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ORIGINAL ARTICLE

Frequency of Vitamin D Deficiency in the Mothers of Low Birth-Weight Newborns: A Cross-Sectional Study

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ABSTRACT

Objective: To determine the frequency of vitamin D deficiency in the mothers of low birth-weight newborns

Study design: A cross-sectional study

Place and Duration: Postnatal/Neonatal ward, Liaquat University Hospital Hyderabad and Jamshoro, from December 2020 to June 2021

Methodology: The study includes full-term newborns who had low birth weights, regardless of gender, and who were admitted to a neonatal or postnatal unit. Each mother gave a 5ml blood sample, which was sent right away to the hospital laboratory. Within 24 to 48 hours following delivery, a diagnostic lab checked the mother's vitamin D level. To determine the neonatal birth weight in kilograms, all the neonates were measured. All of the information about the maternal vitamin D level, the neonatal birth weight, and demographic data were entered after the reports had been collected. The researcher performed all measures. The proforma had all of the information. With SPSS version 20, data analysis was carried out.

Results: The average age of the mother was 26.46 + 3.91 years. A total of 53.6% of newborns were males and 46.4% of newborns were female. Overall 90% of women were housewives, while 10% were employed. Women made up 68.6% of the reservations, while 31.45% were not. A total of 33.6% of all newborns underwent caesarean procedures, compared to a normal vaginal delivery rate of 66.4%. Eighty-seven percent of mothers were vitamin D deficient, and of them, 45.0% had mild deficiencies, 23.6% had moderate deficiencies, 12.1% had severe deficiencies, and 19.3% had normal vitamin D levels. Related to maternal age, newborn gender, and occupation, vitamin D deficiency was statistically insignificant ($p>0.05$), but it was statistically significant (p-0.05) according to a place of residence, educational attainment, SES, parity, booking status, and delivery method.

Conclusion: Frequency of vitamin D deficiency was found to be highly prevalent among mothers, of neonates who presented with low birth weight.

Keywords: Newborn, vitamin D, Birth weight

INTRODUCTION

Low maternal vitamin D levels have been linked to a variety of negative neonatal outcomes, such as small for gestational age and preterm births, harm to the development of the baby's bones and teeth, and an increased risk of infections. [1, 2] The regulation of bone mineralization and calcium and phosphorus balance is greatly influenced by vitamin D. [3] The function of the placenta, calcium homeostasis, and bone mineralization during pregnancy are all critical factors in fetal growth and development.[4]

Numerous observational studies have demonstrated that the important time frame of pregnancy is when vitamin D deficiency may have a negative impact on mother and newborn outcomes. The majority of published research that has examined the connections between maternal vitamin D levels during pregnancy and fetal development have primarily employed birth weight as their primary outcome measure and have produced mixed findings. [5, 6] Normally, the serum levels of circulating and free form rise during pregnancy, but some evidence suggests that many south Asian mothers are vitamin D deficient, which is linked to 25.02% more low birth weight babies than normal birth weight babies in women, [7] despite the fact that it is also linked to disastrous consequences like increased rates of abortion and neonatal infections.

Low birth weight neonates are those with birth weights of less than 2500 g, and they are divided into a considerable increase in the mortality rate compared to those of normal weight, either small for gestational age or with intrauterine growth restriction. [8] By the conclusion of pregnancy, the fetus has received about 25–30 grammes (g) of calcium, the majority of which was given to it during the last trimester. [9]

Between 27% and 91% of pregnant women in the United States, experience vitamin D deficiency or insufficiency. [3] By affecting immune and inflammatory gene expression in infants, vitamin D has an impact on maternal and neonatal health. [10] Low birth weight newborns are always a worry for neonate mortality and morbidity, and they have been associated with necrotizing enterocolitis, intraventricular haemorrhage, and bronchopulmonary dysplasia as major morbidity concerns. [11]

According to a global survey, 62.3% of mothers of LBW neonates had vitamin D deficiency, which was significantly higher than the percentage of mothers with normal vitamin D levels. [12] However, there are no local studies of this nature to be discovered in the literature. In order to determine the prevalence of maternal vitamin D deficiency in low birth weight infants, this study has been planned. It will be advised that vitamin D levels should be evaluated and controlled during prenatal care to reduce the burden of newborn morbidity if this study demonstrates that vitamin D deficiency is substantial in mothers with low birth weight neonates.

METHODOLOGY

This cross-sectional study was conducted at the Postnatal/Neonatal ward, Liaquat University Hospital Hyderabad and Jamshoro, from December 2020 to June 2021. Newborn birth weight <2.5kg was labelled as low birth weight. Maternal vitamin D level than 20 ng/mL was labelled as vitamin D deficiency. The severity of vitamin D deficiency is divided into mild, moderate, and severe. Normal: 25-hydroxyvitamin D >20 ng/mL. Mild deficiency, moderate deficiency and severe deficiency: less than 20 ng/mL, less than 10 ng/mL less than 5 ng/mL respectively.

The percentage (mothers of LBW neonates with vitamin D deficiency was 62.3%) was used in the sample calculation using the Raosoft software for "Sample size computation." The sample size for my study was 140, with a confidentiality level of 95% and a 6% margin of error.

Full-term newborn babies with a low birth weight of either gender received in the neonatal or postnatal ward were included in

the study. Newborns whose mothers had chronic diseases such as Diabetes Mellitus, HTN, Pregnancy Induced HTN, Twin Pregnancy, Thyroid diseases, Asthma and who were taking anti-epileptic drugs were excluded from the study.

All the mothers provided written informed consent after being told of the study's objectives. Within 24 to 48 hours following delivery, a 5ml blood sample from each mother was taken, and it was submitted right away to the hospital's diagnostic laboratory for analysis of the maternal vitamin D level. To determine the neonatal birth weight in kilograms, all the neonates were measured. Following the collection of reports, all the information on the vitamin D status of the mother and the weight of the newborn, along with demographic data, was recorded. The researcher performed all measures. The proforma had all of the information.

Version 20 of SPSS was used to analyse the data. Age, vitamin D level, and birth weight each had their respective means and standard deviations calculated. For each of the following factors—gender, the baby's mother's education level, her occupation, her socioeconomic status, her booking status, her parity, and the method of delivery—frequency and percentages were calculated. It was categorized according to the mother's age, the gender of the newborn, her educational level, her social standing, her booking status, her parity, the mode of delivery, her occupational status, and her vitamin D deficit. A p-value of 0.05 or below was used in the chi-square analysis to determine significance.

RESULTS

A total of 140 low birth-weight newborns were observed for maternal vitamin D deficiency. The maternal mean age was 26.46+3.91 years. Out of all newborn babies, 53.6% were males and 46.4% were females. Out of the total 140 cases, 83.6% were from rural areas and 16.4% were from urban areas. According to maternal education level, 17.1% were illiterate, 26.4% were primary passed, 37.9% had metric level education, 17.1% had intermediate level education and only two women were graduates. (As shown in Table 1)

According to maternal occupational status, out of all study subjects, 90.0% were housewives and 10.0% were working women. In this study out of all study subjects, 45.0% were poor socioeconomically and 55.0% had middle socioeconomic status. According to the booking status, 68.6% of women were booked, while 31.45 were unbooked. As per parity, most of the females 52.9% had a parity of 1-3, followed by 31.4% had a parity of 4-6 and 15.7% had a parity of more than 6. According to the mode of delivery, out of all newborn babies, 66.4% were delivered by normal vaginal delivery and 33.6% underwent cesarean sections. The frequency of vitamin D deficiency was 80.7%, particularly as 45.0 & had a mild deficiency, 23.6% had a moderate deficiency, 12.1% had a severe deficiency, while 19.3% had a normal vitamin D level. (As shown in Table 2)

Table 1: Features of the study participants

Gender	Frequency	Percentage
Male	75	53.6
Female	65	46.4
Residence		
Rural	23	16.4
Urban	117	83.6
Maternal Education		
Illiterate	24	17.1
Primary	37	26.4
Matric	53	37.9
Secondary	24	17.1
Graduation	02	1.4
Maternal Occupation		
Housewife	126	90.0
Working women	14	10.0
Socioeconomic Status		
Poor	63	45.0
Middle	77	55.0

Table 2: Maternal status

Booking status	Frequency	Percentage
Booked	96	68.6
Unbooked	44	31.4
Parity		
1-3	74	52.9
4-6	44	31.4
>6	22	15.7
Mode of delivery		
NVD	93	66.4
C-section	47	33.6
Vitamin D deficiency		
Normal	27	19.3
Mild	63	45.0
Moderate	33	23.6
Severe	17	12.1

Table 3: Maternal vitamin D deficiency

Age (Years	Normal	Mild	Moderate	Severe	Total	P-value
18-25	13	28	11	6	58	0.383
26-30	10	27	20	11	68	
31-35	4	6	2	0	12	
>35	0	2	0	0	2	
Gender						
Male	12	29	23	11	75	0.084
Female	15	34	10	6	65	
Residence						
Rural	0	15	8	0	23	0.006
Urban	27	48	25	17	117	
Occupation						
Housewife	23	56	31	16	126	0.643
Working	4	7	2	1	14	
Socioeconomic						
Poor	9	39	15	0	63	0.001
Middle	18	24	18	17	77	
Parity						
1-3	19	25	21	9	74	0.052
4-6	6	22	10	6	44	
>6	2	16	2	2	22	
Booking						
Booked	21	33	29	13	96	0.002
Unbooked	6	30	4	4	44	
Delivery Mode						
NVD	19	35	29	10	93	0.013
C-section	8	28	4	7	47	

Vitamin D deficiency was statistically insignificant according to maternal age, neonatal gender and occupation (p->0.05). Vitamin D deficiency was statistically significant according to the residence, educational level, SES, parity, booking status and mode of delivery (p-<0.05) (As shown in Table 3)

DISCUSSION

The current study examined the relationship between maternal vitamin D status and birth weight and showed that 80.7% of low birth weight neonates had maternal vitamin D deficiency. Similar findings were found in Chen YH et al [13], which enrolled 3658 qualified mother-and-singleton-child couples.

Further investigation revealed that the maternal serum 25(OH) D level is a significant predictor of the birth weight of newborns below a threshold of roughly 40 ng/mL. According to a different study by Wang H et al [2], the risk of unadjusted small for gestational age (SGA) increased by 19% and the risk of adjusted small for gestational age (SGA) increased by 9% for every 1 ng/mL increase in maternal vitamin D and up to 20 ng/m. In a different study, Wang Y et al.[14] found that both groups had a significant prevalence of vitamin D insufficiency, which was linked to poor neonatal birth weight.

High amounts of vitamin D were found in the maternal and newborn populations as a result of the successful usage of calcium and vitamin D together. [14] The majority of newly released randomized controlled studies (RCTs) have examined the possibility that maternal vitamin D supplementation may have an impact on either maternal or newborn vitamin D insufficiency.[15] There is not much research that specifically addresses the advantages of ingesting calcium and vitamin D during pregnancy for the mother and the fetus.[16] New research reveals that enough vitamin D has a beneficial effect on the skeletal system. Women who take calcium and vitamin D at the same time during pregnancy may minimize their risk of negative outcomes while promoting fetal growth. [17] Maternal vitamin D supplementation can raise circulation 25(OH) D levels, birth weight, and birth length.[18]

With regard to residence, educational attainment, SES, parity, booking status, and method of delivery, vitamin D deficiency were statistically significant in this series (p- 0.05). These results were almost identical to those of the study by Chen YH et al.[2]

On the other hand, it is noted that there is accumulating evidence that the intrauterine environment can have both short-term and long-term effects on the health of the fetus, contributing to the high prevalence of vitamin D insufficiency during pregnancy.[19] According to Lin Set al [20] international investigation, which supports our findings, different SES dimensions and the SES index were both used to thoroughly examine the relationships between SES and vitamin D levels as well as any potential underlying mechanisms. The SES index was created using principal component analysis to combine information about women's and men's education levels, occupations, household income, and spending, eliminating any potential bias that could be caused by a single indicator and resulting in an improvement.

It is a fact that mid-pregnancy is a crucial time for neurodevelopment and that vitamin D is necessary during this time. The absence of association in our study, the link may be explained by population adaptation to low nutritional intakes and/or limited solar exposure during centuries of cultural vegetarian diets and dress regulations for women..[21]

CONCLUSION

Mothers were found to frequently be vitamin D deficient, and their newborns frequently had low birth weights. It has been noted that maternal Vitamin D deficiency may raise the risk of low-birth-weight neonates and that changing a mother's nutritional habits and Vitamin D level may improve the result of her pregnancy. It is necessary to conduct more research on pregnant Pakistani women's use of vitamin D throughout pregnancy and the resulting clinical consequences. A sufficient blood 25(OH) D level early in pregnancy may be ensured by beginning vitamin D supplementation prior to becoming pregnant. It is critical to reduce socioeconomic disparities and encourage low-SES women, who are usually reported to be less educated, poorer, more obese, more likely to smoke now, less likely to engage in physical activity, and less likely to routinely consume milk.

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