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### RESEARCH ARTICLE

#### COMPARISON OF SERUM CALCIUM AND ZINC LEVELS IN NORMAL PREGNANCY AND PREGNANCY WITH PRE-ECLAMPSIA.

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##### Key words:-

calcium, zinc, pre-eclampsia.

#### Abstract

**Research Question:-** To compare and correlate serum calcium and serum zinc levels of pre-eclamptic and normotensive pregnant females.

**Study Design:-** Case control study

**Methodology:-** This study was conducted in randomly selected 100 pregnant females. The study group was further divided into two groups which included 50 pregnant females with pre-eclampsia at gestation of 20 weeks or more as cases and control group which included 50 normotensive pregnant females.

**Results:-** Both serum calcium and zinc levels were significantly low in the study group. Reduction in serum levels of calcium and zinc during pregnancy might be associated with risk of pre-eclampsia, and supplementation of these elements to diet during pregnancy may prevent pre-eclampsia.

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#### Introduction:-

Pre-eclampsia is one of the major complication of pregnancy associated with increased maternal and infant mortality and morbidity.<sup>[1]</sup> According to The National High Blood Pressure Education Program (NHBPEP) Working Group, Pre-eclampsia is characterized by development of BP 140/90 mmHg or greater after 20 weeks gestation in a women with previously normal blood pressure and with proteinuria more than 0.3 g protein in 24-h urine specimen.<sup>[2]</sup> Calcium plays an important role in the function of vascular smooth muscles. Decrease in serum calcium concentration leads to an increase in the intracellular calcium.<sup>[3]</sup> Increase of cellular calcium causes constriction of smooth muscles in blood vessels and increase of vascular resistance and therefore, causes increased blood pressure.<sup>[4]</sup>

Oxidative stress or excessive lipid peroxidation may act as an important factor in the pathogenesis of pre-eclampsia. Zinc is required for the proper functioning of antioxidant enzymes which protect injuries from free radicals. Deficiency of zinc may decrease the effect of antioxidant potential of cells leading to increase in blood pressure.<sup>[1][5][6]</sup> Towards the end of normal pregnancy, maternal serum zinc level declines due to increased foetal demands, haemodilution, decrease in serum albumin levels and hormonal changes, as well as shifting of zinc from plasma to red blood corpuscle can also cause decrease in serum zinc levels in pregnant women.<sup>[7]</sup> The present study

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was carried out to compare and correlate serum calcium and serum zinc levels of pre-eclamptic and normotensive pregnant females.

### Materials & methods:-

The present study was conducted in the Department of Biochemistry and Department of Obstetrics and Gynecology, GMC, Patiala after getting ethical clearance from ethical committee. Study group comprised of 100 pregnant females. The study group was further divided into :

**Cases** – 50 pregnant females with period of gestation more than 20 weeks with pre-eclampsia, diagnosed by National High Blood Pressure Education Program (NHBPEP) criteria.

**Controls** – 50 pregnant females with period of gestation more than 20 weeks who were normotensive.

Blood samples under all aseptic conditions were obtained by venepuncture from all the patients as well as controls after taking their written consent.

### Inclusion Criteria:-

- Pregnant females with POG > 20 weeks with pre-eclampsia.

### Exclusion criteria:-

- All cases of essential hypertension or chronic hypertension due to any other cause. Any associated renal, hepatic, neurological disorders not due to pregnancy induced hypertension. Associated molar pregnancy or twin pregnancy.

Apart from routine investigations serum calcium and zinc levels were estimated in all cases and controls. The estimation was done by colorimetric methods on Erba Chem 5 semi-autoanalyzer.

Serum calcium was done by ortho-cresolphthalein complexone method<sup>[8]</sup> and serum zinc was done by Nitro PAPS method.<sup>[9]</sup>

### Results:-

The mean age of the Pregnant females in the study group was  $24.62 \pm 4.421$  years and in the control group was  $25.54 \pm 4.107$  years.

**Table No.1:-** Distribution of patients according to POG

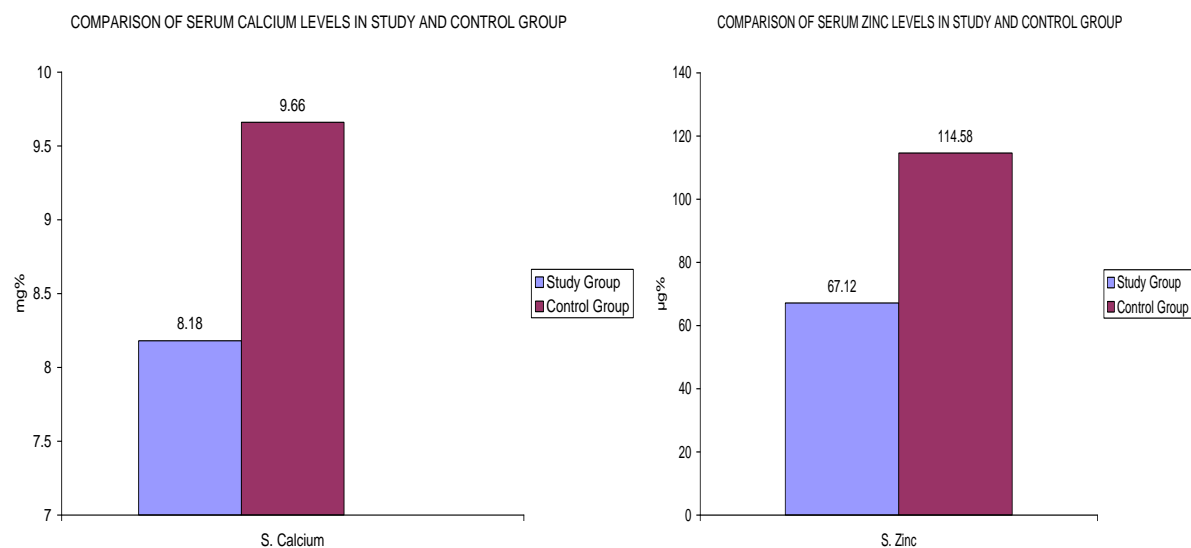
POG (wks)	Cases		Controls	
	No. of cases	%age	No. of cases	%age
20-25	4	8	17	34
26-30	8	16	10	20
31-35	29	58	16	32
>35	9	18	7	14

The percentage of patients in the group 31-35 wks POG was 58% showing the increased risk of pre-eclampsia in this period.

**Table No.2:-** comparison of biochemical parameters in the cases and control group.

Mean $\pm$ SD of the parameter	Group		t value	P value	Significance
	Cases	Controls			
FBS (mg/dl)	77.38 $\pm$ 8.727	74.88 $\pm$ 7.976	1.495	0.138	NS
Blood Urea (mg/dl)	29.84 $\pm$ 8.947	24.34 $\pm$ 3.740	4.010	<0.001	HS
S. Creatinine (mg/dl)	1.112 $\pm$ .2256	1.002 $\pm$ 0.1020	3.142	0.002	S
S. Uric acid (mg/dl)	6.210 $\pm$ 5.7636	4.342 $\pm$ 0.6383	2.278	0.025	S
AST (IU/l)	55.61 $\pm$ 51.69	25.14 $\pm$ 4.52	4.153	<0.001	HS
ALT(IU/l)	50.06 $\pm$ 52.30	18.04 $\pm$ 6.77	4.293	<0.001	HS

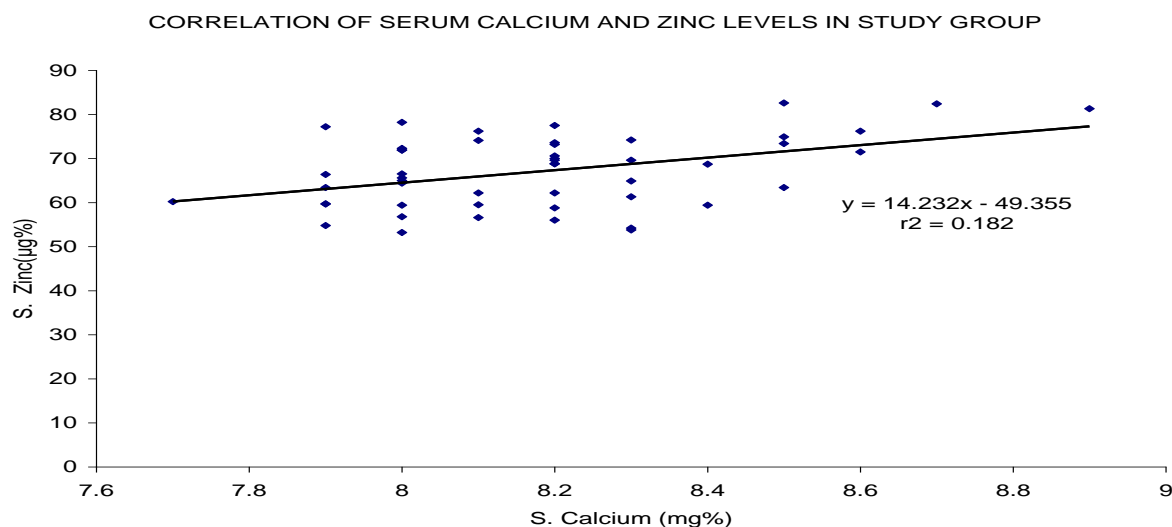
Table 2 shows routine investigations done in both study and control group. Serum urea, creatinine and uric acid were significantly higher in cases as compared to controls (p value <0.05). Serum ALT and AST levels were also significantly high in cases as compared to controls (pvalue <0.001). FBS was comparable in both cases and controls.



**Figure 1(a)(b):-** Comparison of serum calcium and zinc in study and control group.

Mean serum calcium levels were found to be  $9.66 \pm 0.37$  mg/dl in normal pregnancy and  $8.18 \pm 0.24$  mg/dl in pre-eclamptic group. The difference was found to be statistically significant (p value <0.05). Also significantly decreased levels of serum zinc was found in pre-eclamptic females ( $67.12 \pm 8.05$ ) as compared to normal pregnant females ( $114.58 \pm 123.34$ ) (p value <0.05).

Figure 2 shows a positive correlation between serum calcium and zinc in study group which shows a decrease in both the parameters in pre-eclamptic females.



**Figure 2:-** correlation of serum calcium and zinc in study group.

### Discussion:-

About 600,000 women die because of delivery complications every year in the world and about 50% of these cases are due to risky pregnancies.<sup>[10]</sup> As per the WHO recommendations, In populations where calcium intake is low, calcium supplements should be given for the prevention of pre-eclampsia in pregnant women particularly among those who are at higher risk of developing hypertension.<sup>[11]</sup> In our study, decreased levels of serum calcium and zinc were seen in pre-eclamptic females as compared to normal pregnant females and the correlation between both the parameter was highly significant ( $p$  value $<0.05$ ). Similar results were found in a study by Jain et al.<sup>[11]</sup> It has been widely accepted that there is a relationship between low serum calcium levels and pre-eclampsia. Study conducted by Malas et al suggests that maternal serum total calcium and parathyroid hormone are related to pre-eclampsia in pregnancy.<sup>[12]</sup> Hofmyer et al in his study suggests that the calcium supplements play an important role during pregnancy in reducing risk of hypertension and pre-eclampsia.<sup>[13]</sup> This effect was found more significant in those studies where participants had low calcium intake compared to that of where calcium intake was adequate.<sup>[13]</sup> In another study, Trumbo et al suggested that the beneficial effects of calcium supplementation could only be useful in populations whose baseline calcium intake is inadequate.<sup>[14]</sup>

Among the essential trace element zinc is required for proper reproductive health and for optimal cellular function.<sup>[5]</sup> Inadequate dietary intake of zinc has been reported in 82% of the pregnant women worldwide. Decrease in serum zinc concentrations have been found to be related to pre-eclampsia.<sup>[15]</sup> In our study mean serum zinc levels were found to be decreased significantly in pre-eclamptic females as compared to normotensive females. In a similar study by Gupta et al, plasma zinc levels were also significantly low in severe pre-eclampsia and eclampsia while the erythrocyte zinc levels showed no significant change.<sup>[16]</sup> Kangal et al found low levels of maternal copper and zinc related to pre-eclampsia.<sup>[17]</sup> Nutrients can modulate oxidative stress by affecting free radicals or antioxidants.<sup>[18]</sup> Under increased oxidative stress, excessive lipid peroxidation, vasospasm caused by the imbalance of vasodilators and vasoconstrictors may progress towards the development of pre-eclampsia.<sup>[1][4]</sup> Selina et al concluded that the deficiency of calcium and zinc in pre-eclamptic women were related to their inadequate dietary intake and this deficiency could be a risk factor for development of high blood pressure and pre-eclampsia.<sup>[19]</sup> He L et al<sup>[20]</sup> Kumari B<sup>[21]</sup> and Vafaei H<sup>[22]</sup> also suggested the role of serum calcium and zinc in pre-eclampsia in their studies. But according to K Vidhya serum calcium and zinc deficiency cannot be pinpointed as the sole factors for the etiology of pre-eclampsia but they have a definite role in the development of pre-eclampsia<sup>[23]</sup>

### Conclusion:-

Low levels of serum calcium and zinc have been found to be involved in development and pathogenesis of pre-eclampsia. Hence it is suggested that these investigations should be an integral part of the routine workup in early pregnancy for timely recognition and intervention in pre-eclampsia. In the light of the reduction in the concentration of serum calcium and zinc, dietary supplementation or direct replacement therapy of these elements is suggested for women with pre-eclampsia.

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