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The Relationship between First Trimester 25-Hydroxyvitamin D3 Levels and Second Trimester Femur Length and their Effects on Birth Weight and Length at Birth

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Introduction

Vitamin D is important for fetal development because of its important role during cell proliferation, differentiation, and maturation processes [1,2], also vitamin D is important for placental function, calcium homeostasis, and bone mineralization, which are all important determinants for fetal growth and development [3,4]. Primary source of vitamin D is the exposure to sunlight. Sedentary indoor lifestyles, obesity, and avoiding sunlight each contributes to increased vitamin D deficiency. A pregnant woman needs a daily intake of vitamin D of 800–1000 IU, but the actual need varies according to ethnicity, nutritional factors, and sunlight exposure [5]. Vitamin D deficiency in pregnant women is a great public health problem because of its potential effects on the maternal obstetric outcomes and offspring development [6,7] where vitamin D deficiency may affect early organogenesis and subsequently affect later health and disease [8]. Vitamin D deficiency during pregnancy has been associated with increased risk of adverse obstetric outcomes including increased risk of gestational diabetes, pre-eclampsia, threatened preterm birth, cesarean section, bacterial vaginosis [9-11], also may have adverse effects on fetal development and growth include increase risk of preterm birth and fetal growth restriction resulting in low birthweight and small for-gestational-age neonates [12,13]. It has also been shown that intrauterine bone hypo mineralization is associated with vitamin D deficiency and then a reason for congenital rickets, craniotabes, and osteopenia [14]. 25hydroxy vitamin D is the major storage form of vitamin D in the human, so it can be measured in blood to determine the overall vitamin D status [15], it is the best measure of vitamin D status in human [16]. The main goal of our study was to assess the relationship between maternal circulating 25-hydroxyvitamin D3 [25(OH)D3] concentration and second trimester femur length, infant birthweight and length at birth.

Materials and Methods

A prospective study was conducted in El Shatby Maternity University Hospital, Alexandria, Egypt during the period from December 2019 to November 2020 on 300 pregnant women in the antenatal care clinic during their first antenatal visit between (10–13 weeks of gestation). Inclusion criteria were: 20-35 years of age, singleton alive normal pregnancy, between 10 and 14 weeks of pregnancy as confirmed by ultrasonography at recruitment, and most nutritional status as defined by pre-pregnancy body mass index was within normal value. Exclusion criteria were Multiple pregnancies, pregnancies with previously known metabolic disorders, Chronic disease and tumor, chronic debilitating diseases, obesity pregnant women take corticosteroids, drug abuse (including alcohol) and if the pregnant women during the first trimester of the current pregnancy suffered from severe infections, trauma or operation. All the women who fitted for the study were asked to participate in the study after explaining the details of the study and the importance of their follow up then written consent was obtained. Each participant was interviewed for demographic data, complete history taking, obstetric history, past history, medical history and knowledge on nutrition support in pregnancy. Ultrasound was done during the initial visit to measure the Crown-rump length and confirming that the women in the first trimester of pregnancy then a single maternal blood samples was collected in 12th to 14th weeks to measure 25-hydroxyvitamin D3, and were determined in all women. Second trimester femur length was measured in all cases, and the women were followed until the birth. The birth outcomes were weight in grams and birth length in centimeters. The circulating concentration of 25(OH)D3 in pregnant women was measured in the first trimester and the women were categorized into three groups according to its level: deficiency level <20 ng/ml, insufficiency level 20–29.99 ng/ml, and sufficiency level >30 ng/ml [17,18].

Results

300 pregnant women were enrolled in the study, they were classified into three groups according to their first trimester serum vitamin D level. Group A(n=160) deficient group was comprised of serum vitamin D levels less than 20 ng/ml, group B (n=84) insufficient group was comprised of serum vitamin D levels between20-29.99 ng/ml and group C(n=56) sufficient group where vitamin D level >30 ng/ml. Results. Table 1 showed that Serum 25(OH)D was deficient (less than 20ng/ml) in 53.3% (n = 160) which is group A while 28% (n = 84) of pregnant women had insufficient level between(20-29.9ng/ml) (group B) and 18.7%(n=56) had sufficient level (more than 30ng/ml) in group C. There were only 18.7% (56 of 300) had serum 25(OH) more than 30ng/ml which means higher prevalence of low level of vitamin D in pregnant women. There were no significant differences between three groups as regard patient age, gestational age in the first trimester and pre-pregnancy body mass index. There were differences in second trimester femur length and birth height with significant

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Table 1: Birth weight among the three groups.

	Group A	Group B	Group C	P value
	n=160	n=84	n=56	
25(OH)D level	14.49±2.30	22.76±3.68	33.77±4.2	
Incidence of 25(OH)D	53.30%	28%	18.70%	
Patient age	28.2±3.5	28.3±3.7	29.4±2.6	
Pre-pregnancy BMI	23.28±3.52	23.33±3.50	23.64±3.54	
Gestational age(10-14 wk)	11.2±4	12.4±2	11.4±3	
2nd trimester Fl(mm)	33.5±1.3	35.3±8.2	35.96±7.4	0.034
Birth weight (kg)	3490±0.323	3569.45	3572.44	0.067
Birth height(cm)	50.4±2.9	50.5±2.3	50.7±3.7	0.039

difference but there was no difference in birth weight among the three groups.

Discussion

Vitamin D deficiency is a significant problem all over the world. From our study only 18.7% had sufficient level of vitamin D with man value 33.77±4.2 while 53.3% had deficient values of vit D with mean value14.49±2.30 which agree with two studies with small sample sizes conducted by Tao et al, [19] and Wang et al, [20] who found that 69% and 57.1% of pregnant women had vitamin D deficiency with mean levels of 17.57±11.44 ng/ml and 14.38±7.88 ng/ml, respectively. Although a lot of studies focus on the relationships between vitamin D status during pregnancy and maternal and neonatal outcomes, the results of previous studies are inconsistent. Leffelaar et al, [12] study in the Netherlands in 3730 pregnant women found that lower maternal 25(OH)D concentrations are associated with lower birth weight. Perez Lopes et al, [21] through randomized controlled trials showed that vitamin D supplementation during pregnancy was associated with increased circulating 25(OH)D concentrations and a higher birth weight and had a higher birth length than the control group. Morely et al, [22] through an observational study found that gestation length was 0.7 week shorter in infants of 27 mothers with low 25(OH) D *vs.* babies whose mothers had higher concentration. Kozeta et al, [23] study showed that Low maternal 25(OH)D concentrations are associated with proportional fetal growth restriction and with an increased risk of preterm birth and small size for gestational age at birth. Yaun et al, [24] found that there was association between low maternal vit D and LBW and SGA. Elif et al, [25] study showed the associations between low and high maternal 25- hydroxyvitamin D3 levels and fetal growth at birth weight but no difference in birth length.

Scholl et al, [26] study reported that pregnant adolescents with serum 25-hydroxyvitamin D3 >50 nmol/L at delivery had higher fetal femur length and humeral length at the 34th weeks.

In contrast to the above studies, Farrant et al, [27] study on 559 Indian pregnant women did not observe any association of maternal 25(OH)D concentrations and length at birth. Another two studies investigated the association between maternal serum vitamin D and intrauterine fetal growth such as in Korea and Spain, in which no associations were found [28,29]. Mahon et al, showed that, in pregnant women, 25-hydroxyvitamin D3 serum level is not in a certain relationship with fetal growth in Europe and the United States [30]. Other studies investigated the pregnancy outcome and neonatal anthropometric measurements such as birth weight, birth length, head circumference with similar negative results [31,3]. Although systematic reviews found a positive association between maternal serum vitamin D and neonatal anthropometric measurements but a recent Cochrane review suggested inconclusive results [33–35]. These differences in outcome may be due to the difference in study population and smaller sample size which limited the ability to detect these associations.

References

1. Gale CR, Robinson SM, Harvey NC, Javaid MK, Jiang B, Martyn CN, et al. Maternal vitamin D status during pregnancy and child outcomes. Eur J Clin Nutr. 2008; 62: 68–77.
2. Brown AJ, Dusso A, Slatopolsky E. Vitamin D status during pregnancy: maternal, fetal, and postnatal outcomes. Am J Physiol, 1999; 277: 157–175.
3. Hollis BW, Wagner CL. Nutritional vitamin D status during pregnancy: reasons for concern. CMAJ. 2006; 174: 1287–1290.
4. Thorne-Lyman A, Fawzi WW. Vitamin D during pregnancy and maternal, neonatal and infant health outcomes: a systematic review and meta-analysis. Paediatr Perinat Epidemiol. 2012; 26: 75–90.
5. Mulligan ML, Felton SK, Riek AE, Bernal Mizrachi C. "Implications of vitamin D deficiency in pregnancy and lactation." American Journal of Obstetrics and Gynecology. 2010; 202: 429.
6. Sahu M, Bhatia V, Aggarwal A, Rawat V, Saxena P, Pandey A, et al. Vitamin D deficiency in rural girls and pregnant women despite abundant sunshine in northern India. Clin Endocrinol (Oxf). 2009; 70: 680–684.
7. Thandrayen K, Pettifor JM. Maternal vitamin D status: implications for the development of infantile nutritional rickets. Endocrinol Metab Clin North Am. 2010; 39: 303–320.
8. Gluckman PD, Hanson MA, Cooper C, Thornburg KL. Effect of in utero and early-life conditions on adult health and disease. N Engl J Med. 2008; 359: 61–73.
9. Gernand AD, Simhan HN, Klebanoff MA, Bodnar LM. Maternal serum 25-hydroxyvitamin D and measures of newborn and placental weight in a U.S. Multicenter Cohort Study. J Clin Endocrinol Metab. 2013; 98: 398–404.
10. Thorp J, Camargo C, McGee P, Harper M, Klebanoff M, Sorokin Y, et al. Vitamin D status and recurrent preterm birth: a nested case-control study in high-risk women. BJOG. 2012; 119: 1617–1623.
11. Charatcharoenwitthaya N, Nanthakomon T, Somprasit C, Chanthasenanont A, Chailurkit LO, Pattaraarchachai J, et al. Maternal vitamin D status, its associated factors and the course of pregnancy in Thai women. Clin Endocrinol (Oxf). 2013; 78: 126–133.
12. Leffelaar ER, Vrijkotte TG, van EijSDen M. Maternal early pregnancy vitamin D status in relation to fetal and neonatal growth: results of the multi-ethnic Amsterdam Born Children and their Development cohort. Br J Nutr. 2010; 104: 10817.
13. Van den Berg G, van EijSDen M, Vrijkotte TG, Gemke RJ. Suboptimal maternal vitamin D status and low education level as determinants of small-for-gestational-age birth weight. Eur J Nutr. 2013; 52: 273–279.
14. Galthen-Sørensen M, Andersen LB, Sperling L, Christesen HT. "Maternal 25-hydroxyvitamin d level and fetal bone growth assessed by ultrasound: a systematic review." Ultrasound in Obstetrics & Gynecology. 2014; 44: 633-640.
15. Holick MF. High prevalence of vitamin D inadequacy and implications for health. Mayo Clin Proc. 2006; 81: 353–373.
16. Emmen JM, Wielders JP, Boer AK, van den Ouweland JM, Vader HL. The new Roche Vitamin D total assay: fifit for its purpose? Clin Chem Lab Med. 2012; 1–4.
17. Holick MF. Vitamin D status: measurement, interpretation, and clinical

application. Ann Epidemiol. 2009; 19: 73–78.

18. Institute of Medicine. Dietary Reference Intakes for Calcium and Vitamin D. Washington, DC: The National Academy of Sciences Press. 2011.

19. Tao M, Shao H, Gu J, Zhen Z. Vitamin D status of pregnant women in Shanghai, China. J Matern Fetal Neonatal Med. 2012; 25: 237–239.

20. Wang J, Yang F, Mao M, Liu DH, Yang HM, Yang SF. High prevalence of vitamin D and calcium deficiency among pregnant women and their newborns in Chengdu, China. World J Pediatr. 2010; 6: 265–267.

21. Perez-Lopez FR, Pasupuleti V, Mezones-Holguin E, Benites-Zapata VA, Thota P, Deshpande A, et al. Effect of vitamin D supplementation during pregnancy on maternal and neonatal outcomes: a systematic review and meta-analysis of randomized controlled trials. Fertil Steril. 2015; 103: 1278–1288.

22. Morley R, Carlin JB, Pasco JA, Wark JD. Maternal 25-hydroxyvitamin D and parathyroid hormone concentrations and offspring birth size. J Clin Endocrinol Metab. 2006; 91: 906–912.

23. Kozeta M, Anna V, Laura ME, John J M, Darryl W, Thomas H, et al. Maternal vitamin D concentrations during pregnancy, fetal growth patterns, and risks of adverse birth outcomes. Am J Clin Nutr. 2016; 103: 1514–1522.

24. Yuan-H, Lin F, Hu H, Z Yu, Peng Z, Hua W, et al. Maternal Vitamin D Deficiency During Pregnancy Elevates the Risks of Small for Gestational Age and Low Birth Weight Infants in Chinese Population. J Clin Endocrinol Metab. 2015; 100: 1912–1919.

25. Elif G, Umut S, Isil T, Talat UK. The Relationship between First Trimester 25-Hydroxyvitamin D3 Levels and Second Trimester Femur Length and Their Effects on Birth Weight and Length at Birth. Obstetrics and Gynecology International Volume. 2019; 3846485.

26. Scholl TO, Chen X. "Vitamin D intake during pregnancy: association with maternal characteristics and infant birth weight." Early Human Development. 2009; 85: 231–234.

27. Farrant HJ, Krishnaveni GV, Hill JC, Boucher BJ, Fisher DJ, Noonan K, et al. Vitamin D insufficiency is common in Indian mothers but is not associated with gestational diabetes or variation in newborn size. Eur J Clin Nutr. 2009; 63: 646–652.

28. Lee DH, Ryu HM, Han YJ, Lee SW, Park SY, Yim CH, et al. Effects of serum 25-hydroxy-vitamin D and fetal bone growth during pregnancy. J of Bone Metab. 2015; 22: 127–133.

29. Morales E, Rodriguez A, Valvi D, Iniguez C, Esplugues A, Vioque J, et al. Deficit of vitamin D in pregnancy and growth and overweight in the offspring. Int J Obs. 2015; 39: 61–68.

30. P. Mahon, N. Harvey, S. Crozier. "Low maternal vitamin D status and fetal bone development: cohort study." Journal of Bone and Mineral Research. 2010; 25: 14-19.

31. Eggemoen AR, Jenum AK, Mdala I, Knutsen KV, Lagerlov P, Sletner L. Vitamin D levels during pregnancy and associations with birth weight and body composition of the newborn: a longitudinal multiethnic population-based study. Br J Nutr. 2017; 117: 985–993.

32. Ong YL, Quah PL, Tint MT, Aris IM, Chen LW, van Dam RM, et al. The association of maternal vitamin D status with infant birth outcomes, postnatal growth and adiposity in the first 2 years of life in a multi-ethnic Asian population: the Growing Up in Singapore towards Healthy Outcomes (GUSTO) cohort study. Br J Nutr. 2016; 116: 621–631.

33. Aghajafari F, Nagulesapillai T, Ronksley PE, Tough SC, O'Beirne M, Rabi DM. Association between maternal serum 25-hydroxyvitamin D level and pregnancy and neonatal outcomes: systematic review and meta-analysis of observational studies. BMJ. 2013; 346: 1169.

34. Harvey NC, Holroyd C, Ntani G, Javaid K, Cooper P, Moon R, et al. Vitamin D supplementation in pregnancy: a systematic review. Health Technol Assess. 2014; 18: 1–190.

35. Perez-Lopez FR, Pasupuleti V, Mezones-Holguin E, Benites-Zapata VA, Thota P, Deshpande A, et al. Effect of vitamin D supplementation during pregnancy on maternal and neonatal outcomes: a systematic review and meta-analysis of randomized controlled trials. Fertil Steril. 2015; 103: 1278-1288.