ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 08 | August - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

COMPARISON OF MATERNAL SERUM MAGNESIUM LEVELS IN WOMEN WITH PRE-ECLAMPSIA VERSUS NORMOTENSIVE - A CASE CONTROL STUDY

Obstetrics & Gynaecology

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ABSTRACT

Background: Pre-eclampsia is a hypertensive disorder of pregnancy characterized by new-onset hypertension and proteinuria after 20 weeks of gestation. The exact etiology remains unclear, but micronutrient deficiencies—particularly magnesium—have been implicated in its pathogenesis. **Aim:** To correlate serum magnesium levels with the severity of pre-eclampsia and compare them with normotensive pregnant women. **Methods:** A case-control study was conducted over six months (January–December 2024) in the Department of Obstetrics and Gynaecology, Rohilkhand Medical College and Hospital, Bareilly. Serum magnesium levels were analyzed in 60 pregnant women—30 with pre-eclampsia (mild and severe) and 30 normotensive controls. Data were statistically analyzed using SPSS v23.0. **Results:** Pre-eclamptic women had significantly higher systolic and diastolic blood pressures compared to controls. Primigravidas were more common in the pre-eclamptic group. The mean serum magnesium level was lowest in severe pre-eclampsia (1.82 ± 0.36 mg/dL), followed by mild cases (1.89 ± 0.18 mg/dL), and highest in normotensive women (2.01 ± 0.23 mg/dL), showing a significant declining trend with increasing disease severity. **Conclusion:** Hypomagnesemia is significantly associated with pre-eclampsia and its severity. Monitoring and correcting magnesium deficiency may play a role in the prevention and management of pre-eclampsia, warranting further large-scale studies.

KEYWORDS

INTRODUCTION

Pregnancy is a physiological state characterized by high in energy, nutrition and oxygen demand. Various compensatory changes fulfill the needs of the fetus. Such a change may be responsible for deficiency of essential mineral in pregnancy. Pre-eclampsia – a pregnancy associated disorder which is characterized by new onset of maternal hypertension, proteinuria and edema which begins after 20 weeks of gestation. It affects about 3-5% of pregnant women worldwide[1].

Criteria For Diagnosing Pre-eclampsia Include-

1. New onset of maternal SBP 140mmHg or DBP 90mmHg
2. Proteinuria >/= 0.3 gm in 24hour urine sample / protein:creatinine ratio 0.30.

Risk Factors For Pre-eclampsia Include [2]:

1. Previous history of pre-eclampsia
2. Multiple gestations
3. Maternal age > 40 years or under 18 years of age
4. Nulliparity
5. Pre-existing hypertension
6. Obesity BMI>30
7. Change in paternity that from the last pregnancy
8. Increased in the inter pregnancy interval
9. Conception by intracytoplasmic sperm injection
10. Diabetes mellitus
11. Renal disease

Many deficiencies in diet are proposed as a cause for pre-eclampsia over centuries. Studies have shown a relationship in deficiencies of micronutritients and incidence of pre-eclampsia. Diet related deficiency of magnesium have been stablished to play a role in blood pressure regulation and hence the development of pre-eclampsial[3]. Magnesium plays a role in transmission of neurochemicals and peripheral vasodilation[2]. It is involved in the synthesis of vasodilators like prostacyclins & Nitric Oxide, which regulates the vascular tone & reactivity and hence maintains normal blood pressure[4]. Also, the action of magnesium as calcium channel blockers help in reducing the release of calcium and hence in reduction of vascular resistance.

Magnesium deficiency in pregnancy can lead to maternal and fetal nutritional problems and may lead to lifelong consequences. Maternal magnesium intake effects perinatal outcome as well[5]. Magnesium deficiency is also associated with increased excitability of the uterus. premature labour and pre-eclampsia [6].

It can also lead to problems with regulation of body temperature in infant and thus can result in Sudden Infant Death Syndrome and Intrauterine Growth Retardation. It is also associated with hemodilution, renal clearance as well as utilisation of minerals by the growing fetus in most pregnant women. Magnesium is an essential element for fetal well being, and its supplementation may benefit to fetal outcome. Antenatal magnesium sulfate provides fetal neuroprotection[7] .

There was low magnesium levels among mild as well as severe pre-eclampsia cases when compared to normotensive pregnant women and it was concluded that the reduced serum levels of magnesium during pregnancy may possibly cause pre-eclampsia. Etiopathogenesis of pre-eclampsia remains unclear still it has been said that changes in maternal serum magnesium ions may be the factor causing elevation of blood pressure in pre-eclampsia. With these perspective these case control study of correlation of severity of pre-eclampsia with hypomagnesemia was undertaken with objective to assess and correlate magnesium level in pre-eclampsia and normal women which could be useful tool in the management of patients with pre-eclampsia.

Aim

To correlate severity of pre eclampsia with hypomagnesemia

Objective

1. To analyse serum magnesium levels in pre-eclampsia cases.
2. To analyse serum magnesium levels in normotensive controls
3. To correlate serum magnesium levels in pre-eclampsia cases and normotensive controls.
4. To study association of severity of hypomagnesaemia with severity of pre-eclampsia.

MATERIAL AND METHODS

After the approval of ethics committee and informed consent from patient, A Case Control study was conducted over a span of 6 months from Jan'24 to Dec'24, in the Department of Obstetrics and Gynaecology, Rohilkhand Medical College and Hospital, Bareilly.

- **Cases: (n=30)** Pregnant women diagnosed with pre-eclampsia (mild/severe) admitted to the antenatal care (ANC) ward or labor

room.
- **Controls: (n=30)** Normotensive pregnant women admitted for safe confinement.

Inclusion Criteria
- Singleton pregnancies
- Gestational age > 20 weeks
- Diagnosed pre-eclampsia or normotensive pregnancy

Exclusion Criteria
- Chronic hypertension
- Medical complications like (Renal disorders, Diabetes mellitus, Known vascular diseases)
- Magnesium supplementation

Statistical Analysis:
The data collected was entered in Microsoft excel 2007 and was analyzed by using SPSS version 23.0 windows software program. The quantitative data was expressed by mean and standard deviation. The qualitative data was expressed in percentages and the differences between percentages was computed using $\chi 2$ test or Fischer exact test. P value less than 0.05 was considered statistically significant.

RESULTS

Variables	Pre-eclampsia	Normotensive
Age (years)	29.4 ± 4.02	24.85 ± 4.2
Gestational age (weeks)	38.2 ± 1.4	38.5 ± 2.1
SBP	158.4 ± 12.48	112.7 ± 9.4
DBP	97.6 ± 8.24	72.54 ± 6.59

In this study women with pre-eclampsia were older (29.4 ± 4.02years) compared to normotensive women (24.85 ± 4.2years). Gestational age was similar between groups. Systolic (158.4 ± 12.48 mmHg) and diastolic (97.6 ± 8.24 mmHg) blood pressures were significantly higher in the pre-eclampsia group compared to normotensive women (SBP: 112.7 ± 9.4 mmHg; DBP: 72.54 ± 6.59 mmHg).

Gravida	Pre-eclampsia (n=30)	Normotensive (n=30)
G1	20	10
G2-G4	9	17
>G4	1	3

Primigravida (G1) were more common in the pre-eclampsia group (66.7%) compared to the normotensive group (33.3%). In contrast, multigravida women (G2–G4) and grand multigravida (>G4) were more frequent among normotensive women (G2–G4: 56.7% vs. 30%; >G4: 10% vs. 3.3%). This suggests a higher incidence of pre-eclampsia among primigravidas.

Variables	Pre-eclampsia		Normotensive
	Mild	Severe	
Serum Magnesium	1.89 ± 0.18	1.82 ± 0.36	2.01 ± 0.23

The mean serum magnesium levels were lower in pre-eclamptic women compared to normotensive women. Among pre-eclamptics, those with severe pre-eclampsia had the lowest levels (1.82 ± 0.36 mg/dL), followed by those with mild pre-eclampsia (1.89 ± 0.18 mg/dL). Normotensive women had the highest mean serum magnesium level at 2.01 ± 0.23 mg/dL. This shows a declining trend in serum magnesium levels with increasing severity of pre-eclampsia.
- The mean age of women with pre-eclampsia was significantly higher (29.4 ± 4.02 years) compared to normotensive controls (24.85 ± 4.2 years).
- Gestational age was comparable in both groups.
- Systolic and diastolic blood pressures were significantly elevated in the pre-eclampsia group (SBP: 158.4 ± 12.48 mmHg; DBP: 97.6 ± 8.24 mmHg) versus normotensive women (SBP: 112.7 ± 9.4 mmHg; DBP: 72.54 ± 6.59 mmHg).
- Primigravidas were more common among pre-eclamptics (66.7%) than controls (33.3%). Multigravidas (G2–G4: 56.7% vs. 30%) and grand multigravidas (>G4: 10% vs. 3.3%) were more frequent in the normotensive group.
- There was a clear decreasing trend in serum magnesium levels with increasing severity of pre-eclampsia.

DISCUSSION
A study by Rathore et al.(2011)[8] reported reduced magnesium levels in pre-eclamptic patients and recommended early dietary supplementation as a preventive strategy. They emphasized magnesium's role in vasodilation and neurovascular regulation.

A similar inverse relationship between serum magnesium and disease severity. Jain et al. (2010)[9] evaluated serum magnesium levels in 100 pregnant women and found significantly lower magnesium levels in pre-eclamptic patients compared to normotensive controls. The study concluded that magnesium deficiency could contribute to the development of pre-eclampsia by promoting vasoconstriction and increased vascular reactivity.

In contrast, James et al. (2004)[10] found no significant difference in serum magnesium levels between pre-eclamptic and normotensive women, arguing that magnesium alterations may be secondary rather than causal.

CONCLUSION
The present case-control study demonstrates that serum magnesium levels are significantly lower in women with pre-eclampsia compared to normotensive pregnant women, with the lowest levels observed in cases of severe pre-eclampsia. This inverse correlation suggests that hypomagnesemia may play a contributory role in the pathogenesis and progression of pre-eclampsia. Although the exact mechanism remains unclear, the findings support the potential utility of monitoring maternal magnesium levels during pregnancy. Early identification and correction of magnesium deficiency could serve as a preventive measure or therapeutic adjunct in the management of pre-eclampsia. Further large-scale studies are warranted to establish causal relationships and to assess the benefits of routine magnesium supplementation in high-risk pregnancies.

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