Original Article

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Serum Vitamin D Level in Nulliparous and Pregnant Women of South India Tamilnadu Population: A Comparative Study

Collapancheri Santhana Lakshmi*, Umakant Ramchandra Valvekar, Amar Nagesh Kumar*****

Abstract

Background: Prevalence of vitamin D deficiency among pregnant women is commonly seen in many populations across the world. Vitamin D deficiency is a preventable and treatable health problem. Recent studies on vitamin D deficiency in pregnant women reported the adverse effects on maternal health and fetal wellbeing. Recent research on vitamin D deficiency on maternal health outcomes during pregnancy reported associated risk factors such as anemia, gestational hypertension, preeclampsia, gestational diabetes mellitus and caesarean section. Therefore, utmost attention is required in prevention of vitamin D deficiency among pregnant women. *Objectives*: Aim of the present study is to identify the prevalence of vitamin D deficiency and other related risk factors associated with it. Also to determine screening for vitamin D deficiency amongst our population is warranted. *Setting and Study Design*: This is a comparative prospective study. Conducted during the period of December 2016 to October 2017. *Materials and Methods*: Comparison of serum vitamin D levels was studied in 75 nulliparous women and 100 pregnant women. Pregnant females were randomly selected who attended the antenatal clinic. Women with serum 25-hydroxy vitamin D level lower than 10ng/ml were diagnosed as vitamin D deficient. SPSS version 16.0 is used for statistical analysis. *Results:* In the present study, the mean serum 25(OH) vitamin D concentration in nulliparous women was 21.4±8.9 ng/ml and that of parous women is 12.5±10.8 ng/ml at 15-30 weeks of gestation. The difference in vitamin D levels between the two groups is statistically significant. *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; 25 – OH Vitamin D; Antenatal Women; Nulliparous Women; Maternal Risk Factors.

*Associate Professor, Department of Obstetrics and Gynecology
***Assistant Professor, Department of Biochemistry, Karpaga Vinayaga Institute of Medical Sciences, Madhurantagam, Tamil Nadu 603308, India.
**Associate Professor, Department of Obstetrics and Gynecology, BKL Walawalkar Rural Medical College, Saward, Ratnagari, Maharashtra 415606, India.

Corresponding Author:
Collapancheri Santhana Lakshmi,
Associate Professor, Department of Obstetrics and Gynecology, Karpaga Vinayaga Institute of Medical Sciences, Madhurantagam, Tamil Nadu 603308, India.
Email: santhanalakshmi811@gmail.com

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Introduction

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-dehydrocholesterol. For the activation, vitamin D is hydroxylated to 25-hydroxyvitamin D [25(OH)D] in the liver, and in the kidney as 25(OH)D is further hydroxylated to 1,25 dihydroxyvitamin D [$1,25(OH)_2D$] [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 anemia, gestational hypertension, preeclampsia, gestational diabetes, higher rates of caesarean section and preterm delivery [5,7]. 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. If vitamin D deficiency is neglected in antenatal period, damage done by it may be reflected in children after many years. 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. The aim of the present study is to identify the prevalence of vitamin D deficiency and other related risk factors associated with it. Also to know the screening for vitamin D deficiency amongst our population is warranted.

Materials and Methods

This is a prospective comparative study and consists of 175 female subjects. The study was carried out at department of Obstetrics and Gynecology, during the period of December 2016 to October 2017. The study population consists of 100 pregnant women who attended to the antenatal clinic for their routine checkup at 15-30 weeks of gestation, and 75 nulliparous women without any known infertility problem. 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. The estimated date of delivery was determined based on the combination of last menstrual period and ultrasound findings. BMI was calculated as weight (Kg)/height squared (m^2) in the study. Pregnant women ages between 19 – 33 years with singleton pregnancies and a live fetus, gestational age between 15 and 30 weeks were included in the study. Pregnant women with known history of rheumatoid arthritis, thyroid, adrenal, or parathyroid diseases, hepatic or renal failure, bone disorder, type 1 diabetes mellitus, malabsorption, and multiple pregnancies were excluded from the study.

The study was approved by the Institutional Ethics Committee, a written informed consent was obtained from all participants after explaining about the purpose of the study. They were asked to complete a questionnaire that included the characteristics of their pregnancy and information about the factors associated with vitamin D status. Random blood samples were collected and analyzed for 25(OH)D levels.

Gestational hypertension was defined as a blood pressure of 140/90 mmHg or higher that develops after 20 weeks of gestation. Pre eclampsia was defined as gestational hypertension with proteinuria. The diagnosis of gestational diabetes mellitus (GDM) was performed using a DIPSI in which 2 hour serum glucose was measured after a 75g oral glucose load. If the plasma glucose level was ≥ 140 mg/dl it is considered as GDM.

Vitamin D status can be assessed by measuring serum concentration of 25(OH)D which has a reasonably long half-life in the circulation. Measurement of serum 25(OH)D was made by ELFA using fully automated minividas (Biomeriux, Germany) hormone analyzer. Based on the results obtained vitamin D status was categorized into 3 groups as serum 25(OH)D levels <10 ng/ml, between 10–29 ng/ml, and 30 - 100 ng/ml, indicating vitamin D deficiency, vitamin D insufficiency and vitamin D sufficiency respectively [4,9].

Data was presented as mean ± standard deviation (SD) and as percentages for categorical variables. The presence of a normal distribution for each variable was tested by the Shapiro Wilks test. Continuous variables were compared between groups by independent samples t tests for normally distributed variables. The data was analyzed using SPSS package 16.0 (SPSS Inc., Chicago, IL, USA). Multiple variant analysis was conducted to show the association between serum 25(OH)D level, Body Mass Index (BMI). A p value <0.05 was considered as statistically significant.

Results

Study includes 175 women participants, consisting of two groups, Nulliparous and Parous women. Out of 175 participants, 75 are nulliparous women and 100 ages matched pregnant women were recruited for the study. Characteristics of the study population

are shown in Table 1. Comparison of serum 25 – OH vitamin D levels in nulliparous women and pregnant women and the association of risk factors with vitamin D deficiency in pregnant women were also studied in the present study. There is no statistical significance with respect to age of the women in both the groups. Mean age of the nulliparous women was 24.3 ± 7.5 years and that of parous women was 25.5 ± 2.4 years (P value 0.13). Mean BMI of nulliparous women is 24.5 ± 8.7 and that of pregnant women is 26.5 ± 5.7. There is no significant difference in BMI in both the groups (Table 1).

Blood pressure and serum vitamin D levels and other risk factors were measured in all pregnant women with gestational age ranging from 11–25 weeks. Mean systolic blood pressure was 110±9.5 mm of Hg and that of pregnant women is 117±11.4 mm of Hg. Mean diastolic blood pressure was 69 ± 9.1 mm of Hg and that of pregnant women was 73 ± 8.4 mm of Hg. Serum 25 – OH vitamin D levels in nulliparous women 21.4±8.9ng/ml and that of pregnant women was 12.5±10.8ng/ml, the difference is statistically highly significant.

In this study, out of 100 cases, 51 cases (51%) were diagnosed as vitamin D deficient, 30 cases (30%) were diagnosed as vitamin D insufficient, and remaining 19 cases (19%) were found to have sufficient vitamin D levels (Table 2). Thus, the overall prevalence of vitamin D deficiency and insufficiency in pregnant females in this study was 81%. Vitamin D deficiency and insufficiency were prevalent in almost all age groups studied. But vitamin D deficiency is more prevalent among pregnant women compared to nulliparous women. And it is statistically highly significant. In this study we also compared the groups for maternal age, BMI values, education level, systolic and diastolic blood pressures at the baseline study visit (Table 1).

Out of 49 primigravida, 21 cases (42%) were vitamin D deficient, and out of 51 multigravida, 30 cases (58%) had vitamin D deficiency. So, there was a high distribution of vitamin D deficiency in both primi and multigravida. From the Table 3 it is evident that there is a strong association between increasing body mass index (BMI) and vitamin D deficiency and insufficiency. All obese females whose BMI >30 were found to have 100% vitamin D deficiency. In this study of 100 pregnant women, 21 cases had anemia, in which 18 cases (85.7%) had vitamin D deficiency, and 3 cases (14.3%) had vitamin D insufficiency. Total 3 cases of gestational hypertension were diagnosed, of which 2 cases (66.7%) had vitamin D deficiency and 1 case (33.3%) had vitamin D insufficiency. 5 patients were diagnosed as pre-eclampsia, of which 4 pregnant women were found to have vitamin D deficiency and 1 patient was found to had vitamin D insufficiency. Gestational diabeted mellitus (GDM) was found in 6 cases, of which all the 6 (100%) pregnant women had vitamin D deficiency (Table 4).

Table 1: Comparison of clinical parameters among Nulliparous women and Parous women

Parameter	Nulliparous (N=75) (%)	Parous/Parity (N=100) (%)	P value
Age (Years)	24.3 ± 7.5	25.5 ± 2.4	0.13
BMI (Kg/m²)	24.5 ± 8.7	26.5 ± 5.7	0.07
Mean systolic BP (mm of Hg)	110 ± 9.5	117 ± 11.4	0.0001*
Mean diastolic BP (mm of Hg)	69 ± 9.1	73 ± 8.4	0.003*
Vitamin D (ng/ml)	21.4 ± 8.9	12.5 ± 10.8	0.0001*

*p value is statistically significant

Table 2: Prevalence rate of vitamin D deficiency in pregnant women

Vitamin D status	Nulliparous women 75(%)	Parous women 100 (%)
Vitamin D sufficiency (30-100ng/ml)	26 (34.6%)	19 (19%)
Vitamin D insufficiency (10 - 29ng/ml)	30 (40%)	30 (30%)
Vitamin D deficiency (<10ng/ml)	19 (25.4%)	51 (51%)
Number of cases	75	100

Table 3: Status of Vitamin D deficiency according to BMI in pregnant women

BMI	Cases	Deficient	Insufficient	Sufficient
< 20	8	3	5	-
20.1 – 24.9	45	18	17	10
25.0 – 29.9	40	25	6	9
>30	7	5	2	-
Total	100	51	30	19

Table 4: Vitamin D status with other risk factors in pregnant women

Risk factor	Cases (%)	Vitamin D Deficient	Vitamin D Insufficient
Pre eclampsia	5	4	1
Gestational hypertension	3	2	1
Gestational diabetes	6	6	-
Anemia	21	18	3
Number of cases	35	30	5

Discussion

In the present study high prevalence of vitamin D deficiency (51%) and insufficiency (30%) was found among 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 [20], 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 [11], Bartoszewicz et al [12], and Vandevijvere et al [13], 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 [14], primigravida women had severe vitamin D deficiency in about 75.4% cases, and in multigravida, vitamin D deficiency was reported in 80.8% cases.

As expected, there was a positive correlation found between vitamin D deficiency and increase in BMI. This can be possibly due to the sequestration of vitamin D in adipose tissue and its lower dietary intake. Bodnar LM, Simhan HN et al [15] in 2007, in their study, they have concluded that 61% of women who were obese (BMI >30) before pregnancy were found to be vitamin D deficient as compared to 36% of women with pre-pregnancy BMI of <25.

Bodnar LM and Catov JM et al [8], reported a five-fold increased risk of pre-eclampsia in women with 25(OH)D <15ng/mL at <22 weeks of pregnancy. In a study done by Shand et al [9], evaluated vitamin D status in pregnant women who are at high risk of pre-eclampsia and found no association between vitamin D deficiency and risk of pre-eclampsia. Wei et al [16], reported that 25(OH)D < 20 ng/mL at late mid-trimester (24-26 weeks of gestation) but not early pregnancy (12-18 weeks of gestation) was associated with increased risk of pre-eclampsia. In contrast to our study, Parlea et al [17], noted a twofold increased risk of GDM in women with 25(OH)D <29.4 at 15-18 weeks of gestation. A recent study done in pregnant women in their first trimester reported low serum vitamin D levels (<12 ng/ml) was associated with increased risk of low birth weight [18]. A study including 152 nulliparous women in Turkey showed that 44.6% of pregnant women have vitamin D deficiency and maternal vitamin D deficiency is associated with an increased risk of small for gestational age [19]. The variation in results between studies may be due to differences in cut-off points used, population characteristics, sample size and methods to measure 25(OH)D.

Conclusion

Vitamin D deficiency and insufficiency were prevalent in both the groups studied. But vitamin D deficiency is more prevalent among pregnant women compared to nulliparous women. As calcium demand increases during pregnancy, vitamin D status becomes crucial for optimal maternal and fetal outcome. 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. 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 females to avoid maternal and fetal complications which may occur due to vitamin D deficiency. Low 25(OH)D levels may be associated with increased risk of adverse pregnancy outcomes. Yet, further research is required with large number of sample size to determine the levels of vitamin D in early pregnancy and the impact of low 25(OH)D concentrations on risk factors and adverse pregnancy outcome.

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