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Neonatal Vitamin D Status and Its Association with Birth Weight in a Tertiary Care Hospital of Bangladesh

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Abstract **Original Research Article**

Background: Now a days, vitamin D deficiency is a silent and neglected global public health issue. Vitamin D status during pregnancy is integral to maternal health, fetal development and optimal neonatal outcomes. Decreased maternal vitamin D level causes decreased Neonatal vitamin D level and birth weight. ***Objectives:*** To see the association between Neonatal vitamin D level and birth weight. ***Methods:*** This cross-sectional study was conducted at neonatology department in Dhaka Shishu (Children) Hospital from July 2020 to June 2021. All admitted term neonates, aged within 5 days, were taken as cases and venous blood was collected for S. vitamin D level. Data regarding age, sex, birth weight, S. vitamin D status etc. were collected and analyzed by SPSS version-26. ***Results:*** Out of 72 cases, male were 39 (53%) and female 35 (47%). Mean gestational age was 38.9±1.12 wks. Mean birth weight was 2607.4±420.5 gms. Neonates with normal birth weight were 40(54%) and LBW 34 (46%). Mean S. vitamin D level in neonates with normal birth weight was 22.50 ± 7.90 ng/ml (7.50 – 40.20) and that of LBW 18.40 ± 8.10 ng/ml (7.10 – 39.40) which was statistically significant ($p < 0.05$). Thirty-six (48.65%) neonates had normal vitamin D, 20 (27.02%) insufficiency and 18 (23.32%) deficiency. In LBW cases the vitamin D deficiency and insufficiency were more than that of normal birth weight which were statistically significant ($p < 0.05$). Neonatal vitamin D positively correlated with birth weight ($r = +0.45$; $p < 0.001$). ***Conclusion:*** In this study, 49% cases had normal S. vitamin D, 27% insufficiency and 24% deficiency. Among all the term neonates, LBW was 46% and there was significant positive correlation between S. vitamin D level of neonates and birth weight.

Keywords: Neonatal vitamin D, LBW.

INTRODUCTION

Now a days, vitamin D deficiency is a silent and neglected global public health issue [1]. There is increasing evidence showing that vitamin D status during pregnancy is integral to maternal health, fetal development and optimal neonatal outcomes as well as future health of the offspring [2]. Vitamin D promotes adequate mineralization of skeleton, enhances immunity and has an anti-infective role [3, 4]. It has a key role in fetal growth by its interaction with parathyroid hormone and Ca^{2+} homeostasis [3].

The worldwide prevalence of vitamin D deficiency is 30-50% among children and in neonates, ranging from 73% in New Zealand to 94% of newborns in Jordan.[5,6,7] Almost 80% of Bangladeshi children are vitamin D deficient [4, 7]. Nearly two-thirds of the pregnant rural women have hypovitaminosis D in Bangladesh [4]. Higher deficiency in newborns is attributed to the fact that such higher deficiency ranging from 67% to 96% is prevalent in mothers as depicted in various studies on pregnant mothers from southern and northern states of India [8].

Birth outcomes such as small for gestational age, large for gestational age and preterm birth are a concern due to their association with an increased risk of neonatal death and impaired development, which can impact adult quality of life. Vitamin D concentrations during pregnancy have been recently considered as determinants of those [9].

Vitamin D deficiency during pregnancy negatively affects the birth weight in the newborn [10, 11]. Newborns born to vitamin D insufficient mothers

are at greater risk of developing vitamin D deficiency [8].

Since maternal vitamin D level has important influence on Neonatal vitamin D level and birth weight so the study has been conducted to see the association between Neonatal vitamin D level and birth weight in a tertiary care hospital of Bangladesh.

MATERIALS AND METHODS

This cross-sectional study was conducted at neonatology department in Dhaka Shishu (Children) Hospital (DSH) from July 2020 to June 2021. All admitted term neonates, aged within 5 days, which had known documented birth weight were included in this study. Neonates with severe perinatal asphyxia, severe sepsis, major congenital malformation, severe renal problem or any surgical condition, were excluded. A written informed consent was obtained from parents or legal guardian. An ethical clearance was taken from the ethical review committee of Bangladesh Institute of Child Health (BICH), DSH.

Within 24 hours of admission of neonates, 2 ml of venous blood collection was done from the cases in a plain test tube. Serum was separated by centrifuging the sample at -4°C and analyzation done on the same day for the level of 25 (OH) vitamins D using Gentin 1100 Immunofluorescene Quantitative Analyzer (Nanjing, China) at biochemistry laboratory of Dhaka Shishu Hospital. Serum 25(OH) vitamin D level of more than or equal to 30 ng/ml considered sufficient, level between 20 and less than 30 ng/ml as insufficient, and value less than 20 ng/ml considered as deficient (according to Clinical Guideline Subcommittee of the Endocrine Society Task Force). Blood was drawn only when the neonate pricked for another purpose (investigations for the illness with which they brought to hospital).

All cases were managed with hospital protocol. Data regarding age, sex, birth weight, S. vitamin D level etc. were collected.

STATISTICS

The primary variable was S. Vitamin D level and Birth weight. All the data were entered into a personal computer and thoroughly checked for any possible errors and then processed and analyzed by Statistical Package for Social Science (SPSS 26.0 IBM Corporation, New York, USA). Data were expressed as numbers and percentages for categorical variables or as means and range for quantitative variables. To compare categorical variables between groups, the chi-square ($\chi 2$) test was used. Paired and unpaired t- test was used for continuous variables. Pearson correlation test was used to see the association between birth weight and Neonatal vitamin D level. For all statistical test p value < 0.05 was considered as statistically significant.

RESULTS

Out of 74 cases, male were 39 (53%) cases and female 35 (47%). Mean gestational age was 38.9±1.12 wks. Mean birth weight was 2607.4±420.5gms. Neonates with normal birth weight were 40 (54%) and Low birth weight (LBW) 34 (46%) (Table-I). Mean serum vitamin D level in neonates with normal birth weight was 22.50 ± 7.90 ng/dl (range 7.50 – 40.20) and that of LBW 18.40 ± 8.10 ng/dl (7.10 – 39.40) which was statistically significant (Table-II). Out of 74 cases, 36(48.65%) neonates had normal vitamin D level, 20 (27.02%) insufficiency and 18 (23.32%) deficiency. In LBW cases the vitamin D deficiency and insufficiency were more than normal birth weight neonates which were statistically significant (p<0.05) (Table III). Neonatal vitamin D positively correlated with birth weight (r = +0.45; p <0.001) (Fig-1).

Table-I: Basic characteristic of cases

Sex	
Male	**39 (53%)**
Female	**35 (47%)**
Gestational age (mean±SD)	38.9±1.12 wks
Birth weight (mean±SD)	2607.4±420.5gms
<2500	34 (46%)
≥2500	40 (54%)
Dhaka (Capital)	28 (38%)
Outside of Dhaka	46 (62%)

Table-II: Mean serum vitamin D level in neonates (N=74)

Birth weight	Serum Vit D (ng/ml) Mean ± SD (Min – max)	P value
≥2500	22.50 ± 7.90 (7.50 – 40.20)	<0.0001*
<2500	18.40 ± 8.10 (7.10 – 39.40)	

Statistical analysis was done by unpair t test
*significant
p-value <0.05 is the level significance

Table-III: Neonatal S. Vitamin D level according to birth weight (n=74)

Birth weight (gm)	Serum Vit D (ng/ml)			p-value
	Deficient (<20 ng/ml) 18 (23.32%)	Insufficient (20 - <30 ng/ml) 20 (27.02%)	Sufficient (30 ng/ml) 36 (48.65%)	
<2500	15 (20.27%)	12 (16.21%)	7 (9.46%)	<0.05*
≥2500	3 (4.05%)	8 (10.81%)	29 (39.19%)	

Statistical analysis was done by Chi-square test
*Significant
p-value <0.05 is the level significance

This diagram illustrate that Neonatal vitamin D positively correlate with birth weight (r = +0.45; p <0.001).

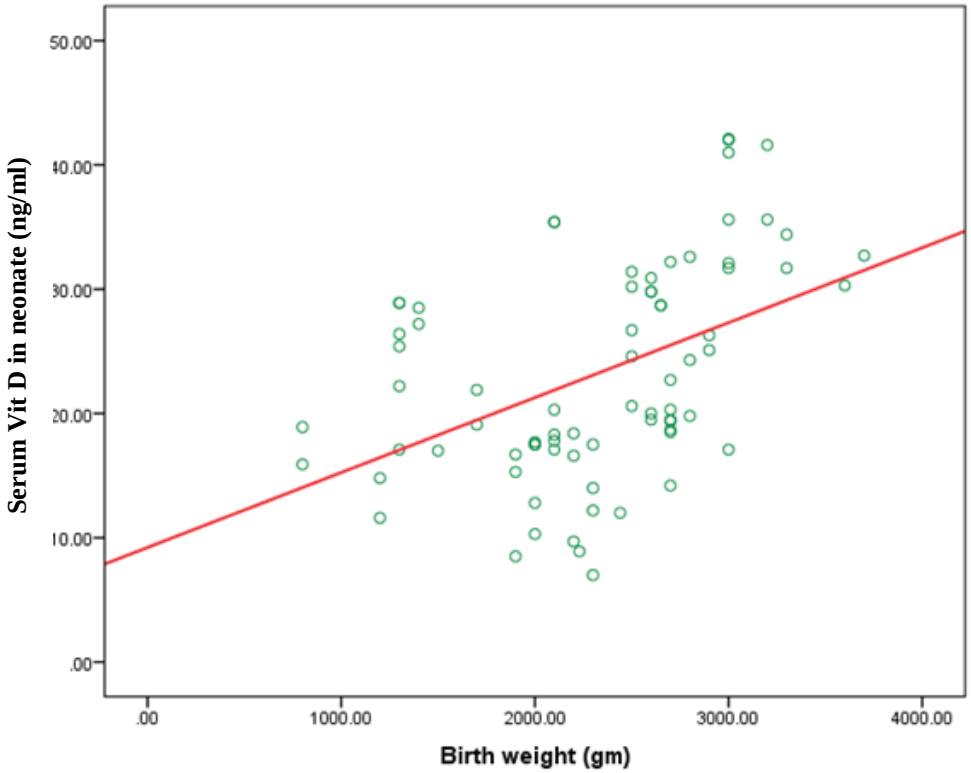

Fig-1: Correlation of S. Vit D in neonate (n=74) with birth weight (n= 74).

DISCUSSION

This cross-sectional study was conducted at neonatology department in Dhaka Shishu (Children) Hospital from July 2020 to June 2021. Total 74 neonates were taken as cases. Among them male were 39 (53%) cases and female 35 (47%). Mean gestational age was 38.9±1.12 wks**.** In this study it was not shown the deficiency category according to gender but other studies shown that male neonates had significant higher rate of S. vitamin D level [6, 8, 11-13].

In this study mean birth weight was 2607.4±420.5 gms. Paulraj *et at*. showed that was 2660.61±353.27 gms in their study [14]. In our study it was found that neonates with normal birth weight was 40 (54%) and LBW 34 (46%). In the study of Rahman *et al*., 78% cases were normal birth weight and 22% LBW that is similar to our study [15].

In our study mean serum vitamin D level in neonates with normal birth weight was 22.50 ± 7.90 ng/ml (7.50 – 40.20) and that of LBW 18.40 ± 8.10 ng/ml (7.10 – 39.40) which was statistically significant. Paulraj *et al*. found mean serum vitamin D level was 20.07 ng/ml in their study [14].

Out of 74 cases, 36 (48.65%) neonates had normal S. vitamin D level, 20 (27.02%) insufficiency and 18 (23.32%) deficiency. In LBW cases the vitamin D deficiency and insufficiency were more than normal birth weight neonates which were statistically significant (p<0.05). Whereas severe deficiency, deficiency, insufficiency and sufficiency respectively were noted in 4 (7%), 30 (56%), 11 (20%) and 9 (17%) of the newborns in the study of Paulraj *et al*. [14]. These findings also were similar to studies done by Agarwal *et al*., Khalessi *et al*., Sathish *et al*., Singh *et al*., Bhimji *et al*, Hajianfar *et al*, Panda *et al*. [5,6,8,13,14,16]

In this study neonatal S. vitamin D level positively correlated with birth weight (r = +0.45; p <0.001). Other study done by Sathish *et al*. also showed a statistically significant association between cord vitamin D level and birth weight [14]. The limitation of this study was no comparison with maternal S. vitamin D level, not taking vitamin D level from cord blood and only hospital neonates taken as cases.

CONCLUSION

In this study, 49% cases had normal S. vitamin D, 27% insufficiency and 24% deficiency. Among all the term neonates, LBW was 46% and there was significant positive correlation between S. vitamin D level of neonates and birth weight. As no comparison was done with maternal vitamin D level and that of neonates so further study is needed to obtain more scientific results.

Author's Contribution Statement

Dr. Maksudur Rahman and Dr Tapan Chandra Roy conceptualized, gathered and analyzed the data. Prof, Dr. M. Monir Hossain supervised and reviewed the manuscript. All authors discussed the methodology, results and contributed to the final manuscript.

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Conflict of Interest

Conflict of interest declared none.

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