

Screening for vitamin D deficiency in pregnant women

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Abstract

Introduction: Vitamin D is an important nutrient during pregnancy for optimal skeletal development of the fetus. Vitamin D deficiency is known to affect the health of mother and the fetus as well. The determination of vitamin D status in pregnant women would be helpful to prevent its adverse effects. The aim of this study was thus to find the vitamin D levels during the antenatal check up.

Materials and Method: The study included 40 pregnant women. The best indicator of vitamin D in the serum is 25 Hydroxy(OH) vitamin D. The status of vitamin D was thus assessed by estimating serum 25(OH) vitamin D levels using chemiluminescence (CLIA) method. Serum Calcium, serum Phosphorus and serum Alkaline Phosphatase (ALP) levels were also measured.

Result: The mean serum 25(OH) vitamin D levels were 25.12 ± 10.17 ng/ml, calcium 9.77 ± 3.44 mg%, phosphorus 4.33 ± 1.76 mg%, and ALP 120.08 ± 77.83 IU/L. The study revealed that 35% pregnant women were deficient (<20ng/ml), 37.5% had insufficient (20-30ng/ml) and 27.5% had sufficient (>30ng/ml) vitamin D levels.

Conclusion: Deficiency of vitamin D is prevalent during pregnancy. The reason for its deficiency could be attributed to inadequate exposure to sunlight or dietary deficiency. Routine antenatal check up should therefore consider screening for deficiency of vitamin D. Furthermore, administering vitamin D supplements should be taken into consideration to prevent vitamin D deficiency in pregnant women and hence in the fetus and neonate.

Keywords: Vitamin D, Pregnant women, Screening, Supplementation.

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Introduction

Vitamin D implements a plethora of tasks within the human body, the most important of which is maintenance of calcium homeostasis and thereby proper care of a rather complex skeletal system. Vitamin D also has some extra skeletal functions through which it works in tandem with various tissues of the brain, heart and even the pancreas.⁽¹⁾ Thus, disturbance of this homeostasis can lead to various complications if the ideal vitamin D levels are not maintained.

The deficiency of vitamin D has emerged as a health problem which is preventable if immediate attention is provided. Exposure to sunlight, latitude, clothing habits, skin pigmentation, diet, and seasonal variations influence serum vitamin D levels. In adults, such deficiencies are often associated with various progressive disorders such as Type II Diabetes Mellitus, infectious diseases or even schizophrenia.⁽²⁾

To satisfy the increasing demand of the fetus and the mother, there is increased requirement for vitamin D. The studies done so far in different countries and even in India have reported that vitamin D deficiency is prevalent during pregnancy.⁽²⁻⁵⁾

The requirement for vitamin D can be achieved simply by daily exposure to adequate sunlight. Yet this seems to be surprisingly impossible, because of the clothing habits and cosmetic reasons prevailing in the Indian women.⁽⁶⁾ Thus sunlight which is the natural

source of vitamin D cannot serve to maintain high levels of this nutrient during pregnancy.

Another prospective solution could be dietary vitamin D. However; Indian dietary lifestyle doesn't satisfy the Recommended Daily Allowance.⁽⁴⁾ The dietary intake throughout pregnancy was below the Estimated Average Requirement (EAR) in a study conducted by Groth SW.⁽⁷⁾

The Centre for Disease Control and Prevention conducted a survey and concluded that women of reproductive age group are exposed to tobacco and second hand smoke. A negative correlation has been observed among tobacco and smoke intake levels and vitamin D levels.⁽⁸⁾ Interestingly it was also noticed that exposure to these toxic substances depend on their educational status as well.⁽⁶⁾

The status of vitamin D in the pregnant women can also be influenced by some pre-pregnancy factors like body weight, physical activity and use of supplements.⁽⁹⁾

A positive correlation exists between maternal and fetal vitamin D levels as revealed from previous study findings. There are many adverse effects of vitamin D deficiency on maternal and fetal outcome. Severe vitamin D deficiency, that is, serum 25 (OH) vitamin D <5ng/ml may lead to preeclampsia, pre term birth, low birth weight, hypocalcemia, gestational diabetes mellitus and rickets, thus affecting both the mother and her child.⁽⁴⁾ In spite of such grave consequences and an

increasing prevalence, few studies have been done in India to evaluate the status of vitamin D during pregnancy. The study was carried out to find the occurrence of vitamin D deficiency in pregnant women.

Materials and Method

This was a short study carried over 2 months (August to September 2015) and included 40 pregnant women attending antenatal care at Dr. D.Y. Patil Medical College, Pune. Pregnant women between 19 to 40 years were included. The subjects with known medical disorders and those taking drugs which may cause Vitamin D deficiency (Steroids and Anti-epileptics) were excluded from the study.

The dietary history and the details about socio-economic, cultural habits were noted.

Written Informed Consent from the subjects and Institutional ethical committee clearance was also obtained, before initiating the study.

Sample Collection: 2 ml of blood sample was collected in plain bulb from the subjects. The separated serum was stored in deep freezer till further analysis.

The following biochemical assays were carried out on all the samples:

1. Serum 25-hydroxy (OH) Vitamin D by Chemiluminescence Immunoassay (CLIA)
2. Serum Calcium by modified Arsenazo method on Auto-analyzer (Rosche, Cobas Integra 400 plus)

3. Serum Phosphorus on Auto-analyzer (Rosche, Cobas Integra 400 plus)
4. Serum Alkaline Phosphatase on Auto-analyzer (Rosche, Cobas Integra 400 plus)

Results

Results revealed that the mean serum 25(OH) vitamin D in pregnant women was 25.12 ± 10.17 ng/ml. The serum 25 (OH) vitamin D levels were adequate (>30 ng/ml) only in 27.5% pregnant women. Vitamin D insufficiency (20-30ng/ml) was found in 37.5% subjects and 35% had vitamin D deficiency (<20 ng/ml). Women in the second trimester had lowest vitamin D levels (Table 2).

Both Calcium (9.77 ± 3.44 mg %) and Phosphorus (4.33 ± 1.76 mg %) in almost all pregnant women was within range, and the ALP levels were very high in patients of the 3rd trimester (mean value= 190.8 ± 72.9 IU/L).

Table 1: Mean Values and Standard Deviation of all Parameters.

	Vitamin D (ng/ml)	Ca ²⁺ (mg %)	Phosphorus (mg %)	ALP (IU/L)
Mean	25.12	9.77	4.33	120.08
Standard Deviation	10.17	3.44	1.76	77.83

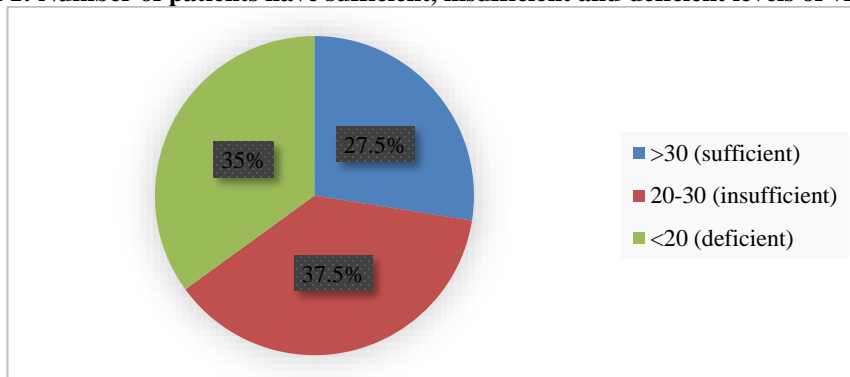
Table 2: Mean Values based on Trimester

Trimester	Number of Patients in each trimester	Mean Vitamin D \pm SD (ng/ml)	Mean Ca ²⁺ \pm SD (mg %)	Mean Phosphorus \pm SD (mg %)	Mean ALP \pm SD (IU/L)
1	8	31.3 \pm 18.7	10.0 \pm 1.2	4.6 \pm 1.3	75.9 \pm 32
2	15	22.8 \pm 11.2	10.9 \pm 1.3	4.7 \pm 2.1	88.0 \pm 29.1
3	17	29.1 \pm 9.9	11.4 \pm 1.4	4.5 \pm 0.7	190.8 \pm 72.9

Table 3: Status of Vitamin D

Vitamin D (ng/ml)	Number of Patients
>30 (sufficient)	11
20-30 (insufficient)	15
<20 (deficient)	14

Graph 1: Number of patients have sufficient, insufficient and deficient levels of vitamin D



Discussion

Vitamin D has emerged as an important nutritional factor in maternal and infant health over the past decade.⁽¹⁰⁾

The status of vitamin D during pregnancy in this study was determined by measuring the serum 25(OH) vitamin D levels. Vitamin D insufficiency and deficiency was clearly evident in the pregnant women who participated in this study.

The root cause for such deficiencies lies in Indian culture that is, by nature, respective yet protective. The history of participants revealed that most (97.5%) were housewives and rarely left the confinement of their homes since the diagnosis of the pregnancy, with the exception being their visits to the hospital. A study by Dave et al reported 51.5% housewives had significantly lower vitamin D levels.⁽¹¹⁾ The clothing habit which is mainly saree and salwar suit also acts as a barrier to sunlight exposure. The explanation for vitamin D deficiency revealed in this study could be less exposure to sunlight.

The amount of sunlight available also depends on pollution. Significantly higher vitamin D levels were reported in those exposed to low pollution as compared to higher exposure.⁽¹²⁾ Hence, vitamin D status during pregnancy is affected by Indian environmental conditions.

Indians also tend to be genetically predisposed to higher melanin content. Indian skin types may require two to three times longer sun exposure (0.75-1.5h versus 0.25-0.5h) than the lighter complexion of Caucasians to synthesize the same amount of vitamin D.⁽⁶⁾ Serum 25(OH) D levels were found to lower in Indian women with high skin pigmentation.⁽⁹⁾

The dietary insufficiency of Vitamin D was revealed from the history of subjects. Most pregnant women were vegetarian and their diet included typical lentils in the form of 'dals' and rice as a meal once in a day. Some women even reported to have become vegetarian after the diagnosis of the pregnancy in order to ensure better health of the baby. None of the women reported to drink milk on routine, instead almost all claimed to drink two cups of tea a day. A study by Dasgupta et al has reported that there is a strong association between vegetarian diet and serum 25(OH) vitamin D levels.⁽¹³⁾ These factors mentioned may have probably contributed to the results achieved; nevertheless the precise impact of diet on Vitamin D levels in an Indian setting is yet to be looked at, this could be a prospective area of research in the future.

In addition to the above facts, lack of dietary supplements could also be another determinant of hypovitaminosis. None of the pregnant women participating were administered vitamin D supplements. Calcium supplements are prescribed routinely from the second trimester onwards, hence most subjects had normal Calcium (mean value: 9.77+/- 3.44) and

Phosphorus (mean value: 4.33+/-1.76) in spite of insufficiency of Vitamin D. The Alkaline Phosphatase levels are in extremely high amounts in patients of the 3rd trimester (mean value: 190.8+/-77.83) as a consequence of increased rate of bone turn-over. A randomized controlled trial by Sablok et al concluded that administration of vitamin D supplements reduces the complications in mother and also improves the fetal outcome.⁽¹⁴⁾

The remedy to overcome vitamin D deficiency during pregnancy could be educating and making them aware about this important nutrient. The availability of this nutrient through sunlight should be emphasized. Encouraging a healthy, pollution free environment as to allow for improved natural light may further help to resolve the issue. Regular vitamin D supplementation in recommended dosage besides calcium could be beneficial. Thus, identification of vitamin D deficiency and resolving it can be possible by implementing these suggestions. The strategy of targeted screening to detect this nutritional deficiency earlier is utmost important and must be emphasized. Optimal maternal and fetal health would thus be maintained while preventing the adverse effects of this nutritional deficiency.

Limitations

The study was limited by a small sample size of patients; forty volunteers were used to represent a much larger community. The majority of them belonged to the mid-twenties, with a very small representation of the older end of the spectrum. The participants were also all from a small area of low socio-economic strata with minimum education; therefore representation of the more educated, more economically stable population was not taken into account.

Another limitation lies with regards to the experimental design; factors affecting levels of Calcium and Phosphorous like Para-Thyroid Hormone were not analyzed as the aim of this study was mainly to assess vitamin D status in pregnancy.

References

1. Maladkar M., Sankar and Komat K. (2015) Vitamin D Efficiency in Pregnancy: An Updated view point in Indian Scenario. *International Journal of Clinical Medicine*, 6, 204-216. <http://dx.doi.org/10.4236/ijcm.2015.63026>.
2. Song SJ, Zhou L, Si S, Liu J, Zhou J, et al. (2013) The high prevalence of Vitamin D Deficiency and Its Related Maternal Factors in Pregnant Women in Beijing. *PLoS ONE* 8(12):e85081. doi: 10.1371/journal.pone.0085081.
3. R.K. Marwaha et al. (2011) Vitamin D status in pregnant women across trimesters and different seasons and its correlation with neonatal serum 25 Hydroxyvitamin D levels. *British Journal of nutrition* (2011), 106, 1383-1389. doi: 10.1017/S000711451100170X.
4. Shakiba, M, and MR Iranmanesh. 'Vitamin D Requirement In Pregnancy To Prevent Deficiency In Neonates: A Randomised Trial'. *Singapore Medical*

- Journal* 54.5 (2013):285-288. doi: 10.11622/smedj.2013110.
5. Vandevijvere, Stefanie, Amsalkhir S, Van Oyen H, Moreno Reyes R et al. 'High Prevalence Of Vitamin D Deficiency In Pregnant Women: A National Cross-Sectional Survey'. *PLoS ONE* 7.8 (2012): e43868. doi: 10.1371/journal.pone.004386.
 6. Jani, Rati et al. 'Widespread 25-Hydroxyvitamin D Deficiency In Affluent And Non-affluent Pregnant Indian Women'. *Bio Med Research International* 2014 (2014): 1-8. doi: 10.1155/2014/892162.
 7. Groth SW, Stewart PA et al. Micronutrient intake is inadequate for a sample of pregnant African-American women. *J Acad Nutr Diet*.2017 Jan 5.
 8. Child Trends databank. (2015). Mothers who smoke while pregnant. Available at: <http://www.childtrends.org/?indicators=mothers-who-smoke-while-pregnant>. Web 9 July 2015.
 9. Woolcott CG et al. Determinants of vitamin D status in pregnant women and neonates. *Can J Public Health* 2016 Dec 27;107(4-5):e410-e416.
 10. Adit A. Ginde, MD et al. Vitamin D insufficiency in pregnant and non-pregnant women of childbearing age in the United States. *Am J Obstet Gynecol*. 2010 May; 202(5): 436.e1-436.e8. doi:10.1016/j.ajog.2009.11.036.
 11. Dave et al. A study of vitamin D levels and associated deficiency in pregnancy and its effect on maternal and fetal outcome. *Int J Reprod Contracept Obstet Gynecol*. 2017, Jan;6(1):84-88.
 12. Hosseinpanah F, pour SH, Heibatollahi M, Moghbel N, Asefzade S, Azizi F. The effects of air pollution on vitamin D status in healthy women: A cross sectional study. *BMC Public Health*. 2010;10:519. doi:10.1186/1471-2458-10-519.
 13. Dasgupta A, Saikia U, Sarma D. Status of 25(OH)D levels in pregnancy: A study from the North Eastern part of India. *Indian Journal of Endocrinology and Metabolism* 2012; 16 (Suppl 2):S405-S407. doi:10.4103/2230-8210.104109.
 14. Sablok, A., Batra, A., Thariani, K., Batra, A., Bharti, R., Aggarwal, A. R., Kabi, B.C. and Chellani, H. (2015), Supplementation of vitamin D in pregnancy and its correlation with feto-maternal outcome. *Clin Endocrinol*, 83: 536-541. doi:10.1111/cen.12751.