

Vitamin D Status in Pregnant Women of Udaipur

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Abstract

This study is aimed to analyze serum concentration of Total Vitamin D in normal pregnant and non-pregnant women. A total number of 200 women, out of which 150 were pregnant with 50 number in each trimester and 50 non pregnant from Udaipur city were selected for the study. They were in the age ranging from 20-35 years. The study was conducted for a period of 9 months. Women were divided into four categories A, B, C and D. Category A, B and C included pregnant women of first, second and third trimester while category D included non-pregnant women. Average total Vitamin D concentration in the first trimester was 21% less than the control group. Similarly, total Vitamin D concentration in the second trimester was 30.4% less than the control and in the third trimester it was 47.3% less than the control. In all the completed trimesters, there is significant reduction in values of vitamin D than control non pregnant group (p value < 0.05).

Therefore, supplementation of Vitamin D during the entire period of pregnancy is recommended in order to avoid the complications associated with Vitamin D deficiency during pregnancy.

Keywords: Vitamin D; Pregnancy; Osteomalacia; Rickets; Vitamin D Binding Protein (VDBP)

Introduction

Vitamin D is a part of complex steroid hormone system. There are two forms of Vitamin D. Vitamin D3 (Cholecalciferol) is produced from the conversion of 7-dehydrocholesterol in skin and Vitamin D2 (Ergocalciferol) is produced in mushrooms and yeast. The biologically active form of Vitamin D is 1,25-(OH)₂D. Although 25-(OH)D has low biological activity, it is the major form of circulating Vitamin D. Serum 25-(OH)D concentrations are generally thought to reflect nutritional status. Production of 1,25-(OH)₂D in the kidney is tightly regulated by plasma parathyroid hormone (PTH) as well as serum calcium and phosphate levels. Vitamin D and its active metabolite 1,25-dihydroxyvitaminD (1,25-(OH)₂D) have classical actions on calcium balance and bone metabolism. Without sufficient 1,25-(OH)₂D, the intestine cannot absorb calcium and phosphate adequately, which leads to secondary hyperparathyroidism and a lack of new bone mineralization (rickets in children and osteomalacia in adults). Vitamin D has an increasingly recognized repertoire of non-classical actions, such as promoting insulin action and secretion, immune modulation and lung development [1,2]. It therefore has the potential to influence many factors in the developing fetus. Vitamin D deficiency is prevalent in country like India, in spite of abundant sunshine. Furthermore, milk, the primary source of calcium, is an expensive food in India. Deficient calcium intake has been shown to be the cause in a large proportion of childhood rickets in India [3] and other tropical countries [4,5] and to contribute to adolescent osteomalacia [3,6].

In a population that already has a high prevalence of Vitamin D deficiency and poor dietary calcium intake, the problem is likely to worsen during pregnancy because of the active transplacental transport of calcium to the developing fetus. The deficiency of Vitamin D in pregnant women may lead to various complications such as

preeclampsia, gestational diabetes, low birth weight, preterm delivery and infectious diseases [7-10]. Further Hypovitaminosis D during pregnancy has important consequences for the newborn, including fetal hypovitaminosis D, neonatal rickets and tetany, and infantile rickets [11,12]. Rickets during infancy has been associated with higher prevalence of lower respiratory tract infections [13], the largest cause of infant mortality in India.

This study was undertaken to determine the prevalence of Vitamin D deficiency in pregnant women and to compare it with non-pregnant women considered as controls.

Materials and Methods

Vitamin D deficiency during pregnancy has a lot of implications in both mother and offspring. With increasing evidence of a link between pregnancy and vitamin D deficiency, the present study was carried out in total number of 200 women. All of these 200 women were vegetarian housewives. Out of which 150 were pregnant and 50 non pregnant with an age ranging from 20-35 years. Among 150 pregnant women, 50 in number were included in each trimester forming three categories A, B and C depending upon the type of trimester first, second or third. Category D included non-pregnant women. The serum Vitamin D concentration was measured in all these 200 women. The study was conducted over a period of nine months. The following criteria were used for exclusion:

1. Muslim women following purdah system
2. Pregnancy toxemia
3. Chronic liver disease
4. Renal disease
5. Undergoing treatment with antitubercular or antiepileptic drug
6. Osteomalacia

7. Women taking vitamin D supplements

The study was done from July 2015 to April 2016 at Arth Diagnostics Private Limited, Udaipur. The blood of the subjects was collected between 8:00 A.M. and 10:00 A.M. after an overnight fast of at least ten hours. The serum was extracted by centrifugation, separated into aliquot and stored at -20°C until analyzed for Vitamin D levels. The analysis was done by Elecsys, Chemiluminescence method (Competitive protein binding assay) on cobas e411, (Roche). Vitamin D is a fat soluble steroid hormone precursor that is mainly produced in the skin by exposure to sunlight. Vitamin D is biologically inert and must undergo hydroxylation steps to become active. Our body can only synthesize Vitamin D3. Vitamin D2 is taken up with fortified food or given by supplements. Physiologically, Vitamin D3 and Vitamin D2 are bound to the vitamin D- binding protein (VDBP) in plasma and transported to the liver to become 25-hydroxy vitamin D (Vitamin D (25-OH)). As Vitamin D (25-OH) represents the major storage form, its blood concentration is used to assess the overall Vitamin D status. More than 95% of Vitamin D (25-OH), measurable in serum is Vitamin D3 (25-OH) whereas Vitamin D2 (25-OH) reaches measurable levels only on patients taking Vitamin D2 supplements [14-16]. The Elecsys Vitamin D total assay employs VDBP to capture both 25-hydroxy vitamin D3 and D2. This assay is intended for the quantitative determination of total vitamin D (25-OH) in human serum and plasma.

Test principle: Competitive protein binding assay.

First the sample is incubated with a pretreatment reagent for nine minutes. Thereby the natural VDBP in the sample is denatured to release the bound Vitamin D (25-OH). Second the sample is further incubated with a recombinant ruthenium-labelled VDBP to form a complex of Vitamin D (25-OH) and the ruthenylated-VDBP. Third, with the addition of a biotinylated Vitamin D (25-OH) a complex consisting of the ruthenium-labeled VDBP and the biotinylated Vitamin D (25-OH) is formed. The entire complex becomes bound to the solid phase (by the interaction of biotin and streptavidin-coated microparticles which are captured on the surface of the electrode). Unbound substances are removed. Applying voltage to the electrode induces chemiluminescent emission which is measured by a photomultiplier. Results are determined via an instrument specific calibration curve which is generated by 2-point calibration and a calibration master curve provided via the reagent barcode.

The laboratory reference range below 10 ng/ml is considered as deficiency, 10-30 ng/ml is insufficiency and levels between 30-70 ng/ml is optimum for serum total Vitamin D.

Results

The serum concentration of total Vitamin D in 150 pregnant women forming category A, B and C with respect to trimester first, second and third were significantly lower as compared to category D (control group) including the non-pregnant women as shown in Table 1. Average total Vitamin D concentration in the first trimester was 21% less than the control group. Similarly, total Vitamin D concentration in the second trimester was 30.4% less than the control and in the third trimester it was 47.3% less than the control. In all the completed trimesters, there is significant reduction in values of vitamin D than control non pregnant group (p value < 0.05).

	Category A	Category B	Category C	Category D
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	First Trimester	Second Trimester	Third Trimester	Non pregnant
				Control Group
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Vitamin D Values	25.84 ± 9.66	22.76 ± 6.30	17.25 ± 4.25	32.72 ± 11.54

Table 1: Total serum Vitamin D concentration in the three trimesters of pregnancy and in the non-pregnant women.

Discussion

This study reveals a high prevalence of Vitamin D deficiency in pregnant women of Udaipur. Hypovitaminosis D and osteomalacia among pregnant South Asian women have been widely reported [17]. Vitamin D deficiency has also been reported in pregnant women in tropical countries, but all studies were in Muslim populations, in whom the practice of purdah might have played an important role [18-24]. In the present study Vitamin D deficiency is more common in the third trimester of pregnancy; the decrease may be due to less sun exposure. A gradual decrease in concentration of Vitamin D seen in this study from control down to third semester is attributable to less exposure to sun as pregnancy grows. Since there is positive correlation between sunlight and Vitamin D status [19], the observed decrease in Vitamin D concentration and deficiency in pregnant women can be attributed to sedentary indoor lifestyle in which there is less exposure to sun. Another possible reason of Vitamin D deficiency in pregnant women is attributable to diets that are not rich in Vitamin D. Dietary sources consumed by pregnant women are very low in Vitamin D content. Indians are usually not eating salmon, sardines, tuna, mackerel which are rich in Vitamin D content. The explanation could also lie in prolonged deficiency of dietary calcium intake among poorer parts of Udaipur because of the expensive nature of milk and milk products. Dietary calcium deficiency has been shown to lead a secondary Vitamin D deficiency in rats [6]. Similar findings are also suggested in studies on humans [3,4].

Conclusion

Serum Vitamin D concentration were observed to be low in pregnant women in all the three trimesters when compared with non-pregnant women. Among all the trimesters, Vitamin D concentration was found to be lowest in the third trimester. Therefore, supplementation of Vitamin D during the entire period of pregnancy is recommended in order to avoid the complications associated with Vitamin D deficiency during pregnancy.

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