

Investigating the Relationship between Vitamin D Level in the Last Month of Pregnancy and Birth Weight in the New-borns Born in Teaching Hospitals Shariati, Al-Zahra, Beheshti in 2012-2013

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Abstract:

Introduction: Vitamin D level in pregnancy is closely associated with birth weight and head circumference. The new-borns of the women who suffer vitamin D deficiency during their pregnancy, will be at the risk of intrauterine growth retardation and death in the first month of life, and also, chronic diseases such as heart disease, blood pressure, and type 2 diabetes in their later life. This research has been conducted to investigate the relationship between vitamin D level in the last month of pregnancy and birth weight of new-borns infants.

Methodology: This is a cross-sectional, descriptive-analytical study. The pregnant women who in their last four weeks of pregnancy had referred to Isfahan Shariati, Al-Zahra, and Beheshti Hospitals in 2012-2013, as well as, their new-borns during the first week of birth, were selected. Blood samples were taken from 52 pregnant women for testing vitamin D level. The mothers were followed up and, using standard scales, the new-borns' weight was measured after delivery. The weights lower than 2500 grams were defined as low birth weight.

Findings: vitamin D level in the subjects was obtained from 5.4 to 90 with the mean 27.48± 18.87. The correlation coefficient of relationship between two variables of birth weight and maternal vitamin D in all subjects was obtained as 0.542. The higher level of maternal vitamin D, the infant's birth weight was more, and the lower the level of maternal vitamin D, the infant's birth weight was less.

Discussion: according to this study, the women who take less vitamin D during their pregnancy will have more low-weight new-borns than the women who take enough Vitamin D. It is recommended that vitamin D can be prescribed as supplement for pregnant women.

Keywords: Vitamin D, pregnancy, low birth weight, new-borns infants

1. Introduction

Inadequate calcium residue during pregnancy and lactation will cause impaired bone development in infant and reduced bone density, and also reduce the secretion of breast milk which in turn will lead to rickets and osteomalacia both in mother and infant, in addition has essentially important in metabolic bone diseases (Ward LM, 2005). Previous studies in Iran have discussed vitamin D and calcium

deficiency. Of school children across the country, 61 percent had lower than 8.8 mg/dl calcium, 6.2 percent had lower than 3.7 mg/dl and 5 percent were with hypocalcaemia and hypophosphatemia. The mean of vitamin D serum level in all age groups of women in Tehran Lipid and Glucose Study was lower than 30 nmol/l, and vitamin D deficiency was more observed in 10-29 years old girls (Azizi F, et al. 2009). In another study, 20 percent of the

pregnant women suffered severe vitamin D deficiency and 40 percent suffered slight Vitamin D deficiency, and generally, 60 percent of women in Tehran suffered from slight to severe Vitamin D deficiency. (Zahedi S, et al. 2004).

Vitamin D level early in pregnancy can affect fetal growth. Vitamin D deficiency affects calcium absorption in pregnant women, resulting in reduced bone growth in fetus. (Eini E, et al.2009). Infants of the women, who have suffered vitamin D deficiency in the first trimester of their pregnancy, were at a two-folded risk of in utero growth restriction. Moreover, their birth weight was low. This restriction creates a situation where the fetus does not have the ability to reach the genetic potential size. These groups of infants are at a 5 to 10 fold risk of mortality in the first month of their lives. (Ward LM, 2005).

Calcium and vitamin D deficiencies may be manifested as hypocalcaemia, craniotabes and rickets (Agarwal R,et al. 2012).Subclinical vitamin D deficiency rarely causes osteopenia in mother and infant rickets (Trilock G, et al. 2012). Vitamin D deficiency may reduce female fertility and increase menarcheal age (Van den Berg G, et al.2013). In a study in Iran, the mean of serum calcium, reported as 8.6 ± 0.7 .(Larijani MB, et al. 2003).In Asian immigrant women living in London, the high prevalence of vitamin D deficiency has been reported in the third trimester of their pregnancy that 37 percent of them had less than 4 nmol/L vitamin D. (Velagapudi A, et al.2011).

In Pakistani women living in Oslo, vitamin D deficiency also have been reported and infants with rickets are mainly born by these mothers. The risk of neonatal seizures and congenital rickets is higher in the infants of the Asian mothers with osteomalacia (Scholl TO, et al.2009). In evaluating vitamin D level in the population of Tehran Lipid and Glucose Study a decline was observed in the serum vitamin D in one third of population especially in the women of reproductive age (Azizi F, et al.2011).It appears that a high intake of phytate prevents the absorption of calcium that this deficiency in turn will lead to vitamin D reduction. On the other hand, scholars consensually believe that

nutrition and dietary intake have a significant role in the level of calcium, vitamin D and other factors related to the calcium metabolism (Mannion CA, et al. 2006).

Given the role of micronutrients such as vitamin D in fetal gaining weight as one of the most important indicators of infant health, in this study, the prevalence of vitamin D level in the last month of pregnancy and its association with birth weight was studied for pregnant women and their new-borns infants in Isfahan teaching hospitals of Shariati, Al-Zahra, and Beheshti in 2012-2013.

Methods and Materials

this study is a cross-sectional, descriptive-analytical study conducted to determine the relationship between vitamin D level and birth weight of the infants for pregnant women and their new-borns infants in Isfahan teaching hospitals of Shariati, Al-Zahra, and Beheshti in 2012-2013. The pregnant women who in their last four weeks of pregnancy had referred to Isfahan Shariati, Al-Zahra, and Beheshti Hospitals in 2012-2013, and their new-borns during the first week of birth, were selected as the sample and participated in the study. Blood samples were taken from 51 pregnant women for testing vitamin D level. The obtained levels of vitamin D were compared with standard levels. A checklist was provided and such information as taking supplements during pregnancy, overall health status, medication use during pregnancy, pre-pregnancy weight and the weight gaining during pregnancy were recorded in this checklist. The mothers were followed up and using standard scales with accuracy of 0.1, the new-borns ' weight was measured after delivery. The weights lower than 2500 grams were defined as low birth weight.

Inclusion criteria include: pregnant women in the last 4 weeks of their pregnancy who have referred to women clinic, no chronic and debilitating disease, no use of supplements and drugs which may confound the tests and consent for participating in the program.

Exclusion criteria include: Small for Gestational Age (SGA) resulting from trauma, surgery, infection, nutritional deficiency, SGA of pregnancy complications or preterm labor,

chronic disease and the use of drugs which affect the metabolism of vitamin D.

Data collection tools in this study: a questionnaire was completed for the patients including age, number of pregnancies, parity, abortion, educational level, mother's employment status, maternal blood level of vitamin D, neonatal weight and gender, delivery type, etc.,. Data were analyzed using SPSS software, t-test, and chi-square and the $p < 0.05$ value was considered as significant.

Results and Findings:

In this study, 51 mothers and their new-borns infants have been studied. Maternal age of the subjects in this study was between 20 to 36 years old. The mean of maternal age was $27.3 + 4.85$. About 16 percent of the mothers were with primary education. More than half of the mothers (62.7%) were high school graduates and 21.6 percent were graduated. About 80 percent of the subjects were housewives and only 20 percent were employed. Less than half of the mothers (35.3%) did not have any history of pregnancy, 35.3 percent have had one experience of pregnancy and 29.3 percent have had more than one experience of pregnancy. About 82 percent of the subjects had no history of abortion, 14 percent have once experienced abortion. 65 percent of the mothers had normal vaginal delivery and the rest (35%) had caesarean delivery.

About 59 percent of the infants were male and 41 percent were female. The new-borns' age was between 37 to 42 weeks, and the average age of them was $38.46 + 2.17$. The infants' weight was between 2250 to 3730g, with the average of $3068.20g + 376.32$. The range of their heights was from 46cm to 52cm, with the

average height of 49.06 and standard deviation of 1.56.

Vitamin D level in the mothers was between 5.4 to 90. The mean of vitamin D was $27.48 + 18.87$. The mean of vitamin D level was obtained as 28.13 for the housewives and 24.82 for the employed mothers.

The mean of vitamin D level has been 19.28 in the mothers who had caesarean and 31.95 for the mothers with normal vaginal delivery.

The mean of vitamin D level in the mothers with abortion history and those with no history of abortion was respectively obtained as 32.40 and 26.42.

The average weight of the infants in the housewife mothers was 3124.75g and in the employed mothers was 2842g.

The average weight of the infants whose mothers had a history of abortion was 2975.56g and this average for the infants whose mothers had no history of abortion was 3088.54.

The mean of vitamin D level was 22.05 in the mothers who had given birth to a female infant and 31.28 in the mothers who had given birth to a male infant.

The mean birth weight of the female and male infants has been respectively as 2929g and 3161g. Thus, the female infants had a lower birth weight than the male infants and as the $P\text{-value} < 0.05$, this difference is statistically significant. According to the following table it can be seen that the Pearson correlation coefficient between birth weight and maternal vitamin D level is 0.502 for the male and 0.591 for the female infants.

The average birth weight of the infants was 3026.67g in the mothers of caesarean and 3091.56g in the mothers with normal vaginal delivery.

Table 1: Relationship between birth weight and maternal vitamin D status in terms of infant gender

p-value	Pearson correlation coefficient	No.	Relationship between birth weight and maternal vitamin D status
0.005	0.502	30	Male infants
0.006	0.591	13	Female infants
<0.0001	0.542	51	All infants

Pearson correlation coefficient between birth weight and maternal vitamin D level is 0.480 for the housewife mothers and 0.758 for the employed mothers and as the P-value for both

groups of mothers is lower than 0.05, therefore it can be said that this relationship is statistically significant both for the housewife and employed mothers.

Pearson correlation coefficient between birth weight and maternal vitamin D level is 0.596 for the mothers with primary education, 0.578 for the high school graduated mothers and 0.524 for the university graduated mothers.

Pearson correlation coefficient between birth weight and maternal vitamin D level is 0.569 for the mothers with no history of abortion and 0.533 for the mothers with a history of abortion.

Pearson correlation coefficient between birth weight and maternal vitamin D level is 0.662 for the nulliparous mothers, 0.599 for the multiparous mothers and 0.375 for the mothers who have previously had 2 or more pregnancies.

Discussion and Conclusion:

Low birth weight (lower than 2500g) is one of the main causes of mortality in new-borns infants, and delayed growth and development of infants at older ages. It is also one of the most important indicators of infant health and survival, and one of the main factors determining the infant's physical and mental growth, as well as, a valid indicator of intrauterine growth. Therefore, it is important to know and moderate the effects affecting birth weight. Annually more than 20 million new-borns infants are born all around the world with a less than normal birth weight that the risk of death in these infants is more likely than the normal infants (Eghbalian F.2007,Hassani Z, et al. 2005).

Halasey et al. (1993) reported that the infants with extremely low birth weight are weaker than their peers in evolution of language, movement, and visual-motional-perceptual memory (HalaseyCLet al.1993).

Khuri et al. in their study show that there is a significant relationship between maternal age, delivery type, the mother's previous abortions, mother's education, age difference between two last children, first pregnancy age, the number of previous pregnancies, mother's RH, and risk factors during pregnancy(Khouri E, et al.1999).

Several studies in Iran have shown that that the level of vitamin D in children is low. The presence of rickets in Tehran and other cities have been shown. For example, a percentage of 1-12 months urban and rural children in Orumieh and under three years old children in Kashan (Rahimi F, et al. 2002), under five years

old children in two cities in Gilan province (Montaseri Z, et al. 2009), and under one year old children in Birjand (Mirnaseri F, et al. 2010) suffer from vitamin D deficiency and its clinical presentation.

The current study was conducted in Isfahan teaching hospitals of Shariati, Al-Zahra, and Beheshti to examine the relationship between maternal vitamin D level in the last month of pregnancy and infants' birth weight.

In Maghbuli et al. study, 66.8 percent of mothers and 93.3 percent of infants during birth had vitamin D deficiency(less than 35nmol/L). There was a significant relationship between vitamin D level of umbilical cord and maternal serum level of vitamin D. Vitamin D level in the infants whose mothers had vitamin D deficiency was lower than the infants whose mothers did not have this deficiency (MaghbuliZ,et al.2010).

Vitamin D deficiency in the mothers with caesarean delivery is more than the mothers with normal vaginal delivery, and as the P-value<0.05, this difference is statistically significant.

Vitamin D deficiency in the mothers with a history of abortion is less than the other mothers but as P-value> 0.05, this difference has not been statistically significant.

Vitamin D deficiency in the mothers who had given birth to a female infants more than those who had given birth to a male infant. As the P-value >0.05, this difference has not been statistically significant.

Vitamin D deficiency in the employed mothers is more than the housewife mothers, but as P-value>0.05, this difference is not statistically significant, that this can be because of the low sample size and its inappropriateness in the groups.

Hence, the weight of the infants whose mothers were employed had been lower than the infants whose mothers were housewivesand as the P-value <0.05, this difference is statistically significant.

In a study conducted by Eghbalian, in terms of mother's being employed and unemployed, no significant difference was observed between the group that had low birth weight infants and the group that had normal infants (Eghbalian F.2007).

The infants with cesarean had a lower birth weight than the latter infants, but as the P-value > 0.05, this difference has not been statistically significant. However, in a study conducted by Shojaei et al, the birth weight of the infants born by caesarean was significantly higher than this weight in the infants born normally.

The infants of the mothers with a history of abortion had a lower birth weight than the other infants, but as the P-value > 0.05, this difference has not been statistically significant. In Eghbalian study, the mothers of low birth weight infants have had more abortions than the other mothers (Eghbalian F.2007).

The weight of the infants whose mothers were employed has been less than the infants whose mothers were housewives and as P-value < 0.05, this difference is statistically significant.

The female infants had a lower birth weight, and as the P-value < 0.05, this difference is statistically significant.

Correlation coefficient between the variables of birth weight and maternal vitamin D level was obtained 0.542 in all subjects. The P-value of this coefficient was obtained less than 0.001, and therefore the assumption of non-linear relationship (assumption that correlation coefficient is zero) of two variables at the level of 0.05 is rejected. This means that these two variables are linked together. In other words, the higher the maternal vitamin D level, the more will be the infant's birth weight and vice versa.

However, in Eghbalian study, in terms of using such micronutrients as vitamin A and D by mother, no significant difference was observed between the group that had low birth weight infants and the normal group (Eghbalian F.2007).

In line with Saburi et al. study, the infants of the mothers who had enough intake of calcium and vitamin D, had significantly a higher Apgar score and birth height than the infants whose mothers had inadequate calcium and vitamin D intake. Adequate intake of calcium and vitamin D through food and supplements, make maternal and fetal gaining weight better that in turn will lead to a higher Apgar score and an appropriate birth height and weight in the fetal (Sabur H, et al. 2007).

Pearson correlation coefficient between birth weight and maternal vitamin D level is 0.502 for the male infants and 0.591 for the female infants, and as P-value is lower than 0.05 both for male and female infants, therefore, it can be said that this relationship is significant both in male and female infants.

Hence, it is said that this relationship is statistically significant both for the housewife and employed mothers. Given the fact that Pearson correlation coefficient is greater for the employed mothers than housewives mothers, it can be concluded that vitamin D deficiency in the employed mothers has more impact upon the birth weight of their infants than the housewife mothers.

As the P-value < 0.05 only for the high school graduated mothers, it can be said that this relationship is significant only for these mothers. The reason that this relationship is not significant in the other two groups is that the sample size in these two groups has been too small.

As the P-value < 0.05 for the mothers with no history of abortion, thus it can be said that this relation is significant for these mothers. That this relationship is not significant in the mothers with a history of abortion can be due to the small sample size in this group of mothers. As the P-value < 0.05 only in nuliparous and multiparus mothers, therefore it can be said that this relation is significant only for the nuliparus and multiparus mothers.

Recommendations:

Testing vitamin D level should be included in routine tests.

Pre-pregnancy and early pregnancy check up of vitamin D level is recommended for the mothers.

The cases of vitamin D deficiency have to be treated.

A similar study can be conducted with a larger sample size and a wider scope.

In a similar study, for obtaining more precise results, the impact of such criteria as living place, household income and nutrition can be considered.

The results of this study may be considered in future studies.

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