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Original Research Article

Vitamin D deficiency and adverse fetal outcome

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ABSTRACT

Background: Vitamin D deficiency is recognized as the most untreated nutritional deficiency in the world. It is plausible that vitamin D deficiency could make the fetal heart more vulnerable to distress/birth asphyxia. Vitamin D deficiency has been hypothesized to be associated with low birth weight, low Apgar score at birth, higher rates of still births and admission to NICU. The aim of present study was to study prevalence of vitamin D deficiency in pregnancy and evaluate perinatal outcome.

Methods: The study was conducted in the department of obstetrics and gynecology, Kamla Nehru Hospital, Shimla, India over a period of 12 months. Six hundred women were included in the study.

Results: All the mothers who had still births suffered from vitamin D deficiency and the severe vitamin D deficiency was there in 90.91% (30) of these subjects. Severe vitamin D deficiency was seen in 78.95% (75) of the subjects having babies with birth weights <2.5 kg compared to 61.16% (288) subjects of the other group.

Conclusions: Adverse fetal outcome are more common in vitamin D deficient group.

Keywords: Apgar score, Neonatal intensive care unit, Still birth, Vitamin D deficiency

INTRODUCTION

Vitamin D deficiency is recognized as the most untreated nutritional deficiency in the world.¹

At no other time during the life cycle, is vitamin D status more important than during pregnancy, as mother is the sole source of vitamin D substrate for her developing fetus.²

Vitamin D is important for postnatal muscle strength. Birth asphyxia is associated with cardiovascular dysfunction, including low ventricular output, lower left ventricular ejection fraction and increased troponin levels. Congestive heart failure may occur in severe cases of asphyxia. It is plausible that vitamin D deficiency could make the fetal heart more vulnerable to distress/birth asphyxia. Several studies have reported

increased frequency of emergency caesarean delivery in relation to low vitamin D levels.³

Neonatal vitamin D levels are correlated with those of their mother, with maternal vitamin D deficiency increasing the risk of neonatal vitamin D deficiency. In an Australian study, hypovitaminosis D was found in 15% of pregnant women and 11% of neonates. Vitamin D deficiency is a major cause of hypocalcaemic seizures in neonates and infants. Hypocalcaemia is not uncommon in neonates and is a potentially severe problem. Mothers of babies who suffer hypocalcaemic seizures are more likely to be vitamin D deficient (85%) than mothers of babies who do not (50%). In another study from Egypt, all mothers of babies with hypocalcaemic seizures had severe vitamin D deficiency. Maternal vitamin D deficiency is a common, and potentially preventable, cause of neonatal hypocalcaemia. This is especially common in South Asian women.⁴

Vitamin D deficiency has been associated with low birth weight and admission to NICU.

METHODS

Observational study conducted in the department of obstetrics and gynecology, Kamla Nehru State Hospital for Mother and child, IGM, Shimla, India w.e.f. 1st August 2017 to 31st July 2018. All women fulfilling the inclusion criteria were included in the study.

Inclusion criteria

- Age 18-40 years
- Primigravida
- Confirmed viable singleton intrauterine pregnancy
- POG more than or equal to 28 weeks.

Exclusion criteria

- Current or past medical illness which may interfere with vitamin D and calcium levels such as hyperparathyroidism, collagen diseases, Cushing’s disease, chronic renal disease, GI disease, lung cancer and ovarian tumours
- Taking medications that interfere with vitamin D and calcium
- Levels-anticonvulsants, corticosteroids, thiazides, thyroxine, heparin, antitubercular drugs
- Known case of diabetes, hypertension
- Multiple pregnancy
- Multiparity.

Six hundred women fulfilling the inclusion criteria at POG >=28 weeks of pregnancy and delivering in labour room of our hospital were included after written informed consent. Information on age, education, occupation, income, religion, diet, vitamin supplements and dairy

products intake, exposure to sunlight etc. was obtained from the subjects using a questionnaire. A fasting blood sample of minimum 2 ml was taken and was tested for serum 25(OH)D by CMIA (chemiluminescent microparticle immunoassay) method in hospital lab. LC-MS/MS (liquid chromatography-mass spectrometry) procedure was used for vitamin D quantification.

The patients were categorised as per the levels:

- Severe deficiency - <10 ng/ml
- Moderate deficiency - 10-19.9 ng/ml
- Mild deficiency - 20-29.9 ng/ml
- Optimal level >=30 ng/ml.

Statistical analysis

All the data was entered in Microsoft excel 2007 spreadsheet. Categorical variables were analysed using Chi square and Fischer exact test. Continuous variables were analysed using the appropriate tests after checking for the normality distribution using Kolmogrov Smirnov test.

- (S) = significant
- (NS) = not significant.

A p-value of 0.05 or less was considered statistically significant.

RESULTS

Out of 600 subjects, 32 (5.33%) subjects had sufficient vitamin D levels and 568 (94.67%) had vitamin D deficiency. Among the vitamin D deficient subjects, 46 (7.66%) had mild, 159 (26.50%) had moderate and 363 (60.50%) had severe vitamin D deficiency.

Table 1: Vitamin D levels and still births.

Births (n=600)	Vitamin D sufficiency (n=32)		Vitamin D deficiency (n=568)		Mild deficiency (n=46)		Moderate deficiency (n=159)		Severe deficiency (n=363)		P value
Live birth (n=567, 94.5%)	32	5.45%	535	94.35%	45	8.42%	157	29.35%	333	62.2%	0.31 (NS)
Still birth (n=33, 5.5%)	0	0%	33	100%	1	3.03%	2	6.06%	30	90.9%	

Table 1 depicts the distribution of the subjects according to live births/still births of the babies. 567 (94.5%) babies were live born and 33 (5.5%) were still born.

Among the vitamin D sufficient group, all 32 subjects had live birth and none had still birth, however in vitamin

D deficient group, 535 (94.19%) subjects had live born babies while 33 (5.81%) subjects had still born babies.

It can be clearly interpreted that all the mothers who had still births suffered from vitamin D deficiency and the severe vitamin D deficiency was there in 90.91% (30) of these subjects.

As depicted in Table 2, out of 600, 97 (16.17%) babies were having weight <2.5 kg and 503 (83.83%) were having weight >2.5 kg.

Among the vitamin sufficient group, 2 (6.25%) subjects had babies weighing less than 2.5 kg while 30 (93.75%) subjects had babies with birth weight more than 2.5 kg.

Table 2: Vitamin D levels and birth weight of baby.

Total (n=600)	Vitamin D sufficiency (n=32)		Vitamin D deficiency (n=568)		Mild deficiency (n=46)		Moderate deficiency (n=159)		Severe deficiency (n=363)		P value
Birth weight <=2.5 kg (n=97, 16.17%)	2	2.06%	95	97.94%	5	5.26%	15	15.79%	75	78.95%	0.22 (NS)
Birth weight >2.5 kg (n=503, 83.83%)	30	5.96%	473	94.04%	41	8.67%	144	30.44%	288	60.89%	

Table 3: Vitamin D levels and Apgar Score at birth.

Total (n=600)	Vitamin D sufficiency (n=32)		Vitamin D deficiency (n=568)		Mild deficiency (n=46)		Moderate deficiency (n=159)		Severe deficiency (n=363)		P value
Apgar<7 (n=118, 19.67%)	3	2.54%	115	97.46%	8	6.96%	24	20.87%	83	72.17%	0.20 (NS)
Apgar>=7 (n=482, 80.33%)	29	6.02%	453	93.98%	38	8.39%	135	29.80%	280	61.81%	

Table 4: Admissions to NICU.

Admission to NICU (n=600)	Vitamin D sufficiency (n=32)		Vitamin D deficiency (n=568)		Mild deficiency (n=46)		Moderate deficiency (n=159)		Severe deficiency (n=363)		P value
Yes (n=105, 17.5%)	2	1.90%	103	98.10%	8	7.77%	22	21.36%	73	70.87%	0.13 (NS)
No (n=495, 82.5%)	30	6.06%	465	93.94%	38	8.17%	137	29.46%	290	62.37%	

In the vitamin D deficient group, 95 (16.73%) subjects had baby birth weights less than 2.5 kg whereas 473 (83.27%) subjects had babies weighing more than 2.5 kg.

Severe vitamin D deficiency was seen in 78.95% (75) of the subjects having babies with birth weights <2.5 kg compared to 61.16% (288) subjects of the other group, thus vitamin D deficiency has definite impact upon the growth of fetus.

Table 3 depicts the distribution of the subjects according to Apgar score of their babies. Out of 600 subjects, 118 (19.67%) babies had Apgar <7 and 482 (80.32%) had Apgar >7. Out of 118 subjects, only 3 (2.54%) mothers had sufficient vitamin D levels and 115 (97.46%) had vitamin D deficiency, further 83 (72.17%) subjects had severe vitamin D deficiency.

Among the rest of 482 subjects, 29 (6.02%) had sufficient vitamin D levels and 453 (93.98%) had vitamin D deficiency, however the difference was not statistically significant (p value=0.20).

Table 4 depicts the distribution of the subjects according to admission to NICU of their babies. Out of 600

subjects, 105 (17.5%) babies were admitted to NICU and 495 (82.5%) were not admitted in the NICU.

Out of 105 subjects whose babies were admitted in NICU, only 2 (1.90%) mothers had sufficient vitamin D levels while 103 (98.10%) had vitamin D deficiency. Among the 103 vitamin D deficient mothers, 73 (70.87%) had severe vitamin D deficiency but the association was not statistically significant (p value =0.13).

DISCUSSION

It is clearly evident from Table 1 that all still births occurred in women who were vitamin D deficient. The results were corresponding to the study conducted by Chauhan N et al.⁵ However in study conducted by Prasad D et al, still births occurred comparatively more in women with vitamin D deficiency 83.33% versus 16.67% in vitamin D sufficient group.¹

In this study vitamin D deficiency was slightly more in mothers whose babies had birth weight less than 2.5kg compared to subjects in whom birth weight were more than 2.5 kg i.e. 97.94% versus 94.04%. Similar results were also observed in studies conducted by Nageshu S et

al, Dave A et al, Prasad D et al, Chauhan N et al.^{1,6,7} Vitamin D deficiency predisposes to low birth weights in babies.

Table 4 depicts the distribution of subjects according to NICU admissions of their babies. As per this study, 98.10% of the subjects whose babies were admitted in the NICU, had vitamin D deficiency, which is similar to the studies conducted by Nageshu S et al and Prasad D et al i.e., 87.5% and 90% respectively.^{1,6}

Vitamin D deficiency makes the fetal heart more vulnerable to fetal distress or birth asphyxia, thus increasing the NICU admissions in babies.

CONCLUSION

This study concludes that there is high prevalence of vitamin D deficiency in pregnancy. Adverse perinatal outcome was more prevalent in the vitamin D deficient group, however more studies are required to establish the direct correlation.

Authors recommend encouragement of outdoor activities, exposure to sunlight, and vitamin D supplementation in those with insufficient vitamin D levels.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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