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# A Comparative Study of Serum Calcium Levels in Pre-Eclampsia Versus Normotensive Pregnant Women

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## ABSTRACT

***Introduction***

*Preeclampsia is described as a pregnancy specific syndrome that can affect virtually every organ system. Proteinuria is an objective marker and reflects the system wide endothelial leak that characterizes the preeclampsia syndrome. Preeclampsia is a leading cause of maternal, fetal, neonatal and perinatal mortality and morbidity worldwide. In our study, the aim was to determine the role of serum calcium level in Preeclamptic patients and normal pregnant women and to compare Serum calcium levels in Preeclamptic patients and normal pregnancies*

***Material and Methods***

*We conducted a prospective comparative study. The study was undertaken in 90 pregnant women. Data for the study was collected from 45 normotensive pregnant women (control group) and 45 Preeclamptic patients (study group) with more than 24 weeks of gestational age at ESIC-MC &PGIMSR Hospital, Bangalore. Between March 2021 to August 2022.*

***Results***

*The mean BMI of cases is 25.03 (S.D=2.65), the mean BMI of controls is 22.89 (S.D=2.18). Student t-test shows that the BMI differs significantly between the two groups ($p<0.005$). The mean systolic BP of cases is 155.47 mm/Hg (S.D=8.26 mm/Hg) and diastolic BP is 96.67 mm/Hg (S.D=5.54 mm/Hg). The mean systolic BP of controls is 119.80 mm/hg (S.D=8.12 mm/Hg) and diastolic BP is 77.20 mm/Hg (S.D=4.37 mm/Hg). The difference was statistically significant ($p<0.001$). The mean serum calcium level of Preeclamptic women (8.23 mg/dl S.D=0.76 )is significantly lower($p<0.001$)than in normotensive patients ( 9.22 mg/dl S.D=0.59 mg/dl).*

***Conclusion***

*This study concludes that serum calcium levels were significantly low in preeclamptic patients. Thus, monitoring serum calcium levels can be effective in preventing maternal and fetal morbidity, mortality and help to reach a favorable outcome in pregnancy.*

***Key words***

*Preeclampsia, Hypertension, BMI, Albuminuria, Serum Calcium.*

## INTRODUCTION

Preeclampsia is best described as a pregnancy specific syndrome that can affect virtually every organ system. Although preeclampsia is much more than simply gestational hypertension with proteinuria, appearance of proteinuria is an important diagnostic criterion. Thus, proteinuria is an objective marker and reflects the system wide endothelial leak that characterizes the preeclampsia syndrome.[1] Preeclampsia usually begins after 20 weeks of pregnancy in a woman whose blood pressure had been normal previously. It can lead to serious, even fatal, complications to both mother and baby. Preeclampsia is associated with an increased risk of placental abruption, preterm birth, fetal intrauterine growth restriction

(IUGR), acute renal failure, cerebrovascular and cardiovascular complications, disseminated intravascular coagulation, and maternal death. Therefore, the need to provide an early diagnosis of Preeclampsia is vital [1].

The requirement of calcium in pregnancy is very high and if unmet leads to demineralization of maternal skeleton, stunted fetal growth, reduced mineralization of the fetal bones and hampers the secretion of calcium in breast-milk [2]. By the end of pregnancy, around 25-30 g of calcium is transferred to the fetal skeleton from the mother. The accumulation begins at the rate of 2-3 mg/day of calcium in the first trimester increasing to 250 mg/day by the end of third trimester [3]. Loss of calcium in breast milk during lactation is around 200-240 mg/day [4]. Approximately, mother loses 3-5% of maternal skeletal calcium content [5]. Initial studies on calcium in pregnancy led to the hypothesis that high calcium intake reduces the incidence of Pregnancy induced hypertension. However, it could not be established the actual reason behind this [6].

There are not many studies that determine the role of serum calcium level in Pregnancy from the Indian population. Therefore, this study aims to assess the levels of calcium in normal pregnant women and in those with preeclampsia.

The period of pregnancy and lactation is a demanding phase for a woman when the calcium demand increases enormously. The foetus and the neonate tend to rely on the mother for calcium. The excessive demand may at times exceed the normal daily intake of the woman. There are specific changes in the body during pregnancy to meet these changes in requirements. The major adaptation is doubling the calcium absorption during pregnancy. This adaptation in mothers also influences the way other disorders of calcium and bone are presented.

## MATERIAL AND METHODS

Study Type: Cross sectional study
Study Place: ESIC-PGIMSR, Rajajinagar,Bangalore
Study Period: March 2021 to August 2022

**Sample Size Calculation:** 45 normal pregnant women, 45 women with preeclampsia, a combined total of size was 90. Sample size was calculated based on a previous study conducted by Rajendra Kumar *et al*.,[48] in which it was observed that mean serum calcium level in the pre-eclampsia group was 8.69 $\pm$ 0.66. In the present study considering the mean difference of 0.8, power of 90% and alpha error of 5%.sample size was estimated to be 45 in each group. (Total 90).

**Formula:** $$N = \frac{(Z\alpha/2+Z\beta)^2\ 2\alpha^2}{\delta^2}$$

## Inclusion Criteria

Patients who are willing to give consent. 2. Patients diagnosed with preeclampsia based on criteria - blood pressure ≥140/90 mmHg on two separate occasions 6 hours apart, 1+ dipstick in two midstream urine samples collected 4 hours apart, urine protein creatinine ratio >0.3mg/dl in more than 20 weeks period of gestation. 3. Asymptomatic pregnant women with gestational age more than 24 weeks of pregnancy with blood pressure less than 130/80 mm Hg. 4. Singleton pregnancy 5. Age 18-40 years.

## Exclusion criteria:

Patients not willing to give informed consent 2. Chronic hypertension 3. Type 1 and 2 diabetes mellitus 4. Diagnosed case of renal disease, cardiovascular disease, liver disorder. 5. K/C/O APLA Syndrome 6. Multiple pregnancy

## PROCEDURE

After obtaining approval and clearance from the institutional ethics committee, considering the inclusion and exclusion criteria, all pregnant women were recruited from Department of Obstetrics and Gynecology, ESICMC & PGIMSR from MARCH 2021 to AUGUST 2022.

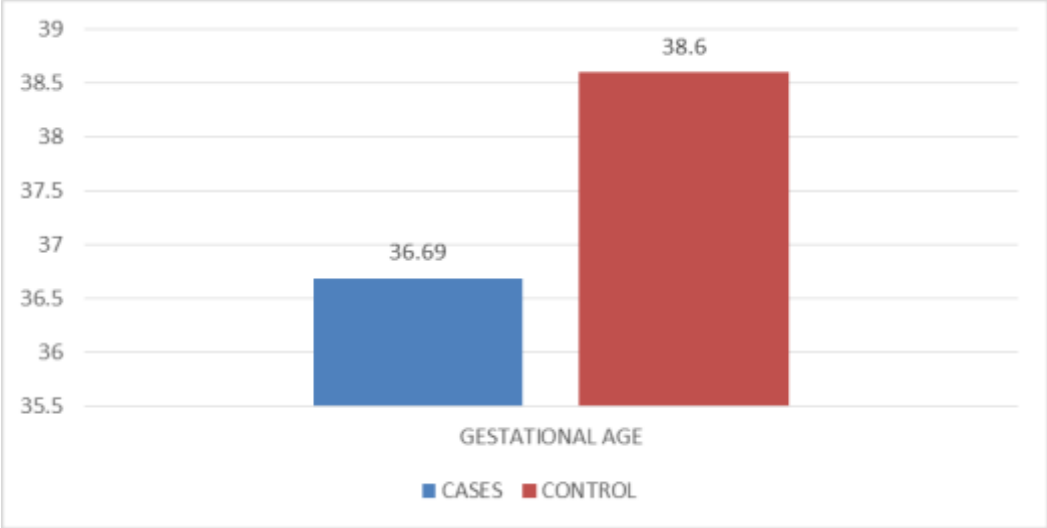
## STATISTICAL ANALYSIS

1) Data recorded was statistically analysed. Data were entered in a predesigned proforma. (Annexure III) Quantitative variables like age, BMI, Blood pressure levels, calcium levels , urine protein creatinine ratio were analysed using descriptive statistics (mean + SD) or median (IQR). Categorical variables were presented using frequency and percentage. Continuous data were represented as mean and standard deviation and the p-value was calculated using an independent t-test.
2) The mean serum calcium levels (continuous variable) were compared between the 2 groups using student t-test.
3) Chi-square test was used as a test of significance for the association hypothesis for categorical/ qualitative data.
4) Pearson's correlation was used to assess the correlation between continuous variables and spearman correlation was used for categorical correlations.
5) Graphical representation of data: MS Excel and MS word was used to obtain the various bar diagrams. SPSS was used to generate the scatterplots for correlation.
6) p value (Probability that the result is not by chance) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

## RESULTS

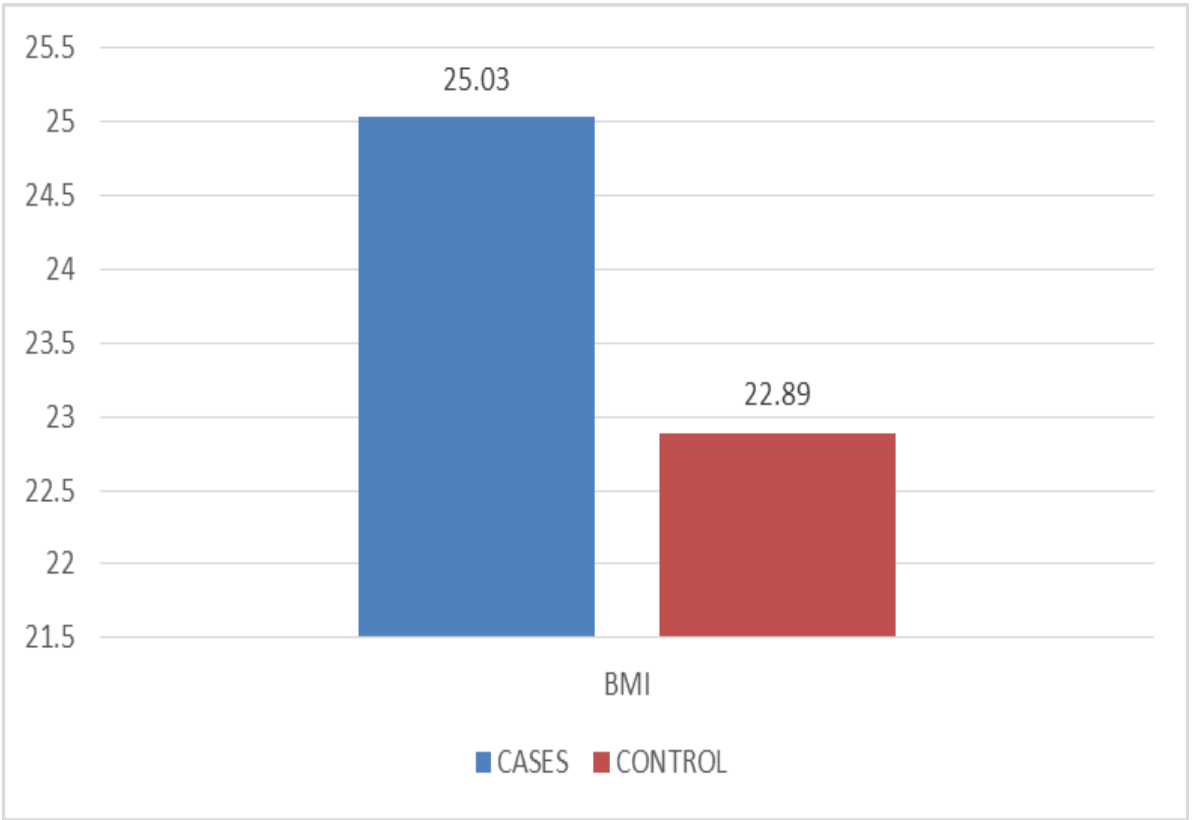
In our study, the mean age of cases was 27.4 years (S. D=4.67 years) and mean age of controls was 25.53 years (S. D=4.64 years). Student t-test showed that the age does not differ significantly between the two groups ($p>0.05$). Among the cases, 20 (44.4%) were primigravida, 25(55.6%) was multigravida, while 25 (55.6%) of the controls were primigravida and 20 (44.44%) were multigravida. Chi-square analysis shows that the difference was not statistically significant ($\chi 2 = 7.510$; $p= 0.057$).

The mean gestational age of cases was 36.69 ± 1.59 weeks and controls were 38.60 ± 1.25 weeks. Comparison of gestational age between cases and controls showed that there was statistically significant difference ($t=-6.33$; $p<0.0001$).

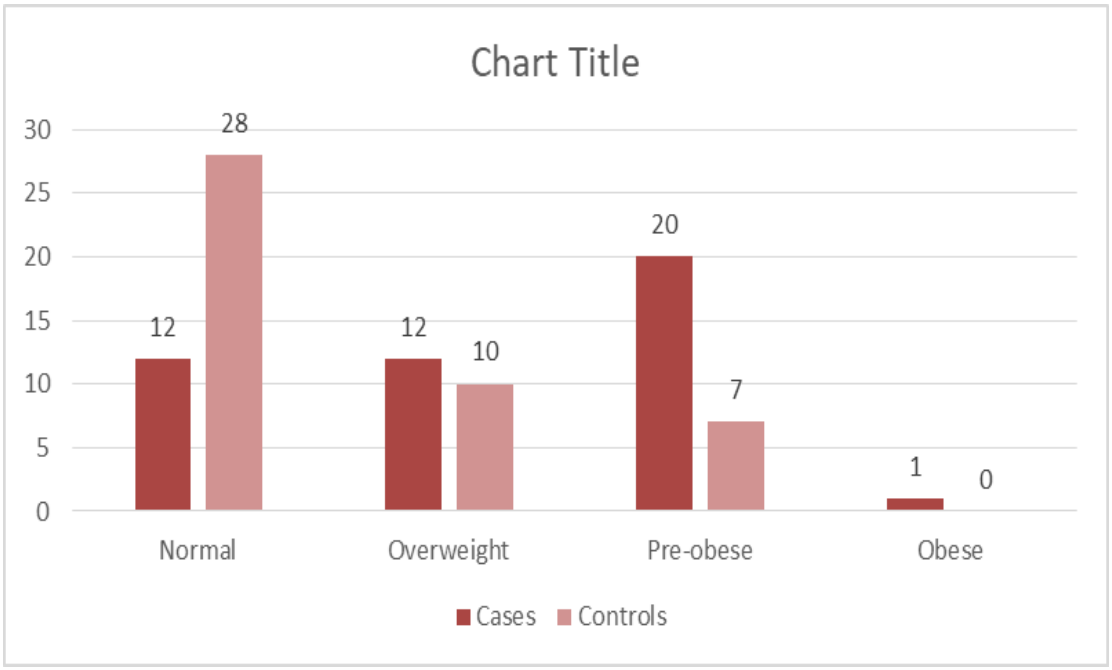



*GRAPH 1: Comparison of gestational age between cases and controls*

The mean BMI of cases was 25.03 ± 2.65 Kg/m2 and that of the controls was 22.89 ± 2.18 Kg/m2. Student t-test showed that the mean difference of BMI between cases and controls was 2.14 Kg/m2 and that this difference was statistically significant (t=4.18; p25 Kg/m2 while only 7 controls were pre-obese. Overall, only 12 cases had normal BMI whereas 28 controls had normal pre-pregnancy BMIs. The remaining 33 cases were overweight (12), pre-obese (20) or obese (1).

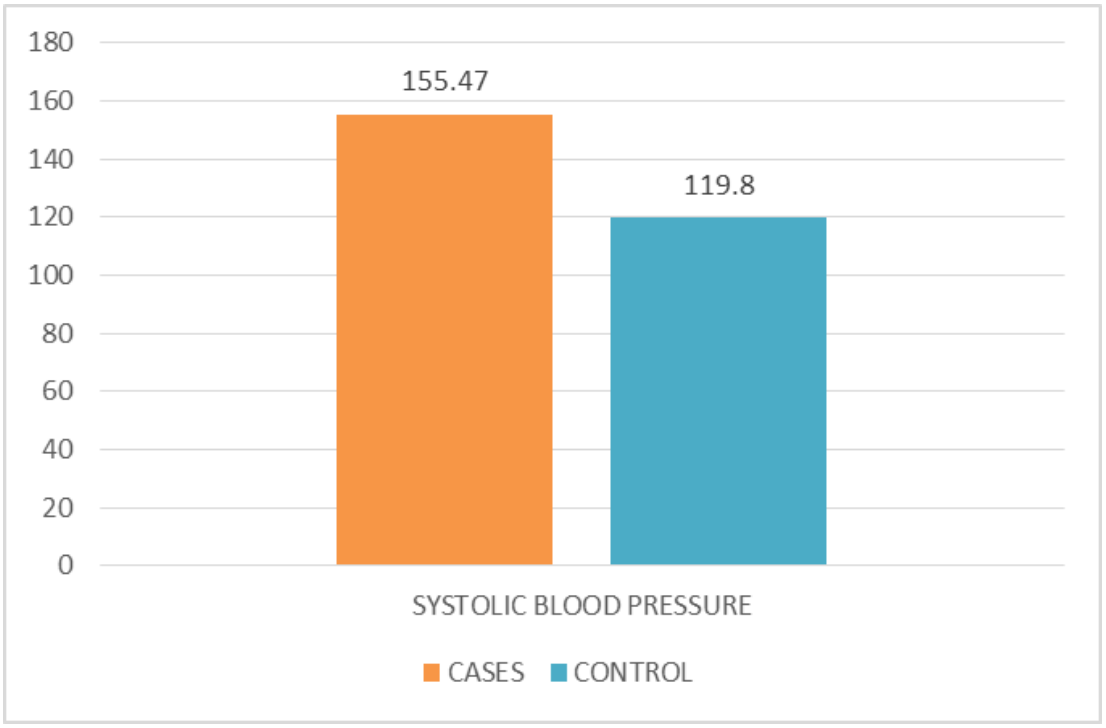



*Graph 2: Comparison of BMI between cases and controls*

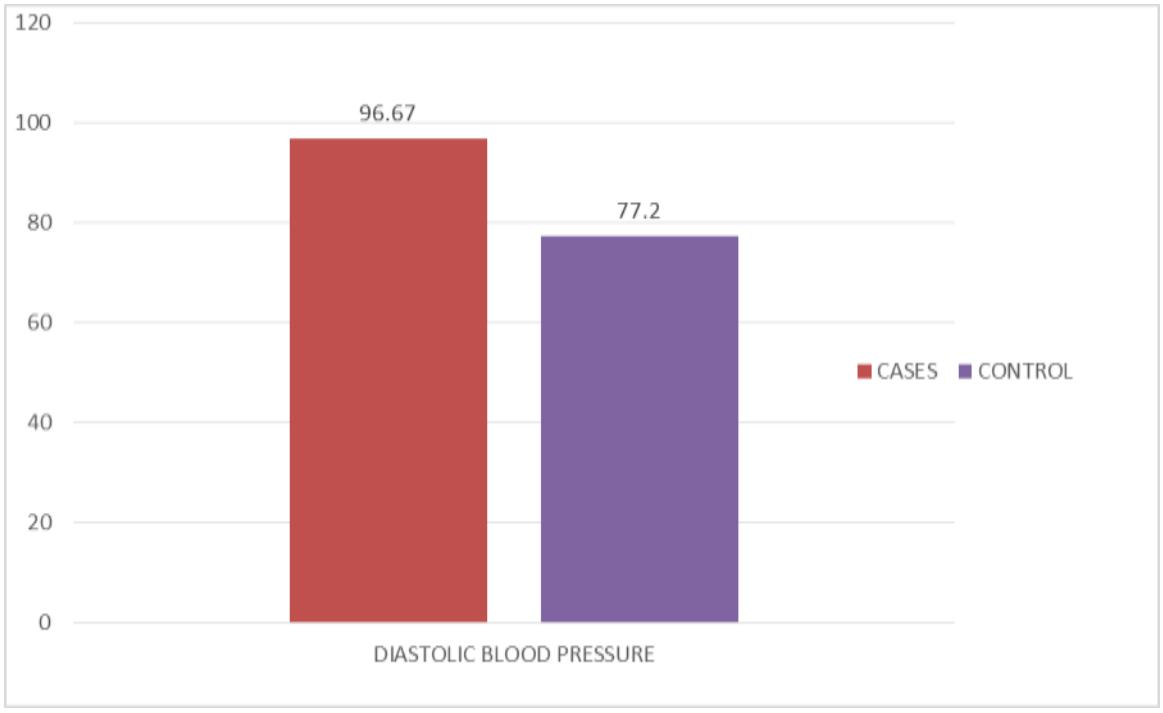



*Graph 3: Comparison of Pre-pregnancy BMI between cases and controls using Asia-Pacific population*

The mean systolic BP of cases was 155.47 ± 8.26 mmHg. The range was between 141 mmHg and 177 mm/Hg. The mean systolic BP of controls was 119.80 ± 8.12 mmHg. The range was between 101 mm/Hg and 135 mm/Hg. The mean diastolic BP of cases was 96.67 ± 5.54mmHg. The range was between 83 mm/Hg and 106 mm/Hg. The mean diastolic BP of controls was 77.20 ± 4.37 mmHg. The range was between 71 mm/Hg and 86 mm/Hg. As the cases were by definition having elevated blood pressure, both SBP and DBP among cases were significantly higher than those of the controls, statistically significant ($p<0.001$).

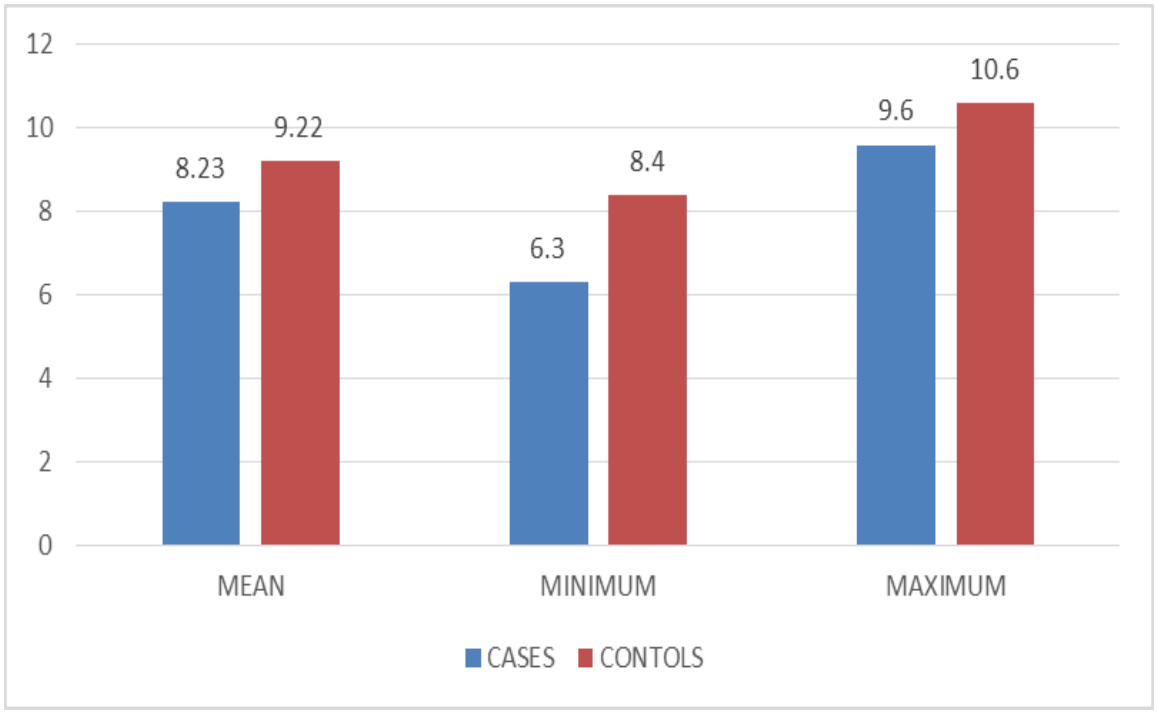



*Graph 4: Comparison of Systolic BP between cases and controls*



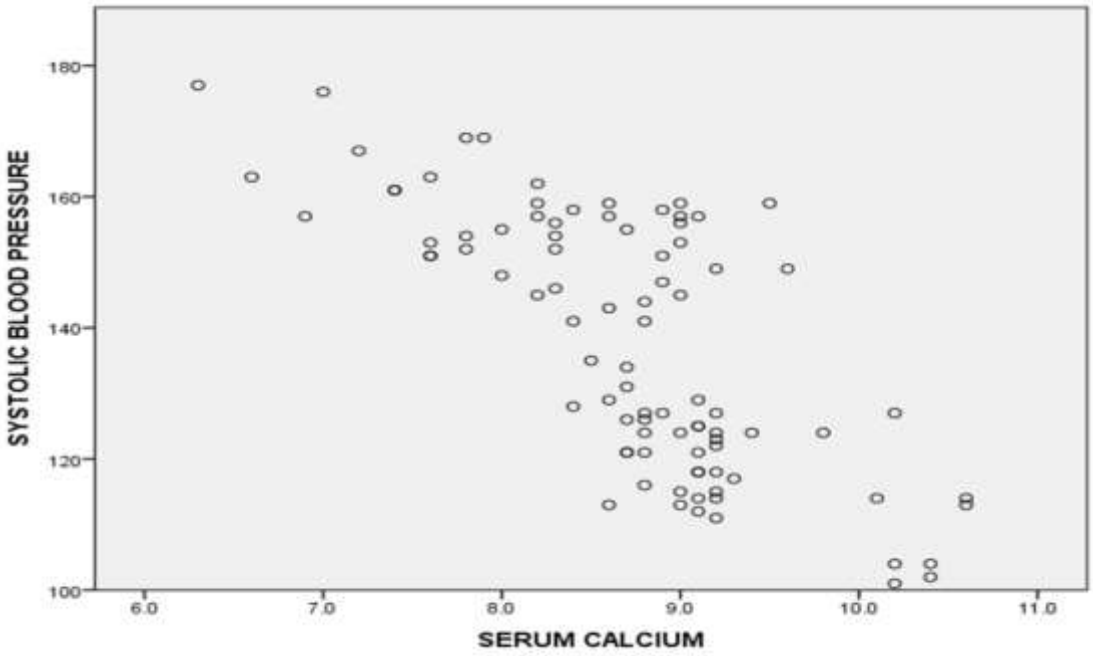

*Graph 5: Comparison of Diastolic BP between cases and controls.*

The mean serum calcium level of cases was 8.23 ± 0.76 mg/dL (range 6.3 - 9.6 mg/dL). The mean serum calcium level of controls was 9.22 ± 0.59 mg/dL (range 8.4-10.6 mg/dL). A comparison of mean serum calcium levels between cases and controls shows that the mean serum calcium is lower by 0.99 mg/dL in cases. The difference was statistically significant ($p<0.001$).

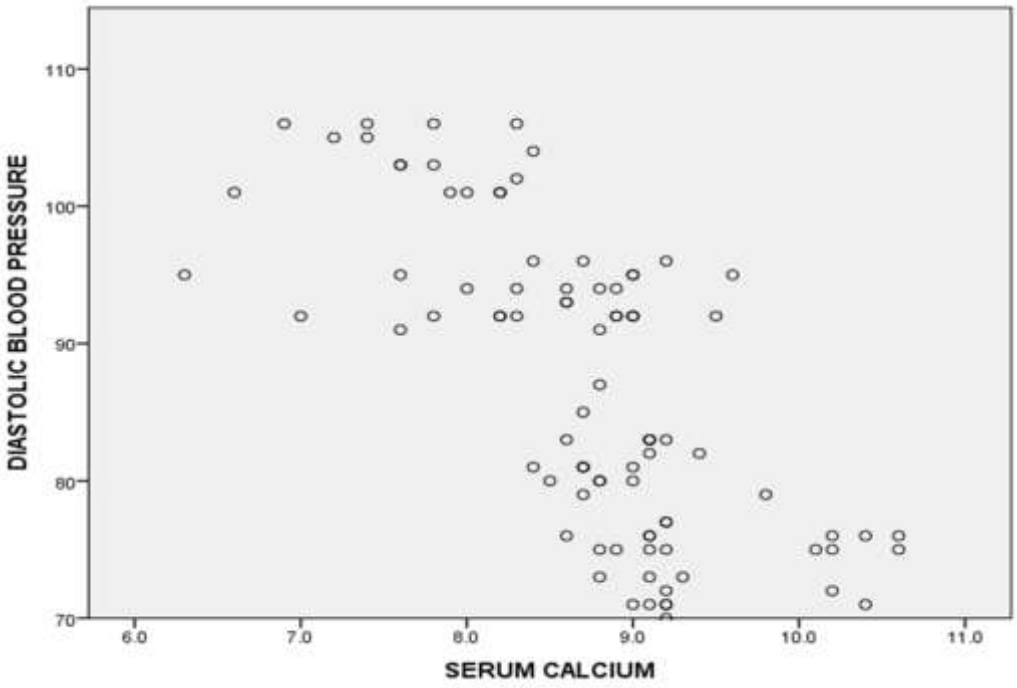



*Graph 6: Comparison of serum calcium levels between cases and controls*

Among the cases and controls, Serum Calcium levels were negatively correlated with Systolic Blood Pressure (Pearson Rho= -0.75). This strong correlation was statistically significant (p value.<0.001) Among the cases the correlation coefficient for Pearson's correlation was -0.663 among the controls, it was -0.624. (both p values <0.0001). Among the cases and controls, Serum Calcium levels were negatively correlated with Diastolic Blood Pressure (Pearson Correlation Coefficient= -0.6). This correlation was statistically significant (p value<0.001). Among the cases the correlation coefficient for Pearson's correlation was -0.502 (p value <0.001) among the controls, it was -0.39 (p-values=0.008).

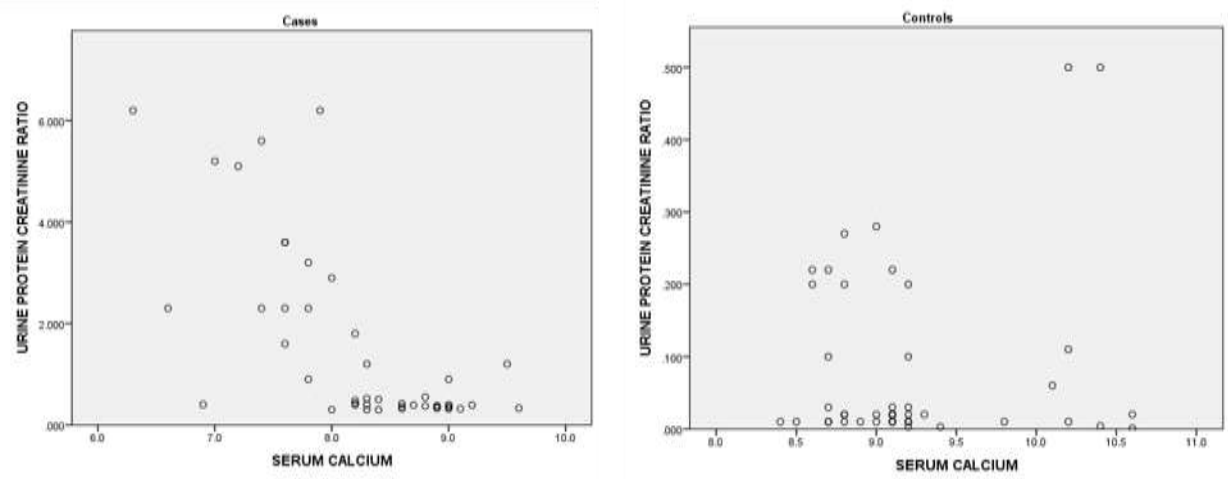



*Graph 7 : Correlation between Serum Calcium and Systolic Blood Pressure*




*Graph 8: Correlation between Serum Calcium and Diastolic Blood Pressure*

Urine PCR was found to be negatively correlated with Serum Calcium, but this was only among the cases (Pearson Correlation Coefficient= -0.691, p-value<0.0001); whereas among the controls there was no significant correlation (Pearson Correlation Coefficient= 0.147, p-value=0.335). This is to be expected as we do not usually see proteinuria among normal pregnant women (without pre-eclampsia).




*Graph 9: Comparing urine PCR (Protein Creatinine Ratio) with Serum Calcium*

The mean birth weight of babies in cases was 2.68 ± 0.55 kg. The mean birth weight of babies of controls was 3.07 ± 0.47 kg. The mean difference was 385gms.The difference was statically significant.

## DISCUSSION

In our study, the mean BMI, Serum Calcium, Systolic BP, and Diastolic BP differs significantly between the two groups. There is a reduction in the serum calcium levels (0.99mg/dL) of cases of Pre-eclampsia as compared to the normal pregnant women.

## CONCLUSION

The result of the present study suggests that hypocalcaemia was present in preeclamptic pregnant women and serum calcium was significantly lower than in normal pregnant women.

Thus, use of serum calcium may help to identify pregnant women at risk of preeclampsia and prompt initiation of education and prophylactic interventions.

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