

Maternal Vitamin D3 Status and Association with Low Birth Weight Infant

Raghad Farhad Ahmed; *Maternity Teaching Hospital/ Erbil Directorate of Health/ Ministry of Health, Erbil, Iraq.*

(Correspondence: blackpears2001@yahoo.com)

Hanaa Al.Ani; *Department of Nursing, College of Nursing, Hawler Medical University, Erbil, Iraq.*

ABSTRACT

Background and Objective: Maternal vitamin D levels may affect fetal growth and cause adverse pregnancy outcomes including low birth weight in neonatal stage. This study was designed to evaluate and determine if the deficiency of maternal Vitamin D associated and affected the growth development of birth weight of neonates.

Methods: This study was carried-out on 200 neonates through a cross-sectional study, that used data from the nursery ward at maternity teaching hospital hospitals in Kurdistan, Iraq during a one year period from March 2016 to March 2017. The neonates were divided into two group two groups, neonates with birth weight < 2500 gr (n=45) and neonates with birth weight > 2500 gr (n = 55). We depend on the data classifications on medical history, physical examination using a questionnaire method for neonate classifications. Birth time blood samples of their mothers were analyzed for serum 25-(OH)-vitamin D using enzyme linked immunosorbent assay method. Maternal vitamin D status was compared in the two groups.

Results: The mean maternal vitamin D level was 24 nmol/L. for mothers with low birth weight and 22 (48.89 %) for mothers with vitamin D deficiency. Seventeen (37.77 %) and 6 (13.34 %) of the mothers with low birth weight had insufficient vitamin D and 6 (13.34 %) had normal Vitamin D levels. The mothers with normal birth weight had a mean vitamin D level of 38.10 nmol/L and the mothers of low levels reached to 10 nmol/L (18.18 %), those of insufficiency vitamin D was 20 nmol/L (36.36 %) and those of sufficient vitamin D 25 nmol/L (45.46 %).

Conclusion: Mothers with low vitamin D levels are more likely to have neonates with low birth weight. Increasing the vitamin D levels through nutrition is important for improving the neonatal body weight.

Keywords: Infant, Low birth weight, vitamin D Deficiency

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INTRODUCTION

Vitamin D affects fetal growth by its interaction with Ca²⁺ homeostasis and parathyroid hormone. Few studies have been conducted to detect vitamin D status in mothers in Iran. In recent study, nearly half of our mothers had vitamin D deficiency. Low vitamin D and osteomalacia in south Asian pregnant women have been widely reported [1,2].

Some investigations have pointed to the effect of micronutrients on birth weight [3]. Vitamin D stressing has a key role in fetal growth by its interaction with parathyroid hormone and calcium homeostasis. Studies have confirmed that insufficient prenatal levels of vitamin D has a strong effect on poor bone mineralization, which has a significant association with small-for-gestational- age births [4]. 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 [3]. Vitamin D deficiency has been seen among people all over the world [5].

The aim of this study was to evaluate the relationship between maternal vitamin D status and neonate birth weight because research suggest that low serum maternal vitamin D may impair fetal growth and cause adverse pregnancy outcomes including intrauterine growth restriction and neonatal low birth weight.

METHODS

Two-hundred mothers participated in this cross-sectional study. Data were collected from the labor ward of Maternity Teaching Hospitals in Kurdistan, Iraq from March 2016 to March 2017. We took a blood sample after delivery and sent it to a private laboratory. The neonates were divided into two groups, neonates with birth weight < 2500 gr (n=45) and neonates with birth weight >2500 gr (n = 55), depending on the data classifications including from medical history, physical examination, and anthropometric measurements of neonates using a questionnaire method for neonates classifications. Birth time blood samples of their mothers were analyzed for serum 25-(OH)-vitamin D and Maternal vitamin D status was compared in studied groups. The inclusion criteria include otherwise healthy women aged 21 to 35 years, having a singleton pregnancy and a term pregnancy. The exclusion criteria included mothers with preeclampsia, eclampsia, postpartum hemorrhage, insulin dependent diabetes mellitus, systemic and chronic disease, hematologic disorders,

infections. Questionnaires filled out and recorded neonatal birth weight and height, gestational age, mode of delivery, mother’s age, parity, race, mother’s education and clinical vitamin D deficiency symptoms. Immediately after birth, 5 ml of mother’s blood was collected, labeled and sent to laboratory to assay serum 25- (OH)-vit D level by 25-Hydroxy Vitamin D Enzyme immunoassay method. Depending on mothers’ 25- (OH)-vitamin D level, all mothers were categorized in deficient (< 25 nmol/L), insufficient (should be defined at thresholds of 75 nmol/L or even higher which would require a much higher intake to reach.)[6,7]. (25-50 nmol/L), normal (> 50nmol/L).

Statistical analysis of the data was carried-out using SPSSPC+ version 16. Data are presented as mean and standard deviation for continuous variables and n% for categorical variables. The Chi Square, T test, Chi-square test and Logistic regression were applied where applicable at the level of significance (p < 0.05).

RESULTS

The mean ±SD of maternal serum vitamin D level in all 200 mothers was 33.26 ± 2.65 nmol/L, mean ± SD of age was 23.32± 3.61 years, and mean ± SD gestational age in weeks was 38.11± 17.38. Other demographic characteristics are shown in Table 1.

Table 1: Demographic characteristics of the study sample

Demographic characteristics	Mean ± SD
Gestational age/ week	38.11± 17.38
Maternal age/year	23.32± 3.61
Birth weight/gm	2645.2± 35.39
Neonatal height (Cm)	46.08± 4.31
Head-circumference (Cm)	33.51±3.39
Maternal serum vitamin D nmol/l	33.26 ± 2.65

Table 2 shows the differences of serum vitamin D levels among mothers with normal birth weight neonates (39.14±3.15) and mothers of LBW neonates (27.38±2.15), (P < 0.01).

Table 3 shows the vitamin D serum level in mothers with LBW & normal birth weight neonates.

There was a significant difference, with 70% of the mothers with sufficient level of vitamin D giving birth to neonates with birth weight ≥ 2500 gm and 50% of mothers with deficient vitamin D giving birth to neonates with low birth weight.

In Table 4, there was no significant difference in the mode of delivery with maternal vit.D level (P= 0.3220).

Table 2: Maternal Vitamin D level in both study groups

Groups	Vit D serum level
Mothers with neonate ≥ 2500 gm	39.14±3.15
Mothers with neonate ≤ 2500 gm	27.38±2.15

* (P < 0.01)

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Table 3: Level of vitamin D and relationship with neonatal birth weight

	Sufficiency N (%)	Insufficiency N(%)	Deficiency N (%)
Mothers of normal birth weight neonate	70 (70)	20 (20)	10 (10)
Mothers of LBW neonate	15 (15 %)	35 (35 %)	50 (50)

*(P = 0.3220)

Table 4: Relationship of vit D and mode of delivery

Mode of delivery	Hypovitaminosis D		Normal Vit.D level	
	N	%	N	%
Cesarean Section	45	46.4	52	53.6
Normal Vaginal Delivery	55	53.4	48	46.6

DISCUSSION

The results from this study are comparable to both national and international studies reporting on the high prevalence of vitamin D deficiency in pregnant women. Vitamin D has well-defined classical functions related to calcium metabolism and bone health, as well as non-classical effects that may influence other aspects of health. There has been considerable recent interest in the role of vitamin D on outcomes related to pregnancy and young child health, but few efforts have been made to systematically consolidate this evidence to inform the research and policy agenda for low-income countries [8]. Vitamin D affects fetal growth by its interaction with Ca²⁺ homeostasis and parathyroid hormone. Few studies have been conducted to detect vitamin D status in mothers in Iran. In recent study, nearly half of our mothers had vitamin D deficiency. Hypovitaminosis D and osteomalacia in South Asian pregnant women have been widely reported, too [1,2].

Our results suggested that there is a significant correlation between LBW and maternal vitamin D deficiency. Our results agree with findings from Bodnar et al. (2010), which found positive relationship between vitamin D deficiency in white mothers and neonatal LBW and a significant correlation between LBW and maternal vitamin D deficiency [9,10]. They showed a positive relationship between vitamin D deficiency in white mothers and neonatal LBW. Another study from the Ali Aghar Hospital of the Iran University of Medical Sciences, Tehran, Iran also showed that maternal vitamin D deficiency may increase the risk of low birth weight neonate and that adding supplements of vitamin D could be beneficial on pregnancy outcomes. Safety of vitamin D supplements and fortification have been proved by

some articles. Mothers using vitamin D supplementation (400-4000 IU/day) in 12-16 weeks showed lower preterm risks [11]. While, those of vit D deficient mothers (25 Hydroxy Vit D < 30) have two-times the chance of giving birth small for gestational age (SGA) babies in compare to those with adequate vitamin D status [12]. The World Health Organization (WHO) has shown the importance of micronutrients including vitamin D, in increasing about 77 gr birth weights and 25% decrease of LBW [3]. This recommendation was contentious as many researchers have argued that insufficiency should be defined at thresholds of 75 nmol/L or even higher, which would require a much higher intake [6,7]. Several recent reviews have covered a rapidly growing body of literature on vitamin D during pregnancy [14], although few have taken a systematic approach (18) and only a couple have focused on the implications for low income country settings [13]. This recommendation was based on the amount of intake necessary to sustain blood levels of 25(OH)D above 50nmol/L for populations with minimal sunlight exposure and was developed solely based on outcomes related to skeletal health [7]. This recommendation was contentious as many researchers have argued that insufficiency should be defined at thresholds of 75 nmol/L or even higher which would require a much higher intake to reach [6,7]. Although a significant difference was found between the mode of delivery and mother's vit D status, our finding was against investigation from Dror et al [14].

CONCLUSIONS

Our results indicated that the high prevalence of vitamin D deficiency has been seen among women especially in developing countries and that neonatal low birth weight (LBW) could be related to

maternal vitamin D deficiency. Modifying maternal nutrition behavior and vitamin D level could be beneficial on prevention of low birth weight. However, more research in this field would contribute to an improvement in maternal and neonatal health.

CONFLICT OF INTEREST

The Author report no conflict of interest

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