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Original Article

Relationship Between Maternal Vitamin D Deficiency and Newborn Anthropometry

Ayesha Ahmed[1*], Shazia Memon[1], Farzana Shaikh[1] and Fahmida Parveen[2]

[1]Department of Peadiatrics, Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan
[2]Department of Obstetrics and Gynecology, Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan

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***Corresponding Author:**
Ayesha Ahmed
Department of Peadiatrics, Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan
dr.ayeshaahmedali@gmail.com

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ABSTRACT

Intrauterine development restriction and low birth weight in the newborn are two negative pregnancy outcomes that can result from maternal hypovitaminosis D. **Objective:** To determine the association between maternal vitamin D level and neonatal anthropometry (birth-weight, birth length and head circumference). **Methods:** This cross-sectional research was conducted in Post-Natal Ward of Liaquat University of Medical and Health Sciences, Hyderabad/Jamshoro, after getting official permission from July 2021 to Dec 2021. Healthy Mothers with alive Newborn aged < 24 hours were enrolled via Non-probability, convenience sampling. After taking due approval and written informed consent from mothers. Data were collected into a structured questionnaire, containing enquiries pertaining to basic biodata, sociodemographic details, Vitamin D levels, and anthropometric measurements of baby. **Results:** The mean age of the mothers was 26.82 (SD ± 7.4) years, predominantly hailing from urban areas (78.5%), with a mean BMI of 23.702 Kg/m^2 (SD ± 4.32). A low birth weight was reported in 53% while very low birth weight was reported in 4% of the cases. Majority of neonates were found to be of small for gestational age irrespective of their gestational age of delivery. **Conclusions:** In compared to babies whose mothers had adequate levels of vitamin D, the study reported that babies of moms with lower levels of vitamin D have smaller birth weights and are smaller for gestational age.

INTRODUCTION

Vitamin D is fat-soluble steroid hormone it is play a vital role in calcium and phosphate metabolism and it is necessary for bone health. Vitamin D deficiency or insufficiency has now become a significant global public health issue, with high vitamin D deficiency rate of 84% during pregnancy [1]. In some other studies prevalence of vitamin D deficiency in pregnancy and newborns reported as 61.5% and 99.5% respectively [2]. A latest research reported that Vitamin D deficiency causes many maternal and fetal problems among larger population. The new born babies who have vitamin D deficiency, have higher changes of being small-for-gestational age (SGA). There is 40 times higher motility rate among such babies than those with normal weight newborn [3]. It has also observed that during pregnancy and with decrease in lactation, vitamin D levels are also declined which has serious side effect on baby growth and may precipitate the risk of rickets among babies. It also increases the chances of having rickets in childhood [4]. When mother has decreases vitamin D level, the baby is prone to symptomatic hypocalcaemia, SGA, and large fontanel [3]. It has been reported that babies with sufficient vitamin D level in early age, have lessen risk of

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health issue like asthma, wheeze, respiratory disorder, cardiovascular disease and autoimmune disease DM type one [5]. In pregnancy, there is increased requirement of this vitamin for the trans-placental transport of calcium to growing baby, it is recommended that the supplemental vitamin D and calcium should be provided to pregnant women [6]. Some data shows that decreased level of vitamin D i.e. <20ng/ml, puts the baby on significant risk for neonatal outcome including intra uterine growth retardation and small for gestation age babies [7]. Vitamin D Supplementation alone during pregnancy having good result in neonatal anthropometry like it increases birth-weight and birth-length, is proven by some studies [6]. The Vitamin D below 4ng/ml during pregnancy is important predictor of low birth weight (LBW) in neonate.8 In the countries like (Pakistan, Bangladesh, and Iran) having strong sun shine present round the year, the women are still not able to obtain full benefit of sun exposure due to socio-cultural factor like burqa or hijab, poor dietary patterns and lack of preventive strategies [9–11]. One of the primary causes of Vitamin D deficiency is thought to be this absence of UV radiation, which in turn decreased cutaneous production [11]. This research was conducted to determine the association between maternal vitamin D level and neonatal anthropometry in terms of birth weight, birth length and head circumference**.** It was aimed that this relationship would help in generating newer recommendations and guidelines regarding the antenatal screening for maternal vitamin D levels and pre-conception counseling of parents especially mothers regarding the use of vitamin D rich diets and/or supplementation.

METHODS

This Comparative cross-sectional research was conducted Post-natal Ward of Liaquat University of Medical and Health Sciences, Hyderabad/Jamshoro. The duration of study was 6 months from July 2021 to Dec 2021 was conducted upon 205 mothers along with their babies, chosen via non-probability consecutive sampling. The sample size was calculated via help of to be RAOSOFT software by taking prevalence of low maternal vitamin D as 84%, confidence interval is 95% and margin of error as 5% [12]. All the healthy mothers having 20 to 40 year who had delivered full term babies within 24 hours (mother and baby pair), enrolled via Non probability - Convenience Sampling. Mothers with known case of chronic disease like renal disease, DM, or gestational Diabetes, hypertension, PIH, thyroid disease, asthma or mothers who were on supplemental vitamin D, or antiepileptic medicine were excluded from the study while babies with any congenital malformation and/or TORCH infection were also excluded. Information regarding the age of Mother, Mother's Height, BMI, MUAC, Education, Vitamin D Levels and New Born Gender, Age (after delivery), Gestational Age, Weight and Length were noted down. The newborn weight was measured using a calibrated weighing scale in grams, the newborn length was measured using an infantometer in centimeters, and the head circumference was measured using a flexible, non-stretchable measuring tape in centimeters. Data were analyzed and calculated by using SPSS software version 23.0. Mean and SD were calculated for quantitative variable and qualitative variable were measured as percentage and frequencies. The Post-stratification chi-square test was applied and p-value <0.05 was consider significant.

RESULTS

The mean age of the mothers was 26.82 (SD ± 7.4) years, predominantly hailing from urban areas (78.5%), with a mean BMI of 23.702 Kg/m^2 (SD ± 4.32). Majority of women obtained formal education i.e. 87%, most women obtained matric or higher education i.e. 42%, followed by primary education i.e. 32.2% (Table 1).

Table 1: Sample Description of Mothers Demographic Information

Sample Description	
Mean Age of the Mothers	26.82 (SD ± 7.4) years
Mean BMI of the Mothers	23.702 Kg/m2 (SD ± 4.32).
Residential Status	
Urban	161 (78.50%)
Rural	44 (21.50%)
Occupational Status	
Working Women	Working Women
Non-Working Women	Non-Working Women
Educational Status of Mothers	
Primary	66 (32%)
Secondary	26 (13%)
Matric & Higher	86 (42%)
No certification but able to read and write	15 (7%)
No certification not able to read and write	12 (6%)

Most of the new born were female i.e. 62% with a mean-birth-weight of 2324 grams. A low birth weight was reported in 53% while very low-birth-weight was reported in 4%. The average length of neonates was 48.02 ± 4.65cm and average head circumference was found to be 33.67 ± 3.23 cm. 81% of the new born were full term while 14% delivered at gestational age of more than 39 weeks (Table 2).

Table 2: Anthropometric Measures Of New Born

Anthropometric Measures Of New Born	
Mean Weight of New Born	2324 grams (SD ± 1334 grams)
Mean Length of New Born	48.02 cm (SD ± 4.65 cm)
Mean Head Circumference of New Born	33.67 cm (SD ± 3.23 cm)
Gender	
Male	78 (38%)
Female	127 (62%)

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Gestational Age	
< 34 Weeks	11 (5.4%)
34-39 Weeks	165 (80.5%)
> 39 Weeks	29 (14.1%)
Birth Weight	
Normal weight	88 (43%)
Low Birth Weight	107 (53%)
Very Low Birth Weight	8 (4%)
Extremely Low Birth Weight	0 (0%)

Majority of neonates were found to be of small for gestational age irrespective of heir gestational age of delivery. The 62.6% of the children of the 139 (67.8%) mothers who had Vitamin D Deficiency, were small for the gestational age in comparison to the 37.4% of gestational appropriate age children. With Vitamin D insufficiency, the similar pattern was observed that 59.2% of the children were small of their gestational age among 49 (23.9%) of mothers who had insufficient levels of Vitamin D (Table 3).

Table 3: Maternal Vitamin D Status vs Anthropometric Measures of New Born

Maternal Vitamin D Status	Anthropometric Measures of The Baby		
	Appropriate for Gestational Age 87 (42.4%)	Small for Gestational Age 116 (56.6%)	Large for Gestational Age 2 (1%)
Vit. D Deficiency 139 (67.8%)	52 (37.4%)	87 (62.6%)	-
Vit. D Insufficiency 49 (23.9%)	18 (36.8%)	29 (59.2%)	2 (4%)
Sufficient Vit. D 17 (8.3%)	17 (100%)	-	-

DISCUSSION

The research aimed to assess the correlation between maternal-Vitamin-D status and neonatal anthropometric measurements. The study concluded an important finding that lower levels of maternal Vitamin D are associated with lower neonatal birth weight. This key finding of my study is in contradiction with that of Aji *et al.*, study, conducted in Indonesia in 2020, which reported no such association [13]. The most widely recognised theory that could explain the relationship between maternal Vitamin D levels & the anthropometric measurements of new born, is genetic in origin, which concludes that Vitamin D regulator genes are present in great numbers in human genome, as much as 5% of total human genome and are responsible for this association [14]. A meta-analysis reported a link between susceptibility of preeclampsia and Gestational Diabetes Mellitus with Vitamin-D deficiency [15]. Furthermore, a significant relationship among Vitamin D with Nausea & Vomiting in Pregnancy, was observed in early pregnancy days [16]. Harvey *et al.*, found mixed results regarding the impact of maternal serum 25(OH) D levels during pregnancy on gestational hypertension risk [17]. Leffelaar *et al.*, study on neonatal measurements found that infants of women with low vitamin-D levels had lesser birth weights than those of women with adequate vitamin-D levels [18]. Other studies have inconsistently shown no connection between maternal vitamin-D levels and any of the neonatal-anthropometric-measurements [19]. According to some studies, vitamin D fortification is safe. Mothers who took 400–4000 IU of vitamin D per day between 12 and 16 weeks had lower risk of preterm delivery [20]. Vitamin D deficient-mothers, have twice the chances of having SGA babies in comparison to the mothers with adequate-Vitamin D status [21]. According to a WHO study, micronutrients like vitamin D play a key role in boosting birth weights by roughly 77 grams and lowering infant LBW by 25% [22]. According to Shin *et al.*, poor prenatal vitamin-D intake is associated with low neonatal-birth-weight and shorter infant-height [23]. But, this study does not find any such relationship. Low-Vitamin-D-levels may be associated with maternal diseases such as gestational-diabetes-mellitus and preeclampsia that hampers the fetal-growth [24]. However, these diseases were controlled by exclusion from the study. Thus, the actual burden of maternal Vitamin-D deficiency can be under-reported. In line with the results of this study, another study reported an important relationship between small-for –gestational-age infants and maternal-Vitamin-D insufficiency [25]. Contradictory to the results of this research, Hashemipour *et al.*, found an independent relationship between infant head-size and maternal-vitamin-D level 26. Although the effects of maternal diet, supplemental consumption, and the quantity of sun exposure on the vitamin D status were not examined in this study, we hypothesize that these elements should be taken into account in future research.

CONCLUSIONS

In compared to babies whose mothers had adequate levels of vitamin D, the study reported that babies of moms with lower levels of vitamin D have smaller birth weights and are smaller for gestational age.

Authors Contribution

Conceptualization: AA
Methodology: SM, FS
Formal analysis: FP, AA, SM
Writing-review and editing: FP, FS

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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