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HYPOVITAMINOSIS D IN PREGNANCY: A CROSS SECTIONAL STUDY

Community Medicine

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ABSTRACT

Background: Vitamin D deficiency is a worldwide problem in adults and children. Vitamin D deficiency during pregnancy has significant implications for the newborn and infants. There is a relative scarcity of data from India about the prevalence of hypovitaminosis D in pregnancy.

Objectives: To determine the prevalence of vitamin D deficiency and its contributory factors in antenatal cases.

Material & Methods: A cross sectional study was conducted at a tertiary care centre in India. Study was conducted on 200 consecutive antenatal females admitted to the hospital or attending OPDs during the study period. Values of S. vitamin D3 was analysed to know the status of vitamin D and a pre-designed structured schedule was used to determine the factors responsible.

Results: Vitamin D deficiency was observed in 35% ANC females while insufficiency was present in 61%. Sufficient levels of vitamin D (>30ng/ml) were present only in 4% ANC females. Significant association was observed between duration of sun exposure and usage of sun screen lotion with vitamin D status in subjects.

Conclusion: High prevalence of vitamin D deficiency was observed among pregnant women. There should be a provision of health education sessions and vitamin D supplements as part of Ante Natal Care.

KEYWORDS

Health Education, Hypovitaminosis D, Pregnancy, Vitamin D levels

INTRODUCTION

Vitamin D is a fat-soluble vitamin which includes both animal-derived cholecalciferol (vitamin D3) and plant-derived ergocalciferol (Vitamin D2) [1]. There are two ways for people to get vitamin D, it is produced in the skin by exposure to UV-B, and from diet and/or supplements [2]. Vitamin D is a part of the "Calcium-vitamin D-Parathyroid hormone" endocrine axis [3]. It is crucial for calcium metabolism and its homeostasis. Adequate calcium intake along with Vitamin D is necessary to maintain peak bone mass achieved by an individual. Vitamin D adequacy during adolescence helps to reduce the risk of osteoporosis later in life. Vitamin D deficiency and low calcium intake are important risk factors for osteoporosis [4,5]. Recently vitamin D has been found to be associated with various conditions like diabetes, hypertension, stroke, dementia, ischaemic heart disease, auto immune disorders, cancer , etc. [6].

India is a vast tropical country extending from 8.4° N latitude to 37.6° N latitude, majority of its population lives in areas receiving ample sunlight throughout the year and hence there was belief that vitamin D deficiency is uncommon in India [7]. However from the data available in the published literature, vitamin D deficiency is very common in India in all the age groups and both sexes across the country [8,9]

Vitamin D deficiency prevails in epidemic proportions all over the Indian subcontinent with a prevalence of 70%–100% in the general population [10]. Inadequate exposure to sunlight and poor nutrition are factors contributing to the vitamin D deficiency. Long indoor working hours may also contribute to deficiency in adult populations particularly in those who are not receiving vitamin D supplements in any form. Cultural factors, repeated, unplanned and un-spaced pregnancies in dietary deficient patients can aggravate vitamin D deficiency in the mother and the foetus [6].

During pregnancy, it is more critical to ensure vitamin D adequacy for the health of both mother and the offspring. Vitamin D deficiency during pregnancy has been associated with increased risk for adverse pregnancy outcomes, including pre-eclampsia, gestational diabetes mellitus, primary caesarean section, bacterial vaginosis, low birth weight, reduced infant size and impaired bone development [11,12].

The worldwide prevalence of vitamin D deficiency during pregnancy ranges from 23% to 90% and it occurs at any stage of gestation [13]. We thus conducted this study to determine the prevalence of vitamin D deficiency and its contributory factors in antenatal mothers.

MATERIALS & METHODS

A hospital based cross-sectional design was adopted for the study. The prevalence of vitamin D deficiency as per literature review was taken as 70% [10].

By using the formula: $\mathbf{n = Z^2p(1-p)/ e^2}$, the sample size came out as 172 (n – sample size; Z - level of confidence (1.96); p - prevalence of vitamin D deficiency and; e - allowable error (taken as 10%). By rounding off, a total of 200 pregnant females were taken up for the study.

The study was conducted from Jan' 15 to Jun' 15. All the women attending obstetrics OPD of PIMS Hospital, aged 18 years and above were eligible for the study. Inclusion criteria includes: Not suffering from any kidney, liver disease or parathyroid disorders. We also excluded candidates taking vitamin supplements or with diseases known to effect calcium absorption or vitamin D metabolism.

Strategy:

Data was collected using a structured, pre-tested questionnaire which had two sections:

Section 1: a) Socio-demographic profile of eligible females, b) Detailed diet history using food frequency method which included history regarding vegetarian or non-vegetarian diet and consumption of vitamin D rich foods on daily basis, c) sun exposure history regarding duration of exposure where minimum adequate amount of exposure was taken to be approximately half hour per day which was decided as per WHO guidelines (stating that 5 to 15 minutes of casual sun exposure of hands, face and arms two to three times a week during the summer months is sufficient to keep your vitamin D levels high [14]), d) Hours of outdoor activity and; e) Use of sunscreen.

Section 2: Recorded values of serum vitamin D which is a part of routine examination for antenatal females. A cut off point of 25-hydroxvitamin D (25(OH) D < 30 nmol/L was applied to define Vitamin D deficiency based on guidelines by Endocrine Society in 2011 [15]. Any complication if occurred in the pregnancy was also recorded.

Women found to be deficient were given treatment, nutritional advices and health education regarding the subject. Ethical clearance was obtained from the ethics review committee of Punjab Institute of Medical Sciences, Jalandhar. Data was analyzed using SPSS 21.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

Most of the subjects were between 21-30 years of age (78%) while only 4% were below 20 years of age. Mean age of study participants was 27.1 years while mean vitamin D level was 23.13+/-4.1 ng/ml. Vitamin D deficiency was observed in 61% ANC females while sufficient levels of vitamin D (>30ng/ml) were present only in 39% ANC females [Table 1]. About three-fourth of the subjects were non-vegetarian while rest were vegetarians. No significant association was observed between dietary habits of ANC females and vitamin D status (p-0.77) [Table 2]. Sun exposure of less than 3 hours/ week was considered inadequate and it was observed that total 178 females did not take minimum amount of sunlight required and 85.2% of them were found to be deficient in Vitamin D and this association was found to be statistically significant ($p< 0.05$) [Table 3]. We also evaluated the effect of Sunscreen and Vitamin D status. No significant association between the use of sunscreen and no. of females with vitamin D deficiency was observed (p-0.87) [Table 4]. But mean vitamin D levels of females using sunscreen was significantly lower than those who were not using it ($p<0.05$) [Table 5]. Complications were observed in about 20% ANC females. Hypertension in Pregnancy was observed in 13% females while 3% females suffered from oligohydramnios. IUGR was noted in 2% pregnancies while 1 case each had PROM and Pre-term delivery. No significant association was observed between presence of complications in ANC females and vitamin D status (p-0.7).

DISCUSSION

Vitamin D is an essential fat soluble vitamin. It is very essential to achieve as well as maintain adequate vitamin D levels in individuals for its important role in human health. During pregnancy, it is more critical to ensure vitamin D adequacy for the health of both mother and offspring. Vitamin D deficiency during pregnancy has been associated with increased risk for adverse pregnancy outcomes.

A hospital based cross sectional study was conducted on 200 antenatal patients with the aim of assessing prevalence of vitamin D deficiency and evaluating various risk factors and associated complications.

Mean age of study participants was 27.1 ± 4.3 years. In a study by Stefanie V et al.[16] to find the prevalence of vitamin D deficiency in pregnant women of Belgium, mean age of study population (n-1331) was 28.5 ± 5.1 years. In a similar study in US population by Lisa M.[17], mean age of study population was 27.9 ± 4.8 years.

Several studies from many countries have reported high prevalence of vitamin D deficiency in pregnant women, ranging from 5% to 84% (the large difference in percentage could be partly due to using different cut-off points) [18-21]. Thus, vitamin D deficiency during pregnancy is becoming a worldwide epidemic. In a USA study, vitamin D insufficiency was reported to be common in both white and black pregnant women, even when mothers were compliant with prenatal vitamin D intake [2]. It is reported that, at delivery, vitamin D deficiency (defined as 25(OH)D< 37.5 nmol/L) and insufficiency (25(OH)D 37.5-80nmol/L) occurred in 29.2% and 54.1% of black women, while 55% and 42.1% of white women, respectively. In another study, MacKay AP et al. assessed 67 pregnant women and found that the mean level of 25(OH)D was 36.0±19.7nmol/L, while 57.1% women showed vitamin D deficiency (25(OH)D < 37.5nmol/L) and 97.4% insufficiency (25(OH)D 37.5-80nmol/L) [18]. Similarly, in an Indian study by Alok S et al., the mean maternal serum 25(OH)D was just 14 ± 9.3 ngm/mL [21].

These results are in accordance with ours, where Vitamin D deficiency was observed in 61% ANC females while sufficient levels were present only in 39% of the females. The mean vitamin D level was 23.13+/-4.1ngm/ml.

To evaluate the role of diet and its effect on vitamin D status of pregnant females, history regarding vitamin D rich food was taken. About three-fourth of the subjects were non-vegetarian while rest were vegetarians. No significant association was observed between dietary habits of ANC females and vitamin D status (p-0.77). Similar findings were observed by Elina Hyppönen and Chris Power [22] in their study in British population where it was seen that 25(OH)D concentrations were significantly higher in participants who used vitamin D supplements than in those who did not ($P < 0.01$ for both) but were not significantly higher in participants who consumed vitamin D–fortified margarine. In another study by Shanna Nesby-O'Dell et al. [23]among African Americans have stated that hypovitaminosis D was independently associated with consumption of milk or breakfast cereal <3 times/wk.

M. Janet Barger-Lux and Robert P. Heaney [24] in their study have shown significant relation between amount of sun exposure and vitamin D levels. People who were exposed to sun for greater time were seen to be having better vitamin D levels. Study reported by H. Glerup et al. [25] reported that Veiled Arab women displayed extremely low values of 25 hydroxyvitamin D: 7.1 +/- 1.1 nmol/L, compared with 17.5 +/- 2.3 (P -0.002) in ethnic Danish Moslems and 47.1 +/- 4.6 nmol/L in normal population ($P < 0.01$). Another study from India by Joshi et al. [26] have shown that Vitamin D deficiency was higher among Kashmiri Muslim females (82%), who wears "Burka" as compared to females from Jammu region (74%). We also observed significant association between sun exposure and vitamin D insufficiency. A total of 178 females (89%) were without minimum amount of sunlight required and 85.2% of them were found to be deficient in Vitamin D.

On evaluating the effect of sunscreen on Vitamin D status of females, it was observed that females who were not using sunscreen had significantly better vitamin D levels but the association between use of sunscreen and no. of females with vitamin D deficiency was not significant (p-0.87). A study by M. Norval and H.C Wulf [27] states that use of sunscreens can significantly reduce the production of Vitamin D under very strictly controlled conditions, their normal usage does not generally result in Vitamin D insufficiency.

The present study helped us to expand the body of knowledge related to prevalence of vitamin D deficiency and its contributory factors in antenatal mothers. The cross-sectional nature of the present study is its major limitation as we could not comment on the causal nature of association. Another limitation of the current study is its lack of data about UVB levels and vitamin D intake.

CONCLUSION

High prevalence of vitamin D deficiency was observed among pregnant women (61%). We also observed significant association between Vitamin D levels and amount of sun exposure where females who were not exposed to adequate sunlight were found to be deficient in vitamin D. We also observed association of low Vitamin D levels with Hypertension in pregnancy.

RECOMMENDATIONS

We were unable to establish a significant association between diet and vitamin D levels. But in present conditions where exposure to sunlight is limited so there is a need to obtain substantial amounts of vitamin D from the diets through fortification and if necessary, by supplementation. So, there should be a provision of prescribing vitamin D supplements to all pregnant females as a routine under antenatal care just like iron and folic acid. Screening for Vitamin D levels should also become a part of routine examination for patients.

Anganwadi workers and ASHA should be trained to provide health education regarding Vitamin D deficiency to all pregnant females, who register them at Anganwadi's. Government should also initiate various IEC (information, Education & communication) activities through Mass Media for Behaviour change of masses regarding importance of Vitamin D.

Table 1. Distribution of subjects based on Vitamin D status

Vitamin D status	N	%
Insufficiency (21-29ng/ml)	122	61
Sufficiency (>30ng/ml)	78	39
Total	200	100

Table 2: Association of dietary habits and Vitamin D status

Diet	Vitamin D Status		Total
	Deficiency	Sufficiency	
Vegetarian	72	0	72
	100.0%	0.0%	100.0%
Mixed	120	8	128
	93.8%	6.3%	100.0%
Total	192	8	200
p- value - 0.77			

Table 3: Association of Sun Exposure with Vitamin D deficiency

Sun exposure > 3hrs/week	Vitamin D status		Total
	Yes	No	
Yes	104	74	178
	58.43%	41.57%	100.00%
No	18	4	22
	81.82%	18.18%	100.00%
Total	122	78	200
p- value - 0.0379			

Table 4: Effect of Sunscreen on Vitamin D status

Sunscreen Use	Vitamin D status		Total
	Yes	No	
Yes	86	54	140
	61.43%	38.57%	100.00%
No	36	24	60
	60.00%	40.00%	100.00%
Total	122	78	200
p- value - 0.87			

Table 5: Association of Mean Vitamin D levels with Sunscreen use

Sunscreen Use	N	Mean Vitamin D levels	SD	p-value
Yes	140	15.2	4.4	**0.01**
No	60	20.4	4.1	

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