

Serum 25- hydroxy vitamin D levels in pregnant women with increase in parity in Tamilnadu population

C Santhana Lakshmi¹, Kumar A.N.², Valvekar U.R.³

¹Dr. Collapancheri Santhana Lakshmi, Associate Professor in Obstetrics and Gynaecology of Karpaga Vinayaga Institute of Medical Sciences, Madhurantgam, Tamilnadu, ²Dr. Amar Nagesh Kumar, Assistant Professor, Department of Biochemistry, Karpaga Vinayaga Institute of Medical Sciences, Madhurantgam, Tamilnadu, ³Dr. Umakant Ramchandra Valvekar, Associate Professor, Department of Obstetrics and Gynecology, B K L. Walawalkar Medical College, Saward, Ratnagari, Maharashtra, India.

Address for Correspondence: Dr. Umakant Ramchandra Valvekar, Associate Professor, Department of Obstetrics and Gynecology, B K L. Walawalkar Medical College, Saward, Ratnagari, Maharashtra, India. Email: urvalvekar@gmail.com

Abstract

Introduction: Prevalence of vitamin D deficiency among pregnant women is a preventable and treatable health problem. Studies on vitamin D deficiency in pregnant women reported the adverse effects on maternal health and fetal wellbeing. Utmost attention is required in prevention of vitamin D deficiency among pregnant women. Aim of the present study is to know the status of vitamin D levels in pregnant women of different gravida and to compare biochemical parameters in pregnant women with increase in parity. **Materials and Methods:** This is a prospective and observational study. Estimation of serum vitamin D levels was studied in 189 pregnant women. Pregnant females were randomly selected, who attended the antenatal clinic from April 2016 to November 2017. Women with serum 25-hydroxy vitamin D level lower than 10ng/ml were diagnosed as vitamin D deficient. **Results:** In the present study, the mean serum 25-OH vitamin D of all pregnant women is 16.7 ± 10.5 ng/ml. Primigravida women had higher 25-OH vitamin D (15.4 ± 10.7 ng/ml) than the second and the third gravida women (10.5 ± 8.9 ng/ml and 9.7 ± 7.6 ng/ml, both $P < 0.001$). The 77% of primigravida women and 55% of second gravida women had serum 25-OH vitamin D concentrations below 10 ng/ml. Strong association was observed between low vitamin D levels and increase in parity. **Conclusion:** The high prevalence of vitamin D deficiency in pregnancy calls for unanimous approach to tackle this grave situation by implementing a national strategy for screening, prevention, and treatment of this deficiency.

Keywords: Vitamin D deficiency, Prevalence, Primigravida, Multigravida, 25-OH vitamin D, Antenatal women, risk factors.

Introduction

Vitamin D is a potent steroid hormone required for calcium metabolism, bone growth and mineralisation. Around 90% of body vitamin D requirement comes from the action of UV light on skin. The average diet contains only about 10% of our requirements - insufficient to prevent deficiency. Vitamin D deficiency is the most frequent health problem in many populations across the world. Nowadays, prevalence of vitamin D deficiency is seen in all age groups [1]. If severe enough, it can preclude normal bone mineralization leading to clinical manifestations such as Rickets or Osteomalacia [2].

Vitamin D is a fat-soluble vitamin synthesized from cholesterol. Exposure to sunlight causes production of

Cholecalciferol or Ergocalciferol from 7-dehydro-cholesterol. For the activation, vitamin D is hydroxylated to 25-hydroxy vitamin D in the liver, and in the kidney as 25(OH)D is further hydroxylated to form 1,25 dihydroxy-vitamin D [$1,25(\text{OH})_2\text{D}$] [3-5]. The main action of vitamin D is to maintain the physiological levels of serum calcium and phosphorus. The importance of vitamin D for skeletal development, modulation of calcium homeostasis, bone formation, and resorption has been well described in literature [4-6]. It has also other vital roles in regulation of immune function, cell growth, and inflammation in the body [4-7].

Recent studies on vitamin D deficiency in pregnant women reported the adverse effects on maternal health and fetal wellbeing. These studies further reported that vitamin D deficiency had association with adverse outcomes in pregnancy such as pregnancy loss,

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gestational hypertension, preeclampsia, gestational diabetes, higher rates of caesarean section and preterm delivery etc [5,7,8]. Vitamin D deficiency during antenatal period is the origin for future health perils in infants such as low birth weight, neonatal rickets, a risk of neonatal hypocalcaemia, asthma and type 1 diabetes. These studies emphasize the importance of adequate serum levels of vitamin D in antenatal women [8-10]. If vitamin D deficiency is neglected in antenatal period, damage done by it may be reflected in children at a later stage. Therefore, utmost attention is required in prevention of vitamin D deficiency among pregnant women.

Determination of vitamin D status in the first trimester provides an opportunity for early detection and prophylaxis of vitamin D deficiency that may help to reduce adverse pregnancy outcomes. Aim of the present study is to know the status of vitamin D levels in pregnant women of different parity and to compare other related biochemical parameters in pregnant women with increase in parity. There is limited number of studies done about the vitamin D status in pregnant women from India, especially from south India. Hence the present project was planned.

Materials and Methods

Study Design and Setting: This is an observational study and consists of 189 pregnant subjects. The study was carried out at department of Obstetrics and Gynecology, during the period of April 2016 to November 2017. The study population consists of 189 pregnant women who attended to the antenatal clinic for their routine checkup. The study was approved by the Institutional Ethics Committee. A written informed consent was obtained from all participants after explaining the purpose of the study.

Inclusion criteria: Pregnant women ages between 19 – 28 years with singleton pregnancies and a live fetus with gestational age 28 weeks were included in the study.

Exclusion criteria: Pregnant women with known history of rheumatoid arthritis, thyroid, adrenal, or parathyroid diseases, hepatic or renal failure, bone disorder, type 1 diabetes mellitus, and multiple pregnancies were excluded from the study.

Results

A total of 189 pregnant women with gestational age of 28 weeks and more were recruited for the study. The mean age of the pregnant women was 23.7 ± 4.5 years. In total, 64% (n =121) of them were in the age group of 19–24 years. About 30% of the total pregnant women were of second gravida and 16% were of 3rd gravida. The mean serum 25-OH vitamin D level of the pregnant women level of primigravida women was 15.4 ± 10.7 ng/ml, the second gravida women had serum 25-OH vitamin D concentration of 10.5 ± 8.9 ng/ml while that of third gravida women was 9.7 ± 7.6 ng/ml (Table 1). It is evident, from table 1 that there is a strong inverse relation between vitamin D and gravida in this population. Further serum calcium

Sampling collection and methods: Blood was collected by antecubital vein puncture from the subjects and immediately transferred into a clot activator tube. Blood samples were centrifuged at 3500 rpm for 10 min at room temperature for separating the serum. Serum samples were analyzed for 25-OH vitamin D levels, calcium and phosphorous. Serum samples with vitamin D levels less than 10 ng/ml were considered as deficient of vitamin D [8-10].

Serum calcium was estimated by Arsenazo III method and serum phosphorous was estimated by phosphomolybdate method, using the commercial kits available in the market for semi-automated biochemistry analyzer. Vitamin D status was assessed by measuring serum concentration of 25-OH vitamin D which has a reasonably long half-life in the circulation. Measurement of serum 25-OH vitamin D was made by ELFA using fully automated minividas (Biomerieux) hormone analyzer.

Based on the results obtained, vitamin D status was categorized into three groups. Group I, as serum 25(OH)D levels <10 ng/ml, group II between 10–29 ng/ml, and group III 30-100 ng/ml, indicating vitamin D deficiency, vitamin D insufficiency and vitamin D sufficiency respectively [4 -6,8-10]. The gestational age at delivery was determined by menstrual dating, while the ultrasound estimates of gestational age were used in women that had missed or uncertain dates.

Statistical analysis: Data was presented as mean \pm standard deviation (SD) and as percentages for categorical variables. Continuous variables were compared between groups by independent samples t tests for normally distributed variables. The data collected were subjected to statistical tests of mean and standard deviation utilizing the SPSS-16.0 version. To compare the mean serum 25 – OH vitamin D levels among pregnant women of different parity, one-way analysis of variance (ANOVA) was utilized.

The multiple comparison test was carried out to identify significant difference in the mean vitamin D levels among pregnant women with gravida 1, gravida 2 and gravida 3. A p value <0.05 was considered as statistically significant.

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and phosphorous levels were also compared in primi, second and third gravida women. Serum calcium levels were decreased with increase in parity while phosphorous levels were increased with increase in parity (Table 1). Further logistic regression analysis revealed that women with second or third gravida were at a 1.69 times higher risk of vitamin D deficiency ($P < 0.001$) compared to the primigravida women (odds ratio 1.71; 95% confidence interval: 1.6–2.2, $P < 0.001$).

Table-1: Serum vitamin D, calcium and phosphorous levels of pregnant women according to parity.

Parity	Number of Cases (n=189)	25- OH Vitamin D conc. (ng/ml)	Calcium	Phosphorous
Primigravida	102 (54%)	15.4 ± 10.7	8.3 ± 1.2	3.9 ± 0.5
2 nd Gravida	57 (30%)	10.5 ± 8.9	7.9 ± 0.8	4.4 ± 0.7
3 rd Gravida	30 (16%)	9.7 ± 7.6	7.5 ± 0.6	5.3 ± 0.9

Table-2: Distribution of pregnant women according to serum vitamin D levels.

Vitamin D status	n (%) 189	Mean ± SD (ng/ml)
Vitamin D deficiency (<10ng/ml)	89 (47%)	9.0 ± 3.4
Vitamin D insufficiency (10 – 29ng/ml)	74 (39%)	13.5 ± 5.7
Vitamin D sufficiency (30-100ng/ml)	26 (14%)	21.9 ± 9.8
Number of cases	189	16.7 ± 10.5

Table-3: Mean values of biochemical parameters in pregnant women according to vitamin D status

	Deficient	Insufficient	Sufficient
Number of women (n=189)	89	74	26
25 – OH vitamin D (ng/ml)	9.0 ± 3.4*	13.5 ± 5.7*	21.9 ± 9.8*
Calcium (mg/dl)	7.7 ± 0.5*	8.2 ± 0.4*	8.9 ± 0.6*
Phosphorous (mg/dl)	5.8 ± 0.7*	4.9 ± 0.3*	4.2 ± 0.7*

*p value <0.0001 highly significant (odds ratio 1.71; 95% confidence interval: 1.6–2.2, $P < 0.001$).

The mean serum 25 – OH vitamin D level of all the pregnant women was 16.7 ± 10.5 ng/ml. About 47% (n = 89) of the pregnant women had serum 25 – OH vitamin D levels < 10 ng/ml (Table 2). There was a significant decrease ($P < 0.01$) in serum vitamin D level with the increase in parity. Pregnant women with 2nd and 3rd gravida had a significantly lower serum vitamin D level compared to primigravida women (Table 1).

Table 3 shows the mean values of serum 25 – OH vitamin D, calcium and phosphorous levels according to the vitamin D status in pregnant women. It was found that serum calcium level was also found low, while phosphorous level was high in vitamin D deficient pregnant women when compared to vitamin D sufficient pregnant women. This difference is statistically significant ($p < 0.0001$).

Discussion

This study investigated the relationship between serum vitamin D status and increase in parity. Since circulating 25-OH vitamin D represents the best indicator of vitamin D status of an individual [10]. Therefore, in this study, serum 25-OH vitamin D level was opted to determine vitamin D status. In the present study, it was found that 25-OH serum vitamin D levels in primigravida women were significantly higher than that of second and third gravida women. The increase in circulating 25-OH vitamin D levels during the first-trimester pregnancy is consistent with a prior report that reported that 1,25 (OH)₂

vitamin D levels are more than 2-fold those of non-pregnant adult by 12 weeks of gestation [11]. Although the 1,25(OH)₂ D was tested in this study. However, during pregnancy, 25-OH vitamin D diffuses across the placental barrier, whereas 1,25(OH)₂ D does not readily cross placenta [12, 13].

The locally synthesizing 1, 25-OH vitamin D in maternal decidual cells depends on available 25-OH vitamin D in circulation as a substrate for 1 α -hydroxylase [14]. It demonstrated that adequate 25-OH vitamin D

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concentrations were essential during pregnancy. Vitamin D deficiency in the mother could be vertically transmitted to the fetus [12 – 15].

In the present study high prevalence of vitamin D deficiency (47%) and vitamin d insufficiency (39%) was found in pregnant women. This could be because of poor or inadequate intake dietary intake and higher skin pigmentation. The present study results are comparable to the study conducted by Sharma et al., [16] who found that the prevalence of vitamin D deficiency in pregnant females in North Indian population was 93%.

The prevalence of vitamin D deficiency was comparatively less in studies conducted by Ravinder et al., [17] Bartoszewicz et al., [18] and Vandevijvere et al., [19]. In this study, vitamin D deficiency and insufficiency were found to be higher in multigravida as compared to primigravida. This could be due to repeated cycles of pregnancy and lactation in multigravida. In a study reported by Choi et al, [20] primigravida women had severe vitamin D deficiency in about 75.4% cases, and in multigravida, vitamin D deficiency was reported in 80.8% cases.

The screening maternal vitamin D status, vitamin D supplementation during pregnancy and the effects of the deficiency on offspring are controversial. The importance of adequate vitamin D stores during pregnancy and the risk of vitamin D deficiency has been emphasized by multiple authority bodies in western countries including, UK Department of Health and Canadian Paediatric Society. However, the American College of Obstetrics and Gynaecology has not supported screening all pregnant women for vitamin D deficiency [21 -22].

Conclusion

The findings of the present study indicate that there is a high prevalence of vitamin D deficiency among pregnant women of South Indian population. To tackle this grave situation, there is a need for conducting multicentric studies as a national program for screening, prevention, and treatment of this vitamin D deficiency among pregnant women of Indian population. Programs need to be developed to increase the awareness of this problem among people and to provide adequate doses of vitamin D supplements to pregnant women.

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