Vitamin D deficiency and its associating factors: A cross-sectional analytic study

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Abstract— *Vitamin D deficiency is widely prevalent throughout the world. Pregnant women, neonates and infants form most vulnerable groups for vitamin D deficiency. Hypovitaminosis vitamin D in pregnancy has been reported to cause various fetomaternal effect. So this study was conducted to find out proportion of vitamin D deficiency among pregnant women and to assess the effects and its associating factors. For this purpose 120 Pregnant women on their first visit to hospital irrespective of gestational age were taken. Apart from routine obstetrical investigation, serum vitamin D (total) level was estimated. All results were recorded and analyzed statically. It was observed that 84.1% were found to be vitamin D deficient. Mean age of vitamin D deficient group and non deficient group were 28.31±3.86 and 26.37±2.83 years respectively. Religion and parity of women was not found to be associated with vitamin D deficiency whereas age, type of diet and use of sunscreen was found to be associated. Vitamin D deficiency was found significantly more in elderly, vegetarians and users of sunscreen than their counterparts. Regarding maternal and neonatal outcomes, development of preeclampsia, LSCS as mode of delivery, delivery of pre term and LBW babies were having controversial findings. So it suggest much more researches in this regards.*

Keywords: Feto-Maternal Outcome, Hypovitaminosis D, Maternal Blood Vitamin D, Vitamin D Status in Pregnancy.

I. INTRODUCTION

Vitamin D, is a lipid-soluble vitamin and prohormone which is known to play an important role in bone metabolism through regulation of calcium and phosphate homoeostasis[1]. Vitamin D traditionally known as "Anti- ricketic or sunshine vitamin". It is a unique nutrient because it can be synthesized endogenously (skin) and it function as a hormone[2]

Vitamin D deficiency is prevalent worldwide and its unrecognized epidemic is common in all age groups ranging from 46-90%[3-6.]Various Indian studies have reported vitamin D deficiency in all age groups and involving both sexes. It's prevalence ranging between 40-93%.[7,8,] During pregnancy high prevalence of vitamin D deficiency has been reported from various region of world, ranging from 45 - 100%.[4-6] and in Indian population it has been reported to the tune of 42-93%.[9,10]

Studies regarding prevalence of vitamin D deficiency in antenatal women in India are mainly from Northern and southern India[9,10] and very a few from central Part of India, thus this study has been undertaken in order to know the burden of vitamin D deficiency in antenatal women in ANCs of JLN Hospital and Research Centre Bhilai Steel Plant, Bhilai, Chhattisgarh, India.

II. METHODOLOGY

This hospital based observational study was conducted in the Department of Obstetrics and Gynaecology in collaboration with the department of nuclear medicine of Jawahar Lal Nehru Hospital and Research Centre, Bhilai, Chhattisgarh, India, from October 2015 to November 2016. Proper approval from the hospital ethical committee was taken for the study.

Antenatal women on their first visit to hospital, irrespective of period of gestational age were included in this study. ANCs on vitamin D supplementation in early pregnancy before attending this hospital and who had any disease like hypertension & diabetes mellitus were excluded from the study. ANCs who were not willing to participate in this study also excluded from study. Finally 120 ANCs were selected for this study.

Sample size was calculated 104 subjects at 95% confidence limit and 12% relative allowable error assuming as follows vitamin D deficiency in pregnant women 72.1%. So for this study 120 ANCs were included. study.

After taking written informed consent and general information, routine obstetrical investigation, serum vitamin D level estimation was done by fully automated Chemiluminescent immunoassay and Radioimmunoassay (RIA) of each of the subject. They were divide into following category as per Vitamin D status:-

Reference range:- recently revised institute of medicine's (IOM) criteria 2010 [11]

S. No.	Vitamin D Status	Vitamin D3 Level (ng/ml)
1	**Vitamin D sufficiency**	**≥30**
2	**Vitamin D insufficiency**	**21-29**
3	**Vitamin D deficiency**	**20 or <20**

For the study purpose all antenatal women will be divided in to two groups:

1. Group 1: Those who were having Vitamin D 30 and more than 30 i.e. **Vitamin D sufficient group**
2. Group 2: Those who were having Vitamin D less than 30 i.e. **Vitamin D deficient group**

Statistical data analysis: Data thus collected were entered in Microsoft Excel Sheet on same day so as to minimize data entry bias if any. Analyses were done by using SPSS version 24 (trial version). The results were presented as percentages and association was assessed by Chi-square test. P-value of less than 0.05 was taken as significant.

III. RESULTS

Majority 49(40.83%) of ANCs first visit was in 28-36 weeks of gestational age. Minimum 6(5%) patient's first visit was in first trimester (<12 week). Out of these 120 ANCs, 101 cases (84.1%) were found vitamin D deficient. (Figure 1)

The mean age of vitamin D deficient and sufficient group was found 28.31±3.86 and 26.37±2.83 years respectively. This difference in mean age was with significant difference ($p<0.05$). (Table 1)

Maximum number (114 (95%) of ANCs were Hindu. Out of 101 vitamin D deficient ANCs, 97 (96.03%) were Hindus whereas out of 19 vitamin D sufficient ANCs only 17 (89.47%) were Hindus. On

further analysis religion of ANC was not found to be associated with vitamin D status (p>0.05). (Table 1)

Maximum number 81(67.5%) ANCs were vegetarian. Out of 101 vitamin D deficient ANCs, 75 (74.26%) were vegetarian whereas out of 19 vitamin D sufficient ANCs only 6 (31.58%) were vegetarians. This distribution of ANCs with vitamin D deficiency as per the type of diet was found statistically significant (p <0.001) i.e. proportion of vitamin D deficient women were found significantly more (p<0.001) in vegetarians. (Table 1)

Majority of ANCs, 84(70%) were belonged to primipara only 36 (30%) were multipara. Out of 101 vitamin D deficient ANCs, 71 (70.3%) were primipara whereas out of 19 vitamin D sufficient ANCs only 13 (68.42%) were primipara. On further analysis parity of ANC was not found to be associated with vitamin D status (p>0.05). (Table 1)

Table 1
Comparison of Characteristics of Vitamin D Deficient and Vitamin D Sufficient Study subjects

Characteristics		Vitamin D Deficient (N=101)	Vitamin D Sufficient (N=19)	Significance
Age	**(Mean ± SD) Years**	28.31±3.86	26.37±2.83	**P=0.039 S**
Religion	**Hindu**	97	17	**P=0.528 NS**
	Muslim	**4**	**2**	
Type of Diet	**Vegetarian**	**75**	**6**	**P<0.001 S**
	Non vegetarian	**26**	**13**	
Parity	**Primipara**	**71**	**13**	**P=0.913 NS**
	Multipara	**30**	**6**	

Among these 120 ANCs, 69 (57.75%) were using sunscreen lotion/cream. Out of 101 vitamin D deficient ANCs, 65 (64.36%) were using sunscreen whereas out of 19 vitamin D sufficient ANCs only 4 (21.05%) were using sunscreen. On further analysis, Vitamin D deficiency was found significantly more in ANCs using sunscreen lotions (p< 0.05). (Figure 2)

Figure 1
Distribution of ANCs as per Vitamin D Status

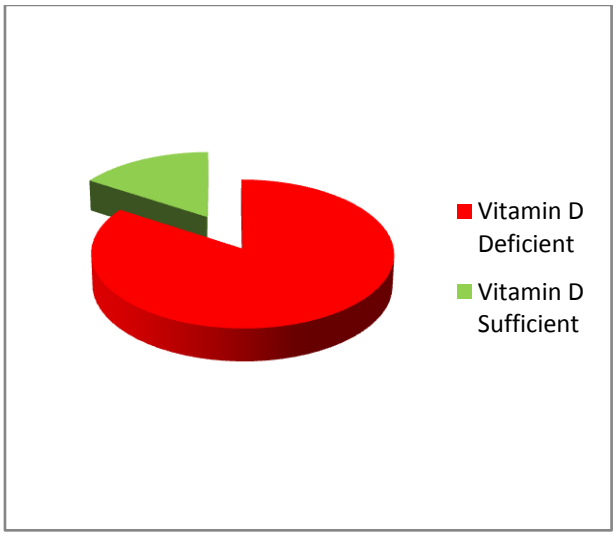
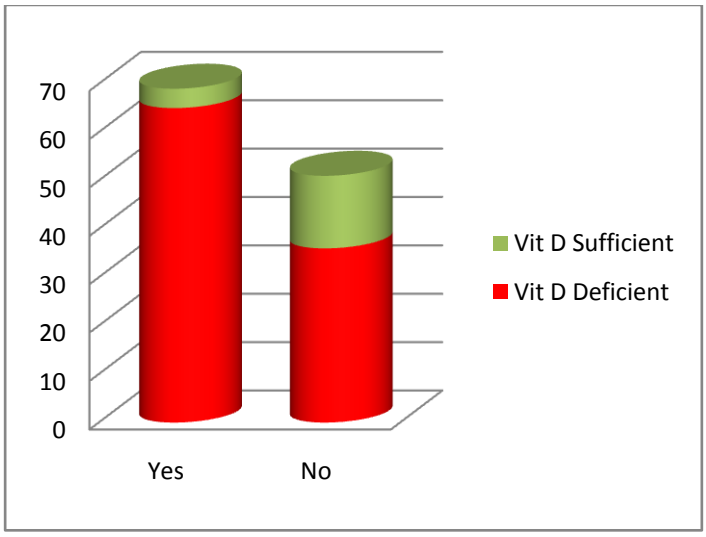


Figure 2
Association of Vitamin D Status with Sunscreen lotion



Out of 120 ANCs, 33(27.5%) ANCs developed preeclampsia and rest 87 (72.5%) ANCs were normotensive. Out of 101 vitamin D deficient ANCs, 26 (25.74%) were with preeclampsia whereas out of 19 vitamin D sufficient ANCs only 7 (36.84%) were with preeclampsia. This distribution of preeclampsics in vitamin D deficient and vitamin d sufficient group was without any significant difference. (p>0.05). (Table 2)

In this study of 120 ANCs, only 2 (1.6%) ANCs developed GDM out of which one was vitamin D sufficient and another one was vitamin D deficient as number of cases who developed GDM was only 2 and majority (98.01%) of ANCs were euglycemics. This distribution of ANCs with GDM in vitamin D deficient and vitamin D sufficient group was without any significant difference. (p>0.05). (Table 2)

Out of 120 ANCs, 30 (29.7%) ANCs delivered by LSCS. Out of 101 vitamin D deficient ANCs, 23 (22.77%) had LSCS whereas out of 19 vitamin D sufficient ANCs only 7 (36.84%) had LSCS. This distribution was with significant difference (p<0.05). Surprisingly LSCS were found significantly more in ANCs with vitamin D sufficiency. (Table 2)

Table 2
Comparison of Maternal Complication in Vitamin D Deficient and Vitamin D Sufficient Study subjects

Characteristics		Vitamin D Deficient (N=101)	Vitamin D Sufficient (N=19)	Significance
Preeclampsia	**Yes**	26	7	**P=0.475 NS**
	No	**75**	**12**	
GDM	**Yes**	**1**	**1**	**P=0.720 NS**
	No	**100**	**18**	
LSCS	**Yes**	**23**	**7**	**P=0.039 S**
	No	**78**	**6**	

In the study of 120 ANCs 108 (90%) ANCs delivered at term and 12 (10%) ANCs gave birth to preterm baby. Out of 101 vitamin D deficient ANCs, 10 (9.9%) delivered preterm babies whereas out of 19 vitamin D sufficient ANCs only 2 (10.52%) delivered preterm babies. This difference in proportion of preterm babies born by vitamin D deficient ANCs and vitamin D sufficient ANCs was found not significant (P>0.05) (Table 3)

Out of 120 ANCs 35 (29.1%) ANCs delivered low birth weight babies. Out of 101 vitamin D deficient ANCs, 27 (26.73%) delivered LBW babies whereas out of 19 vitamin D sufficient ANCs only 8 (42.1%) delivered LBW babies. This difference in proportion of LBW babies born by vitamin D deficient ANCs and vitamin D sufficient ANCs was found not significant (P>0.05) (Table 3)

Table 3
Comparison of Neonatal Complication in Vitamin D Deficient and Vitamin D Sufficient Study subjects

Characteristics		Vitamin D Deficient (N=101)	Vitamin D Sufficient (N=19)	Significance
Preterm	**Yes**	**10**	**2**	**P=0.739 NS**
	No	**91**	**17**	
LBW	**Yes**	**27**	**8**	**P=0.281 NS**
	No	**74**	**11**	

IV. DISCUSSION

In this present study proportion of vitamin D deficiency was found 84.1%. Almost similarly observations were made by Jani R et al (2004),[8] Sachan A et al (2005),[9] Dasgupta et al (2011)[10] and Rooplekha Chauhan et al (2015)[12] who reported 100%, 84.3%, 42% and72.1% respectively.

Although religion and parity of ANC was not found to be associated with vitamin D deficiency in this present study but age & type of diet were found the associating factors. Vitamin D deficincy was found significantly higher in elder age group and vegetarians than their counterparts.

In present study, mean age of vitamin D deficient and sufficient group was found 28.31±3.86 and 26.37±2.83 years respectively, which was with significant difference. Johnson D et al (2015)[13] conducted study on 310 pregnant women and found mean age 24.3 (range 18-40 year) of vitamin D deficient ANCs which was little lesser the present study.

Regarding type of diet observations of Crowel et al[14] were well in resonance with present study who found that plasma 25(OH)D concentration were lower in vegetarian than meat and fish eater as in this present study also observed that vitamin D deficient ANCs were significantly higher in vegetarians.

In present study, although proportion of vitamin D deficient ANCs were little higher in primipara than multipara but it was not found significant. Parity was not found to associate with vitamin deficiency by other authors also.

Use of sunscreen lotion/cream was found to be associated with vitamin D deficiency. ANCs who has used sunscreen cream are more prone to developed vitamin D deficiency than who do not. This association with sunscreen cream also reported Holick MF et al[15] in 1977 and Mallah et al[16] 2011. Holick MF et al[15] found that the most important source of vitamin D is skin's synthesis of vitamin D from sunlight and use of sun-block and time spend indoor increases the risk of vitamin D deficiency. Mallah et al[16] 2011 conducted a study in Jordanians at national level revealed that women who wear hijab or niqab were more likely to have low levels vitamin D.

In this study, development of preeclampsia was not found to be associated with vitamin D deficiency. But Bodnar et al,[17] Baker et al,[18], Robinson et al[19] and Rooplekha Chauhan[12] also found that prevalence of vitamin D deficiency is more prevalent in preeclamptic women.

In present study, LSCS were found significantly more in ANCs with vitamin D sufficiency whereas Dror D K et al[20] found no change in mean vitamin D level between women who underwent caesarean delivery and who did not. Moreover contrary to present findings, Merewood et al[21] found that women with low vitamin D level had four times the odds of caesarean delivery.

In this study delivery of pre term babies was not found to be associated with vitamin D deficiency whereas Wagner et al[22] in 2013 that supplemented 257 pregnant women since 12-16 week of gestational age with vitamin D (2000IU) found risk reduction in preterm infection and preterm birth.

In present study delivery of LBW babies was not found to be associated with vitamin D deficiency whereas Brook et al[23] also reported reduced incidence of low birth weight babies in vitamin D supplement Asian mother.

V. CONCLUSION

Vitamin D deficiency was found in 84.1% pregnant women. Religion and parity of women was not found to be associated with vitamin D deficiency whereas age, type of diet and use of sunscreen was found to be associated. Vitamin D deficiency was found significantly more in elderly, vegetarians and users of sunscreen than their counterparts.

Among maternal and neonatal outcomes, development of preeclampsia, LSCS as mode of delivery, delivery of pre term and LBW babies were having controversial findings. So it suggest much more researches in this regards.

CONFLICT OF INTEREST

None declared till now.

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