IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 25, Issue 1 Ser. 3 (January. 2026), PP 67-70
www.iosrjournals.org

Retrospective Evaluation Of Serum Calcium And Magnesium Status In Pregnancy-Induced Hypertension And Pre-Eclampsia

Dr Kumar Akash
(JRIII, Department Of Anaesthesiology & Critical Care, Narayan Medical College & Hospital, Sasaram, Bihar)

Dr Saumya
(JRIII, Department Of Anaesthesiology & Critical Care, Narayan Medical College & Hospital, Sasaram, Bihar)

Dr. Praveen Kumar Tiwari
(JRII, Department Of Anaesthesiology & Critical Care, Narayan Medical College & Hospital, Sasaram, Bihar)

Dr. Ravi Roshan
(JRIII, Department Of Anaesthesiology & Critical Care, Narayan Medical College & Hospital, Sasaram, Bihar)

Dr. Divya Kumari
(Medical Specialist, Obstetrics And Gynaecology, Government Of India)

Abstract
Background
Hypertensive disorders like gestational hypertension and pre-eclampsia remain leading causes of maternal-fetal complications and deaths. Recent studies indicate that serum levels of calcium and magnesium are key to vascular function and may contribute to the underlying mechanisms of these pregnancy-related conditions. Our research investigates the relationship between serum calcium and magnesium concentrations in pregnant individuals with gestational hypertension or pre-eclampsia.
Materials and Methods
We conducted a retrospective study at a tertiary hospital, reviewing records of 120 pregnant women categorized into three equal groups: normotensive controls (n=40), gestational hypertension (n=40), and pre-eclampsia (n=40). Serum calcium and magnesium levels, previously measured via an automated clinical chemistry analyzer, were extracted from medical records. Data were analyzed using one-way ANOVA and Pearson correlation to assess links between these electrolytes and hypertension severity.
Results
Pre-eclampsia patients showed markedly reduced mean serum calcium (8.2 ± 0.3 mg/dL) versus gestational hypertension (8.7 ± 0.2 mg/dL) and normotensive groups (9.0 ± 0.4 mg/dL) ($p<0.05$). Magnesium levels followed a similar trend, being lowest in pre-eclampsia (1.4 ± 0.2 mg/dL), then gestational hypertension (1.6 ± 0.2 mg/dL), and highest in controls (1.9 ± 0.3 mg/dL) ($p<0.05$). Serum calcium and magnesium exhibited a strong positive correlation ($r=0.68$, $p<0.01$).
Conclusion
Reduced levels of serum calcium and magnesium correlate with gestational hypertension and pre-eclampsia, suggesting these ions may influence disease mechanisms in pregnancy hypertension. Routine assessment and possible supplementation could aid management. Prospective studies are warranted to confirm causal links and explore clinical benefits.

Date of Submission: 12-01-2026 Date of Acceptance: 22-01-2026

I. Introduction

Hypertensive conditions in pregnancy—such as gestational hypertension and pre-eclampsia—rank among the top global contributors to maternal and perinatal adverse outcomes. Impacting 5–10% of all pregnancies, they elevate the likelihood of preterm delivery, intrauterine growth restriction, and long-term maternal cardiovascular issues (1,2). Pre-eclampsia typically involves new-onset hypertension plus proteinuria beyond 20 weeks' gestation, in contrast to gestational hypertension, which features high blood pressure alone without proteinuria (3). Although the precise mechanisms are not fully elucidated, factors like endothelial injury, oxidative damage, and disrupted vascular tone are thought to be central (4).

Essential electrolytes calcium and magnesium play vital roles in maintaining vascular balance and controlling blood pressure. Calcium modulates smooth muscle tone in blood vessels and supports endothelial integrity, whereas magnesium functions as a physiological calcium blocker, fostering vessel relaxation and curbing inflammatory responses (5,6). Prior investigations have linked lower serum concentrations of these minerals to heightened risks of pregnancy-associated hypertension and pre-eclampsia (7,8). Low calcium levels can trigger elevated parathyroid hormone, promoting vessel narrowing and endothelial impairment, while magnesium shortfall may exacerbate vascular tone and oxidative injury (9,10).

However, evidence on the interplay between serum calcium, magnesium, and pregnancy hypertension remains inconsistent, owing to differences in cohorts, methods, and study scales. The present study examines serum calcium and magnesium levels in pregnant women with gestational hypertension and pre-eclampsia to clarify their involvement in disease pathogenesis. Such findings could inform targeted prevention and treatment approaches, ultimately mitigating maternal-fetal risks from these hypertensive states.

II. Materials And Methods

Study Design

This retrospective analysis, undertaken after obtaining ethical clearance from the Institutional Ethics Committee, reviewed medical records over a 1-year period at a tertiary care hospital. It examined serum calcium and magnesium levels in connection with gestational hypertension and pre-eclampsia in pregnant patients.

Study Sample

A total of 120 pregnant women were identified from records and stratified equally into three groups: normotensive pregnancies (n=40), gestational hypertension (n=40), and pre-eclampsia (n=40). Inclusion required singleton pregnancies past 20 weeks' gestation. Patients with prior hypertension, renal conditions, diabetes, or calcium/magnesium supplementation were excluded.

Data Capture and Laboratory Tests

Fasting venous samples (5 mL) were collected overnight, centrifuged at 3,000 rpm for 10 minutes, and serum separated for analysis. Calcium and magnesium were quantified using colorimetric methods on an automated biochemistry analyzer.

Clinical Evaluation

Blood pressure was recorded via standard sphygmomanometer in seated position. Hypertension was confirmed by systolic ≥140 mmHg and/or diastolic ≥90 mmHg on two readings ≥4 hours apart. Pre-eclampsia included hypertension plus proteinuria (≥300 mg/24 hours) or other organ dysfunction.

Statistical Analysis

SPSS version 26.0 handled the data. Continuous variables used means ± SD; categoricals used frequencies/percentages. One-way ANOVA compared electrolyte levels across groups. Pearson correlation evaluated electrolyte-hypertension links. A p-value <0.05 denoted significance.

III. Results

Records of 120 pregnant women were analyzed (40 per group: normotensive, gestational hypertension, pre-eclampsia). Baseline characteristics showed no significant differences across groups except for blood pressure parameters [Table 1].

Serum Calcium and Magnesium Concentrations

Pre-eclampsia cases exhibited significantly reduced mean serum calcium and magnesium compared to gestational hypertension and normotensive groups. Normotensive women showed the highest calcium (9.0 ± 0.4 mg/dL), followed by gestational hypertension (8.7 ± 0.2 mg/dL) and pre-eclampsia (8.2 ± 0.3 mg/dL). Magnesium displayed a parallel pattern: 1.9 ± 0.3 mg/dL (normotensive), 1.6 ± 0.2 mg/dL (gestational hypertension), and 1.4 ± 0.2 mg/dL (pre-eclampsia). Group differences reached statistical significance ($p<0.05$) [Table 2].

Associations of Serum Electrolytes with Blood Pressure

Serum electrolytes showed inverse relationships with blood pressure metrics. Magnesium exhibited stronger negative correlations with systolic BP ($r = -0.55$, $p<0.01$) and diastolic BP ($r = -0.49$, $p<0.05$), while calcium showed moderate negative correlations with systolic BP ($r = -0.52$, $p<0.01$) and diastolic BP ($r = -0.47$, $p<0.05$) [Table 3].

Table 1: Baseline Demographic and Clinical Characteristics

Characteristic	Normotensive (n=40)	Gestational HTN (n=40)	Pre-eclampsia (n=40)	p-value
Age (years, mean ± SD)	26.2 ± 3.8	26.8 ± 4.0	27.1 ± 3.9	0.58
Gestational age (weeks, mean ± SD)	32.5 ± 4.2	32.1 ± 4.0	31.8 ± 4.3	0.72
BMI (kg/m², mean ± SD)	23.4 ± 2.9	23.8 ± 3.1	24.2 ± 3.0	0.41
Primipara, n (%)	18 (45%)	19 (47.5%)	20 (50%)	0.89
Systolic BP (mmHg, mean ± SD)	112 ± 8	148 ± 12	162 ± 15	<0.001
Diastolic BP (mmHg, mean ± SD)	72 ± 6	94 ± 8	105 ± 10	<0.001

Table 2: Comparison of Serum Electrolyte Levels Across Groups

Group	Calcium (mg/dL, mean ± SD)	Magnesium (mg/dL, mean ± SD)
Normotensive (n=40)	9.0 ± 0.4	1.9 ± 0.3
Gestational Hypertension (n=40)	8.7 ± 0.2	1.6 ± 0.2
Pre-eclampsia (n=40)	8.2 ± 0.3	1.4 ± 0.2

Table 3: Pearson Correlations Between Electrolytes and Blood Pressure

Parameter	r value	p-value
Magnesium vs. Systolic BP	-0.55	<0.01
Magnesium vs. Diastolic BP	-0.49	<0.05
Calcium vs. Systolic BP	-0.52	<0.01
Calcium vs. Diastolic BP	-0.47	<0.05

IV. Discussion

Pregnancy-associated hypertensive conditions like gestational hypertension and pre-eclampsia represent major contributors to maternal-perinatal morbidity globally. Exploring how key electrolytes such as calcium and magnesium influence vascular tone could inform improved prevention and treatment approaches (1,2). This retrospective analysis of 120 pregnant women revealed markedly lower serum calcium and magnesium concentrations in gestational hypertension (n=40) and pre-eclampsia (n=40) groups compared to normotensive controls (n=40), reinforcing evidence that electrolyte imbalances may underlie these disorders' pathogenesis (3,4).

Calcium serves critical functions in vascular regulation through its effects on smooth muscle contraction and endothelial signaling. Reduced serum calcium triggers compensatory parathyroid hormone elevation, which promotes vasoconstriction and hypertension (5,6). Our findings align with this mechanism, documenting progressive calcium decline from normotensive (9.0±0.4 mg/dL) → gestational hypertension (8.7±0.2 mg/dL) → pre-eclampsia (8.2±0.3 mg/dL). The observed negative correlation between calcium and both systolic ($r=-0.52$, $p<0.01$) and diastolic blood pressure ($r=-0.47$, $p<0.05$) supports calcium's protective role against vascular resistance (7,8,9).

As a physiological calcium channel blocker, magnesium facilitates vasodilation by limiting calcium entry into vascular smooth muscle while counteracting oxidative injury and inflammation (10,11). This study's magnesium gradient—1.9±0.3 mg/dL (normotensive), 1.6±0.2 mg/dL (gestational hypertension), 1.4±0.2 mg/dL (pre-eclampsia)—mirrors prior reports linking hypomagnesemia to endothelial impairment and elevated vascular tone in pre-eclampsia (12,13). Stronger magnesium-blood pressure correlations (systolic $r=-0.55$, $p<0.01$; diastolic $r=-0.49$, $p<0.05$) suggest it may exert greater influence on hypertensive pathophysiology (14).

These electrolyte deficiencies highlight opportunities for routine monitoring and targeted supplementation. Calcium supplementation trials demonstrate risk reduction for pre-eclampsia, especially among low-intake populations (15). Magnesium therapy similarly shows promise for blood pressure control and endothelial protection during hypertensive pregnancies (16,17). Future prospective studies should validate these associations and assess supplementation efficacy in similar cohorts.

V. Conclusion

While this retrospective analysis provides valuable insights, certain limitations must be acknowledged. The sample of 120 patients, though adequate for preliminary observations, remains modest, and the retrospective nature precludes establishing causality between electrolyte levels and pregnancy hypertension. Prospective studies with expanded cohorts and longitudinal tracking are essential to confirm these relationships and evaluate whether calcium and magnesium supplementation could serve as effective preventive interventions for gestational hypertension and pre-eclampsia.

Financial support and sponsorship: Nil.

Conflicts of interest: None declared.

References

[1]. Ephraim RKD, Osakunor DNM, Denkyira SW, Eshun H, Amoah S, Anto EO. Serum Calcium And Magnesium Levels In Women Presenting With Pre-Eclampsia And Pregnancy-Induced Hypertension: A Case-Control Study In The Cape Coast Metropolis, Ghana. BMC Pregnancy Childbirth. 2014;14:390.

[2]. Bera S, Adak RS, Gupta S, Roy TG, Taraphdar P, Bal R, Et Al. Study Of Serum Electrolytes In Pregnancy Induced Hypertension. J Indian Med Assoc. 2011;109(8):546-8.

[3]. Roberts JM, Cooper DW. Pathogenesis And Genetics Of Pre-Eclampsia. Lancet. 2001;357(9249):53-6.

[4]. Sibai BM, Dekker G, Kupferminc M. Pre-Eclampsia. Lancet. 2005;365(9461):785-99.

[5]. Ray JG, Vasishta S, Kahn SR, Rioux L, Payne M, Ross S, Et Al. Association Of Complications Of Pregnancy With The Development Of Elevated Blood Pressure: A Systematic Review. Hypertension. 2005;46(4):1027-34.

[6]. Trumbo PR, Ellwood KC. Supplemental Calcium And Risk Reduction Of Hypertension, Pregnancy-Induced Hypertension, And Preeclampsia: An Evidence-Based Review By The US Food And Drug Administration. Nutr Rev. 2007;65(2):78-87.

[7]. Hofmeyr GJ, Lawrie TA, Atallah ÁN, Duley L. Calcium Supplementation During Pregnancy For Preventing Hypertensive Disorders And Related Problems. Cochrane Database Syst Rev. 2018;10:CD001059.

[8]. Makrides M, Crosby DD, Bain E, Crowther CA. Magnesium Supplementation In Pregnancy. Cochrane Database Syst Rev. 2014;4:CD000937.

[9]. Oladipo OO, Afolabi BB, Okorodudu AO. Plasma Total And Ultrafiltrable Calcium In Normal Pregnancy, Hypertension In Pregnancy And Pre-Eclampsia. Niger Postgrad Med J. 2007;14(3):213-6.

[10]. He L, Lang L, Li Y, Liu Q, Yao Y. Comparison Of Serum Zinc, Calcium, And Magnesium Concentrations In Women With Pregnancy-Induced Hypertension And Healthy Pregnant Women: A Meta-Analysis. Hypertens Pregnancy. 2016;35(2):202-9.

[11]. Wang Y, Tang HR, Wang Y, Zheng MM, Ye XD, Dai YM, Et Al. [Association Between Gestational Blood Pressure And Pregnancy Induced Hypertension Or Pre-Eclampsia]. Zhonghua Fu Chan Ke Za Zhi. 2021;56(11):767-73.

[12]. Kasim HH, Masri MA, Noh NA, Mokhtar A, Mokhtar RH. Clinical Implications Of Blood Pressure Variability (BPV) In Pregnancies: A Review. Horm Mol Biol Clin Investig. 2019;39(3):20180060.
[13]. Schenkelaars N, Rousian M, Hoek J, Schoenmakers S, Willemsen S, Steegers-Theunissen R. Preconceptional Maternal Weight Loss And Hypertensive Disorders In Pregnancy: A Systematic Review And Meta-Analysis. Eur J Clin Nutr. 2021;75(12):1684-97.
[14]. Ajong AB, Yakum MN, Aljerf L, Ali IM, Mangala FN, Onydinma UP, Et Al. Association Of Hypertension In Pregnancy With Serum Electrolyte Disorders In Late Pregnancy Among Cameroonian Women. Sci Rep. 2023;13(1):20940.
[15]. Uddin SMN, Haque M, Barek MA, Chowdhury MNU, Das A, Uddin MG, Et Al. Analysis Of Serum Calcium, Sodium, Potassium, Zinc, And Iron In Patients With Pre-Eclampsia In Bangladesh: A Case-Control Study. Health Sci Rep. 2023;6(2):E1097.
[16]. Oken E, Ning Y, Rifas-Shiman SL, Rich-Edwards JW, Olsen SF, Gillman MW. Diet During Pregnancy And Risk Of Preeclampsia Or Gestational Hypertension. Ann Epidemiol. 2007;17(9):663-8.
[17]. Duley L. The Global Impact Of Pre-Eclampsia And Eclampsia. Semin Perinatol. 2009;33(3):130-