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Anne Vitamin Düzeylerinin Bebek Doğum Ağırlığı Üzerine Etkisi

The Effects of Maternal Vitamin Levels on Infant Birth Weight

Meryem HOCAOGLU [1] Orcid ID:0000-0002-1832-9993
Özgül BULUT [2] Orcid ID:0000-0001-9939-7375
Taner GUNAY [1] Orcid ID:0000-0002-3985-0702
Abdulkadir TURGUT [1] Orcid ID:0000-0002-3156-2116
Fahri OVALI [2] Orcid ID:0000-0002-9717-313X

[1]Department of Obstetrics and Gynecology, Goztepe Training and Research Hospital, Istanbul Medeniyet University, Istanbul, Turkey

[2]Department Of Pediatrics, Division Of Neonatology, Istanbul Medeniyet University Goztepe Training and Research Hospital, Istanbul, Turkey

ÖZ

Amaç: Gebelikte malnutrisyon ve vitamin eksikliği, düşük doğum ağırlığı, nöral tüp defektleri, plasenta ve fetüs anomalileri ve erken doğum ile sonuçlanır. Bu çalışmanın amacı, gebelikte anne vitamin D, B12, folat ve homosistein düzeylerinin termde doğan bebeklerin doğum ağırlığı üzerine etkilerini araştırmaktır.

Gereç ve Yöntemler: Bu retrospektif çalışmaya, İstanbul Medeniyet Üniversitesi Göztepe Eğitim ve Araştırma Hastanesi' nde Ocak 2017 ile Aralık 2019 tarihleri arasında doğum yapan 76 gebe dahil edildi. Gebeler, 37-42 gebelik haftalarında bakılan vitamin D, B12, folat ve homosistein düzeylerine göre normal ve düşük olarak gruplandırıldı. Serum vitamin D <20 ng/mL, B12 vitamini < 200 pg/mL, folat <2.5 ng/mL ve homosistein < 5 µM/L değerleri düşük olarak kabul edildi Her iki gruptan doğan bebeklerin doğum kiloları arasında anlamlı fark olup olmadığı ve anne vitamin düzeylerinin doğum ağırlığı üzerine etkisi araştırıldı.

Bulgular: Annelerin yaş ortalaması 24.7±4.5, ortalama gestasyon yaşı 39.6±1 haftaydı. Bebeklerin ortalama doğum ağırlığı 3320±345 gramdı. Gebelikte anne vitamin D, B12 ve homosistein düzeyleri ile bebeklerin doğum ağırlıkları arasında ilişki olmadığı (P>0.05) saptandı. Bununla birlikte, yenidoğan kilosuna etki eden faktörler dışlandığında gebelikte anne folat düzeyi ile bebek doğum ağırlığı arasında pozitif bir ilişki olduğu saptandı (p<0.05).

Sonuç: Bu çalışmanın sonuçlarına göre, bebek doğum ağırlığının belirlenmesinde anne folat düzeyinin önemli bir rolü olduğu söylenebilir.

Anahtar kelimeler: Vitamin D, vitamin B12, folat, homosistein, gebelik

ABSTRACT

Aim: Malnutrition and vitamin deficiency during pregnancy result in low birth weight, neural tube defects, placenta and fetus anomalies and preterm delivery. The aim of this study is to investigate the effects of maternal vitamin D, B12, folate and homocysteine levels on infant birth weight.

Materials and Method: The retrospective study population comprised 76 pregnancies delivered at Goztepe Training and Research Hospital affiliated to Istanbul Medeniyet University between January 2017 and December 2019. Women were grouped as normal and low according to the vitamin D, B12, folate and homocysteine levels recorded at 37-42 weeks of gestation. Maternal serum vitamin D, B12, folate and homocysteine levels were defined as low <20 ng/mL, <200 pg/mL<2.5 ng/mL, and <5 µM/L, respectively. It was investigated whether there was a significant difference between infant birth weight in both groups and the effects of mother serum vitamin levels on the infant birth weight.

Results: The mean maternal age and gestational age were 24.7±4.5 and 39.6±1 week, respectively. The mean infant birth weight was 3320±345 gram. There was no relationship between maternal vitamin D, B12 and homocysteine levels during pregnancy and neonatal birth weight(p>0.05). When confounding variables were adjusted, a positive correlation was found between maternal folate level and infant birth weight (p <0.05).

Conclusion: According to the results of this study, it can be considered that the level of maternal folate plays an important role in determining the birth weight of the infants.

Key worlds: Vitamin D, vitamin B12, folate, homocysteine, pregnancy

INTRODUCTION

A healthy diet is crucial throughout a whole lifetime, especially during pregnancy (1). In special periods such as growth, development, pregnancy and nursing during which there is an increased need for nutrition, the risk for the emergence of micronutrient deficiencies such as iron, vitamin D, folic acid and vitamin B12 is also increased. Vitamin and mineral deficiencies during pregnancy increase the risk for malformations, preterm delivery and low birth weight (2).

Sorumlu Yazar/ Corresponding Author:
Meryem Hocaoğlu
Dr. Erkin cad. Istanbul Medeniyet University, Goztepe Training and Research Hospital, Kadıkoy, Istanbul, Turkey.
E-mail: dr.meryemtaskiran@gmail.com

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Every year, 15-20% of infants born globally are born with a low birth weight (≤2500 g), which accounts for more than 20 million births (3). One of the most important factors that influence perinatal morbidity and mortality is birth weight (4). More than 80% of 2.5 million newborns that die every year have a low birth weight (5). As for the low-birth weight infants that survive, they have a higher risk for many diseases including growth and neurodevelopmental retardation and diabetes and cardiovascular diseases at later stages of life (5). For that reason, the pregnant' s diet is of utmost importance for the fetal health both before and after delivery. This study aimed at assessing the effects of vitamin D, vitamin B12, folate and homocysteine levels on infant birth weight.

MATERIALS AND METHOD

This retrospective study included pregnant women who gave birth at Goztepe Training and Research Hospital affiliated to Istanbul Medeniyet University between January 2017 and December 2019 at 37-42 weeks of gestation. The research protocol used in this study was approved by the Istanbul Medeniyet University, Goztepe Training and Research Hospital, Clinical Studies Ethic Committee (Decision no:2020/0012). The exclusion criteria included chronic disease, multiple pregnancies, preeclampsia, eclampsia, placental abruption, substance abuse such as smoking or alcohol use and congenital abnormalities. The data of patients were obtained retrospectively from the maternal clinic and nursery file records. The clinical and demographic characteristics of pregnant women and infants were recorded. Furthermore, at 37-42 weeks of gestation levels of 25-hidroxy vitamin D (25-OH D), vitamin B12, folate and homocysteine levels studied at the Biochemistry Laboratory of the Istanbul Medeniyet University, Goztepe Teaching and Research Hospital as well as the gestational age at delivery of infants, their birth weight, sex and mode of delivery were also examined. Based on the records, it was learned that pregnant women did not regularly take vitamins during pregnancy. Study subjects were grouped as 'normal' and 'low' based on the serum 25-OH vitamin D, vitamin B12 and folate levels that were assessed at third trimester. The values that were accepted as low were as follows: 25 OH Vitamin D <20 ng/mL (6), Vitamin B12 < 200 pg/mL (7), Folate <2.5 ng/mL (8) and homocysteine <5 µM/L (9). It was investigated whether the infants in both groups had significant differences between their birth weights. Gestational age (GA) was determined from the last menstrual period and verified during the routine first-trimester ultrasound measurement of the fetal crown-rump length. Infants with a birth weight ≤2500 g were considered as having low birth weight.

Statistical Analysis

The descriptive variables were presented as being the number and percentage as well as the mean and standard deviation. In the absence of a normal distribution, the Mann-Whitney U test was used for the comparison of constant variables between groups. Univariate and multivariate linear regression models were created to examine the effect of vitamin levels on infant birth weight. The analyses were conducted using the SPSS version 20. $p<0.05$ was considered statistically significant.

RESULTS

The study included 76 pregnant women. The mean maternal age was 24.7±4.5 years while the mean gestational age was 39.6±1 weeks. As for the mode of delivery, 63% of the patients had vaginal delivery while 37% had Caesarian section. Out of the infants born, 46 were male and 52 were female. The minimum birth weight of infants was 2680 g while the maximum birth weight was 4350 g and the mean weight was 3320±345 g (Table 1).

Table 1. Demographic and clinical characteristics of participants

	N=76 **(mean ± SD)**
Characteristics	
Maternal age, years	24.7±4.5
BMI	28.12±3.68
Gestational age, weeks	39.6±1
Infant birth weight, gram	3320±345
Mode of delivery, n (%) NVD CS	 48 (63) 28 (37)
Sex, n (%) Male Female	 35 (46) 41(56)

Abbreviations: BMI, body mass index; SD: standard deviation; NSD, Normal vaginal delivery; CS, Caesarean section

Vitamin B12 deficiency was identified in 54% of the mothers, vitamin D deficiency in 50%, homocysteine deficiency in 59% and folate deficiency in 8%. In groups with normal and low levels of vitamin D, vitamin B12, folate and homocysteine, no difference was identified in terms of neonatal birth weight (p>0.05) (Table 2).

Table 2. Maternal vitamin levels during pregnancy and infant birth weights

	Number (%)	Vitamin levels (mean ± SD)	Infant birth weight (mean ± SD)	p
Vitamin D level (ng/mL)				0.18
Normal	38 (50)	34.6±17.1	3365±344	
Low	38 (50)	11.8±4.6	3274±344	
Vitamin B12 level (pg/mL)				0.55
Normal	35 (46)	294±119	3292±296	
Low	41 (54)	148±31	3343±383	
Folate level (ng/mL)				0.33
Normal	70 (91)	11.8±5	3334±342	
Low	6 (8)	2±0.2	3155±371	
Homocysteine level (µM/L)				0.81
Normal	31 (41)	6.5±1.5	3352±396	
Low	45 (59)	3.9±0.5	3297±307	

Abbreviations: SD: standard deviation
p <0.05 was considered statistically significant

A regression analysis was performed to check for the effect of body mass index on the neonatal birth weight towards the aim of assessing the effect of vitamins on birth weight and a positive correlation was identified only between the folate level and infant birth weight (16.23 (2.19; 30.27), p<0.05) (Table 3).

Table 3. Effect of maternal vitamin levels during pregnancy on infant birth weight

	B	B 95% GA
Vitamin D (ng/mL)	0.15	-3.00; 6.40
Vitamin B12 (pg/mL)	1.70	-0.58; 0.87
Folate (ng/mL)	16.23*	2.19; 30.27
Homocysteine (µM/L)	-23.78	-71.04; 23.48

Univariate and multivariate linear regression models were created to examine the effect of vitamin levels on infant birth weight.

The vitamin levels were corrected according to the body mass index

DISCUSSION

Adequate intake of micronutrients during pregnancy has critical importance for healthy pregnancy results and for metabolic activities that enable tissue growth and functioning in the developing fetus. The studies conducted have identified associations between folate deficiency and congenital malformations [neural tube defect (NTD), cleft lip and palate, cardiac abnormalities], pregnancy complications (spontaneous abortus, preeclampsia, placental abruption), anemia, preterm delivery and low birth weight (10).

Our study determined that maternal folate level had a positive effect on the neonatal birth weight and that one unit of increase in the folate level led to an increase of 16 g in the neonatal birth weight. As a result of a meta-analysis where nine studies were reviewed, it was found that 707 pregnant participants had a folic acid supplement of 250-5000 mcg/day between weeks 12 and 22. An investigation into the effects of folic acid supplement intake after the first trimester on birth weight showed that the study groups delivered infants with higher birth weights than control groups and that a two-fold increase in the folate intake increased the birth weight by 2% (11). Folate pathway has the potential to influence fetal growth via a few mechanisms. Folic acid plays a significant role in nucleic acid synthesis. Folate and vitamin B12 are co-factors in the conversion of homocysteine to methionine. Methionine provides the methyl group required for gene regulation, tissue growth and development (12). A low level of folate is associated with a high total homocysteine level, which has been associated with various clinical conditions that have negative effects on fetal growth including high serum levels of amino acid and placental vasculopathy (13, 14).

The increased folate requirement in pregnant women cannot be covered by diet alone. For that reason, folic acid supplements are recommended globally (15). The World Health Organization recommends every woman to take folic acid supplements or consume nutrients rich in folic acid at 400 mcg/day or 2800 mcg/week in order to prevent health problems such as neural tube defects and anemia during and, if possible, before pregnancy (16). In Turkey, a folic supplement of 400 µg/day in a diet is recommended as of the pre-gestational period and during the first 12 weeks of pregnancy in order to prevent neural tube defects (17).

The biological functions where vitamin D plays a role are various. This vitamin assumes regulatory roles in immune system, nervous system and cardiovascular system ranging from skeletal metabolism to calcium homeostasis for bone growth (18). In association with pregnancy, vitamin D deficiency most often causes preeclampsia, gestational diabetes and periodontal diseases. Among these, preeclampsia and gestational diabetes result in fetal intrauterine growth restriction (IUGR) and preterm delivery, thereby negatively influencing the entire life of the neonate (18, 19). Vitamin B12 and folate are essential vitamins that play a role in the metabolism of DNA and RNA and are essential for cellular growth and proliferation (8). Maternal vitamin B12 deficiency has been found to be associated with increased pregnancy complications such as spontaneous abortus, intrauterine growth restriction and neural tube defects (20). In the literature, there are studies which show that deficiencies of vitamin D and vitamin B12 lead to low birth weight (19,21,22) while there are other studies which show that these vitamins do not influence the neonatal birth weight(23, 24). In our study, it was identified that vitamin D and vitamin B12 levels did not influence the neonatal birth weight.

Plasma total homocysteine concentration is generally 30% to 60% lower in healthy pregnant women as compared to non-pregnant women under physiological conditions and the lowest total homocysteine levels are observed in the second trimester. The deficiencies in the dietary intakes of vitamins B (B2, B6, B12) and decrease in their bloodstream concentrations increase the total homocysteine plasma concentration via the regulatory effect (25). A high level of homocysteine is considered to be causing placental pathology, thereby resulting growth restriction in fetus (26). In our study, none of the pregnant women had a high level of homocysteine. No differences were identified between groups with low and normal homocysteine levels in terms of neonatal birth weight.

This study has limitations, too. The first one is that the study design is retrospective and the second one is that a medium level of patients and healthy controls were included. Therefore, there is a need for more extensive studies.

CONCLUSION

Adequate intake of micronutrients in pregnancy is very important for the protection and improvement of both maternal and fetal health. According to the results of this study, it can be concluded that the maternal folate level has a significant role in determining infant birth weight. It may be appropriate to recommend a folic acid-rich diet during pregnancy, to assess the overall health and dietary situation of every pregnant woman and to provide folic acid supplement whenever needed.

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