

THE ASSOCIATION BETWEEN MATERNAL SERUM MAGNESIUM LEVEL AND PREGNANCY OUTCOMES

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ABSTRACT

Objective: To find out the association between maternal serum magnesium levels and preterm labor, neonatal weight, and the duration of labor.

Methodology: This observational study was conducted at the Social Security Hospital in Hamadan City, the west of Iran, from October 2014 to January 2015. The case group included 32 preterm labour women (28 to <37 weeks pregnant women) and the control group included 32 term pregnant women. The maternal serum magnesium level, the duration of the first and second stage of labor were measured in both the groups.

Results: The duration of gestational age was significantly lower in cases compared to controls ($P < 0.001$). The average birth weight was significantly lower in the case group than in the control group ($P < 0.001$). The mean (SD) level of maternal serum magnesium was 2.12 (0.27) and 1.95 (0.16) in the control and case groups, respectively ($P = 0.004$). The duration of the first stage of labor was lower in the case group than in the control group ($P = 0.001$). There was a positive correlation between maternal serum magnesium level and gestational age (0.3305) and neonatal weight (0.2975) and a negative correlation between maternal serum magnesium level and the duration of the first and second stage of labor (-0.0184 and -0.0445, respectively).

Conclusion: Low level of maternal serum magnesium is associated with poor pregnancy outcomes, including preterm labor and low birth weight.

Key Words: Low birth weight, Premature obstetric labor, Magnesium

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INTRODUCTION

Preterm labor is defined as the onset of labor prior to the completion of 37 weeks of gestational age, counting from the first day of the last menstrual period¹. Preterm labor is associated with perinatal morbidity and mortality. A majority of neonatal deaths and over one third of infant deaths linked to preterm birth^{2,3}. Magnesium is the fourth most common element in the body and the second most essential intracellular cation after potassium. Serum levels of magnesium range from 1.5 to 2.1 mg/dl⁴. This element freely crosses the placental-uterine barrier and accumulates in the fetus. Therefore, the serum level of maternal magnesium is apparently reflected in the fetus⁵. The serum magnesium levels fall during pregnancy as gestational age increases. The frequency of magnesium deficiency in pregnancy has been reported to be between 4.6% and 48%⁶.

Decrease in magnesium level may play an important role in the physiology of delivery. It may be responsible for magnesium deficiency in myometrium leading to initiation of uterine contractions and premature labor. Hypomagnesaemia may lead to neuromuscular excitability resulting in muscle cramp and uterine hyperactivity⁷.

Some studies reported that low levels of magnesium may be associated with preterm labor, neonatal weight lost and leg cramp⁷⁻⁹. On the other hand, there are several other evidence that reported no correlation between level of magnesium and birth weight^{5,10,11}. This study was conducted to assess the association between maternal serum magnesium level and preterm labor, neonatal weight and the duration of labor.

METHODOLOGY

This observational study was conducted at the Social Security Hospital in Hamadan City, the west of Iran, from October 2014 to January 2015. The research committee of Islamic Azad University, Hamadan Branch, approved the study. Verbal informed consent was received from all participants. Inclusion criteria consisted of pregnant women: (a) nulliparous; (b) single pregnancy; (c) without preeclampsia; (d) no drug use except Fe and Folic Acid. Exclusion criteria consisted of pregnant women who exited during study.

According to the results of a previous study conducted by Hantoushzadeh⁷, the mean (SD) level of magnesium in women having preterm and term labors was reported 1.73 (0.38) and 2.0 (0.18) mg/dl, respectively. Accordingly, we arrived at a sample size of 32 for each group and a total sample size of 64 at 95% significance level and 95% statistical power.

The case group included 32 preterm pregnant women (28 to <37 weeks pregnant women) and the control group included 32 term pregnant women. In the both groups, the maternal serum magnesium level in blood was examined. From each patient 3cc blood was taken in the labor ward at delivery for measuring of serum magnesium. The blood was collected in a 20cc plain container and immediately transferred to the laboratory where serum was separated by centrifugation at 2000 rpm following clot retraction. The separated serum was then frozen at -80°C until the time for analysis. Analysis was done in laboratory using the kit manufactured by Pars Azmoon, Iran. The duration of the first and second stage of labor (minute) was measured and assessed.

The independent t-test was used for comparison the continuous variables and The Pearson correlation coefficient for exploring the correlation between continuous variables. All statistical analyses were performed at 0.05 significant levels using Stata version 11 (StataCorp, College Station, TX, USA).

RESULTS

The characteristics of the cases and controls are given in table 1. There was no statistically significant difference between the age and height of the pregnant women in the case and control groups. However, the duration of gestational age was significantly lower in cases compared to controls ($P < 0.001$). The average birth weight was significantly lower in the case group than in the control group ($P < 0.001$). The mean (SD) level of maternal serum magnesium was 2.12 (0.27) and 1.95 (0.16) in the control and case groups, respectively ($P = 0.004$). The duration of the first stage of labor was lower in the case group than in the control group ($P = 0.001$). However, there was no statically significant difference between the duration of the second stage of labor between the two groups ($P = 0.109$).

Correlation among the maternal serum magnesium level, gestational age, the duration of the first and second stage of labor and neonatal weight is given in table 2 using Pierson correlation coefficient. There was a positive correlation between maternal serum magnesium level and gestational age (0.3305) and neonatal weight (0.2975) and a negative correlation between maternal serum magnesium level and the duration of the first and second stage of labor (-0.0184 and -0.0445, respectively). There was a positive correlation between gestational age and neonatal weight (0.6803) and the duration of the first and second stage of labor (0.4572 and 0.3475, respectively). In addition, there was a positive correlation between the neonatal weight and the duration of the first and second stage of labor (0.2500 and 0.3036, respectively).

The relationship between maternal serum magnesium level and gestational age and neonatal weight is given in Figure 1a and 1b, respectively. As shown in these figures, there is a direct association between maternal serum magnesium level and gestational age and neonatal weight.

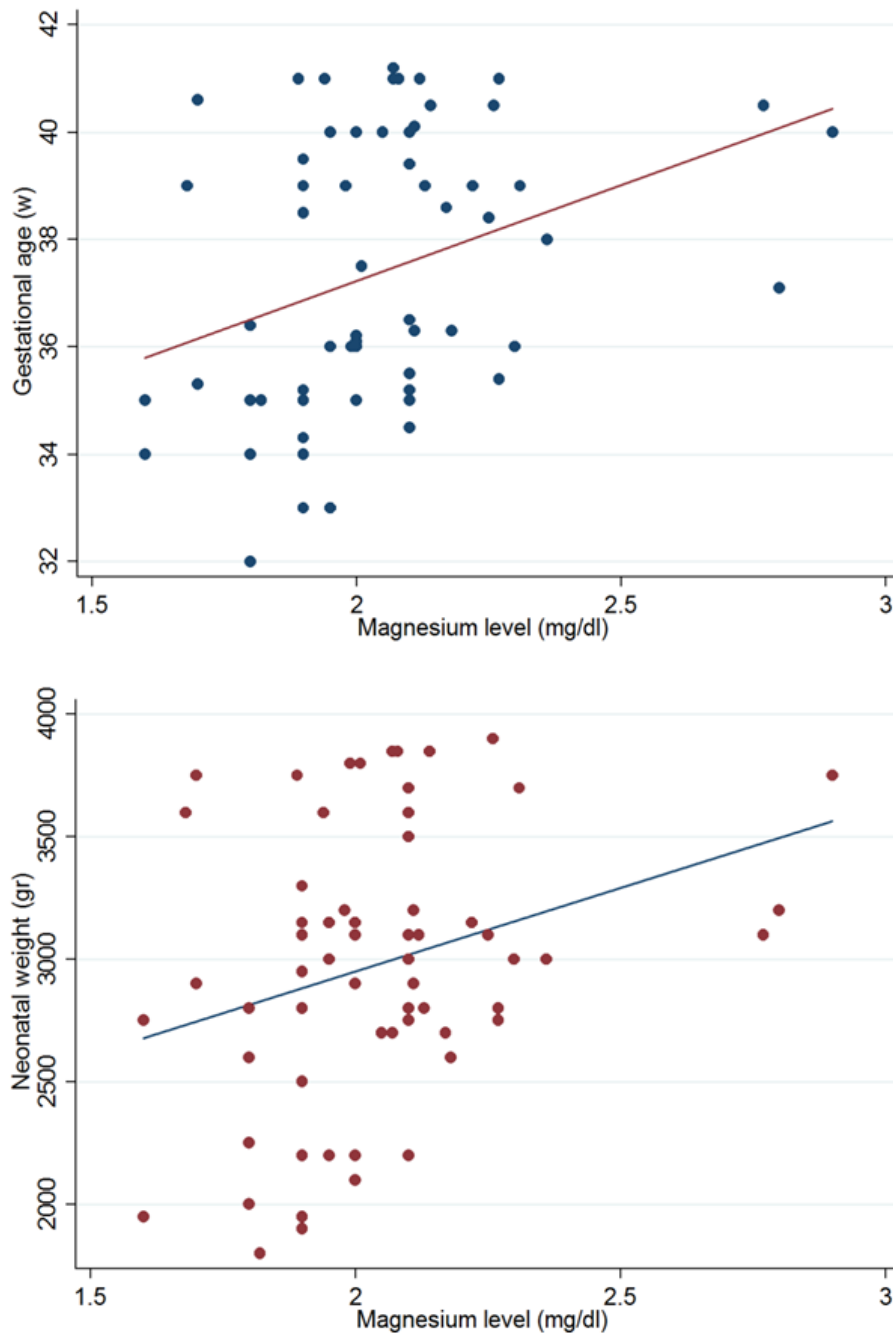
Table 1: Comparison of the characteristics of the term pregnant women (controls) and the preterm pregnant women (cases)

Variables	Controls		Cases		P value
	Mean	SD	Mean	SD	
Age (yr)	25.18	4.37	24.56	3.76	0.542
Height (cm)	163.38	7.07	161.29	5.34	0.192
Gestational Age (w)	39.66	1.10	35.06	1.06	0.001
Birth Weight (gr)	3320.31	383.29	2627.41	501.47	0.001
Serum Magnesium levels (mg/dl)	2.12	0.27	1.95	0.16	0.004
Duration of 1st stage of Labor (min)	362.40	210.26	220.83	113.12	0.001
Duration of 2nd stage of Labor (min)	73.09	64.35	52.45	30.00	0.109

Table 2: Correlation among the maternal serum magnesium level (mg/dl), gestational age (wks), the duration of the first and second stage of labor (min), using Pierson correlation coefficient

Variables	Magnesium Level	Gestational age	1 st stage of labor	2 nd stage of labor
Magnesium Level	1.0000			
Gestational age	0.3305	1.0000		
1st stage of Labor	-0.0184	0.4572	1.0000	
2nd stage of Labor	-0.0445	0.3475	0.4732	1.0000

Figure 1: The association between serum magnesium levels and gestational age (a) and neonatal weight (b)



DISCUSSION

Our study indicated that maternal serum magnesium level was associated with preterm labor. In addition, there was a direct correlation between maternal serum magnesium level and gestational age and neonatal weight.

Based on the results of a case-control study conducted by Bhat et al⁹ in 2012, serum magnesium level in women with preterm labor was significantly lower than women with term labor (1.343 ± 0.09 mg/dl versus 1.875 ± 0.013 mg/dl, respectively). In addition, Hantoushzadeh et al⁷ reported that serum magnesium level in preterm pregnant women was lower than term pregnant women (1.7 ± 0.38 versus 2 ± 0.184).

Watson et al¹² performed a prospective cohort study on 504 pregnant women in New Zealand in 2010 and investigated the association between infant birth weight and maternal diet and supplement intake. They reported a positive correlation between magnesium intake during pregnancy and neonatal birth weight. On the other hand, Pourarian et al⁵ conducted a case-control study on 180 pregnant women in 2014 and reported no significant association between maternal magnesium level and infant birth weight and gestational age.

Kurzel¹³ investigated the effect of serum magnesium levels in pregnancy on preterm labor and indicated that hypomagnesaemia (magnesium equal to or less than 1.4 mg/dl) can be considered as a marker for true preterm labor. A proposed hypothesis suggests that magnesium has an immediate effect on placenta vascular flow and its depletion can have an adverse effect on the placenta vascular dilation leading to placenta insufficiency¹⁴.

The prophylactic use of magnesium supplementation is an issue of debate. Based on the current knowledge, there is not enough evidence to suggest prophylactic therapy with magnesium sulfate in order to reduce pregnancy and neonatal unwanted outcomes^{3,15,16}. However, further research should be carried out based on randomized clinical trial to assess whether the prescription of magnesium supplement can prevent preterm labor.

CONCLUSION

Low level of maternal serum magnesium is associated with several pregnancy outcomes, including preterm labor and low birth weight.

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CONTRIBUTORS

EJ conceived the idea, planned the study, and drafted the manuscript. BF, MA and PH helped acquisition of data and did statistical analysis. All authors contributed significantly to the submitted manuscript.