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RESEARCH ARTICLE
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A COMPARATIVE STUDY OF LEVELS OF SERUM CALCIUM, MAGNESIUM AND SODIUM IN PREGNANT MOTHERS IN SECOND AND THIRD TRIMESTERS AS PREDICTORS OF PRE-ECLAMPSIA

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Background:
Hypertensive disorders are major factors responsible for morbidity and mortality in pregnancy and Preeclampsia is a Pregnancy Specific Syndrome characterized by Hypertension with BP 140/90mm Hg or more, Proteinuria and edema contributing significantly to Maternal and Foetal Morbidity and Mortality. Imbalances of serum sodium and potassium levels are involved in functioning of vascular smooth muscles, leads to vasoconstriction and hypertension in PE. Calcium deficiency stimulates parathyroid hormone and leading to vasoconstriction. Magnesium regulates blood pressure by monitoring vascular tone and structure. Hypocalcaemia and hypomagnesaemia have been implicated in the pathogenesis of pre-eclampsia.

Aim and Objectives:
1. To assess serum values of sodium, magnesium and calcium in second and third trimester of pregnancy.
2. To find the association between serum levels of calcium, magnesium and sodium and pre-eclampsia in second and third trimesters of pregnancy.
3. To assess demographic variations among the antenatal mothers.

Materials and Methods:
This is Observational cross-sectional study was done from January 2022 to December 2022 at the Department of Obstetrics and Gynaecology at Madurai Medical College Hospital in 100 pregnant women attending our outpatient department. All the cases were selected in the second trimester follow up to third trimester and belongs to the age group 18-35years with Singleton pregnancy. Cases with

any medical history of chronic hypertension, diabetes, renal disease, liver disease were excluded from the study. The statistical analysis was performed using SPSS version 16.

Results and Conclusion: The results were presented as a mean ± SD and p value of less than 0.001 is considered as significant. In our present study, Serum sodium, magnesium and calcium levels were lower in 3rd trimester among preeclampsia as compared to levels among normal antenatal mothers in 3rd trimester and were statistically significant. Lower serum magnesium, sodium and calcium levels is statistically significant in predicting the Preeclampsia in at risk mothers. Screening of serum Calcium, Magnesium and Sodium levels is essential for all antenatal cases for early detection and management of Complications of Pre-eclampsia.

Key words: Pre-eclampsia, Serum Calcium, Magnesium and Sodium

INTRODUCTION

Pre-eclampsia is dangerous complication of pregnancy and A unique multisystem disorder of human pregnancy of unknown aetiology, pre-eclampsia is characterized by abnormal vascular response to placentation. This abnormal response is associated with several pathologic changes such as increase in systemic vascular resistance, enhancement of platelet aggregation, reactivated coagulation system, and endothelial cell dysfunction.(1) Traditional diagnosis involves combined presentation of high blood pressure and proteinuria with newer definitions involving maternal organ dysfunction of hepatic / renal systems, complications either neurological or haematological, uteroplacental dysfunction, or restriction of fetal growth. In the absence of treatment, pre-eclampsia can be fatal, and in low-resource settings, this disorder is a major contributor of maternal and child mortality.(2)Screening pregnant women for biochemical markers of pre-eclampsia (PE) can reduce health care costs by early detection of mothers at increased risk for PE. This helps to avoid unnecessary suffering and hospitalization of pregnant women with suspect or mild PE. It also enables monitoring progression of the disease thereby optimizing time for delivery and reduce premature births.(3) In a developing country like India with a huge variation of obstetric services available in the country due to the influence of several factors, studies which compare the association between calcium, magnesium and sodium levels are lacking. This study focusses on the relationship between these parameters in a woman with preeclampsia and establish base line values which could serve as a launch pad for future studies in this direction

MATERIAL AND METHODS

This study was performed in 100 Antenatal mothers attending the Department of Obstetrics and Gynaecology OPD in Government Rajaji Medical College and Hospital, Madurai and 5ml of venous blood sample collected and analysed serum calcium, serum magnesium, serum sodium, RFT (Blood urea, serum creatinine) and urine albumin in fully automated chemistry analyser and Blood pressure was recorded. The statistical analysis was performed using SPSS version 16.

Inclusion criteria:

1. All antenatal mothers in second trimester,
2. Age 18 – 35 years, Singleton pregnancy,
3. No proteinuria,
4. Normal renal function tests,
5. Available for follow up in third trimester

Exclusion criteria:

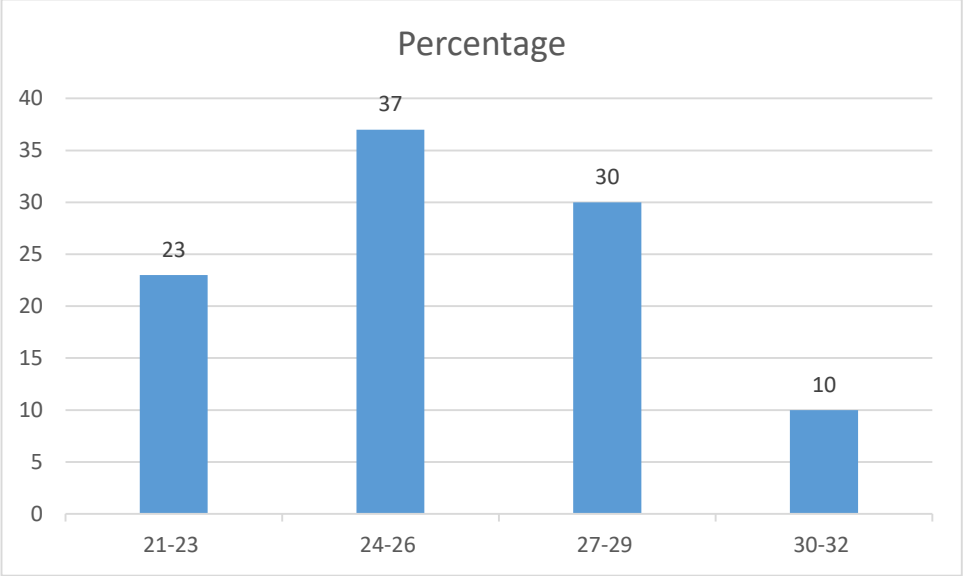
1. Those not willing to consent**,**
2. Antenatal mothers with chronic hypertension on/not on antihypertensive medication,
3. Diabetes mellitus**,**

4. Renal diseases as evidenced by abnormal renal function test, Autoimmune diseases accompanying pregnancy

RESULTS AND STATISTICAL ANALYSIS

100 pregnant women with or without history of preeclampsia who fulfil the inclusion and exclusion criteria were enrolled for this study. The mean age of the study participants was 25.74 ± 2.71 years. The youngest mother was 21 years old while the maximum age recorded was 31 years. 72% of the study population were multigravida while 28% were primigravida.

Chart 1 Age distribution among study participants



Majority of the mothers were in the age group of 24 – 30 years (37.0%), followed by 27-29 years age group (30.0%). The lowest age group was between 30-32 years (10.0%) 15 % of the study population had preeclampsia. Among those with preeclampsia the distribution characteristics is as follows

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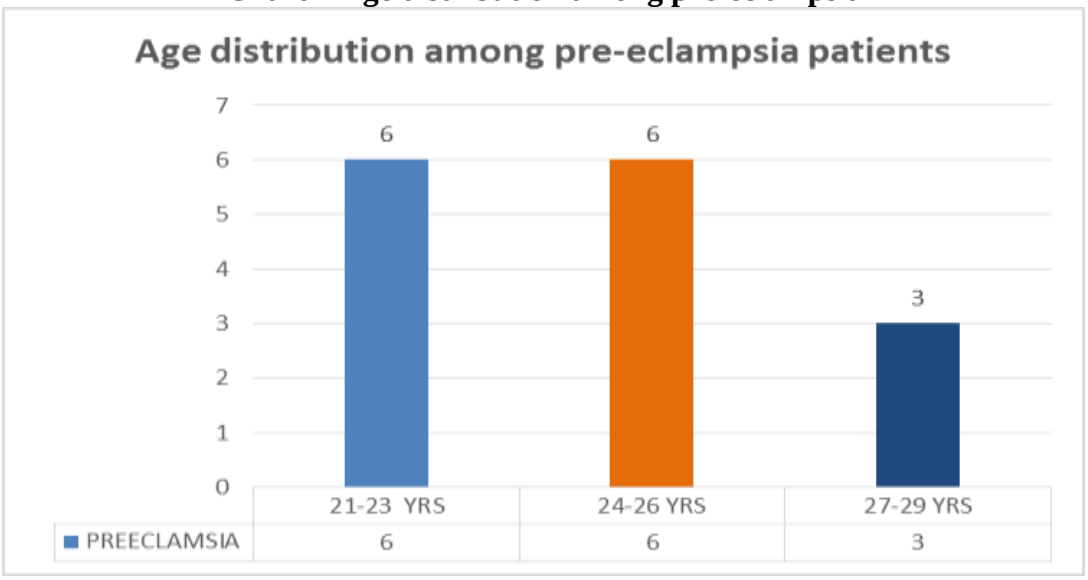
Chart 2 Age distribution among pre-eclampsia



The mean age among pre-eclamptics was 24.27 ± 2.34 years with a maximum of 29 years and a minimum of 21 years. The age distribution shows equal distribution among 21-23 years age group and 24-26 years to the tune of 40% while 3 patients were in the 27-29 years age category.

Table 1 Biochemical parameters among preeclamptic mothers in 2nd and 3rd Trimester

Parameter	**2nd trimester(n=15) (Mean ± SD)**	**3rd trimester(n=15) (Mean ± SD)**	**F value**
S.Sodium	139.33 ± 3.45	136.26 ± 1.28	10.378 (p = 0.003)
S.Magnesium	1.67 ± 0.08	1.63 ± 0.07	1.13 (p = 0.296)
S.Calcium	8.95 ± 0.12	8.97 ± 0.08	0.273(p = 0.60)

Serum sodium level is lower in 3rd trimester among pre eclampsia patients as compared to levels in 2nd trimester. However lower serum sodium levels observed among pre eclampsia patients in 3rd trimester with normal 2nd trimester mothers was statistically significant

Table 2 Preeclampsia versus Normal antenatal mothers (2nd trimester)

Parameter	Preeclampsia(n=15) (Mean ± SD)	Normal (n=85) (Mean ± SD)	mean difference	P value
S.Sodium	139.33. ± 3.45	140.56 ± 2.87	1.23	0.141
S.Magnesium	1.67 ± 0.08	1.91 ± 0.19	0.24	< 0.001
S.Calcium	8.95 ± 0.12	10.06 ± 0.41	1.11	< 0.001

Serum sodium, magnesium and calcium levels were lower in 2nd trimester among preeclamptics as compared to levels among normal antenatal mothers in 2nd trimester. However lower serum sodium levels observed among preeclamptics Compared with normal antenatal mothers was not statistically significant.

Table 3 Preeclampsia versus Normal antenatal mothers (3rd trimester)

Parameter	Preeclampsia(n=15) (Mean ± SD)	Normal (n=85)(Mean ± SD)	F value
S.Sodium	136.27 ± 1.28	138.26 ± 1.28	< 0.0001
S.Magnesium	1.63 ± 0.07	1.83 ± 0.07	< 0.001
S.Calcium	8.97 ± 0.08	9.98 ± 0.45	< 0.001

Serum sodium, magnesium and calcium levels were lower in 3rd trimester among preeclamptic as compared to levels among normal antenatal mothers in 3rd trimester and were statistically significant

DISCUSSION

This prospective study was carried out at the Department of Obstetrics and Gynaecology at Madurai Medical College Hospital in 100 pregnant women attending our outpatient department. The study population were subjected to analysis of serum sodium, calcium and magnesium levels in second and third trimesters. Of these, 15 % who had low levels of serum Magnesium and Calcium levels developed preeclampsia. Majority who developed preeclampsia were in the age group of 24-30 years followed by 27-29 years. This is in conformity with the general incidence where preeclampsia is more common in the younger age group.

Most of the patients in the study group who developed preeclampsia were primigravida . This is in conformity with other studies like that of Mac gillivray which showed 15 times higher incidence in primi (Mac gillivray 1959)[(4)]

In our study women who developed preeclampsia had lower levels of serum Magnesium,Sodium and calcium when compared to women who remained normotensive who had normal levels of serum magnesium,Sodium and calcium. In my study during 2nd trimester-The mean serum magnesium levels in the normotensive group who subsequently developed preeclampsia was 1.67 ± 0.08 mg/dl. The mean serum magnesium levels who remained normotensive was 1.91

± 0.19 mg/dl. The mean serum calcium levels in the women who subsequently developed preeclampsia was 8.95 ± 0.12 mg/dl. The mean serum calcium levels in the women who remained normotensive was 10.06 ± 0.41mg /dl. The mean serum sodium levels in the normotensive group who subsequently developed preeclampsia was 139.33. ± 3.45 meq/L. The mean serum sodium levels who remained normotensive was 140.56 ± 2.87 meq/L. In my study during 3rd trimester-The mean serum magnesium levels in the normotensive group who subsequently developed preeclampsia was 1.63 ± 0.07mg/dl. The mean serum magnesium levels who remained normotensive was 1.83 ± 0.07mg/dl. The mean serum calcium levels in the women who subsequently developed preeclampsia was 8.97 ± 0.08mg/dl. The mean serum calcium levels in the women who remained normotensive was 9.98 ± 0.45 mg /dl. The mean serum sodium levels in the normotensive group who subsequently developed preeclampsia was 136.27 ± 1.28 meq/L. The mean serum sodiumlevels who remained normotensive was 138.26 ± 1.28 meq/L.

Similar results were observed in the following studies: According to S.R.Ambwani, UH Shah et al.,5 the serum magnesium, sodium and calcium levels were lower in women with preeclampsia when compared to normotensivepregnant women. Serum magnesium levels were (1.34 ± 0.06 meq/l vs 2.06 ±0.67 meq/l, P< 0.0001).

According to Kisters K, Niecher W 83, the serum magnesium levels were lower in Preeclamptic women when compared to normotensive pregnant women (1.31 ± 0.16 mg / dl vs 1.83 ± 0.29 mg / dl, P < 0.001).

In a study by J Kar, R.Jina 84 the serum magnesium levels were found tobe lower in women with Preeclampsia compared to pregnant women who remained normotensive (1.51 ± 0.21 mg/dl vs 2.12 ± 0.19 mg/dl, P < 0.001).

In the study by Malas NO, Shurideh ZM26 also the serum calcium and sodium levels in women with Preeclampsia were lower compared to normal pregnant women (8.22 ± 0.12 mg% vs 9.50 ± 0.16 mg%, P < 0.005).

According to Kosch M, Hausberg M et al.,28 the serum calcium levels in women with Preeclampsia were lower than the levels in normal pregnant women(1.96 ± 0.15 mmol/l vs 2.20 ± 0.10 mmol / l, P < 0.01).

Lower serum magnesium, sodium and calcium levels is statistically significant in predicting the Preeclampsia in at risk mothers.

CONCLUSION

Preeclampsia is a multisystem disorder unique to pregnancy Magnesium being natures “calcium channel blocker, inhibits contaction smooth muscle through binding to calcium sites. Deficiency of Magnesium will potentiates the action of calcium in smooth muscle, vasospasm and

there by causation of preeclampsia. Hypernatremia in antenatal preeclampsia mothers is probably attributed to release of atrial natriuretic and Brain natriuretic peptides preceding the entire spectrum of pathophysiology of preeclampsia. This low cost technique is ideally suited as a screening test for women even in resource poor settings like India. Mineral supplementation during the antenatal period may influence significantly, the occurrence of hypertensive disorders in pregnancy.

Hence we conclude that screening with Calcium, Magnesium and Sodium is essential for all antenatal cases for early detection and management of complications of Pre-eclampsia

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