitamin D during pregnancy was 11.7 ± 6.97 weeks, and the dose of vitamin D supplementation was 5.8 ± 3.28 drops.

The general characteristics of the infants of the mothers are given in Table 2. The mean age of the infants was 6.8±3.37 months, birth weight was 3209.2 ± 421.51 g, and birth length was 49.9 ± 2.47 cm. While 5.6% of infants were never breastfed, 78.9% continued to breastfeed. Most of the infants were given vitamin D supplementation immediately or within 15 days after birth. 91.9% were still using vitamin D supplements daily and the dose of vitamin D supplementation was 3.3 ± 1.30 drops.

Table 1. General Characteristics of the Mothers

Variables	n	%
	X̄±SD	
Maternal age (years)		
15-19	8	1.0
20-24	118	14.5
25-29	329	40.2
30-34	231	28.2
≥ 35	132	16.1
Maternal age (years)	30.0 ± 5.10	
Maternal education level		
Illiterate	11	1.3
Literate	24	3.0
Primary school	45	5.5
Middle school	77	9.4
High school	188	23.0
University	428	52.3
Master graduate	45	5.5
Working status		
Currently working	282	34.5
Not working	536	65.5
Intake of vitamin D supplements during pregnancy		
Used	537	65.6
Did not use	281	34.4
The person who recommends using the vitamin D supplement during pregnancy		
Doctor	521	97.0
Pharmacist	4	0.7
Dietitian	7	1.4
Friend	4	0.7
Media	1	0.2
Intake of Vitamin D supplement during pregnancy (week)	11.7 ± 6.97	
Intake of Vitamin D supplement during pregnancy (quantity, drops)	5.8 ± 3.28	

X̄: mean; SD: Standard Deviation

Table 3 shows the attitudes and behaviours of mothers regarding vitamin D supplementation. The majority of the mothers (67.8% and 63.0%, respectively) responded as "I disagree" with the suggestions that "There is no need for vitamin D supplementation for breastfed infants" and "There is no need for vitamin D supplementation when infants are sunbathing regularly".

The knowledge of mothers about vitamin D are shown in Table 4. 97.2% of them chose "correct" for the sun is a rich source of vitamin D and 51.8% for vegetables and fruits containing high levels of vitamin D. On the other hand, 82.9% thought that the statement "if the breastfeeding mother uses vitamin D supplements, her baby does not need vitamin D supplementation" was "incorrect". The majority of the participants stated that vitamin D is necessary for the growth of the baby (95.0%), strengthens the immune system (93.5%), helps calcium absorption (90.2%), and in its deficiency, bone development stops and the incidence of diseases such as asthma and diabetes increases (75.8%) (Table 4).

Table 2. General Characteristics of the Infants

Variables	n	%
	X̄±SD	
Age (months)	6.8 ± 3.37	
Birth weight (gram)	3209.2 ± 421.51	
Birth length (cm)	49.9 ± 2.47	
Status of breastfeeding		
Never	46	5.6
Breastfed but currently not breastfeeding	127	15.5
Continuing to breastfeed	645	78.9
Starting to complementary feeding (month)	5.3 ± 1.59	
Currently, giving vitamin D supplement		
Yes	753	92.0
No	65	8.0
When to start giving vitamin D supplementation*		
Immediately after birth	215	28.6
Within 15 days after birth	288	38.3
First month	135	17.9
Second month	48	6.4
Third month	50	6.6
Sixth month	10	1.3
After the sixth month	7	0.9
Frequency of giving vitamin D supplements*		
Daily	692	91.9
Three days in the week	49	6.5
Less than three days in the week	12	1.6
Dose of vitamin D supplementation (drops)	3.3 ± 1.30	

X̄: mean; SD: Standard Deviation
*The total number of samples was calculated on mothers who gave vitamin D

Table 3. Attitudes and Behaviours of Mothers Regarding the Vitamin D Supplementation

	n	%
If a vitamin D supplement is recommended for my baby by the doctor, I will use it		
Agree	751	91.8
Undecided	52	6.4
Disagree	15	1.8
There is no need for vitamin D supplementation for breastfed infants		
Agree	98	12.0
Undecided	165	20.2
Disagree	555	67.8
There is no need for vitamin D supplementation when infants are sunbathing regularly		
Agree	88	10.7
Undecided	215	26.3
Disagree	515	63.0
I recommend my friends and people around me use vitamin D for infants		
Agree	551	67.4
Undecided	155	18.9
Disagree	112	13.7

Table 4. The Knowledge of Mothers About Vitamin D

	n	%
Sunlight is a rich source of vitamin D		
Correct	795	97.2
Incorrect	23	2.8
Vegetables and fruits contain high levels of vitamin D		
Correct	424	51.8
Incorrect	394	48.2
If the breastfeeding mother uses vitamin D supplements, the infant does not need vitamin D supplementation		
Correct	140	17.1
Incorrect	678	82.9
Vitamin D supplementation should be started in the first month of the infant		
Correct	493	60.3
Incorrect	325	39.7
Vitamin D is important for the growth of the infant		
Correct	777	95.0
Incorrect	41	5.0
Vitamin D strengthens the immune system		
Correct	765	93.5
Incorrect	53	6.5
In vitamin D deficiency, bone development stops, the incidence of diseases such as asthma and diabetes increases in the infant		
Correct	620	75.8
Incorrect	198	24.2
Vitamin D helps calcium absorption		
Correct	738	90.2
Incorrect	80	9.8

DISCUSSION

Vitamin D deficiency is a critical health issue all around the world, especially in developing countries. Turkey is one of the countries where vitamin D deficiency is common (Taşkıran & Cansu, 2016). The maternal vitamin D level required for a healthy pregnancy is vital. It is stated that its deficiency may be related to many diseases that pose a risk for maternal and infant health (Gürz, Artıran İğde & Dikici, 2015; Kabaran & Ayaz, 2013). In this respect, within a project initiated in 2011 by the General Directorate of Maternal and Child Health and Family Planning of the Turkish Ministry of Health, it is recommended that all pregnant women be given 9 drops (1200 IU) of vitamin D once a day for a total of 12 months, starting after the second trimester of pregnancy until the sixth month after delivery (T.C. Sağlık Bakanlığı Halk Sağlığı Genel Müdürlüğü, 2011). It was found that 65.6% of mothers used vitamin D supplements during pregnancy in this study. Studies conducted in Turkey suggest that the majority of mothers use vitamin D supplements during pregnancy and that high rates of use are associated with higher education levels and maternal age of the sample groups (Açıkgöz & Şahan, 2021; Aronsson et al., 2013; Dağhan, Uysal Toraman, Yelten, Taşkıran & Savan, 2019). In this study, more than half of the mothers were university (52.5%) and master (5.5%) graduates, and the mean age of the mothers was 30 years, which may be related to the high rates of vitamin D supplement use. Our study results show that pregnant women started using vitamin D supplements at 11.7 ± 6.97 weeks on average and used 5.8 ± 3.28 drops. The results of a comprehensive (n=7326) cohort study on maternal dietary supplement use suggested that 65% of mothers had adequate vitamin D use during pregnancy. However, as these mothers were at high risk, their pregnancies were followed up regularly. Dağhan et al. (2019) determined that although the vitamin D supplement use during pregnancy was common, only 22% of mothers

used vitamin D at the recommended level (1200 IU). Our study results showed that vitamin D use starts in the second trimester week on average; however, the amount is lower than the recommended dose.

Within the scope of the project initiated to prevent vitamin D deficiency in infants in Turkey, it is recommended to provide infants with 400 IU (3 drops) vitamin D supplement everyday, starting after birth and during infancy, regardless of the nutritional habits of the newborn (T.C. Sağlık Bakanlığı Halk Sağlığı Genel Müdürlüğü Çocuk ve Ergen Sağlığı Dairesi Başkanlığı, 2017). In this study, it was determined that 78.9% of the infants continued to breastfeed and the majority of the mothers (91.9%) gave their infants vitamin D supplementation as recommended (everyday), and at the required dose (3.1±1.30 drops on average). A study showed that 88% of mothers gave their infants vitamin D supplements every day, while 60.0% gave them such supplements at 400 IU/day (Şolt & Dolgun, 2018). Similarly, Dağhan et al. (2019) reported that 87.8% of the mothers gave vitamin D supplements to their infants, 65.4% used vitamin D daily, and 52.4% used vitamin D at 400 IU/day. Similarly, in other studies, it was seen that high number of mothers give their infants vitamin D after birth (Rasheed, 2017; Soliman, Wahdan, Abouelezz & Sabbour, 2020).

Vitamin D content was found <20-78 IU/L in the breast milk of mothers who received 400 IU vitamin D supplement daily. This will not protect infants who are exclusively breastfed from vitamin D deficiency (Gürz et al., 2015). In a study, 40.5% of mothers stated that the vitamin D content of breast milk was insufficient (Çataklı, Taşar & Oğulluk, 2014). Similarly, in another study, 69.6% of mothers reported that breast milk did not contain enough vitamin D for infants (Dağhan et al., 2019). Two-thirds of the mothers participating in this study answered the proposition "There is no need for vitamin D supplementation for breastfed infants" as "I disagree" and stated that although the infant was breastfed, it cannot meet their vitamin D need. On the other hand, 82.9% stated that even if the mother took vitamin D supplements while breastfeeding, the infant should also use such supplements.

The ultraviolet rays of the sun initiate the synthesis of vitamin D in the skin. The best source to meet the vitamin D requirement is sunlight. However, in some cases (low socioeconomic level, use of sunscreen, winter months, or sunbathing when the sun is at an oblique angle or behind a window, etc.), vitamin D cannot be synthesized in sufficient amounts (Hatun, Özkan & Bereket, 2011). In this study, almost all mothers think that sunlight is a rich source of vitamin D, and 63.0% believe that vitamin D supplementation is needed for their infants, even if they sunbathe them regularly. It is good news that most mothers give correct answers about vitamin D supplementation in that their infants need vitamin D supplementation even if they are breastfed or sunbathing.

Food sources containing vitamin D are limited. Although vitamin D is found in foods of animal origin such as some oily fish, cheese, beef liver, and eggs, and fortified foods (milk, yogurt, cereals, etc.), it is impossible to meet the need for vitamin D through diet alone (Benedik, 2021). One of every two mothers participating in our study states that vegetables and fruits contain high levels of vitamin D. Soliman et al. (Soliman et al., 2020) reported that 29.8% of mothers considered vegetables and fruits among the sources of vitamin D. In other studies, mothers consider vegetables such as spinach (30-49.2%) (Çataklı et al., 2014; Dağhan et al., 2019; Şolt & Dolgun, 2018) and mushrooms (18.3%) (Evgin & Teskereci, 2021) as a rich source of vitamin D. It is crucial to enhance mothers' knowledge about vitamin D sources. Therefore, support programs should focus on nutritional sources of this vitamin in addition to the sun being a rich source of vitamin D.

Vitamin D plays a critical role in bone metabolism and growth by triggering calcium homeostasis. It is well known that vitamin D deficiency leads to rickets. In recent years, it has been stated that vitamin D has a regulatory role in endocrine and immune functions, therefore it protects children against diabetes, acute respiratory diseases, asthma, and infections (Abrams, Coss-Bu & Tiosano, 2013; Makhsudov & Yilmaz, 2020). Our study shows that the majority of mothers have sufficient knowledge about the functions of vitamin D and the diseases that can occur in its deficiency. In Çataklı et al.'s study (2014), 52.3% of the mothers stated that if their children were not given vitamin D, their walking would be delayed, and 12.0% reported that their children would get sick frequently. Other studies report that most mothers think that vitamin D is critical for the development of bones. However, few mothers

know that it has a positive effect on the immune system and prevents chronic diseases such as diabetes (Kara Elitok et al., 2020; Soliman et al., 2020). It is thought that mothers' knowledge of the effects of vitamin D on their infants' health and the problems that can occur in its deficiency may increase their adherence to vitamin D supplements. A study evaluating the views of 194 parents in England about giving vitamin D supplements to their infants aged 0-2 years reported that few mothers gave vitamin D supplements to their infants regularly (everyday), and 23% of the parents did not know why vitamin D was important for health (Day, Krishnarao, Sahota & Christian, 2019).

The limitations of the study include the collection of study data by web-based questionnaire method, the sample consisting of well-educated mothers, and the likelihood that mothers misremember their vitamin D use during their pregnancy since a long time has passed since such period. Considering the low number of subjects in similar studies in the literature, this study has a high number of subjects, which is its strength.

CONCLUSION

In conclusion, it is essential to maintain projects about the importance of vitamin D supplementation and raise awareness, to protect and strengthen maternal and infant health and prevent diseases associated with vitamin D deficiency. Vitamin D supplementation programs, which are offered free of charge to mothers and children across Turkey, are effective in avoiding vitamin D deficiency and insufficiency. However, for such programs to achieve their purpose, it is necessary to raise awareness of mothers and adapt their attitudes and behaviours against receiving vitamin D supplements.

This study shows that most mothers comply with the time and amount of vitamin D use recommended for themselves and their infants in "Vitamin D Supplementation Programs", and that they are well-informed about vitamin D supplementation.

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Ethics Committe Approval

Ethics committee approval was received for this study from the Akdeniz University Clinical Research Ethics Committee (Date: 07.07.2021 and No: KAEK 513).

Author Contributions

Idea/Concept N.S.K, G.S, H.K.A, M.S.K.E; Design: N.S.K, G.S, H.K.A., M.S.K.E; Supervision/Consulting: N.S.K; Analysis and/or Interpretation: N.S.K, M.S.K.E; Literature Search: N.S.K, G.S.; Writing the Article: N.S.K, G.S, H.K.A, M.S.K.E; Critical Review: N.S.K, H.K.A, M.S.K.E

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Conflict of Interest

The authors have no conflict of interest to declare.

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