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# Correlation between Maternal and Neonatal Blood Vitamin D Levels and Its Effect on Newborn Anthropometry

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**ABSTRACT**
Background – Vitamin D deficiency in pregnancy is associated with a variety of adverse health outcomes in neonates . Vitamin D deficiency in newborn affects the newborn anthropometry andis also associated with impaired neurodevelopment in infants.
METHOD- The current study was conducted to identifyvitamin D deficiency in pregnant women and their newborns in a tertiary care centre to determine the correlation between maternal and neonatal vitamin D deficiency and also to identify its effect on newborn anthropometry.
25 hydroxy vitamin D was assessed from maternal venous blood at 37-40 weeks of pregnancyand cord blood vitamin D was estimated in all healthy term newborns of these selected mothers. Detailed newborn anthropometric measurements were taken in those selected babies within 72 hours of birth.
RESULTS- A total number of 95 pregnant women and their 95 infants were consecutively recruited in our study. In our study,7.3% mothers were severely deficient of vitamin D whereas 48.6%, 33.6% had deficient and insufficient levels of serum vitamin D respectively and 10.5% had sufficient vitamin D levels. Among the newborn 9.5%, 46.3%, 32.6%, 11.6% were severely deficient, deficient, insufficient, sufficient in terms of serum 25(OH ) Vitamin D3 level. Maternal vitamin D level is significantly associated with socioeconomic status and sun exposure and they were p=0.04 and 0.005 respectively as depicted by chi- square analysis. On the contrary, maternal vitamin D level was not associated with maternal age, BMI, type of delivery.
The newborn birth weight (p=0.000), birth length(p=0.001), head circumference(p=0.0001), chest circumference(p=0.001) has significant association with cord vitamin D level at $p<0.05$ level depicted by Anova Method.
CONCLUSION-In our study, we have found that there is a wide prevalence of vitamin D deficiency in pregnant women and also their newborns. There was a strong correlation between maternal and cord blood vitamin D level and it also affects the neonatal anthropometry.

## I. INTRODUCTION

Vitamin D is one of the essential ingredients in terms of metabolic and physiological processes in the human body. The main source of vitamin D is its synthesis in dermis and epidermis, which is facilitated by ultraviolet B (UVB) rays from the sun which is approximately 90 percent of the entire body need[1]. However, sources of this vitamin exist in foods such as egg yolk, fatty fish, fish oil, fortified foods and vitamin supplements but the dietary role of vitamin D is minimal. Thus, inadequate sun exposure and in turn reduced dermal synthesis is considered as one of the main determinants of vitamin D deficiency[2].

During pregnancy,a woman maintains her vitamin D requirements to support her own health but also needs extra amount to support her foetus.[3]In utero, the vitamin D level of the fetus is entirely dependant on the vitamin D from mother[4].

Vitamin D deficiency in mother is associated with a variety of poor health outcomes in newborn infants[5] . The evidence about vitamin D deficiency in early life being associated with poor neurodevelopment and anthropometry outcome is increasing[6].

The serum 25 hydroxyvitamin D is considered the best indicator of serum vitamin D level. It may be affected by sunlight, season, ethnicity, vitamin D supplementation and other factors[7].

The current study was conducted to determine the vitamin D deficiency in pregnant women and their newborns in a tertiary care centre in Silchar and look for correlation between maternal and neonatal vitamin D deficiency and also to note its effect on newborn anthropometry.

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## II. METHOD

The study was conducted in a tertiary care centre in Silchar for a period of one year from June 2020 to May 2021. It was a cross sectional hospital based study. Sample size was calculated using standard sample size calculation formula.

$$n= z^2 pq / 10\% \text{ of } p^2$$

where

$z^2$= abscissa of the normal curve that cuts off on area α at the tails

p= prevalence

q= 100-p

Relative error = 10%

p value was obtained from study conducted by Shrestha et al[8].

10% non-response role was also taken into consideration while calculating the sample size.

A total of 95 singleton, apparently healthy pregnant women and their neonates , fulfilling the inclusion criteria were studied. Written consent was obtained from each study subject. The Institutional ethical clearance was obtained to conduct the study.

**INCLUSION CRITERIA**

- Healthymothers aged 21 to 35 years , singleton pregnancy.
- Term,healthy babies with 5 minute APGAR score more than or equal to 8 .

**EXCLUSION CRITERIA**

**MOTHER-**

- Multiple pregnancy
- Chronic illness like diabetes, chronic heart disease, hepatic or renal impairment, tuberculosis, fat malabsorption, severe anemia, malnutrition of mother.
- Obstetric conmplications like pregnancy induced hypertension, gestational diabetes mellitus, infections.
- Women using medication known to affect bone metabolism.

**INFANTS-**

- Newborns with any sort of congenital disease and chromosomal abnormalities.
- Preterm babies
- Any major illness of newborn like sepsis, pneumonia, haemolytic disorders, birth asphyxia.
- Babies whose parents have refused to give consent for the study

Maternal characteristics such as age, height, weight, parity, level of education, occupation, total income of family and obstetrical history, exposure to sunlight were recorded in a standardized questionnaire. Exposure to sunlight was calculated by history of daily activity pattern( activity leading to sun exposure for atleast 30minutes) and by history of clothing( calculated as per Wallace rule of 9, which allocates 9% of body surface area to each arm , the front and back of each lower limb, the front and back of the chest , the abdomen , the head and 1% for genitalia).

25 hydroxy vitamin D was assessed at 37-40 weeks of pregnancy in the venous blood of mothers.

Neonatal cord blood vitamin D levels were determined. Newborn anthropometric measurements like birth weight, length, head and chest circumference were measured within 72 hours of birth.

STATISTICAL ANALYSIS- Data were presented as mean and standard deviation for continuous variables and percentage for categorical variables. Baseline characteristics were compared using the chi-square analysis and Anova method. Pearson correlation method was used to test the correlation between measured parameters and plotted on scatter diagram. P value of less than 0.05 was considered significant.

LABORATORY MEASUREMENTS:

2ml of venous blood from mother and 3ml of cord blood from each neonate was collected.

Serum level of 25OH VITAMIN D was measured via a competitive immunoassay technique using the VITROS 25OH Vitamin D Total Reagent Pack and VITROS 25OH Vitamin D Total calibrations on the VITROS ECI/ECIQ Immunodiagnostic system, the VITROS 3600 immunodiagnostic system and the VITROS 5600 Integrated system.

TABLE- 1 The cut offs utilised to define vitamin D deficiency was based on Institute of Medicine[9].

| VITAMIN D STATUS | LEVELS |
|---|---|
| SEVERE DEFICIENCY | ≤5 ng/ml |
| DEFICIENCY | ≤15 ng/ml |
| INSUFFICIENCY | 15 to 20ng/ml |
| SUFFICIENCY | 20-100ng/ml |

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**RESULTS**

| AGE | SEVERE DEFICIENCY (7) | DEFICIENCY ( 46) | INSUFFICIENCY (32) | SUFFICIENCY (10) | P VALUE |
|---|---|---|---|---|---|
| 21-25 | 1 | 14 | 13 | 4 | |
| 26-30 | 2 | 6 | 1 | 0 | 0.3 |
| 31-35 | 3 | 8 | 10 | 3 | |
| 36-40 | 1 | 18 | 8 | 3 | |

TABLE 2: MATERNAL VITAMIN D LEVEL ASSOCIATION WITH MATERNAL AGE

| Socio economic status | SEVERE DEFICIENCY (7) | DEFICIENCY ( 46) | INSUFFICIENCY (32) | SUFFICIENCY (10) | P value |
|---|---|---|---|---|---|
| Upper class | 0 | 1 | 1 | 2 | |
| Upper middle | 1 | 0 | 6 | 1 | |
| Lower middle | 0 | 11 | 10 | 3 | 0.04 |
| Upper lower | 1 | 3 | 1 | 2 | |
| Lower | 5 | 31 | 14 | 2 | |

TABLE 3: MATERNAL VITAMIN D LEVEL ASSOCIATION WITH SOCIO - ECONOMIC STATUS

| SUN EXPOSURE (30 minutes) | SEVERE DEFICIENCY (7) | DEFICIENCY ( 46) | INSUFFICIENCY (32) | SUFFICIENCY (10) | P value |
|---|---|---|---|---|---|
| YES | 2 | 10 | 5 | 7 | 0.005 |
| NO | 5 | 36 | 27 | 3 | |

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TABLE 4- ASSOCIATION OF MATENAL VITAMIN D WITH SUN EXPOSURE

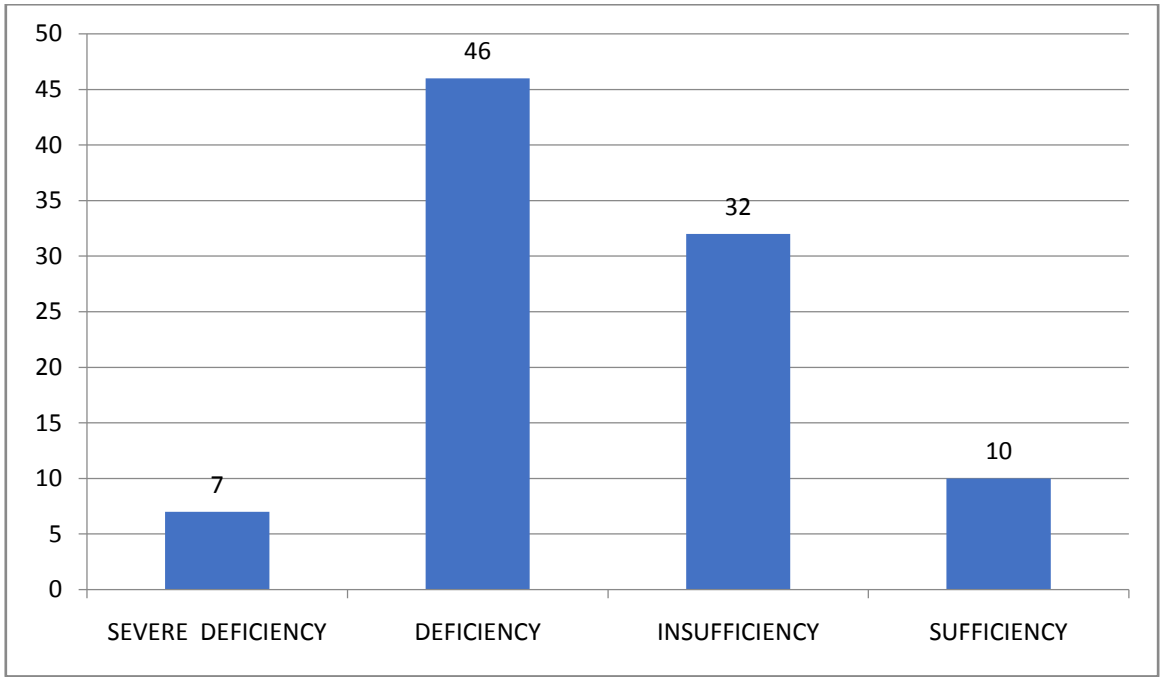


FIGURE1: DISTRIBUTION OFMATERNAL SERUM LEVELS OF 25(OH)D3 IN THE STUDY SUBJECTS

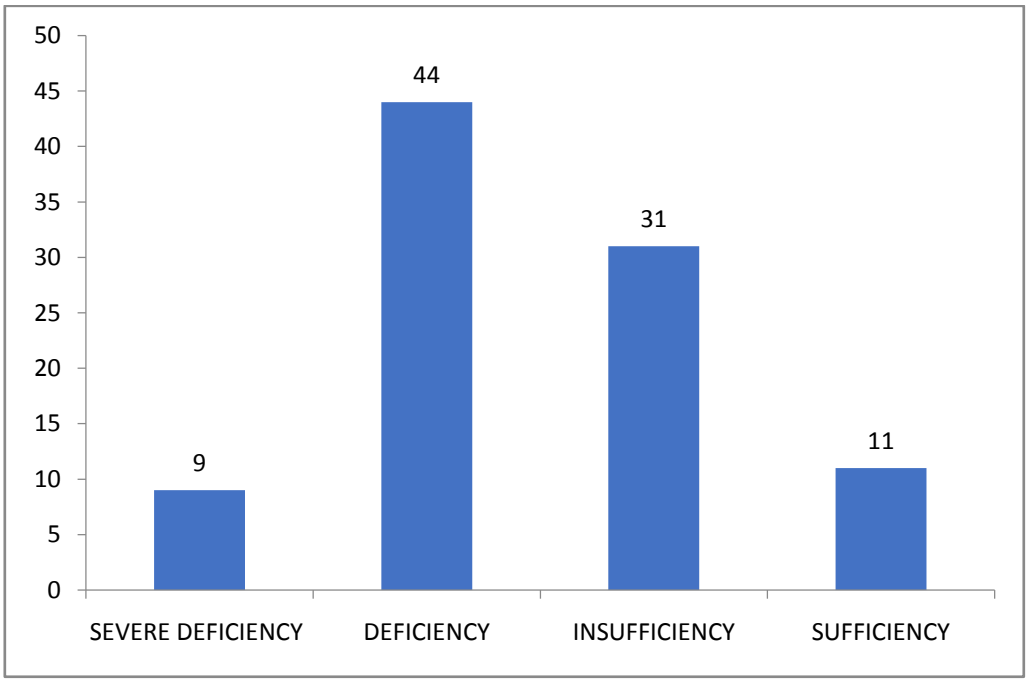


FIGURE 2: DISTRIBUTION OF NEWBORN SERUM LEVELS OF 25(OH) VITAMIN D3IN THE STUDY SUBJECTS

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| | SEVERE DEFICIENCY | DEFICIENCY | INSUFFICIENCY | SUFFICIENCY |
|---|---|---|---|---|
| MOTHER | 7 | 46 | 32 | 10 |
| NEWBORN | 9 | 44 | 31 | 11 |

Table 5- MATERNAL venous vitamin D level and NEONATAL cord blood vitamin D level.

A total of 95 pregnant women and 95 infants were consecutively recruited in our study. Amongst pregnant women 7.3%, 48.6%, 33.6%, 10.5% were severely deficient , insufficient and sufficient respectively whilst amongst the newborn 9.5%, 46.3%, 32.6%, 11.6% were severely deficient, deficient, insufficient, sufficient in terms of serum 25(OH ) Vitamin D3 level. Table 3 and table 4 shows that maternal vitamin D is significantly associated with socio-economic status and sun exposure respectively. They were p=0.04 and 0.005 respectively. Maternal vitamin D level was not associated with maternal age, BMI, type of delivery and the p value were 0.3, 0.31 , 0.5 respectively as depicted by chi square analysis.

Table 6 shows that the newborn birth weight (p=0.000), birth length(0.001), head circumference(p=0.0001), chest circumference(0.001) has significant association with cord vitamin D level at p<0.05 level by ANOVA METHOD.

| **CHARACTERISTICS** | **SEVERE DEFICIENCY (9)** | **DEFICIENCY ( 44)** | **INSUFFICIENCY (31)** | **SUFFICIENCY (11)** | **P value** |
|---|---|---|---|---|---|
| BIRTH WEIGHT (g) | 2098±58.9 | 2460.45±142.5 | 2537.03±61.8 | 3016±151.3 | 0.000 |
| BIRTH LENGTH(cm) | 37.66±0.977 | 42.73±3.88 | 42.92±4.47 | 55.42±5.48 | 0.001 |
| HEAD CIRCUMFERENCE (cm) | 28.44±0.99 | 30.82±1.41 | 33.02± 2.25 | 36.53±2.21 | 0.0001 |
| CHEST CIRCUMFERENCE (cm) | 26.4±0.66 | 30.22±1.95 | 31.01±2.07 | 33.31±3.22 | 0.01 |

TABLE 6: NEWBORN CHARACTERISTICS ASSOCIATION WITH CORD VITAMIN D LEVEL.

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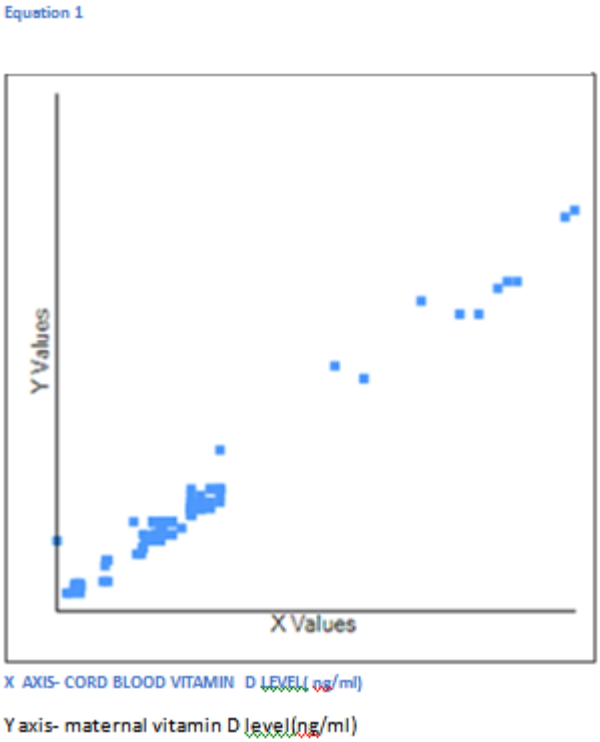


FIGURE 3 demonstrates strong correlation between the vitamin D levels in maternal and cord blood (r=0.9873, p<0.05) as calculated by Pearson correlation coefficient method.

## III. DISCUSSION

Our study showed that pregnant women and newborn were vitamin D deficient. Arya et al found in his study that 63% of pregnant women were vitamin D deficient and 81 % of newborn were deficient[10]. We found a positive correlation between maternal vitamin D level, socio-economic status and sun exposure that correlated with the study by Prasad et al[11].

Our study showed vitamin D deficiency is more in mothers of lower socio-economic group which is consistent with the study by Andiran et al[12]. Atiq et al found lower vitamin D level among mothers and newborn of higher socio economic group who mostly preferred to stay indoors[13]. In our study we found no correlation between number of pregnancies, maternal age, mode of delivery.

Our study showed a significant positive correlation between maternal 25(OH)Vit D during pregnancy and cord blood levels at birth. Transplacental passage of maternal vitamin D is the only source of vitamin D in newborn. Hence pregnant women need to be replenished with vitamin D so that there is sufficient amount of vitamin D that would last for 4 to 6 months of life of newborn[14,15].

Maternal vitamin D status were found to be positively correlated with birth weight. This finding was also seen in the study by Bodner et al[16]. We have also found a positive correlation of maternal vitamin D status with birth length, head circumference and chest circumference and this was also found in studies by Song et al[17], Satish et al[18].

## CONCLUSION

We found that there is a wide prevalence of vitamin D deficiency in pregnant women and also their newborns. Since there was a strong correlation between maternal and cord blood vitamin D level and it also affects the neonatal anthropometry, we can assess maternal vitamin D level on routine basis or atleast high risk mothers in the antenatal period or third trimester at latest and recommend for VIT D supplementation during pregnancy.

## BIBLIOGRAPHY

[1]. Holick MF. High prevalence of vitamin D inadequacy and implications for health. Mayo Clinic Proceedings. 2006;81(3):353-73.
[2]. Kelishadi R, Poursafa P. Air pollution and nonrespiratory health hazards for children. Arch Med Sci. 2010;6(4):483-95
[3]. Kovacs CS. The role of vitamin D in pregnancy and lactation: insights from

animal models and clinical studies. Annu Rev Nutr. 2012;32:97-123

[4]. Wagner CL, Howard C, Husley TC, Lawrence RA, Taylor SN , Will H, Ebeling M, Huston J, Hollis BW. 2010. Circulating 25- hydroxyvitamin D levels in fully breastfed infants on oral vitamin D supplementation. Int J Endocrinology**2010**:235035

[5]. Bowden SA, Robinson RF , Carr R Mahan JD.2008. Prevalence of vitamin D deficiency and insufficiency in children with osteopenia or osteoporosis referred to a paediatric metabolic bone clinic. Paediatrics 121:e 1585-1590

[6]. O'Loan J, Eyles DW, Kesby J , Ko P, McGrath JJ, Burne TH.2007. Vitamin D deficiency during various stages of pregnancy in the rat ;its impact on development and behavior in adult offspring. Psychoneuroendocrinology 32:227-234

[7]. Paxton GA, Teale GR, Nowson CA, Mason RS, McGrath JJ, Thompson MJ, Siafarikas A, Rodda CP, Munns CF. 2013. Vitamin D and health in pregnancy, infants, children and adolescents in Australia and New Zealand: a position statement.

[8]. Shrestha D, Budhathoki S, Pokhrel S, Sah AK, Shrestha RK, Raya GB, Shrestha R, Pasakhala R, Smith C, Dhoubhadel BG. Prevalence of vitamin D deficiency in pregnant women and their babies in Bhaktapur, Nepal. BMC nutrition. 2019 Dec;5(1):1-6.

[9]. PGT Textbook of Paediatrics, 2nd Edition,page no-1008

[10]. Arya V, Bhambri R, Godbole MM, Mithal A. Vitamin D status and its relationship with bone mineral density in healthy Asian Indians.

[11]. Prasad D, Smita, Singh K, Nisha S (2018) Vitamin D in Pregnancy and its Correlation with Feto Maternal Outcome. Int J Contemp Med Res 5: 31.

[12]. Andiran N.Ozon A. The risk factor for vitamin D deficiency I Breast fed newborns and their mothers. European society for pediatric Endocrinology 39th Annual meeting. Brussels. 17-19 september 2000.

[13]. Atiq M. Suria A. Maternal Vitamin D deficiency in Pakistan. Acta Obstet Gynecol S cand 1998;77:970-3.

[14]. Wagner CL, Taylor SN, Dawodu A, Johnson DD, Hollis BW. Vitamin D and its role during pregnancy in attaining optimal health of mother and fetus. Nutr. 2012;4(3):208-30.

[15]. Zhuang XL, Zhu ZW, Zhu DB, Chen LQ, Zhao ZY, Shao J. Maternal-neonatal vitamin D status and related factors. Zhonghua Er Ke Za Zhi. 2012;50(7):498-503.

[16]. Bodnar LM, Catov JM, Zmuda JM, Cooper ME, Parrott MS, et al. (2010) Maternal serum 25-hydroxyvitamin D concentrations are associated with small-for-gestational age births in white women. J Nutr 140: 999-1006.

[17]. Song SJ, Si S, Liu J, Chen X, Zhou L, et al. (2012) Vitamin D status in Chinese pregnant women and their newborns in Beijing and their relationships to birth size. Pub Health Nutr 16: 1-6.

[18]. Sathish P, Raveendran S, Padma R, Balakrishnan D, Muthusami M (2016) Correlation between maternal and neonatal blood vitamin D levels and its effect on the newborn anthropometry. Int J Reprod Contracept Obstet Gynecol 5: 2983-2988.