



COMPARATIVE STUDY OF SERUM CALCIUM AND MAGNESIUM LEVELS IN WOMEN WITH PRE ECLAMPSIA AND NORMOTENSIVE PREGNANT WOMEN

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ABSTRACT **Objectives:** The objective of the study is to establish a relation between serum calcium and magnesium levels with severity of pre-eclampsia and to compare the levels with normotensive pregnant women. **Materials And Methods:** 200 women with pre-eclampsia and 200 normotensive pregnant women were included in this hospital based, cross sectional study; serum calcium and magnesium levels were measured and data was analysed. **Results:** The serum calcium concentration was significantly lower in pre-eclamptic cases as compared to normotensive controls. (7.903 ± 0.292 Vs 9.227 ± 0.598 mg/dl, $p < 0.001$). Serum magnesium concentration was significantly lower in severe preeclampsia cases as compared to mild preeclampsia. (7.67 ± 0.32 Vs 7.991 ± 0.22 mg/dl, $p < 0.001$). **Conclusion:** Measurements of serum calcium and magnesium among women at risk may be used to predict onset and severity of pre-eclampsia.

KEYWORDS : Preeclampsia, serum calcium, serum magnesium

INTRODUCTION

Hypertensive disorders of pregnancy occur in about 10% of all pregnant women worldwide. In India, the incidence of pre-eclampsia is about 8-10% [1]. Pre-eclampsia is responsible for approximately 50,000 maternal deaths worldwide, 25% of all cases of intrauterine growth restriction and 15% of preterm births in developed countries [2,3,4].

The latest ACOG guidelines (2020) define preeclampsia as a disorder of pregnancy associated with new-onset hypertension, occurring after 20 weeks of gestation and near term with proteinuria; or without proteinuria with any sign of end organ damage [3].

Despite research, etiology of preeclampsia still remains elusive and has captivated many schools of thought, hence once called as "disease of theories".

Recently, nutritional deficiency of minerals like calcium and magnesium is considered to play a significant role in etiopathogenesis of preeclampsia. Calcium causes vasoconstriction by decreasing prostacyclin production, increasing parathormone secretion and by increasing the effect of angiotensin II and noradrenaline in the blood vessel wall [5,6]. Therefore, low calcium levels may lead to elevation of blood pressure in pre-eclamptic mothers.

Magnesium is a cofactor for enzymes and peripheral vasodilator for smooth muscles by regulating contractile protein, modulating transport of calcium, sodium, and potassium; regulating energy dependent cytoplasmic and mitochondrial pathways [7].

Therefore, alterations in these nutrients may be predisposing factors to preeclampsia. There is a need for further investigations on the role of calcium and magnesium in etiopathogenesis of pre-eclampsia.

MATERIALS AND METHODS –

A hospital based comparative, cross-sectional study was conducted in the department of Obstetrics and Gynaecology, Gauhati Medical College and Hospital, Guwahati from 1st April 2020 to 31st March 2021. 200 pre-eclamptic and 200 normotensive women aged 18 – 35 years with live singleton pregnancy of beyond 34 weeks gestational age were included after informed written consent after meeting inclusion and exclusion criteria. They were further categorized as – 1) Mild preeclampsia- systolic BP >140 and <160 mm of Hg and diastolic BP >90 and <110 mm of Hg and proteinuria $>2+$ on dipstick but without any end organ damage. 2) Severe preeclampsia- systolic BP ≥ 160 and diastolic BP ≥ 110 mm of Hg with end organ damage. Serum calcium and magnesium levels were measured in each group and compared.

Data was analysed using SPSS version 21. A p value less than 0.05 is considered as statistically significant.

RESULTS :

Study group was distributed on basis of severity, 55 out of 200 pre eclamptic mothers had severe pre-eclampsia and 145 had mild pre-eclampsia.

Table 1: Mean systolic blood pressure in cases and controls

Group	Mean SBP	SD	Std. Error Mean	Median (IQR)	p value
Control	116.270	5.984	0.423	120(110-120)	<0.001
Case	155.890	7.799	0.552	154(150-160)	

Table 1 shows mean SBP in pre-eclamptic women was 155.89 ± 7.799 mm of Hg and in normotensive pregnant women was 116.27 ± 5.94 mm of Hg and difference was statistically significant.

Table 2 : Mean diastolic blood pressure in cases and controls

Group	Mean DBP	SD	Std. Error Mean	Median (IQR)	p value
Control	75.740	5.662	0.400	80(70-80)	<0.001
Case	104.380	5.729	0.405	102(100-110)	

Table 2 shows mean DBP in pre-eclamptic women was 104.38 ± 5.729 mm of Hg and in normotensive pregnant women was 75.74 ± 5.662 mm of Hg and difference was statistically significant.

None of the patients took the WHO recommended 1.5-2 g Calcium supplementation for prevention of preeclampsia.

Table 3: Serum Calcium levels in cases and controls

	N	Mean S. Calcium	SD	p value
I. Control	200	9.227	0.59805	<0.001
II. Case	200	7.903	0.292	
IIa. Mild PE	145	7.991	0.22202	<0.001
IIb. Severe PE	55	7.6709	0.32641	

Table 3 shows that serum calcium concentration was significantly lower in pre-eclamptic cases as compared to normotensive controls. (7.903 ± 0.292 Vs 9.227 ± 0.598 mg/dl, $p < 0.001$) and in severe preeclampsia cases as compared to mild preeclampsia. (7.67 ± 0.32 Vs 7.991 ± 0.22 mg/dl, $p < 0.001$).

Table 4: Magnesium levels in normotensive women, mild and severe pre-eclampsia

	N	Mean serum Magnesium	SD	p value
I. Control	200	1.957	0.13394	<0.001
II. Case	200	1.770	0.228	
IIa. Mild	145	1.8434	0.16575	<0.001
IIb. Severe	55	1.5745	0.25547	
Total	400	1.8632	0.20913	

Table 4 shows that serum Magnesium levels are significantly lower in pre-eclamptic cases as compared to normotensive controls. (1.770±0.016 Vs 1.957±0.134 mg/dl, p<0.001).

Table 5– Correlation of systolic BP and diastolic BP with serum calcium levels, where Y represents serum calcium

Correlation with S. calcium			
Pearson Correlation	R	p value	Equation
SBP	-.421**	<0.001	Y= -0.016*X + 10.359
DBP	-.428**	<0.001	Y= -0.022*X + 10.176

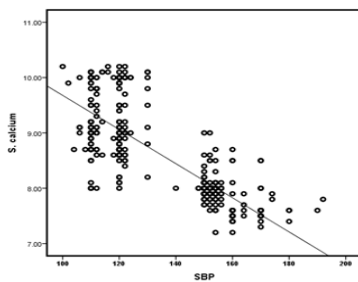


Figure 1 : Scatter diagram showing correlation of serum calcium with systolic blood pressure (SBP)

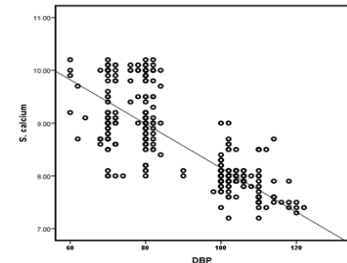


Figure 2 : Scatter diagram showing correlation between diastolic BP and serum calcium

Table 8, Figure 1 and 2 show that serum calcium had a significant negative correlation with systolic BP (R = -0.421, p<0.001) and diastolic BP (R=-0.428, p<0.001).

Table 9 – Correlation of systolic BP and diastolic BP with serum magnesium levels, where Y represents dependent variable (s. magnesium)

Correlation with S. magnesium			
Pearson Correlation	R	p value	Equation
SBP	-.467**	<0.0001	Y= -0.014*X + 3.9
DBP	-.441**	<0.0001	Y= -0.018*X + 3.602

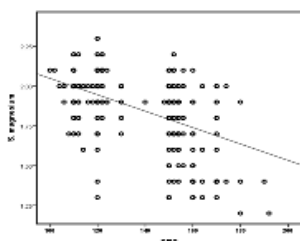


Figure 3 – Scatter diagram showing correlation between serum magnesium and systolic blood pressure in pre eclamptic women

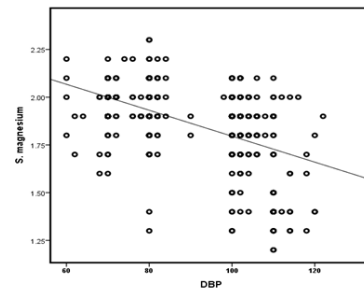


Figure 4 – Scatter diagram showing correlation between serum magnesium and diastolic BP in pre-eclamptic women.

Table 9, Figure 3 and 4 show that serum magnesium had a significant negative co-relation with systolic BP (R = -0.467, p<0.0001) and diastolic BP (R=-0.441, p<0.0001).

DISCUSSION :-

Deficiencies of minerals like calcium, magnesium, zinc, etc increases in pregnancy due to growing demands and may affect in an adverse way.

Our study compared the two groups on the basis of the levels of serum calcium and magnesium levels.

In our study (2021), mean serum calcium level in women with mild preeclampsia is 7.991±0.22 mg/dL, women with preeclampsia with severe features is 7.67±0.32 mg/dL and normotensive pregnant women is 9.227±0.598mg/dL. These findings were comparable more or less with other studies by Kanagal et al (2014) [8], Baruah et al (2015) [9], Aghade et al (2017) [10], Agu and Okeudu et al (2018) [11]. In this study, we also found a negative correlation between serum calcium and systolic/diastolic blood pressure in preeclamptic women, that suggests a strong association between deficiency of calcium and onset and progression of preeclampsia. A similar negative correlation was seen in the study conducted by Aghade et al [10].

In our study, it was found that serum magnesium levels are significantly lower in women with preeclampsia cases as compared to normotensive controls. (1.770±0.016 Vs 1.957±0.134 mg/dl, p<0.001). Also, the magnesium levels are significantly lower in severe preeclampsia as compared to mild preeclampsia (1.57±0.255 Vs 1.84±0.166 mg/dl; p<0.001).

Sukonpan and Phupong (2004) [12] and Jain et al (2009) [13] also concluded that serum magnesium levels are significantly lower in the women with pre-eclampsia as compared to normotensive group. In the study conducted by Jain et al (2009), Magnesium levels in severe preeclampsia were less than that of patients with mild preeclampsia, but the difference was not found to be statistically significant.

However, magnesium levels in patients with severe preeclampsia was significantly lower than the normotensive group (p=0.0008) as well as women with preeclampsia (p=0.03). They found a significant negative correlation of magnesium and calcium with both systolic and diastolic BP, similar to our study.

Limitations – 1) Dietary intake and supplementations were not considered in the study. Therefore, it is not clear if supplementation of these minerals would help in preventing the disease or not. And, therapeutic intervention in the form of calcium and magnesium supplementation, to prevent preeclampsia warrant further research and study.

2) The calcium and magnesium levels were only measured once during admission. A follow-up study right from pre-pregnancy status or first trimester would be more beneficial in identifying the role of these minerals

CONCLUSION:-

The findings in this study revealed a significant low level of serum calcium and magnesium in pre-eclampsia and suggest that they may be used as markers for preeclampsia. Therefore, serial measurements of serum calcium and magnesium among women who are at risk may be

used to predict the onset and severity. However, therapeutic intervention to supplement calcium and magnesium in pregnant women for prevention of preeclampsia requires further study.

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