

# Estimating Serum Vitamin D Levels and Assessing its Influencing Factors among Antenatal Women in a South Indian Town-Kumbakonam Urban Rural Epidemiological Study: KURES-5

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## Abstract

**Background:** Adequate antenatal Vitamin D intake is essential for maternal and fetal health during pregnancy and avoidance of adverse outcomes. The normal and abnormal concentrations are not well established in the different parts of the world with varying customs in life. We intended to estimate the normal random serum Vitamin D levels among antenatal mothers in the first trimester and whether factors such as age, weight, and religion have any influence on the same. **Materials and Methods:** In this epidemiological study of 644 parturients, we collected the blood samples from asymptomatic antenatal mothers in the first trimester. A simple convenient sample of mothers on no other supplements except folate was selected. The present study was done from April 2019 to March 2020 after individual informed consent and ethical clearance. The factors such as age, weight, type of diet, occupation, and religion were noted. The estimation of Vitamin D3 levels was done by the well described chemiluminescent technique. A value of <20 ng/ml was defined as deficient. Student *t*-tests, analysis of variance, and correlation tests were done accordingly to find out the influence of the above factors on the level. **Results:** 83.7% of all women were deficient in Vitamin D3, if the level of 20 ng/ml was taken as cutoff. The mean Vitamin D3 level was  $14.57 \pm 6.73$  ng/ml. Religion wise, the mean Vitamin D3 was 16.63 ng/ml in Hindus (sample – 402/644), 10.55 ng/ml in Muslims (sample – 207/644), 14.27 ng/ml in Christians (sample – 16/644), and 15.08 ng/ml in others (sample – 19/644). There was a significant reduction in the levels of Vitamin D in Muslim women. There is no influence of age, weight, or dietary pattern. **Conclusion:** A majority of Indian pregnant women were deficient in Vitamin D3, worse among Muslims. We conclude that lifestyle changes with more exposure to sunlight should be suggested to all women in the reproductive age group to circumvent the problem. Health education on these lines should be imparted to them.

**Keywords:** Pregnancy, religion, Vitamin D

## INTRODUCTION

There is little consensus among medical fraternity on what constitutes a “normal” Vitamin D3 level in pregnancy. The Institute of Medicine recommendations suggest a cutoff normal level of 20 ng/ml in pregnancy. There are many recommendations between 20 and 50 ng/ml.<sup>[1]</sup> From a simple bone demineralization and rickets, Vitamin D has assumed a bigger role in human health, especially reproductive health. The deficiency of this vitamin has been linked to fetal neurodevelopment, placental function, and hypertensive disorders of pregnancy. Hence, adequate supplementation of

nutrients, especially Vitamin D3 becomes essential during the antenatal period.<sup>[2]</sup> Allowing antenatal mothers to be deficient

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in this vitamin is likely to have major detrimental effects in the fetus. In India, especially in a semi-urban town, most of the women in the reproductive age group get exposed to sunlight even though they are nonworking homemakers. Hence, in this setting, we hypothesized the prevalence of deficient mothers will be very much in the acceptable range. The incidence of deficiencies was actually reported between 60% and 80% in many of the studies, and this factor prompted us to know the exact Vitamin D values and the incidence of mothers deficient in this vitamin. We also theorized that there will be religious differences in values as women embracing Islam usually have reduced exposure to sunlight. As Muslim women are being brought up with less outdoor activities and especially after a purdah, their exposure to direct sunlight is arguably less than others. Bony abnormalities have been established in such Vitamin D deficient Muslim women.<sup>[3]</sup> We probably expected a reduced serum level among Muslim women. A vegetarian diet is usually deficient in Vitamin D and possibly a more incidence of deficiency among these people was also expected. In this study, we also tried to establish any other factors such as age, weight, or diet have got any influence on the level of Vitamin D in pregnant mothers in the first trimester.

## MATERIALS AND METHODS

This prospective, epidemiological, observational study was conducted in a semi-urban town of South India with a population of approximately one and half lakhs. The institutional ethics and review board (IRBSTH 101/2019) has approved the study. The present study was done from April 2019 to March 2020, in accordance with the declaration of Helsinki. A convenient sampling method was employed, and continuous eligible pregnant patients were selected for the study. The inclusion criteria were pregnant women in the first trimester with no known systemic illness and taking no other vitamin supplements except folic acid. The exclusion criteria were parturient with any other systemic or endocrine disease, drug intake which can alter Vitamin D estimation, or unwilling to give consent to participate in the research study. Any patient with bony disorders and with hyperemesis was excluded. This study was informed to all mothers, and a written informed consent was obtained from each of them. Random sampling of blood for vitamin D3 was taken from all parturients in the first trimester. As the sampling was done in the first trimester, no drugs except folate were given to those patients. The age, height, weight, religion, gravida, and type of diet: either a vegetarian or a nonvegetarian was noted. The present occupation was noted. The parturients who worked earlier but quit their jobs due to various reasons were considered homemakers. The type of work, if they were employed, whether heavy laborers or having white collar jobs such as software, offices, or banks were recorded. The procedure of collecting blood was explained to all parturients in the vernacular language, and consent was obtained from each one of the patients. Vitamin D3 assay was done in all the collected blood samples as a screening test. The tests were done in only asymptomatic patients. The assays

were done using chemiluminescence immunoassay system of maglumi systems 600 standardized to a precision of 99%. With an approximate population of 150,000, a crude birth rate of 3.6, application of qualtrix software of statistics, provided a sample size of 384, with a 95% confidence level, and a margin of error of 5%. We recruited 644 parturients to add power to the study. The results were subjected to the descriptive analyses, analysis of variance, Student's *t*-tests whichever was deemed suitable and necessary, and a  $P < 0.05$  was considered statistically significant. A Pearson or a Kendall correlation analyses were done for selected intergroup data according to type of data. All analyses were done after feeding the data excel sheet into the SPSS software 20.0 version (IBM Corp., Armonk, N.Y., USA) for statistical interpretation.

## RESULTS

All the 644 patients completed the study. Around 83.7% were deficient in Vitamin D3 if 20 ng/ml was taken as cutoff point to diagnose the same and 96.3% were found to be insufficient if the value was increased to 30 ng/ml. The mean age was  $26.55 \pm 4.02$  years with religion wise values indicated in Table 1. The mean age was less in 'Other' category which included Jainism mainly, but the number is too less to project the same.

The mean weight is  $63.33 \pm 12.1$  Kg, whereas the height was  $156.96 \pm 7.05$  cm. The mean Vitamin D3 values were  $14.57 \pm 6.73$  ng/ml. The similar values for Muslims were  $10.55 \pm 4.69$ . This value was significantly less than Hindus and even other religions also [Table 2].

The other variables had no significance with Vitamin D levels. The age and weight had positive correlation but with an insignificant  $R < 0.3$  [Table 3].

## DISCUSSION

The decreased levels of Vitamin D3 in antenatal mothers have been incriminated with many illnesses to both the mother and the fetus.<sup>[4]</sup> There is an increased awareness about the

**Table 1: Number of parturients and age - religion wise**

| Religion  | Number of patients | Mean age (years) |
|-----------|--------------------|------------------|
| Hindu     | 402                | 26.96±3.99       |
| Muslim    | 207                | 26.11±4.10       |
| Christian | 16                 | 25.06±3.08       |
| Others    | 19                 | 23.79±2.22       |

**Table 2: Religion wise Vitamin D values**

| Religion  | Number of patients | Vitamin- D (ng/ml), mean±SD |
|-----------|--------------------|-----------------------------|
| Hindu     | 402                | 16.63±6.95                  |
| Muslim    | 207                | 10.55±4.69                  |
| Christian | 16                 | 14.27±2.46                  |
| Others    | 19                 | 15.08±2.31                  |

Hindu versus Muslim:  $P < 0.001$  Muslim versus others:  $P = 0.013$

**Table 3: Demographic variables and Vitamin D levels**

| Correlation between                        | Coefficient value |
|--|-------------------|
| Age and Vitamin D levels (Pearson's)       | 0.16              |
| Height and Vitamin D levels (Pearson's)    | 0.42              |
| Weight and Vitamin D levels (Pearson's)    | 0.28              |
| Gravidity and Vitamin D levels (Kendall's) | 0.81              |
| <i>P</i> <0.001                            |                   |

nonclassical actions of this vitamin in pregnant mothers. The deficiency of this vitamin is being associated with insulin resistance, hypertensive disorders in the mother, growth problems, and seizures in the neonate. In our study, the mean Vitamin D3 level was 16.63 in Hindus, whereas it was 10.55 in Muslims also well below the overall average of 14.57 ng/ml. Muslim women usually after pregnancy do not move out of their homes frequently. The custom of their dress also begets exposure to sunlight and its consequences. In a single study so far Husain *et al.*<sup>[5]</sup> have shown that there is no difference between Hindus and Muslims in Vitamin D level. The sample size is smaller in their study with testing being done during lactation. Hence, this is the first such study which demonstrated the difference between religions with Muslims showing the levels significantly lower. Nikita *et al.*<sup>[6]</sup> have also demonstrated a very high incidence of Vitamin D deficiency among mothers. Our study is different in that the sampling of blood was taken before any vitamin supplementation during the first trimester of pregnancy. Many other studies have not clearly mentioned the same, and hence, our study assumes significance in reporting the results. Our mean values were between 14 and 16 ng/ml in non-Muslims. Such a high incidence of deficiency is raising eyebrows about the validity of the cutoff value. However, almost all the other studies have reported a high incidence which goes along with our studies. Our area is a semiurban area where 100% of antenatal mothers go out daily as part of their home care duties. As such, we have not precisely measured the time of sun exposure in any of them. Our geographical area is a delta area with bright sunshine for around at least 10–11 months a year. Hence, a mean of 16.63 ng/ml in Hindus with a sample size of 402 asymptomatic women is likely to question the cutoff value of 20 or 30 to some extent. We could probably suggest that around 15 ng/ml could be taken as normal. Supplementing the Vitamin D as capsule can continue as a part of excess needs, but the values need to be established to brand anyone as deficient in this vitamin. The levels of this vitamin were not significantly different when we consider age weight and diet in our study. Obesity<sup>[7]</sup> is likely to cause deficient Vitamin D, but, in our study, it was not showing any correlation. The five rules for nutrient studies as suggested

by Heaney<sup>[8]</sup> was not adhered to in many of the Vitamin D involved randomized controlled trials. As such, these types of nutrient trials are difficult to conduct because it is not easy to establish the deficiency in both the groups. The vegetarians are more prone for deficiency of this vitamin.<sup>[9]</sup> However, we did not project our data in these lines as more than 95% of all the study women were nonvegetarians.<sup>[9]</sup> This is first described study clearly depicting differences in Vitamin D levels with different religions.

### Limitations

Our study is a simple, prospective, observational study with 644 parturients. This is an epidemiological work which did not look into any correlation of vitamin deficiencies with other adverse outcomes in the fetuses with follow-ups.

### CONCLUSION

We conclude that a majority of antenatal women were deficient in Vitamin D, being worse in the Muslim population. We suggest to have a relook at the normal value of 20 ng/ml. Adequate supplements of this vitamin should be advised in rural clinics also.

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### Conflicts of interest

There are no conflicts of interest.

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