

# Evaluation of vitamin D status of pregnant women in the Western Black Sea region of Turkey

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## ABSTRACT

**Aims:** Vitamin D (Vit-D) is an essential fat-soluble vitamin for the body whose central role is to regulate phosphorus and calcium homeostasis. Various studies have shown that Vit-D deficiency in pregnant women can have adverse consequences for the mother and the fetus. Therefore, in this study, we aimed to evaluate the Vit-D level in first trimester pregnant women in the Western Black Sea region of Turkey. We then examined the relationship between these levels and age.

**Methods:** In this cross-sectional study, 214 first trimester pregnant women who applied for medical examination at the Obstetrics and Gynecology outpatient clinic between 2015 and 2018 were included. The demographic characteristics and obstetric histories of pregnant women were recorded. Maternal serum Vit-D levels were compared. Vit-D < 12 ng/mL was considered a Vit-D deficiency, and 12–20 ng/mL was considered a Vit-D insufficiency.

**Results:** The records of 214 pregnant women aged 17 to 44 were reviewed. The mean Vit-D level in pregnant women was  $21.08 \pm 16.45$  ng/mL. We divided women into four groups based on their Vit-D levels: normal, deficiency, insufficiency, and high levels. There were 30 (14.01%) pregnant women with normal Vit-D levels, 91 (42.52%) pregnant women with deficiency, and 91 (42.52%) pregnant women with insufficiency. Then, we divided women into two groups: those under 30 and those over 30. There were 139 (64.95%) women under 30 years old and 75 (35.05%) women 30 years and older. The proportion of those under 30 years old who had Vit-D deficiency and insufficiency levels was 60/91 (65.9%) and 61/91 (67.03%), respectively. Vit-D deficiency and insufficiency were found in 31/91 (34.06%) and 30/91 (32.96%) of those aged 30 and older, respectively. There was no significant relationship between Vit-D levels and age ( $p=0.381$ ).

**Conclusion:** We found that Vit-D deficiency is more common in first trimester pregnant women in the Western Black Sea region of Turkey. Pregnant women should take Vit-D supplements to reduce morbidity and its effects on fetuses and newborns.

**Keywords:** Pregnant women, vitamin D, age

## INTRODUCTION

As a steroid prohormone, Vitamin D (Vit-D) is an essential fat soluble vitamin for the body, whose central role is to regulate phosphorus and calcium homeostasis, resulting in bone mineralization.<sup>1</sup> Sunlight (90%) is the primary source of Vit-D in humans, followed by food (10%) as the next major source of Vit-D.<sup>2</sup> After the skin is exposed to the sun's ultraviolet B rays and protected against hypovitaminosis D, Vit-D2 (ergocalciferol) and Vit-D3 (cholecalciferol) are transferred to the liver and hydroxylated to 25-hydroxyvitamin D (25(OH)D).<sup>3</sup> 25(OH)D is the normal state of Vit-D circulation in the body.<sup>4</sup>

Vit-D deficiency is a common global deficiency,<sup>5</sup> and it can lead to immune system dysfunction, an increased risk of cancer, neurological dysfunction, muscle weakness, chronic pain, and exposure to various diseases, including cardiovascular disease, diabetes, and rheumatic disease.<sup>6</sup> Vit-D in pregnant

women has an important role in fetal health, embryogenesis, calcium homeostasis, and fetal skeletal development.<sup>7</sup> A balanced maternal diet before, and during pregnancy supports optimal growth and development in the fetus and offspring.<sup>8</sup> Various articles have shown that Vit-D inadequacy in pregnant women can have adverse consequences for the mother and the fetus, including small for gestational age, gestational diabetes mellitus (GDM), and preeclampsia.<sup>9</sup> A systematic review found that Vit-D has a significant relationship with increasing mean birth weight and height for up to a year and lowering the risk of small-for-gestational-age, recurrent or persistent wheezing, and offspring recurrent or persistent asthma for up to three years.<sup>10</sup> Although all of these effects have been confirmed in many studies, Vit-D deficiency has a high prevalence rate, ranging from 20% to 85% in pregnant women.<sup>2</sup> In a study conducted in two regions of Turkey, Gür et al.<sup>11</sup> reported that the prevalence of Vit-D deficiency in pregnant women ranged from 27.8 to 76.3%.

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Therefore, in this study, we aimed to evaluate the Vit-D level in pregnant women in the Western Black Sea region of Turkey. We then examined the relationship between these levels and age.

## METHODS

The study was carried out with the permission of Zonguldak Karaelmas University Research Ethics Committee (Date: 21.11.2018, Decision No: 2018/22). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

### Study Population

This retrospective study evaluated the laboratory data of 214 first trimester pregnant women (mean age $\pm$ SD: 27.68 $\pm$ 5.35 years) attending the Department of Gynecology and Obstetrics, Faculty of Medicine, Zonguldak Karaelmas University, Zonguldak, Turkey, between February 2015 and December 2018. None of the women were taking Vit-D supplements prior to blood sampling. The patient population was not taking vitamin D because pre-conception vitamin D measurement was not routinely performed and patients did not have information about the need for prophylactic vitamin D intake. After obtaining the approval of the Institutional Ethics Committee of the same hospital, we used the hospital's electronic database of pregnancy-related variables.

### Vit-D Level Analysis

The Vit-D status of the participants is determined using serum 25(OH)D analysis. After collecting venous blood samples from participants, the samples are analyzed by the liquid chromatography mass spectrometry method. The criteria for these cut points are as follows: Less than 12 ng/mL of serum 25(OH)D indicates deficiency, 12 to 20 ng/mL indicates insufficiency, and 20 to 50 ng/mL indicates adequate levels.<sup>12</sup>

### Statistical Analysis

Statistical analysis was performed using the IBM SPSS (Statistical Package for the Social Sciences) program, version 21, and the Open Epi Info software, version 3.01 (source: www.openepi.com). Results were given as mean $\pm$ standard deviation (S.D.). The X2 test was used to examine the relationship between women's ages and Vit-D levels. A p-value less than 0.05 was considered statistically significant.

## RESULTS

The records of 214 first trimester pregnant women between the ages of 17 to 44 were examined. The mean Vit-D level in pregnant women was 21.08 $\pm$ 16.45 ng/mL. The baseline findings for pregnant women are shown in **Table 1**.

The pregnant women were divided into four groups based on the accepted cut-off values for Vit-D levels: normal, deficient, insufficient, and high. There were 30 (14.01%) pregnant women with normal Vit-D levels, 91 (42.52%) pregnant women with deficiency, and 91 (42.52%) pregnant women with deficiency. The level in 2 (0.93%) was above the average level.

Then we divided the women into two groups; under 30 years old and those over 30 years old. There were 139 (64.95%) women under 30 years old and 75 (35.05%) women 30 years and older. The proportion of those under 30 years old who had Vit-D deficiency and insufficiency levels was 60/91 (65.9%) and 61/91

(67.03%), respectively. Vit-D deficiency and insufficiency were found in 31/91 (34.06%) and 30/91 (32.96%) of those aged 30 and older, respectively. There was no significant relationship between Vit-D levels and age (p=0.381). The results are shown in **Table 2**.

**Table 1. Baseline findings of pregnant women**

Ages, years mean (SD) min-max	27.68 $\pm$ 5.35 (17-44)
Vitamin D level, ng/mL, mean (SD)	21.08 $\pm$ 16.45
Education level, n (%)	
Illiterate	1 (0.5)
Primary school	43 (20.1)
Middle school	87 (40.7)
High school	42 (19.6)
University	41 (19.2)
Education level of husbands, n (%)	
Illiterate	1 (0.5)
Primary school	45 (21)
Middle school	63 (29.4)
High school	60 (28)
University	45 (21)
Pre-pregnancy doctor referral, n (%)	
Yes	38 (17.8)
No	176 (82.2)
Pregnancy planning, n (%)	
Planned	124 (57.7)
Not Planned	90 (42.3)
Smoking, n (%)	
Yes	25 (11.7)
No	189 (88.3)
Use of folic acid before pregnancy, n (%)	
Yes	27 (12.6)
No	187 (87.4)
Delivery, n (%)	
Normal delivery	129 (60.3)
Cesarean section	85 (39.7)
Gravidity, n (%)	
Primigravid	68 (31.8)
Multigravid	146 (68.2)
Parity, n (%)	
Primiparous	87 (40.7)
Multiparous	127 (59.3)
Data is presented as n (%). Values are mean $\pm$ SD or numbers and percentages.	

**Table 2. Vit-D levels in pregnant women**

	Vit-D levels				p
	Deficiency (<12 ng/mL) n:91 (%)	Insufficiency (12-20 ng/mL) n:91 (%)	Normal (20-50 ng/mL) n:30 (%)	High (>50 ng/mL) n:2 (%)	
Ages					0.381
<30 years	60 (65.93)	61 (67.03)	16 (53.34)	2 (100)	
$\geq$ 30 years	31 (34.06)	30 (32.96)	14 (46.66)	0 (0)	
Data is presented as n (%).					

## DISCUSSION

During periods of rapid cell division in the fetus, tissues and organs of the body undergo critical growth.<sup>13</sup> Any stimulus or problem in fetal planning or during the developmental period can affect the life of the fetus.<sup>14</sup> Significant changes occur in the mother's Vit-D and calcium metabolism in order to meet the fetus's need for mineralization and bone growth. During the first trimester of pregnancy, the fetus accumulates 2 to 3 mg of calcium in the skeleton daily, reaching 4 to 6 mg in the last trimester of pregnancy.<sup>15</sup> Recent studies examining the effects of Vit-D deficiency in pregnant women have shown links

between Vit-D deficiency and various problems, including increased cesarean delivery rates, insulin resistance, pre-eclampsia, GDM, and bacterial vaginosis.<sup>16</sup> A study of pregnant women also found that taking 4,000 IU/d could reduce complications such as cesarean section, preterm delivery, or maternal infections.<sup>17</sup> In our study, there was no additional increase in cesarean section rates in pregnant women who spent the first trimester and preconceptional period without vitamin D supplementation.

Vit-D deficiency in women of reproductive age continues to be one of the major problems for women worldwide. Pregnant women can develop Vit- D deficiency due to a lack of sunlight exposure, frequent use of sunscreen creams, dark skin color, closed clothing styles, lack of support for Vit- D during pregnancy, living in a polluted city environment, and disorders in Vit- D metabolism. There are many studies examining the link between low maternal Vit-D levels and many diseases in their babies.<sup>18,19</sup> Prasad et al.<sup>20</sup> assessed 88% of pregnant women for Vit- D deficiency. In Boyle et al.<sup>21</sup> study, Vit-D deficiency was detected in 53% of pregnant women, and in 4.4% severe Vit-D deficiency was detected. In our study, it is thought that there is a high rate of vitamin D insufficiency and deficiency due to the lack of pre-pregnancy doctor consultation and the geographical conditions and clothing style.

In Turkey, a program for pregnant women has been implemented since May 2011 in which women should receive 1200 IU of Vit-D daily from the twelfth week of pregnancy. This program will continue for up to six months after the baby is born. Preconceptional vitamin D prophylaxis has not yet been implemented by the Ministry of Health. Many studies in Turkey have examined Vit-D levels in pregnant women. A study on the concentration of Vit-D in pregnant women in the Middle East showed that this amount is <25 nmol/L for women in early pregnancy.<sup>22</sup> In a meta-analysis, Alpdemir et al.<sup>23</sup> evaluated that Vit-D deficiency in pregnant women was 76.3% in Turkey. A study conducted in the East Black Sea region of Turkey found that Vit-D deficiency ( $\leq 20$  ng/mL) and severe Vit-D deficiency ( $\leq 5$  ng/mL) were observed in between 94.2% and 24.2% of mothers, respectively.<sup>24</sup> Ozdemir et al.<sup>25</sup> observed that mean Vit- D levels were significantly lower in pregnant women in the Istanbul district. A study by Cakir et al.<sup>26</sup> found that summer levels of Vit-D in pregnant women were significantly higher than in winter in Turkey. In a study conducted by Ateş et al.<sup>27</sup> 45.9% of the pregnant women had severe Vit-D deficiency. These results are also consistent with our data and we think that this deficiency is obvious because there is no vitamin D level examination in the pre-pregnancy routine screening and the society has less use from the sun.

In our study, we aimed to evaluate the level of Vit-D in pregnant women in the Western Black Sea region. The average Vit-D level was found to be  $21.08 \pm 16.45$  ng/mL. We classified the 214 first trimester pregnant women who took part in the study as having deficiency, insufficiency, or normal Vit-D status. Two of the women had Vit-D levels that were higher than the accepted cut-off value. The total number of women with Vit-D deficiency or insufficiency was 182/214 (85.04%). Our results were found to be compatible with many studies in our country. We then evaluated the Vit-D levels in women under the age of thirty and over the age of thirty. We wondered if vitamin D levels were related to age and health knowledge experience. Although our results were

not statistically significant, Vit-D deficiency and insufficiency were more common in the group under 30 years of age (**Table 2**). This could be because the majority of the patients included were under the age of 30. We predict that vitamin D level is higher over the age of thirty due to aging and the related increase in health literacy and experience gained from previous pregnancies.

### Study Limitations

Our study has some limitations. First, our samples consisted only of pregnant women in the Western Black Sea region and first trimester pregnant women. These data may not reflect the whole country and all pregnancy period. Another limitation is that the Vit-D analysis was not evaluated according to months. It is a known fact that Vit-D levels are lower in the winter months. However, it is an advantage of our study that the data obtained from the Western Black Sea region can guide the pregnancy support programs in the region.

## CONCLUSION

In order for newborn babies to be healthy, it is necessary to provide optimal conditions in the mother's womb. Our findings show that Vit-D deficiency is common in pregnant women in the Western Black Sea region. It is necessary to investigate the causes of Vit-D deficiency and insufficiency in the group under the age of 30 and take precautions accordingly. Pregnant women should consider taking Vit-D supplements to reduce morbidity and the effects of pregnancy and lactation on fetuses and newborns. It can also be envisaged that the vitamin D level should be included in the routine screening program before pregnancy planning.

## ETHICAL DECLARATIONS

**Ethics Committee Approval:** The study was carried out with the permission of Zonguldak Karaelmas University Research Ethics Committee (Date: 21.11.2018, Decision No: 2018/22).

**Informed Consent:** Because the study was designed retrospectively, no written informed consent form was obtained from patients.

**Referee Evaluation Process:** Externally peer-reviewed.

**Conflict of Interest Statement:** The authors have no conflicts of interest to declare.

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