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Original Research Article

Estimation of vitamin D levels in low risk and high risk pregnancy and to evaluate maternal and neonatal outcome

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ABSTRACT

Background: Vitamin D is linked with various physiological processes involving multiple organ systems and its deficiency is associated with pregnancy complication like pre-eclampsia, gestational diabetes mellitus, preterm delivery and low birth weight babies. The objective of this study was to estimate vitamin D levels in both low risk and high risk pregnant women and to correlate with the maternal and neonatal outcome.
Methods: This was a prospective case control study from December 2020 to June 2022 at M. S. Ramaiah Medical College and Hospital, Bengaluru. All pregnant women between 28 weeks and 40 weeks of gestation were included in the study. Enzyme-linked immunosorbent assay (ELISA) method was used for quantitative determination of 25 hydroxy vitamin D in serum of all pregnant women.
Results: A total of 166 pregnant women were included in the study, of which 81 subjects were high risk and 85 pregnant women were low risk. The mean vitamin D levels was 19.96 ng/ml in high risk group and 26.8 ng/ml in low risk group and this was statistically significant. In high risk group 23.45% were deficient and in low risk group 12.94% were deficient which was significant. The neonatal birth weight and serum vitamin D levels showed a strong correlation in low risk group as compared to the high risk group.
Conclusions: Vitamin D deficiency or insufficiency in pregnancy can lead to complications in both mother and fetus. Estimation of vitamin D levels in pregnancy and supplementation can lead to healthy baby and healthy mother.

Keywords: Vitamin D levels, Pre-eclampsia, Gestational diabetes mellitus, Low birth weight

INTRODUCTION

Vitamin D is well known to be involved in bone metabolism, cell functioning and reproduction. These are studied from childhood, puberty to old age.[1,2] Vitamin D is involved in various physiological processes as diverse as vascular health, immune function and respiratory health. Vitamin D is involved in implantation and placental development and immunomodulatory action.[3,4]

Low vitamin D levels have been associated with adverse pregnancy outcomes like hypertension, gestational diabetes mellitus, preterm delivery and low birth weight.[5,6] The precise mechanism involved between pre-eclampsia and vitamin D are yet to be determined.[7]

Vitamin D is a prohormone that is derived from cholesterol.[8] Vitamin D occurs naturally in fish and some plants but is not found in significant amount in meat, vegetables and fruits.[8] The recommendation of vitamin D is 200 IU/ day for both pregnant and non-pregnant individuals.[9]

The relative contribution of dietary vitamin D is low in humans, compared with endogenous production from sunlight.[10.11]

Exposure to sunlight, especially ultraviolet B photons, initiates conversion of provitamin D3 to previtamin D3. This binds to vitamin D binding protein for transport in the circulation and is stored in fat or metabolised in the liver.[11] It is hypothesised that low calcium levels through vitamin D mediation leads to development of pre-eclampsia.[8] There is no consensus regarding the optimal level of vitamin D in pregnancy.[12]

Aims and objectives

Objectives of the study was to correlate the vitamin D levels with maternal and neonatal outcome.

METHODS

This was a prospective case control study done at the Department of Obstetrics and Gynaecology, M. S. Ramaiah Medical College and Hospital, Bengaluru from December 2020 to June 2022. All pregnant women with gestational age between 28 weeks to 40 weeks were included in the study. A total of 166 subjects were included. 81 subjects were allotted in the high risk group and 85 pregnant women were in the low risk group.

Enzyme linked immunosorbent assay (ELISA) test was used for quantitative determination of 25 hydroxy vitamin D in serum of all women included in the study.

The following range for classification was used given in Table 1.

Table 1: Classification based on vitamin D levels.

25 hydroxy vitamin D levels	Reference range (ng/ml)
Deficient	0-10
Insufficient	10-30
Sufficient	30-100
Toxicity	>100

Inclusion criteria

All pregnant women between 19 years to 40 years with singleton pregnancy and with gestational age between 28 weeks to 40 weeks, irrespective of gravidity were included.

Exclusion criteria

All pregnant women with connective tissue disorder, those on vitamin D supplements and those taking drugs which affects vitamin D metabolism were excluded.

Statistical analysis

Descriptive statistics of gestational diabetes mellitus, pre-eclampsia, vitamin D deficiency, low birth weight, preterm delivery will be analysed in terms of percentage. Chi square test would be used to find the association between these and vitamin D deficiency.

RESULTS

During the study period a total of 166 women were included. 81 were high risk group and 85 were low risk group. The mean age in the high risk group was 28.2 years and in the low risk was 27.4 years.

The education, job, income was similar in both the groups and there was no statistical significance. In the study, primigravidae were 43.5% and multigravidae were 56.5% in low risk group. In high risk group, primigravidae were 28.4% and multigravidae were 71.6%.

The mean gestational age in low risk group was 38.2 weeks with a standard deviation of 1.206, while in high risk group, the mean gestational age was 36.3 weeks with standard deviation of 2.3 which was statistically significant with p<0.001 (Table 2).

Table 2: Mean gestational age of subjects in the study (n=166).

High risk (n=81)		Low risk (n=85)		P value
Mean	**SD**	**Mean**	**SD**	
36.325	2.354	38.208	6.352	<0.001

In the high risk group, 23.4% had vitamin D deficiency, 59.2% had insufficiency and 17.2/5 had sufficient vitamin D. in the low risk, 12.94% had deficiency, 42.35% had insufficiency and 44.7% had sufficient levels. The difference was statistically significant with p value less than 0.01 (Table 3).

Table 3: Serum vitamin D levels in both the study groups (n=166).

Parameters	High risk (n=81) (%)	Low risk (n=85) (%)
Deficiency	19 (23.4)	11 (12.94)
Insufficiency	48 (59.2)	36 (42.35)
Sufficiency	14 (17.2)	38 (44.7)

The mean vitamin D levels in high risk group was 19.962 ng/ml and 26.898 ng/ml in low risk group. This difference was statistically significant with p value <0.001 (Table 4).

Table 4: Mean vitamin D levels in high risk and low risk group (n=166).

Variables	Mean	SD	P value
High risk (n=81)	19.962	11.659	<0.001
Low risk (n=85)	26.898	14.904	

The serum vitamin level in various clinical conditions were compared. There was no statistical significance.

The mean birth weight of the newborn was studied in both the groups. Birth weight and serum vitamin D levels showed a stronger correlation (0.365) in low risk group and was highly significant, and in high risk group it was 0.253 and was weak.

In the high risk group, 41.9% of newborns were shifted to neonatal intensive care unit (NICU) for observation and 9.41% in the low risk group. 14.8% in the high risk group were admitted in NICU and 4.7% if newborns in low risk group were admitted. The p value was less than 0.001 which was statistically significant (Table 5).

Table 5: Neonatal outcome among the study groups (n=166).

Parameters	High risk (n=81) (%)	Low risk (n=85) (%)
Shifted to NICU for observation	34 (41.9)	8 (9.41)
NICU admissions	12 (14.8)	4 (4.7)

DISCUSSION

During pregnancy and lactation, mothers provide large amount of calcium to the developing fetus and suckling newborn.[13] Many women are deficient in vitamin D both before and during pregnancy.[14] High maternal concentration of vitamin D may increase the risk of atopic disorders to children.[14] Hence, supplementation during pregnancy to be targeted to deficient pregnant women and not all.[14] Vitamin D deficiency may be associated with increased risk of wide range of chronic diseases that are different from the classic action of calcium on bone homeostasis.[15] Vitamin D insufficiency is associated with increased risk of gestational diabetes mellitus, pre-eclampsia and small for gestational age infants.[16] Vitamin D deficiency is associated with increased risk of cancer (breast), chronic inflammatory disease, autoimmune disease, metabolic syndrome and skeletal disorder like osteoporosis.[17] Screening of women during their first prenatal visit for vitamin D levels and subsequent supplementation prevent complications.[18] There is controversy regarding the increased rate of caesarean section with vitamin D deficiency. Caesarean section indications are variable related to many other obstetric factors. Vitamin D supplementation during pregnancy was associated with increased birth weight and increased circulating vitamin D levels.[19]

A defect of dental enamel was found in high proportion of infants where mothers did not receive supplementation during pregnancy.[20] Vitamin D acts as a modulator of implantation, cytokine production and immune response to infections.[21] Vitamin D levels in early pregnancy is inversely associated with gestational diabetes mellitus risk.[22] In our study, the average age of the study population was 28.2 years as in our country, the age of marriage is early. This is similar to the study done by Lacroix et al, who has reported average age as 28.4 years.[23] Bener et al has reported average age as 39.8 years.[24] In our study, multiparous ladies have low vitamin D levels compared to primigravidae. This was similar to the study of Bener et al.[24]

In our study, the mean gestational age in high risk group was 36.32 weeks. Bener et al reported the same mean gestational age of 36 weeks in their study.[24]

In our study, pre-eclampsia and gestational diabetes mellitus were associated with low levels of vitamin D of 17.5 ng/ml and 21.2 ng/ml. Bener et al reported vitamin D level of 17.7 ng/ml with gestational diabetes mellitus and 18.01 ng/ml with pre-eclampsia. Sedighere et al reported vitamin D level of 19.6 ng/ml in preeclampsia.[25] Dror et al reported vitamin D level of 20 ng/ml in pre-eclampsia.[26]

In our study, in the high risk group who had vitamin D deficiency had low birth weight babies. The mean birth weight difference in the newborns between high risk and low risk group was 393 grams. Bowyer et al reported the difference of 132 gm.[27]

Limitations

The number of cases were limited and the study was done for a short period.

CONCLUSION

Vitamin D is known to play a role in bone metabolism. Recently vitamin D has been linked to physiological processes that include placental development, immunological response, respiratory health and vascular health. Vitamin D is linked to various pregnancy complications like gestational diabetes mellitus, pre-eclampsia, infections, caesareans sections, fetal growth restriction and low birth weight. Many women go undetected with vitamin D deficiency hence, estimation of vitamin D levels in pregnancy and supplementation may prevent complications and lead to a healthy baby and a healthy mother. It is essential to have healthy diet and adequate exposure to sunlight. The best practical solution is to fortify food items with vitamin D and provide for at risk population.

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