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Original Research Article

Vitamin D levels in pregnant women in Uttarakhand, India

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ABSTRACT

Background: A balanced, nutritious diet is an important aspect of a healthy pregnancy and its outcome. Vitamin D plays an important role in regular bone growth and in adequate function of innate immune system, including barrier function of mucous membrane. Vitamin D deficiency in adult females may increase risk of pre-eclampsia, gestational diabetes, bacterial vaginosis. The present study was undertaken to find the prevalence of Vitamin D deficiency in the women of Uttarakhand, India.
Methods: The study was conducted in the Department of Obstetrics and Gynecology, Himalayan Institute of Medical Sciences (HIMS), Swami Ram Nagar, Dehradun, India over a period of 12 months. Sample size was 100 pregnant females attending antenatal clinic.
Results: Out of 100 subjects, 21 (21%) had deficient, 69 (69%) had insufficient and 10 (10%) had sufficient vitamin D status. Out of 21 deficient subjects, 18 (85.71%) were Hindus, 2 (9.52%) were Muslims, 1 (4.76%) was Sikh and no deficiency was seen in Christian. In the present study, deficient vitamin D status was seen in 1 (4.76%) in lower, 16 (76.19%) in middle and 4 (19.04%) subjects in upper socioeconomic status.
Conclusions: It is concluded from our study that there is serious vitamin D deficiency and insufficiency in the women of Uttarakhand, India.

Keywords: Bacterial vaginosis, Gestational diabetes, Nutritious diet, Pre-eclampsia, Vitamin D deficiency

INTRODUCTION

A balanced, nutritious diet is an important aspect of a healthy pregnancy and its outcome.[1] Several micronutrients such as zinc, manganese, magnesium etc and fat-soluble vitamins (A, D, E, K) and water soluble vitamins (B, C), carotenoids and various minerals are important for the health of the developing fetus.[2] In view of under nutrition in developing countries they may require supplements during pregnancy.

Vitamin D plays an important role in regular bone growth and in adequate function of innate immune system, including barrier function of mucous membrane.[3] Humans can fulfil their vitamin D requirements by either ingesting food rich in vitamin D or by exposing to the sunlight for enough time to produce adequate amounts Vitamin D deficiency is prevalent in India that is unexpected in a tropical country with abundant sunshine.[2]

This paradox may be partly explained by the many prevalent social and cultural practices in India that preclude adequate exposure of adolescent girls and young women to sunshine. Newly married females are expected to cover themselves even more and discouraged from outdoor activity. Increasing urbanization that result in poor outdoor activity and greater pollution coupled with skin pigment, may further compound to this problem.[4]

Even for young girls restriction of outdoor activities, confinement at home, pardah system more in certain ethnic groups may restrict supply of vitamin D. Due to poverty, non availability of non vegetarian food and due to social and religious compulsions there may not be adequate intake of vitamin D and lack of exposure of these women to sunshine may further lead to serious vitamin D deficiency.

Vitamin D deficiency in adult females may increase risk of pre-eclampsia, gestational diabetes, bacterial vaginosis.[5] Various malpresentation, cephalo-pelvic disproportion and difficult deliveries increases the risk of caesarean section. It may also increase the risk of fetal hypovitaminosis D, neonatal rickets and tetany, lower respiratory tract infections, low birth weight, the largest cause of infant mortality in India.[6] This study was undertaken to study the vitamin D levels in antenatal women.

METHODS

The study was conducted in the Department of Obstetric and Gynecology, Himalayan Institute of Medical Sciences (HIMS), Swami Ram Nagar, Dehradun, over a period of 12 months after obtaining written informed consent and ethical clearance certificate from the institute.

It was a Observational, cross sectional study. Considering the prevalence of vitamin D deficiency among women in India to be 80% (57) with an allowable error of 10% sample size calculated was 100 (100% enumeration during the study period) convenient sampling. Sample size was 100 pregnant females attending antenatal clinic.

All pregnant subjects presenting to the Obstetrics and Gynaecology department. Subjects were selected from antenatal clinic OPD, HIMS, Dehradun.

Inclusion criteria

- All pregnant women between 12 weeks to 24 weeks.
- Less than 30 years of age.

Exclusion criteria

- All high risk pregnancies including
- pre-eclampsia, diabetes mellitus, anemia, twin pregnancy, HIV positive, HBsAg positive, jaundice, heart disease, history of seizures
- gravida 5 or more
- on category C, D and X drugs
- bad obstetric history.

Study tool

Structured study instruments (questionnaires/ formats/ subject proformas and investigations) were developed used to generate data for the study. Specific investigations were done as applicable.

Serum 25 hydroxy vitamin D estimation was done by the ELISA technique using kit obtained from DRG and readings were taken by Mind ray MR-96A microplate reader. Kit specified range is:

Serum Alkaline phosphatase, Serum Calcium, Serum Phosphorous estimation were done on the unicel DXC 800 clinical chemistry analyser using protocols as prescribed by the manufacturer Beckman coulter (India) private Ltd.

RESULTS

Out of 100 subjects, 21 (21%) had deficient, 69 (69%) had insufficient and 10 (10%) had sufficient vitamin D status with mean 25(OH)D levels 7.21±1.82,17.25±4.43, 41.85±7.70 (Table 1).

Table 1: Distribution of subjects according to vitamin D status.

	No. of patients	25 (OH)D level mean±sd
Deficiency	21 (21%)	7.21±1.82
Insufficiency	69 (69%)	17.25±4.43
Sufficiency	10 (10%)	41.85±7.70

Deficiency = <10, insufficiency = 10-29, sufficiency = 30-100

Out of 21 deficient subjects, 18 (85.71%) were Hindus, 2(9.52%) were Muslims, 1 (4.76%) was Sikh and no deficiency was seen in Christian. 69 subjects with insufficient vitamin D status, 56 (81.15%) were Hindus, 9 (13.04%) were Muslims, 3 (4.34%) were Sikh and 1 (1.44%) was Christian. All the subjects with sufficient vitamin D status were Hindus (Table 2).

Table 2: Distribution of subjects according to vitamin D status and religion.

Religion	Deficiency (n=21)	Insufficiency (n=69)	Sufficiency (n=10)
Hindu	18 (85.71%)	56 (81.15%)	10 (100%)
Muslim	2 (9.52%)	9 (13.04%)	0
Sikh	1 (4.76%)	3 (4.34%)	0
Christian	0	1 (1.44%)	0

In the present study, deficient vitamin D status was seen in 1 (4.76%) in lower, 16 (76.19%) in middle and 4 (19.04%) subjects in upper socioeconomic status. Insufficient status of vitamin D was seen in 6 (8.69%) of lower, 54 (78.26%) of middle and 9 (13.04%) subjects of upper socioeconomic status.

Sufficient vitamin D status was seen in 1 (10%) of lower, 8 (80%) of middle and 1 (10%) subject of upper socioeconomic status (Table 3).

Table 3: Distribution of subjects according to vitamin D status and socioeconomic status.

SE status	Deficiency (n=21)	Insufficiency (n=69)	Sufficiency (n=10)
Lower	1 (4.76%)	6 (8.69%)	1 (10%)
Middle	16 (76.19%)	54 (78.26%)	8 (80%)
Upper	4 (19.04%)	9 (13.04%)	1 (10%)

In this study, deficient vitamin D status was seen in 9 (42.85%) primigravida and 12 (57.14%) multigravida. Insufficient vitamin D status was seen in 34 (49.27%) primi gravida and 35 (50.72%) multigravida. Sufficient vitamin D status was seen in 6 (60%) primigravida and 4 (40%) multigravida. p value was o.670 (>0.05) which was statistically not significant (Table 4).

Table 4: Distribution of subjects according to vitamin D status and parity.

Parity	Deficiency (n=21)	Insufficiency (n=69)	Sufficiency (n=10)
Primigravida	9 (42.85%)	34 (49.27%)	6 (60%)
Multigravida	12 (57.14%)	35 (50.72%)	4 (40%)

Chi square =0.8; p = 0.670.

In the current study, deficient vitamin D status was seen in 1 (4.76%) fair, 17 (80.95%) wheatish and 3 (14.28%) dark individuals. Insufficient vitamin D status was seen in 3 (4.34%) fair, 60 (86.95%) wheatish, and 6 (8.69%) dark individuals. Sufficient vitamin D status was seen in 1 (10%) fair, 9 (90%) wheatish subjects. None of the dark subjects had sufficient vitamin D status (Table 5).

Table 5: Distribution of subjects according vitamin D status and complexion.

Complexion	Deficiency (n=21)	Insufficiency (n=69)	Sufficiency (n=10)
Fair	1 (4.76%)	3 (4.34%)	1 (10%)
Wheatish	17 (80.95%)	60 (86.95%)	9 (90%)
Dark	3 (14.28%)	6 (8.69%)	0

DISCUSSION

One Hundred pregnant subjects presenting to the antenatal OPD between 12-24 weeks, less than 30 years of age without any known complications were included and subjected to clinical evaluation and investigations. Prevalence of vitamin D deficiency and insufficiency in Uttarakhand and its association with maternal outcome was studied.

In present study, prevalence of severe vitamin D deficiency in between 12-24 weeks was 21%, and that of vitamin D insufficiency was 69% and overall prevalence of vitamin D deficiency was 90%. Sufficient vitamin D levels were seen in 10% of the patients. Similar results were reported by Sachan et al showing overall prevalence of vitamin D deficiency in pregnant women as 84.3% and 84% in urban and rural population in northern India.[7] An extensive study of existing literature reveals widespread variation in prevalence of vitamin D status of pregnant women, in range of environment all over the world in second trimester was 44.9% in African American and 2% in whites in USA, 50.6% in Ireland, 83.5% in turkey, 80.5% in Australia and 74.1% in India.[8]

Variation in these studies is due to inadequate skin synthesis and supplementation. Sunlight exposure promotes vitamin D synthesis and given the number of days the sun shines in South Asia, one would expect the region to be free from vitamin D deficiency. Unfortunately, there is high prevalence of vitamin D deficiency due to lack of proper diet, poor calcium intake, social customs like Burqa and the Purdah system in Muslims and remaining confined to the four walls of primitive housing that deprives the elderly, children and female population of the benefit of the sunshine.[9]

In the current study, deficient vitamin D status in Hindus was 85.71%, Muslim was 9.52% and 4.76% in Sikh. Insufficient vitamin D levels were found in 81.15% in Hindu population, 13.04% in Muslims, 4.34% in Sikh and 1.44% in Christian.

The overall prevalence of deficient and insufficient vitamin D status among Hindus were 74/84 (88.09%) and Muslims were 11/11 (100%).

Current results were consistent with the study by Siddiqui and Rai who found that in Northern Pakistan where sunlight was available in abundance, rickets was a common problem in infants and children. They attributed the hypovitaminosis D to malnutrition, lack of awareness and antenatal factor.[10]

In the current study, vitamin D deficiency is highest in middle socioeconomic status which is 76.19%, 19.04% in upper socioeconomic status and 4.76% in lower socioeconomic status. Vitamin D insufficiency middle, upper and lower socioeconomic status is 78.26%, 13.04% and 8.69% respectively.

A similar study by Atiq et al found lower vitamin D levels in mothers and infants of upper socioeconomic status. This is because women of upper and middle socioeconomic status mostly prefer to live indoors and have reduced exposure to direct sunlight.[11]

While Andiran et al found vitamin D deficiency in lower socioeconomic class. The explanation could lie in prolonged deficiency of dietary calcium intake because of expensive nature of milk and milk products.[12]

In the present study, deficient vitamin D levels in primigravida was 42.85% and multigravida was 57.14%. The prevalence of insufficient vitamin D levels in primigravida subjects was 49.27% and 50.72% in

multigravida. p value was found to be 0.670(>0.05) which was statistically not significant.

Similarly, Pehlivan I et al found that prevalence of vitamin D levels in primigravida was 39.7% and 46.1% in second and third gravida (p value-0.606) which showed no significant difference.[13]

Similarly, in the current study no significant difference was seen in between deficient and insufficient vitamin D status of primigravida and multigravida.

In the current study deficient vitamin D status was highest among wheatish (80.95%), dark (14.28%) and (4.76%) among fair individuals. Insufficient vitamin D status was seen in 86.95% wheatish, 4.34% fair, and 8.69% dark individuals.

Similarly, in a study by Bodnar LM et al and Matsuoka et al reported lower 25(OH)D levels among black as compared to fair skinned subjects.[14,15] Present study shows higher prevalence of vitamin D deficiency and insufficiency among whitish and darker individuals. This is due to color of skin of South Asian population varies from light brown to almost dark. Dark pigmentation has been found to decrease skin synthesis of vitamin D because UV light cannot reach the appropriate layer of the skin.

CONCLUSION

It is concluded from present study that there is serious vitamin D deficiency and insufficiency in the women of Uttarakhand. Most vitamin and mineral supplements contain 400 IU/day vitamin D as cholecalciferol which is probably inadequate to correct vitamin D deficiency in pregnancy.

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