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Original Research Article

A Study on Correlation between Maternal Vitamin D Levels and Low Birth Weight Babies in Tertiary Care Centre: An Observational Study

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Abstract

Background: Vitamin D is a fat-soluble vitamin that plays a major role in calcium and phosphorus homeostasis and bone metabolism in the body. Maternal hypovitaminosis D may impair fetal growth and cause adverse pregnancy outcomes including intrauterine growth restriction and neonatal low birth weight. In the present Study we aimed to find out correlation between the vitamin D level and Low Birth Weight.

Materials and Methodology: This is an observational Case-control study conducted in department of obstetrics and Gynaecology, Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar for the duration of one year. We have included 80 patients divided into cases and controls. Depending on mother's 25(OH) Vitamin D level, all mothers were categorised in Deficient <25 ng/dl, Insufficient 25 to 50 ng/dl, Normal >50 ng/dl, Toxic level >250ng/dl.

Results: observed that maximum patients were from the age group of 21 – 30 years in cases as well as in controls. Among the cases 65% of the mothers were obese and 25% of the mothers were underweight. There was positive and significant correlation between birth weight and Vitamin-D level.

Conclusion: neonatal low birth weight could be related to maternal vitamin D deficiency. Modifying maternal nutrition behaviour and vit D level could be beneficial on prevention of low birth weight, there is a need for recommendation for vitamin D supplementation during pregnancy.

Keywords: Vitamin-D, Hypovitaminosis, Maternal Nutrition, Homeostasis

Introduction

Vitamin D is a fat soluble vitamin that helps body to absorb calcium and phosphorus. Having adequate amount of vitamin D, Calcium and phosphorus is essential for bulding and keeping strong bones. Recently, there has been considerable recognition of the importance of its role in modifying the immune system and regulating cell proliferation and cell differentiation[1, 2]. Vitamin D deficiency was defined as a serum 25-hydroxy Vitamin D (25-OH D) concentration less than 20 ng/ml, while Vitamin D insufficiency was defined as a 25-(OH)-D concentration less than 30 ng/ml[3]. Due to the function of Vitamin D, many concerns have been raised regarding important impacts of Vitamin D deficiency and the association risk of diseases such as chronic kidney disease, cystic fibrosis, obesity, etc. [4, 5]

Low birth weight (LBW) refers to term or preterm neonates with birth weight < 2500 gr. These neonates may be small for gestational age or have intrauterine growth restriction. Mortality rate in such neonates is 40 times more than those with normal weight [6]. Vitamin D (vit D) has a key role in fetal growth by its interaction with parathyroid hormone and Ca2+ homeostasis. Studies confirmed that insufficient prenatal and postnatal levels of vit D have great effects on poor bone mineralization which have significant association with small for gestational age births [7]. Hypovitaminosis D, especially among pregnant women, is a major public health problem with a very high prevalence ranging from 18% to 84%. Maternal vitamin D levels have been shown to positively correlate with birth weight centile as has been shown in studies from various countries [8-10].

Vitamin D deficiency is unexpected in India, a tropical country where there is adequate overhead sun for most of the time all of the year. But due to the recent urbanization that results in poor outdoor activity and greater pollution burden, coupled with other factors, may further aggravate this problem. Thus in the present study we aimed to find out correlation between the vitamin D level and Low Birth Weight

Materials and Methodology :

This is an observational Case-control study conducted in department of obstetrics and Gynaecology, Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar for the duration of one year. We have included 80 patients divided into cases and controls on the basis of following inclusion and exclusion criteria.

Inclusion Criteria

- Term neonates with birth weight (>2500gm) and their mothers.
- Term neonates with birth weight (<2500 gm) and their mothers.
- Mode of delivery : either vaginally or by caesarean section.

Exclusion Criteria

Mothers with, Pre eclampsia, Eclampsia, Postpartum haemorrhage, Insulin dependent diabetes, Twin pregnancy, Systemic and chronic disease, Haemotology disorder, Drug abuse, Neonates with congenital malformation and infection.

Subject could be divided into cases and control based on the neonatal birth weight.

- Cases : Mother of neonates with birth weight <2500gm
- Controls :Mother of neonates with birth weight >2500gm

Methodology

In order to determine maternal vitamin D level, immediately two hours after delivery 5ml of mothers blood will be collected, labelled and sent to laboratory to assay serum 25 (OH) vitamin D level by 25 hydroxy vitamin d enzyme immunoassay method. Depending on mother's 25(OH) Vitamin D level, all mothers were categorised in

- Deficient <25 ng/dl

- Insufficient 25 to 50 ng/dl
- Normal >50 ng/dl
- Toxic level >250ng/dl

Statistical Analysis

Collected data entered in Microsoft excel 2016 for further analysis. Qualitative data were presented in the form of frequency and percentage, while quantitative data were presented in the form of mean and standard deviation. Mean difference between the cases and controls were assessed by using t-test, and association were assessed by using chi-square test. Pearson correlation test was applied to check correlation between Birth weight and Vitamin D level. P-value<0.05 was considered as statistically significant. Statistical Analysis was carried by using software SPSS version 25.

Observation and Results :

In the present study we had 40 cases and 40 controls, we observed that maximum patients were from the age group of 21 – 30 years in cases as well as in controls. Among the cases more than 50% of the patients were form age group of 25 - 30 years. Among the cases 65% of the mothers were obese and 25% of the mothers were underweight and other demographic variable shown in bellow table.

Table 1 : Distribution of demographic variables between cases and Controls.

Parameters	Cases	Controls	Chi-square	P-value
Maternal Age Group				
>20 Years	4(10%)	6(14%)	8.21*	0.041
21 -25 Years	8(20%)	17(42%)		
26-30 Years	22(55%)	10(26%)		
>30 Years	6(15%)	7(18%)		
Gestational Age				
38th Weeks	29(72.5%)	8(20%)	23.25**	<0.001
39th Weeks	7(17.5%)	26(65%)		
40th weeks	4(10%)	6(15%)		
Parity				
Primi	28(70%)	23(57.5%)	1.35	0.244
Multiparous	12(30%)	17(42.5%)		
Body Mass Index				
<18.5	10(25%)	8(20%)	44.21**	<0.01
18.5-24.9	4(10%)	31(77.5%)		
>25	26(65%)	1(2.5%)		
Complexion				

Fair	9(22.5%)	15(37.5%)	2.14	0.14
Dark	31(77.5%)	25(62.5%)		
Mode of Delivery				
Normal	7(17.5%)	28(70%)	22.4**	<0.001
LSCS	33(82.5%)	12(30%)		

*P-value<0.05 significant at 5% level of Significance and **P-value<0.05 highly significant 5% level of significance.

Table 2 : Distribution of birth weight and Haemoglobin between cases and Control.

Parameters	Cases	Controls	Chi-square	P-value
Birth Weight				
<2.0 Kg	3(7.5%)	0(0%)	39.02**	<0.001
2.01-2.5 Kg	31(77.5%)	6(15%)		
2.51-3.00 Kg	6(15%)	34(85%)		
Haemoglobin				
<10	16(40%)	4(10%)	9.6**	0.001
>10	24(60%)	36(90%)		

*P-value<0.05 significant at 5% level of Significance and **P-value<0.05 highly significant 5% level of significance.

Table 3 : Mean distribution of Vitamin D in birth weights.

Birth Weight	Vitamin D level			
	Mean	Std. Dev	t-value	P-value
<2.5 Kg (N=40)	10.45	2.61	13.84**	0.001
>2.5 Kg (N=40)	21.67	3.87		

**P-value<0.05 highly significant 5% level of significance.

Above table shows that birth weight of the baby less than 2.5Kg had low level of vitamin D level in their mothers and those had weight more than 2.5 kg had high level of vitamin D level and this difference between the mean of vitamin D was statistically significant.

Table 4 : Correlation between birth weights and Vitamin D level.

	Vit D Vs Birth Weight

Pearson Correlation	0.786
Sig. (2-tailed)	<0.001
N	80

Discussion:

We have conducted present observational case-control study in our institution, in the department of Obstetrics and Gynecology, on 80 patients, divided into two equal groups and the relationship between maternal vitamin D3 level and low birth weight babies were studied.

Karimnagar district lies at latitude of 18.438555°N and longitude of 79.128838°E and experiences dry inland climatic conditions with hot summers and cool winters. Yet, the apparently healthy populations including pregnant mothers in this area were found to be deficient in Vitamin D as suggested by unpublished studies conducted in our institution.

In Present study, increasing maternal age showed a significant decrease in serum vitamin D levels (p value =0.005) This is supported by studies conducted by Indian journal of basic applied medical research, June 2017 and also by journal of pregnancy and child health in UAE 2014.

Study showed that among cases primi was 70% and multi was 30%. Among control, primi was 57.5% and muti was 42.5%.thus there was no significant correlation between parity and vitamin D deficiency.

Increasing BMI (obesity) was associated with vitamin D deficiency and low birth weight babies observed in our studies. In our study we found that 40% of the cases had haemoglobin less than 10 while 60% of the cases had Hb level was more than 10

Our study showed that mean vitamin D level in mothers among cases was 10.45 ± 2.61 ng/mL was lower than in mothers of normal birth weight newborns 21.67 ± 3.87 ng/mL so this difference in mean vitamin D Level was statistically significant and this findings was consistent with the study by Khalessi et al. [11] and other studies [12, 13]. Maternal vitamin D levels were found to be positively correlated with birth weight ($p<0.01$). This finding was also seen in the study by Bodner et al. [14] Australian researchers found that mean birth weight was 200 g lower ($p <0.01$) in babies of vitamin D deficient mothers [15]. Many other studies have also reported an association between infant size and vitamin D status. We have also found a positive correlation of maternal vitamin D status with birth length ($p<0.01$), head circumference ($p<0.01$) and chest circumference (<0.01) and this was compatible with studies by Song et al. [16] and Satish et al. [17] was against findings by Khalessi et al. [11].

Efforts to support adequate maternal vitamin D intake, outdoor activity during pregnancy, and an adequate supply of vitamin D in neonates are important for preventing neonatal respiratory morbidities. [18] Our study has some limitation that, we have not measured difficiency and insufficiency of Vitamin D level among the cases, and also our sample size was very less, thus again some more multicentric studies required to confirm the vitamin D outcome.

Conclusion :

From above observation and discussion we can conclude that this study shows neonatal low birth weight could be related to maternal vitamin D deficiency. Modifying maternal nutrition behaviour and vit D level could be

beneficial on prevention of low birth weight, there is a need for recommendation for vitamin D supplementation during pregnancy. Also more research in this field will be contribute to improve maternal and neonatal health.

Conflict of Interest : None to declare

Funding : None

Ethical Approval : Approved from Institutional Ethical Committee

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