

# Assessment Of Association Of Serum Calcium And Serum Magnesium In Gestational Hypertension And Pre-Eclampsia

Dr. Gauri Shinde/Pawar<sup>1</sup>, Dr. Manisha Laddad<sup>2\*</sup>, Dr. R P Patange<sup>3</sup>, Dr. N. S. Kshirsagar<sup>4</sup>

<sup>1</sup>Assistant Professor, Department of Obstetrics and Gynaecology, KIMS, Karad, Maharashtra, India

<sup>2\*</sup>Associate Professor, <sup>3</sup>Professor and HOD, Department of Obstetrics and Gynaecology, KIMS, Karad, Maharashtra, India

<sup>4</sup>Professor, Department of Obstetrics and Gynaecology, KIMS, Karad, Maharashtra, India

\*Corresponding Author: Dr. Manisha Laddad

\*Associate Professor, Department of Obstetrics and Gynaecology, KIMS, Karad, Maharashtra, India Email: drmanishald@gmail.com  
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## Abstract

**Background:** Dietary deficiency of calcium consequently reduces serum calcium levels and has been implicated as a cause of pre-eclampsia. The present study was conducted to assess association of serum calcium and serum magnesium in gestational hypertension and pre-eclampsia.

**Materials & Methods:** 90 patients with a singleton pregnancy in the third trimester between the age group of 18-35 years were divided into 2 groups. Each group had 45 patients. Group I were cases having blood pressure (BP)  $\geq 140/90$  mmHg and group II had normal, normotensive pregnant patients (controls). Comparison of levels of serum calcium and magnesium of both the groups was done.

**Results:** The mean serum calcium in group I was 8.21 mg/dl and in group II was 8.92 mg/dl. The mean magnesium level in group I was 1.68 mg/dl in group I and 1.87 mg/dl in group II. The difference was significant ( $P < 0.05$ ). Systolic blood pressure & serum calcium shows a negative correlation. The correlation between the systolic blood pressure & serum magnesium shows a strong negative correlation, and is significant with a p value of 0.05. Diastolic blood pressure & serum calcium shows a negative correlation which is statistically significant. The correlation between diastolic blood pressure & serum magnesium is statistically significant.

**Conclusion:** Hypocalcaemia and hypomagnesaemia could not be possible modifiable factors in the causation of hypertension in pregnancy.

**Key words:** Preeclampsia, Serum magnesium, Calcium

## INTRODUCTION

Preeclampsia is one of the commonest etiologies of fetal and maternal mortality and morbidity. The incidence of preeclampsia in developing nations is estimated to be 4–18%. Thus, 16% of all maternal mortality in developed countries and 9% of maternal mortalities in Asia and Africa are said to be due to hypertensive disorders in pregnancy.<sup>1</sup>

Dietary deficiency of calcium consequently reduces serum calcium levels and has been implicated as a cause of pre-eclampsia in some studies. This theory can be explained by the vasoconstrictive effect that is caused by reduced serum calcium levels.<sup>2</sup> Stimulation of 1.25-dihydroxycholecalciferol has been implicated in this vasoconstrictive mechanism. Furthermore, Low serum calcium stimulates parathyroid hormone (PTH) production, which increases the intracellular calcium levels, this forms the physiological basis behind the hypothesis that hypocalcemia may lead to vasoconstriction and consequently a rise in BP.<sup>3</sup> This leads to contraction of vascular smooth-muscle resulting in hypertension. Magnesium is “nature’s physiological calcium blocker” and the effects of hypocalcemia are further augmented with decreased levels of serum magnesium.<sup>4</sup> Hypomagnesemia opens the L type Ca<sup>2+</sup> channel and blocks the Ca<sup>2+</sup>-ATPase present in sarcoplasmic reticulum and leads to increased intracellular calcium. Low serum magnesium decreases prostacyclin production which in itself leads to vasoconstriction.<sup>5</sup> The present study was conducted to assess association of serum calcium and serum magnesium in gestational hypertension and pre-eclampsia.

## MATERIALS & METHODS

The present study comprised of 90 patients with a singleton pregnancy in the third trimester between the age group of 18-35 years. All gave their written consent for the participation in the study.

Data such as name, age, gender etc. was recorded. Patients were divided into 2 groups. Each group had 45 patients. Group I were cases having blood pressure (BP)  $\geq 140/90$  mmHg and group II had normal, normotensive pregnant patients (controls). Comparison of levels of serum calcium and magnesium of both the groups was done. Estimation of serum

calcium was done by the NM-BAPTA method. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

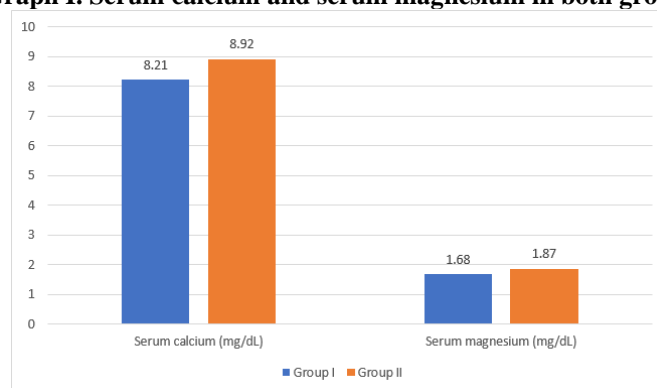
## RESULTS

**Table I. Serum calcium and serum magnesium in both groups**

Parameters	Group I	Group II	P value
Serum calcium (mg/dL)	8.21	8.92	0.04
Serum magnesium (mg/dL)	1.68	1.87	0.02

Table I, graph I shows that mean serum calcium in group I was 8.21 mg/dl and in group II was 8.92 mg/dl. The mean magnesium level in group I was 1.68 mg/dl in group I and 1.87 mg/dl in group II. The difference was significant (P< 0.05).

**Graph I. Serum calcium and serum magnesium in both groups**



**Table II. Serum calcium, magnesium and systolic blood pressure**

Systolic blood pressure (mm Hg)	Serum calcium	Serum magnesium
140-149	8.8	1.8
150-159	8.4	1.8
>160	8.2	1.6
P value	0.21	0.05

Table II shows that the systolic blood pressure & serum calcium shows a negative correlation. The correlation between the systolic blood pressure & serum magnesium shows a strong negative correlation, and is significant with a p value of 0.05.

**Table III. Serum calcium, magnesium and diastolic blood pressure**

Diastolic blood pressure (mm Hg)	Serum calcium	Serum magnesium
90-99	8.4	1.8
100-109	8.7	1.7
>110	8.0	1.6
P value	0.05	0.02

Table III shows the diastolic blood pressure & serum calcium shows a negative correlation which is statistically significant. The correlation between diastolic blood pressure & serum magnesium is statistically significant.

## DISCUSSION

The endothelial dysfunction seen in preeclamptic pregnant women may persist years after the episode, and therefore preeclamptic women may be at high risk of cardiovascular diseases later in life.<sup>6</sup> Though the etiology of preeclampsia remains unclear, many theories suggest abnormal placental implantation and abnormal trophoblastic invasion as possible causes. The molecular basis of this condition is unresolved in literature.<sup>7</sup> It has been postulated that fluctuations in maternal serum ions may be the precipitating cause of elevated blood pressures in preeclampsia.<sup>8</sup> Dietary deficiency of mineral ions has been shown to have a harmful effect on the pregnant mother and growing fetus and possibly complicate preeclampsia. Dietary deficiency of magnesium has been established to play a role in blood pressure regulation and hence development of preeclampsia.<sup>9</sup> Evidence supporting routine magnesium supplementation for all pregnant women has not been substantiated by research, though most studies have reported reduced magnesium levels in pregnancy and worse levels in preeclampsia.<sup>10</sup> The present study was conducted to assess association of serum calcium and serum magnesium in gestational hypertension and pre-eclampsia.

We found that mean serum calcium in group I was 8.21 mg/dl and in group II was 8.92 mg/dl. The mean magnesium level in group I was 1.68 mg/dl in group I and 1.87 mg/dl in group II. Naik et al<sup>11</sup> in their study 60 patients with a singleton pregnancy in the third trimester between the age group of 18-35 years were included. They found that serum calcium and serum magnesium was significantly decreased amongst the cases when compared with the control group.

We found that systolic blood pressure & serum calcium shows a negative correlation. The correlation between the systolic blood pressure & serum magnesium shows a strong negative correlation, and is significant with a p value of 0.05. Darkwa et al<sup>12</sup> compared serum magnesium and total calcium levels of preeclamptic and normal pregnant women. Mean serum magnesium and total calcium levels in preeclamptic women were 0.70±0.15 and 2.13±0.30 mmol/L, respectively. Mean serum magnesium and total calcium levels in normal pregnant women were 0.76±0.14 and 2.13±0.35 mmol/L, respectively. There was a statistically nonsignificant difference in serum magnesium and total calcium in preeclamptic women compared to normal pregnant women, with p-values of 0.092 and 0.972, respectively.

We found that diastolic blood pressure & serum calcium shows a negative correlation which is statistically significant. The correlation between diastolic blood pressure & serum magnesium is statistically significant. The National Nutrition Monitoring Bureau (NNMB) from 10 Indian states shows that the daily calcium intake during pregnancy and lactation for Indian women is less than 30% of RDA.<sup>13</sup> This shows that most pregnant and lactating women in India have low dietary calcium intake. Ugwuja et al<sup>14</sup> in a study conducted among Nigerian women using atomic absorption spectrophotometry for assaying serum calcium and magnesium, found no significant difference in serum calcium but significantly reduced serum magnesium in preeclamptic women as compared to normal pregnant women.

Magnesium and calcium are important cofactors for various enzymatic processes and water balance in cells. These trace elements play an essential role in vascular smooth muscle tone and contraction, and hence they are vital in blood pressure regulation.<sup>15</sup> Various studies have reported a decrease in serum magnesium levels as a possible etiology of preeclampsia. This evidence is supported by the usefulness of magnesium sulfate therapy for prophylaxis and treatment of seizures associated with preeclampsia/eclampsia.<sup>16</sup>

The limitation the study is small sample size.

## CONCLUSION

Authors found that hypocalcaemia and hypomagnesaemia could not be possible modifiable factors in the causation of hypertension in pregnancy.

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