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A Study of Serum Electrolytes in Normal Pregnancy and Pre-eclampsia and their Significance as a Diagnostic tool.

KEYWORDS: Serum Electrolytes, Pre-eclampsia, Normal pregnancy.

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ABSTRACT *Introduction: Many studies supports the significance of relation between calcium and magnesium levels in preeclampsia patients. The present study has undertaken to show the serum electrolyte levels in pre-eclampsia and normal pregnancy and their significance in Pre-eclampsia. Materials and Methods: The serum samples were analyzed for serum levels of sodium, potassium, calcium, magnesium by using semi-Auto analyzers. Results: Serum sodium and potassium levels were lower in preeclampsia women when compared to normal pregnancy, but were statistically insignificant. Serum calcium and magnesium levels were lower in pre-eclamptics ($p<0.0001$) when compared to normotensives, which signifies statistically. Conclusion: Studying these electrolytes help us to understand the pathogenesis of pre-eclampsia and also aid in the treatment of pre-eclampsia. To reduce the incidence of pre-eclampsia due to calcium deficiency, sufficient balanced diet is necessary for pregnant women.*

Introduction:
Hypertensive disorders in pregnancy are pre-eclampsia and eclampsia. Pregnancy Induced Hypertension (PIH) is one of the most common disorder among pregnant women which is an important cause of both maternal and fetal morbidity and mortality [1]. Pre-eclampsia is defined as a hypertensive disorder that occurs after 20 weeks of gestation which is characterized by high blood pressure (≥140/60 mmHg), oedema or Proteinuria (>300mg urinary protein/day) [2]. The Incidence of preeclampsia ranges from 4-8% [2].

Pre-eclampsia effects many organs with unknown etiology [3], it can progress to eclampsia with more severity and can result in generalized seizures and cortical blindness [4]. The etiology of preeclampsia is still inconclusive despite of its prevalence and severity. Defective trophoblast invasion because of disturbed interactions between fetal trophoblasts and maternal cells, is considered to be major pathophysiology [5].

Predisposing factors of preeclampsia are preeclampsia in previous pregnancy, first pregnancy (primigravida), obesity, family history of PIH, Age 40 years or more, calcium deficiency [6], underlying medical complications like diabetes, hypertension, renal disease and antiphospholipid bodies, placental ischemia, genetics and immune mal adaptation [7].

Many studies supports the significance of relation between calcium and magnesium levels in preeclampsia patients [8-11]. Calcium plays an important role in smooth muscle function. Increase in the intracellular calcium causes vasoconstriction, increase in peripheral resistance and therefore increase in blood pressure [12]. Magnesium acts as a cofactor for the sodium potassium ATP ase activity [13]. Hence all the electrolytes - sodium, potassium, calcium, magnesium involve in the cardiovascular effects and helps in smooth functioning . Their alteration in pre-eclamptics when compared with normotensive pregnancies is important to study.

The present study has undertaken to show the serum electrolyte levels in Pre-eclampsia and normal pregnancy and their significance in Pre-eclampsia.

Materials and Methods:
This is a prospective study done at Department of Biochemistry, Govt. Medical College, Ananthapuramu. Informed consent has taken from all the selected individuals before going for serum electrolytes analysis. Ethical committee has approved to do this study.

A total of 80 pregnant women were selected, who were in the age group of 20-40 years with gestational age > 24 weeks. Those selected persons were divided into two groups for analysis.

Group 1 - Control group - 40 Pregnant women with normal blood pressure and without proteinuria.

Group 2 - Study group - 40 Pregnant women presenting with classical features of pre-eclampsia such as high blood pressure (140/80 mmHg, Oedema, Proteinuria).

Medical history and significant past history of all the patients has taken. Control and Study group were underwent systemic, Obstetric and Gynecological examination, then they were advised for serum electrolytes investigation.

A 5ml venous blood has collected in to a plain test tube from antecubital vein under aseptic precautions. The blood was allowed to clot and after centrifugation serum was collected. Usually all the blood samples were processed within 4-6 hours, if there is any delay samples were kept in refrigerator. The serum samples were analyzed for serum levels of sodium, potassium, calcium, magnesium. All the electrolytes were analyzed by using semi-Auto analyzers. Serum sodium and potassium were estimated by Electrolyte Kit Method [14]. Serum Calcium was estimated by Assenazo III method [15]. Serum Magnesium was estimated by calmagite dye method [16].

The normal values of serum electrolytes are:

Serum Sodium - 135-145 meq/L
Serum Potassium - 3.5-5 meq/L

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Serum Calcium - 9-11 mg/dL
Serum Magnesium - 1.8-3 mg/dL.

All the estimated values of electrolytes were entered in excel sheet and analyzed mean and standard deviation. P value was calculated for electrolytes between control and study group using Graph pad software under paired 't' test. The $P < 0.05$ were considered statistically significant.

Results:
A total of 80 pregnant women were studied. They were distributed into two groups 40 members in each, normotensives and pre-eclamptics. Both control group and Study group were assessed for their mean age in years, gestational age and BMI (Table No.1). Most of the pre-eclamptics were in the age group of 25-30 years. Age in years, gestational age in weeks and BMI variables statistical insignificant in pre-eclamptics when compared with normotensives. Out of 40 pre-eclampsia patients 28 (70%) were primigravida and 12 (30%) were multigravida.

Table No:1 Demographic data related to normotensives and pre-eclamptics

Characteristics	Control group	Study group	P value
Age in years	24.09±4.5	25.23±3.6	0.2146
Gestational age in weeks	26.24±5.7	27.32±7.8	0.4816
BMI in Kg/m2	24.43±4.2	25.26±8.5	0.5814

Serum electrolytes estimated levels among normotensives and pre-eclamptics were tabulated in Table No:2. Serum sodium and potassium levels were lower in pre-eclampsia women when compared to normal pregnancy, but were statistically insignificant. Serum calcium and magnesium levels were lower in pre-eclamptics ($p<0.0001$) when compared to normotensives, which signifies statistically.

Table No:2 Serum Electrolytes levels in Pre-eclampsia and Normal pregnancy

Serum Electrolytes	Control group	Study group	P value	Significance
Serum Sodium	134.12±3.60	132.9±2.12	0.0686	NSS
Serum Potassium	3.49±0.43	3.56±4.21	0.5040	NSS
Serum Calcium	9.35±0.31	8.42±0.62	0.0001	SS
Serum Magnesium	1.92±0.42	1.28±0.13	0.0001	SS

NSS - Not Statistically significant; SS- Statistically significant

Discussion:
Pre-eclampsia became a major public health problem which has a greater impact on maternal, fetal morbidity and mortality. Pre-eclampsia may result in many problems like intrauterine growth retardation, preterm birth, still birth, placental abruptio, antepartum and post partum hemorrhage, acute hepatic and renal failure, seizures, maternal death [17].

One of the reason for preterm births is preeclampsia, as about 10% of preeclampsia occurs before 34 weeks of gestation. Delivery is the only cure for pre-eclamptics, along with electrolyte correction helps in reducing morbidity and mortality of mother and fetus. Mode of delivery and time of delivery depends on the mother and fetal health status [3].

Serum electrolytes estimation is most important in pre-eclampsia which useful to study the physiological and pathological changes of it. During pregnancy most of the Indian women are facing nutritional deficiencies because of dietary deficiencies of minerals and vitamins. Many conditions such as pre-eclampsia, eclampsia, Intrauterine growth retardation has close relation with dietary deficiency of calcium and magnesium [18].

In the present study, Serum electrolytes were analyzed by considering the normal values of particular serum electrolyte. Serum Calcium and Magnesium were significantly lowered in pre-eclampsia women when compared to normal pregnancy. In line with this study Hojo M et al [19], Abdellah A et al [8], Sayyed KA et al [20], Idogun ES et al [21], Sandip S et al [22], Richard Kobina et al [23] also observed that serum calcium levels lower in pre-eclampsia woman when compared to normal pregnancy. Indumati V et al [24] documented that total serum calcium and also ionized calcium were lower in pre-eclampsia when compared to normal pregnancy and women without pregnancy. In contrast to this study few studies [25-27] reported that there is no significant difference in calcium levels among pre-eclamptics and normal pregnant women. Among Pre-eclamptics, Magnesium levels lower than normal pregnant women, which is supported by Seydoux J [28], Standley CA [29].

Calcium and Magnesium are essential in pregnancy which plays an important role in metabolic activities at cellular level and vital for muscle contraction. Many studies has been implicated the relation of calcium with PIH in various ways. When there is decrease in serum calcium, then intracellular calcium increases, results in constriction of smooth muscle s of blood vessels and in turn leads to increase in vascular resistance [30]. Low serum calcium levels stimulates parathyroid hormone and renin release, which in turn increases intra cellular calcium levels, results in increase in blood pressure[31]. Decreased magnesium levels cause partial membrane depolarization and decreased repolarization along with opening of Ca+2 membrane channels, leading to increase in intracellular Ca+2 [29].

As per this study the mean of serum sodium and potassium levels were in the normal range in both pre-eclampsia and normal pregnant women, but slightly lower in pre-eclamptics. Difference of sodium and potassium levels in women with pre-eclampsia and normal pregnancy is not statistically significant. Singh HJ [32], Villanueva LA [33] supported this study by their observation as there is no significant change in serum sodium and potassium levels in pre-eclampsia women when compared with normal pregnancy. Indumati et al [24] documented that sodium levels decreased significantly in pre-eclamptics than normal pregnancies and potassium levels were shown no much significant difference between them. As the preeclampsia severity increases, the serum sodium levels declines [34].

Conclusion:
Serum calcium and magnesium levels lower in pre-eclamptics when compared to normal pregnancy women. Serum electrolyte levels may not be the only reason responsible for pre-eclampsia, there are many other factors. Studying these electrolytes help us to understand the pathogenesis of pre-eclampsia and also aid in the treatment of pre-eclampsia. To reduce the incidence of pre-eclampsia due to calcium deficiency, sufficient balanced diet is necessary for pregnant women. Diet with more calcium and less sodium helps pregnant women from developing Pre-eclampsia.

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