



RESEARCH ARTICLE

MINERALS LEVELS IN PRE-ECLAMPTIC PREGNANT WOMEN IN THEIR THIRD TRIMESTER COMPARED WITH NORMAL PREGNANCY

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ABSTRACT

Back-ground: Preeclampsia, a systemic illness of late pregnancy seen in approximately 6% of primigravid women, is an important cause of maternal & fetal morbidity. The levels of calcium and magnesium in pregnancy may implicate in their possible role in pregnancy induced hypertension. This study assessed serum Ca^{2+} , Mg^{2+} , Na^+ and K^+ levels in women with PIH (pregnancy induced Hypertension) and Preeclampsia compared with normal pregnancy.

Material & Methods: This study was conducted on 100 pregnant women as a control & 100 pre-eclamptic women as a study group. We evaluate the serum potassium, sodium, magnesium, calcium levels in both the group.

Result: The result of this study we found evaluated serum potassium level as compared to control it is significantly higher. Calcium, Sodium, Magnesium are significantly low.

Conclusion: In the light of the above observations, it can be concluded that Pre-eclamptic pregnant women have higher levels of S. Potassium decreased level of S. Calcium & Magnesium and no significant difference in Sodium levels as compared to normotensive pregnant women in their IIIrd trimester pregnancy. Lowered plasma or serum Magnesium concentrations in pre-eclampsia may contribute to the development in hypertension in pregnancy. In addition, a disturbed Calcium homeostasis is observed in pre-eclampsia.

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INTRODUCTION

Pre-eclampsia is a disorder that occurs only during pregnancy & affects both the mother & the fetus. According to the World health Organization, preeclampsia is a major cause of both maternal & fetal neonatal morbidity and mortality (Roberts and Redman, 1993; Dekker, 1994; Zeeman *et al.*, 1992; Zuspar, 1984; Margillivrad, 1983). The incidence rate of pre-eclampsia stands at 3-10% globally (Osungbade *et al.*, 2011) with a 7% rate reported amongst Gghanain pregnant women (Obed and Aniteye, 2007; Turpin *et al.*, 2008). Taking into account numerous studies conducted, the aetiology of this condition remain unknown (Onder *et al.*, 2003), although factors such as obesity, diabetes, calcium (Ca^{2+}) deficiency (Sibai, 1996), advanced maternal age, oxidative stress, placental ischemia, genetics and immune maladaptation have been implicated (Serhal, 1987).

A role for altered calcium metabolism in the pathogenesis of this disorder as suggested by epidemiologic evidence linking low dietary level of calcium with increase incidence of pre-eclampsia (Belizan *et al.*, 1980). Changes in intracellular calcium and magnesium concentrations seem to be involved in the pathogenesis of preeclampsia. On the basis of the therapeutic effects of Magnesium salts and the known vasodilating properties of Magnesium, it was suggested that a deficiency in Magnesium contributed to the development of vasoconstriction in pre-eclampsia (Altura *et al.*, 1983). Therefore the objective of present study was to determine the state of electrolyte imbalance by estimating the levels of serum Na^+ , K^+ , Mg^{++} and Ca^{2+} in normotensive & pre-eclamptic pregnant women in their third trimester pregnancy.

MATERIALS AND METHODS

This study was performed in 200 pregnant women in their third trimester age group between 20-35 years. All the subjects were categorized under two group's viz. control group and study group. For the biochemical parameters to be analyzed,

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blood sample were collected after an overnight fast from the antecubital vein avoiding venostasis in all subjects. Plain vials were used for the estimating of serum minerals (Na^+ , K^+ , Mg^{++} and Ca^{2+}). Serum Sodium, Potassium and Calcium were measured by electrolyte analyzer. Magnesium was estimated by Neil & Nelly method (expressed as mg/dl). Biochemistry analyzer was used for the measurement of Absorbance.

Statistical analysis

Values are expressed as mean \pm sd the significant mean differences between groups assessed by the Student "t" test and distribution of Probability (p).

RESULTS

- Mean Serum Potassium (K^+) levels were elevated in study group as compared to control group (4.95 ± 0.99 vs 4.38 ± 0.80 mEq/L). Levels were significantly higher in pre-eclamptic group as compared to Normotensive ($p < 0.001$).
- Mean Serum Calcium (Ca^{2+}) levels were significantly lower in preeclamptic group as compared to Normotensive group. The percentage decrease in study group in 7.52% ($p < 0.05$).
- Mean Serum Sodium (Na^+) levels were almost same in both group. The difference was statistically insignificant ($p < 0.1$).
- Mean Serum Magnesium (Mg^{2+}) levels were slightly lower in pre-eclamptic group when compared to normotensive group levels were statistically significant ($p < 0.05$). The percentage decrease in pre-eclamptic group was 3.4%.

S.N.	Particulars	Normotensive	Pre-eclamptic
1	Potassium	4.38 ± 0.80	$4.95 \pm 0.99 (p < 0.001)$
2	Sodium	142 ± 1.12	$141 \pm 1.95 (p < 0.01)$
3	Calcium	8.27 ± 1.46	$7.96 \pm 0.22 (p < 0.05)$
4	Magnesium	1.47 ± 0.22	$1.42 \pm 0.19 (p < 0.05)$

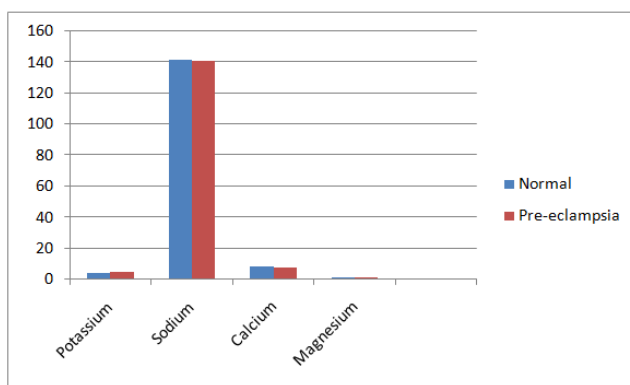


Figure 1. Levels of Potassium (K^+), Sodium (Na^+), Calcium (Ca^{++}) and Magnesium (Mg^{++}) in preeclampsia compared with normal pregnancy

DISCUSSION

Hypertensive disorders of pregnancy are associated with increased morbidity and mortality, especially during delivery. Our study was conducted to assess the levels of serum K^+ , Na^+ , Ca^{2+} and Mg^{2+} in pregnant women with PE a compared to that in normal pregnancy. Serum calcium and magnesium

are very important for metabolism at the cellular level and are vital for muscle contraction and cell death and neuronal activity (Sandip *et al.*, 2013), making it very essential in pregnancy. The observation of low Ca^{2+} and Mg^{2+} levels is in agreement with other studies on hypertensive disorders in pregnancy (Abdellah and Abdrabo, 2014; Sayyed and Sonttake, 2013; Indumati *et al.*, 2011). A probable theory to this observation may be that when serum calcium levels decreased, the levels of intracellular calcium increased, leading to constriction of smooth muscles in blood vessels and therefore increased vascular resistance (Ingec *et al.*, 2006; Lopez-Jaramillo, 2000; Szmidi-Adjide *et al.*, 2006), culminating in a raised systolic and diastolic blood pressure (Kesteloot *et al.*, 2011). The present study showed that serum magnesium level was significantly reduced in pre-eclampsia mothers compared with the healthy control group. The level in pre-eclampsia women was not only significantly low when the diagnosis was confirmed, but also the initial level from early on in the pregnancy was lower than the control group.

These findings confirmed that hypomagnesemia may be one of the etiologies of preeclampsia. A study by Seydoux J revealed that serum magnesium decrease with progress in pregnancy (Kesteloot *et al.*, 2011). These results were consistent with earlier study by Handwerker *et al.* (1999) where the study group has lower serum Magnesium than control group and in study by Seydouse *et al.* (2011) where mean serum magnesium was slightly rise in study also correspond to the studies by Zhao, 1995 and Frankel Y *et al.* (1989) where mean serum magnesium was slightly lower in study group as compared to control group. Hence difference between two groups was statistically in significant.

During pregnancy, there is a great demand for calcium intake to respond to the higher demands for calcium caused by the process of fetal bone formation. Furthermore, there is dilution of the cation due to the expand extracellular fluid volume, and to the normal hypercalciuria of pregnancy consequent to increase glomerular filtration. Thus, serum ionized calcium concentrations depends on an adequate calcium intake (Fren *et al.*, 1991). It was reported that preeclamptic women present a reduction in extracellular calcium concentration with low levels of the serum ionized calcium and abnormal calcitropic hormone levels (Lopez-Jaramillo *et al.*, 1989).

Our studies further indicated no change in serum sodium levels in pre-eclamptic as compared to normotensive pregnancies. Serum Potassium (Na^+) levels however showed a highly significant increase in pre-eclamptic pregnant women. These findings are in close conformity with the findings of Agyei-Frampong *et al.* (2000) who demonstrated that there was only slight correlation between the plasma sodium levels and diastolic blood pressure with no significant difference between normotensive & pre-eclamptic subjects. Serum potassium levels however, showed a highly significant increase in pre-eclamptic women. These results were consistent with earlier study by Handwerker *et al.* (2000) where the study group had significantly higher levels of serum potassium than control group. Normal pregnancy has been associated with a decrease in mean serum potassium possibly related to a physiologic increase in Na^+/K^+ adenosine triphosphatase activity in the cell membranes, causing a shift of K^+ into cells with extrusion of

Na⁺. Thus our findings of higher extracellular K⁺ levels in toxemia may be of interest.

Conclusion

In the light of the above observations, it can be concluded that Pre-eclamptic pregnant women have higher levels of S. Potassium decreased level of S. Calcium & Magnesium and no significant difference in Sodium levels as compared to normotensive pregnant women in their IIIrd trimester pregnancy. Lowered plasma or serum Magnesium concentrations in pre-eclampsia may contribute to the development in hypertension in pregnancy. In addition, a disturbed Calcium homeostasis is observed in pre-eclampsia. In pre-eclamptic pregnant women undergoing Magnesium Sulfate therapy, before Magnesium therapy, ionized Calcium levels were lower in pre-eclamptic women than in normotensive pregnancy. In the presence of elevated Magnesium levels ionized Calcium appears to be tightly regulated. On the basis of above findings it can be concluded that a disturbance in electrolyte imbalance plays a significant role in the pathogenesis of Preeclampsia. This complicated condition of pregnancy occurs not only due to mineral deficiency but also due to an associated effect of physiologically induced oxidative stress. Therefore, serum mineral levels (Sodium, Potassium, Calcium and Magnesium) may not only be used as effective markers of PIH or preeclampsia but their imbalance may be regarded as a status of oxidative stress as well.

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