



Serum Calcium Levels in Preeclampsia

**Feriha Fatima Khidri^{1,2*}, Hina Riaz^{1,3}, Farah Naz⁴, Almas⁵,
Arsalan Ahmed Uqaili³, Roohi Naz⁶ and Faiza Kamran Ali⁷**

¹Medical Research Centre, Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan.

²Department of Biochemistry, Bilawal Medical College, Pakistan.

³Department of Physiology, Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan.

⁴Dr. Ruth K.M Pfau Civil Hospital Karachi, Pakistan.

⁵Suleman Roshan Medical College, Tando Adam, Pakistan.

⁶Department of Biochemistry, Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan.

⁷Lady Willingdon Hospital, Khairpur Mirs, Pakistan.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Objectives: To determine the serum calcium levels in mild and severe preeclampsia and compare it with normal pregnancy.

Methods: It was a comparative cross sectional study. Thirty five normotensive pregnant women, n=30 women with mild preeclampsia and n=70 with severe preeclampsia were recruited at Liaquat University of Medical and Health Sciences, Hospital. The serum calcium was measured and levels were compared among three groups. The data was analysed on SPSS v. 20.

Results: The gestational age was more in the normal pregnancy compared to mild and severe preeclampsia (38.7±2.1 vs 36.7±3.6 and 36.2±2.8, p-value=0.0002). The calcium concentration was less in the both groups of preeclampsia i.e., 8.41± 0.96 mg/dl in mild and 8.02± 0.77 mg/dl in severe preeclampsia vs 9.2± 0.32 mg/dl in normal pregnant women, (p-value <0.001).

Conclusion: We found lower levels of serum calcium in preeclampsia, suggesting its possible role in pathogenesis. Further studies to investigate the potential role of dietary supplementation of micronutrients during pregnancy are recommended.

*Corresponding author: E-mail: ferihafatima@yahoo.com;

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1. INTRODUCTION

Preeclampsia affects about 2–7% of the pregnant women worldwide, consequently leading to pregnancy complications. The etiology of the preeclampsia remains indistinct, however the basic mechanism relates to the defected placenta and oxidative stress. Micronutrients have the fundamental and crucial role in the metabolism, tissue function and immune response [1-3].

The evidence implies that antioxidants and minerals may have an important role in preeclampsia. Macrominerals and trace minerals such as calcium, copper, zinc and magnesium are linked to preeclampsia [4, 5]. Human body stores calcium in the most abundant amount, with greater than 99% in the bones and teeth and below 1% extracellularly. It is the fundamental element required for the cell signaling and bone growth [6]. Apart from this, it exhibits an essential role in muscular contraction and regulating water levels in cells. Alteration of levels of plasma calcium may affect the blood pressure. The decline in the serum calcium and raised intracellular calcium may increase blood pressure in preeclampsia. The same pattern has been observed in serum magnesium levels in preeclampsia. Magnesium is a cofactor for various enzymes and essential for the maintenance of tone and contraction of blood vessels to regulate the blood pressure. This is important to understand the therapeutic importance of magnesium sulfate as the drug of choice in severe preeclampsia and eclampsia. Furthermore, studies have found the significantly lower calcium and higher magnesium levels in preeclampsia [1,7]. It is observed that the modification of minerals and micronutrients during pregnancy may increase the risk of preeclampsia. Determining the trace elements and minerals in pregnancy is important to ascertain the potential function in the etiology and may help clinicians treat and prevent preeclampsia by recommending supplementations. The present study was conducted to measure the serum levels of calcium in preeclampsia.

2. METHODS

A comparative cross sectional study was performed at Liaquat University of Medical and Health Sciences, Hospital during the period of

Jan 2015 to July 2016. Thirty five normotensive pregnant women, n=30 women with mild preeclampsia and n=70 with severe preeclampsia were recruited at the time of admission before receiving any medications. Women with heart and kidney disorders, lung and liver disorders, diabetes mellitus and other endocrine disorders were excluded.

Mild pre-eclampsia specified as blood pressure \geq 140/90 mmHg and severe preeclampsia as blood pressure \geq 160/110 mmHg along with proteinuria (\geq 0.3g/24h, or \geq 1+ by dipstick); after 20th weeks of pregnancy in a previously normotensive woman [3]. After informed consent, collected blood samples were centrifuged and serum stored at -20°C till testing. The serum calcium was measured on Roche Modular system c501 autoanalyzer. The data was analysed on SPSS v. 20 (IBM Corp., Armonk, N.Y., USA) [8].

3. RESULTS

The clinical variables are shown in Table-1. The age was non-significant among three groups (p -value=0.22). The systolic/diastolic blood pressure was elevated in mild and severe groups of preeclampsia compared to normal pregnancy (p -value $<$ 0.001). The gestational age was more in the normal pregnancy compared to mild and severe preeclampsia (38.7 ± 2.1 vs 36.7 ± 3.6 and 36.2 ± 2.8 , p -value=0.0002). Table-2 shows the serum calcium in three groups. The calcium concentration was less in the both groups of preeclampsia compared to the normal group (p -value $<$ 0.001).

4. DISCUSSION

The analysis of the results indicates that women with mild and severe preeclampsia have significantly lower serum calcium as contrast to normal group (8.41 ± 0.96 mg/dl and 8.02 ± 0.77 mg/dl vs 9.2 ± 0.32 mg/dl, p -value $<$ 0.001). The present findings are in accordance to the results of previous studies. A study showed significantly reduced plasma calcium in preeclampsia than in the normal pregnancy (2.07 ± 0.318 mmol/L vs. 2.41 ± 0.224 mmol/L, $P <$ 0.001), recommending calcium supplementation in pregnancy to decrease risk for preeclampsia [9]. Another study conducted on Bangladeshi women revealed that serum calcium levels were less in preeclampsia as compared to normal pregnancy (7.63 ± 0.42 vs 8.12 ± 0.94 mg/dl, respectively) [10].

Table 1. Clinical parameters for the three groups

Parameters	Normal pregnancy (n = 35)	Mild preeclampsia (n = 30)	Severe preeclampsia (n = 70)	p-value
Age (years)	25.6 ± 2.6	24.6 ± 3.2	24.8 ± 2.2	0.22
Gestational age (weeks)	38.7 ± 2.1	36.7 ± 3.6	36.2 ± 2.8	0.0002
Systolic BP (mm Hg)	110 ± 10.2	146 ± 10.6	180.2 ± 15.2	< 0.001
Diastolic BP (mm Hg)	85 ± 10.6	95 ± 10.8	120 ± 15.5	< 0.001

BP: Blood Pressure, n: number; Values are given as mean ± SD
Significance difference by one-way analysis of variance (ANOVA)

Table 2. Comparisons of serum calcium for the three groups

	Normal pregnancy (n = 35)	Mild preeclampsia (n = 30)	Severe preeclampsia (n = 70)	p-value
Serum calcium (mg/dl)	9.2 ± 0.32	8.41 ± 0.96	8.02 ± 0.77	< 0.001

n: number; Values are given as mean ± SD
Significance difference by one-way analysis of variance (ANOVA)

Parvin S et al. [11] also observed hypocalcemia in mild preeclampsia (8.2 ± 0.2 mg/dl) and severe preeclampsia (7.6 ± 0.3 mg/dl) groups as compare to healthy pregnant women (9.0 ± 0.5 mg/dl) *p*-value=0.001. Al-Jameil N et al. [12] found reduced calcium levels in high risk and preeclampsia groups as oppose to normal pregnant women (*p* < 0.001) in Saudi population. An Indian study reported higher calcium concentration in the control group (8.94 ± 0.6 mg/dl), contrary to cases to have lower levels of serum calcium (8.61 ± 0.78 mg/dl; *p* < 0.05). It was also found that hypertensive women with hypocalcemia had adverse maternal and perinatal outcomes contrary to normal pregnant women [13]. It was observed that hypocalcaemia may enhance the risk of preeclampsia more than 8-fold [14]. In contrast to the positive association, certain other studies did not report an association between calcium levels and preeclampsia [15-18], that may be due to differences in the study design, analytical techniques and different population and socio-economic conditions.

It has been evidenced that there is a progressive regression in the calcium, zinc and magnesium concentration in maternal serum during pregnancy. Furthermore, less intake of certain micronutrients and increased metabolism may further decrease their serum levels [19]. During preeclampsia, increased free radicals and decrease micronutrient levels may lead to oxidative stress. During pregnancy, increased parathyroid hormone and renin due to hypocalcemia cause increased intracellular calcium in vascular smooth muscle; resulting

vasoconstriction and enhanced vascular resistance and consequently preeclampsia. Moreover, it has been found that systolic/diastolic blood pressure has positive correlation with lower concentrations of serum calcium, magnesium and zinc in preeclampsia, which indicates the correlation of reduced levels of trace elements with production of oxidative stress, enhanced vascular resistance and hypertension [12, 20].

5. CONCLUSION AND RECOMMENDATIONS

In conclusion, we found that the preeclamptics had lower serum calcium contrary to normal pregnancy. These results suggest the possible role of calcium in preeclampsia pathogenesis. Further studies are necessitated to investigate the potential role of dietary supplementation of micronutrients during pregnancy.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT AND ETHICAL APPROVAL

As per international standard or university standard guideline Patient's consent and ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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