

Evaluation of Serum Calcium, Magnesium, Copper, and Zinc Levels in Women with Pre-eclampsia

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Abstract

Background: Pre-eclampsia along with its complications seems to be one of the major causes of maternal morbidity and mortality. Despite numerous studies, the etiology of pre-eclampsia has not yet been fully elucidated. According to recent studies changes in the level of blood trace elements can be an adverse event in human and animal pregnancy. The present study determines whether maternal serum levels of calcium, magnesium, copper, and zinc in patients with pre-eclampsia are lower than matched control subjects.

Methods: Serum calcium, magnesium, copper, and zinc levels were measured in 52 women with pre-eclampsia in their third trimester of pregnancy as patients group, and in 52 healthy normotensive pregnant women as control group with similar maternal and gestational ages. All women were primigravida with singleton pregnancy. Data on body mass index (BMI), maternal and gestational ages, serum calcium, magnesium, copper, and zinc levels were collected and compared between the two groups.

Results: There were no significant differences between the two groups in body mass index and maternal and gestational ages. Serum calcium, magnesium, copper, and zinc levels were 8.97 ± 0.49 , versus 8.70 ± 0.58 ($P=0.27$), 1.90 ± 0.24 versus 1.90 ± 0.26 ($P=0.75$), 21 ± 2.60 versus 21 ± 2.32 ($P=0.47$), and 13.07 ± 3.20 versus 12.91 ± 3.01 ($P=0.78$) for control and patients groups respectively.

Conclusion: The mean serum levels of calcium, magnesium, copper and zinc between the two groups were not significantly different. It seems that these trace elements are not involved in the pathogenesis of pre-eclampsia.

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Keywords • Preeclampsia • calcium • magnesium • copper • zinc

Introduction

Pre-eclampsia is a transient but potentially dangerous complication of pregnancy that affects 3-5% of pregnancies.^{1,2} Pre-eclampsia has been dubbed the "disease of theories" because of the multiple hypotheses have

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been proposed to explain its occurrence.³

In spite of numerous studies, the etiology of pre-eclampsia has not been fully elucidated. Some studies have concluded that changes in levels of blood metals observed in pre-eclamptic patients may implicate the pathogenesis of pre-eclampsia.^{4,5} Whereas, other studies have failed to show an association between the serum concentrations of these elements and occurrence of pre-eclampsia.^{6,7}

High rate of pre-eclampsia in developing countries have forced some authors to conclude that malnutrition is a risk factor in the etiology of pre-eclampsia and implicate it by deficit intake of calcium and zinc.⁸

On the basis of some studies' claim that blood calcium and magnesium have a relaxant effect on the blood vessels of pregnant women,¹ we tried to find out whether there is a correlation between pre-eclampsia and the serum levels of calcium, magnesium, and copper in pregnant women. This was done by measuring the blood concentrations of calcium, magnesium, copper, and zinc in primigravid pre-eclamptic women and comparing them with matched normotensive pregnant women. This is the first study that measures serum concentrations of four elements simultaneously in pre-eclamptic women.

Patients and Methods

The present study was approved by Ethical Committee of Uromiyeh University of Medical Sciences. The study population was one hundred and four primigravida women, in their third trimester with singleton pregnancies, admitted to Kosar Obstetrics hospital affiliated to Uromiyeh University of Medical Sciences. A written informed consent was obtained from the participants in the study. Pre-eclampsia was defined as new onset of hypertension after 20 weeks of gestation with high systolic (≥ 140 mmHg) and diastolic blood pressures (≥ 90 mmHg) and proteinuria (300mg/24 h).¹ According to previous studies that reported serum magnesium level of 0.67 ± 0.05 and 0.70 ± 0.06 mmol/l for pre-eclampsia and normotensive groups respectively, and considering power=80% and significant level=95%, 52 pregnant women with pre-eclampsia and 52 healthy normotensive pregnant women were enrolled in the study. Inclusion criteria, based on the maternal chronological age or gestational age were; negative history of hypertension or other diseases associated with hypertension and no taking diuretic or magnesium or other metal containing medications. At the time of admission to the hospital, venous blood

samples were collected and their sera were isolated by centrifugation and stored at $4-8^{\circ}\text{C}$ until analysis.

Serum levels of calcium and magnesium were measured with Pars Azmoon kit using auto analyser (Arsenazo method) and Chim Azmoon kit using photometric (Xylidl blue method) respectively. Serum concentrations of zinc and copper were measured by colorimetric method using Randox kit (Randox, UK).

Statistical Analysis

Data were presented as mean \pm SD. Comparison of serum levels of the elements between the two groups was performed by Student's *t* test and $P < 0.05$ was considered as statistically significant.

Results

The total study population was 104, 52 cases in each group.

The mean of ages, maternal body mass indices, and gestational ages of the two groups were not significantly different (table 1).

Table1: The characteristics of the study population.

	Case (n=52)	Control (n=52)	P value
Age (years)	25.70 \pm 1.20	22.70 \pm 1.50	0.07
BMI (kg/m ²)	21.58 \pm 50	21.38 \pm 51	0.84
EGA (weeks)	35.20 \pm 0.80	36.70 \pm 1.10	0.27

BMI= Body mass index, EGA= Estimated gestational age

There was no significant difference in serum concentrations of calcium between the patients with pre-eclampsia and normotensive controls ($P = 0.27$).

There was no significant difference in serum concentrations of magnesium between the patients with pre-eclampsia and normotensive controls ($P = 0.75$).

There was no significant difference in serum concentrations of copper between the patients with pre-eclampsia and normotensive controls ($P = 0.47$).

There was no significant difference in serum concentrations of zinc between the patients with pre-eclampsia and normotensive controls ($P = 0.78$). Table 2 shows the serum concentration of these four elements in the patients and control groups.

Discussion

The mean maternal age, mean gestational age, and BMI were not significantly different between the two groups (table 1). Women with a greater BMI in pregnancy are more likely to become hypertensive than those with a lower

Table 2: Comparison of the serum concentrations of four elements in pre-eclampsia and control groups.

	Patients (n=52)	Controls (n=52)	P value
Calcium (mg/dl)	8.70±0.58	8.97±0.49	0.27
Magnesium (mg/dl)	1.90±0.26	1.9±0.24	0.75
Copper (mg/dl)	21.40±2.32	21±2.60	0.47
Zinc (mg/dl)	12.91±3.01	13.07±3.20	0.78

BMI.⁹ However, in the present study, BMI excluded as a cause of pre-eclampsia.

In many studies, decrease in serum magnesium levels has been considered as the cause of pathogenesis of pre-eclampsia.¹⁰ Serum copper, zinc, calcium and magnesium levels have been compared between pre-eclamptic and healthy pregnant women in various studies. Some results showed that copper, zinc, and calcium levels were significantly lower in pre-eclamptic patient, whereas magnesium concentrations showed no significant differences between the two groups.¹¹ Magri et al. did not find a relationship between the serum levels of calcium, magnesium, and zinc and gestational hypertension, therefore, they proposed that these elements might not clinically participate in the pathogenesis of the gestational hypertension.¹²

The results of the present study showed no significant differences in the serum levels of calcium (P=0.27), magnesium (P=0.75), copper (0.47), and zinc (P=0.78) between pre-eclampsia group and healthy pregnant individuals, which is compatible with the findings in another study.¹² Richard et al. showed that there was not any difference in the serum level of ionized calcium between pregnancy-induced hypertension and normal pregnant women.¹³

Magnesium sulfate is used for treatment of seizure and prophylaxis in women with eclampsia and pre-eclampsia worldwide. Magnesium may act by opposing calcium - dependent arterial constriction and may also antagonize the increase in intracellular calcium concentration.¹³ Aali et al. rejected this idea that magnesium exerts its effect in pre-eclampsia by modulating serum level of ionized calcium.¹⁴

Dietary calcium deficiency has been proposed as a possible cause of pre-eclampsia. In a prospective study, researchers administered two grams of elemental calcium in women after 13 – 21 weeks of pregnancy to assess the role of calcium for preventing preeclampsia. The results of that study showed that calcium supplementation during pregnancy did not prevent pre-eclampsia in healthy nullipara women.¹⁵

Conclusion

The mean serum levels of calcium, magnesium, copper and zinc between the two groups

were not significantly different. For defining the role of serum electrolytes in pre-eclampsia more research is necessary. The results of the present study showed that these elements did not play a prominent role in the pathogenesis of pre-eclampsia.

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Conflict of Interest: None declared

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