STUDY OF SERUM CALCIUM, MAGNESIUM & URINE MICROALBUMIN LEVELS IN NORMAL & PRE-ECLAMPTIC GESTATION & TO COMPARE WITH NON-GESTATIONAL VALUE.

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ABSTRACT: Pre-eclampsia is a multisystem disorder of unknown etiology, unique to pregnancy, which complicates 3%-5% of pregnancies in the western world. The Present study is done with an aim to study the levels of minerals (calcium, magnesium) microalbuminuria levels in normal & pre-eclamptic gestation & to compare with non-gestational reference values. A total of 150 women were studied for various parameters like Serum Calcium, Magnesium & urine Microalbumin. Women are distributed in 3 groups as follows:

Group A (n=50) Consist of non-pregnant normotensive women. The age group is 18-30 years (mean age 24 years).

Group B (n=50) Consist of women having normal uncomplicated pregnancy without hypertension. The age group is 20-30 years (mean age 22 yrs)

Group C (n=50) Consist of women with pre-eclampsia. The age group is 20-32 years (mean age 24 yrs).

The mean $\pm$ SD Calcium Values in Group A, B & C are 9.5 ± 1.0 , 8.99 ± 0.31 , 7.7 ± 0.59 (mg/dl) respectively. Statistically significant decrease ($p < 0.05$) is seen in Group C. The mean $\pm$ SD Magnesium values in Group A, B & C are 2.2 ± 0.3 , 2.0 ± 0.1 , 1.93 ± 0.2 (mg/dl) respectively. There is a statistically significant decrease in serum Magnesium values in both Group B & Group C as compared to Group A. The mean $\pm$ SD Microalbumin values in Group A, B & C are 24 ± 6 , 28 ± 4 , 90 ± 30 (mg/dl) respectively. There is a statistically significant increase in Microalbumin values in Group C as compared to Group A.

Hence it can be concluded from the present study that a reduction in serum levels of calcium and, magnesium, during pregnancy might be possible contributors in etiology of pre-eclampsia, and supplementation of these elements to diet may be of value to prevent pre-eclampsia. Early pregnancy levels of microalbuminuria can be used as predictors of PE with high negative predictive value.

KEYWORDS: Preeclampsia, Calcium, Magnesium, Microalbumin

INTRODUCTION: Pre-eclampsia is a major cause of maternal morbidity and mortality worldwide. There have been many screening tests evaluated in the literature over the years for predicting. [1] Despite decades of research into the condition, the ability of clinicians to predict

pre-eclampsia prior to the onset of symptoms has not improved significantly.

Pre-eclampsia is a multisystem disorder of pregnancy, which complicates 3%-5% of pregnancies in the western world [2]. The cause of pre-eclampsia remains unknown and the only known cure is delivery of the fetus and placenta. Despite decades of research into the condition, predicting which women are at increased risk of developing pre-eclampsia remains problematic. Identifying "at-risk" women is an important aim

Furthermore, predicting pre-eclampsia in women with underlying conditions such as diabetes and chronic hypertension would be of great clinical value. [3]

Attention has therefore turned in recent years towards identifying maternal markers which are raised in women who go on to develop pre-eclampsia which have been used in the prediction of pre-eclampsia and explore potential future areas of investigation.

Our aim in the present study is the levels microalbuminuria in predicting hypertensive complications in pregnant patients & to determine the changes in the levels of minerals (Calcium & magnesium), if any, as a biochemical marker of pregnancy induced hypertension in normal & pre-eclamptic pregnancy.

MATERIAL AND METHODS: The present study was done in the Department of Biochemistry, MGM Medical College, Indore.

- A Cross sectional study was carried out on pregnant women with gestation between 20-40 weeks. A total of 150 women were studied for Serum Calcium, Magnesium & urine Microalbumin.
- Group A (n=50) Consist of non-pregnant normotensive women. The age group is 18-30 years (mean age 24 years).
- Group B (n=50) Consist of women having normal uncomplicated pregnancy without hypertension. The age group is 20-30 years (mean age 22 yrs)
- Group C (n=50) Consist of women with pre eclampsia. The age group is 20-32 years (mean age 24 yrs).

Following Patients were excluded from the study:

- i) Pregnant women presenting hypertension or any medical complication before 20 weeks of gestation.
- ii) Eclamptic women.
- iii) Mentally retarded pregnant women.

All the cases were informed about the study and asked to give written consent to participate in the study.

Consent from ethical committee is also taken to carry out the above research.

5 ml of venous blood and urine samples were collected and calcium, magnesium & microalbumin tests were performed.

- Routine investigations like Hb, PCV, Urine microscopy, BT/CT, platelet count & ultrasonography were also performed.
- Microalbumin in urine samples were estimated in urine sample by Accucare kit on Accu-lab 201 semiautomatic auto analyzer.
- Calcium & Magnesium were estimated by 9180 analyzer by Roche diagnostics.

ORIGINAL ARTICLE

STATISTICAL ANALYSIS: The comparison between three groups was done using student 't' test. Mean $\pm$ SD Values were calculated and a p value < 0.05 was considered to be statistically significant

OBSERVATION & RESULT:

Table 3: Serum Calcium Magnesium & Urine Microalbumin Levels in Group A,B and C:

Group	Serum Magnesium (mg/dl)	Serum Calcium (mg/dl)	Urine Microalbumin(mg/dl)
Group A(50)	2.2 $\pm$ 0.3	9.5 $\pm$ 1.0	24 $\pm$ 6
Group B(50)	2.0 $\pm$ 0.1 ^{\$}	8.99 $\pm$ 0.31 ^{\$}	28 $\pm$ 4 ^{\$\$\$}
Group C(50)	1.93 $\pm$ 0.2 ^{**}	7.7 $\pm$ 0.59 [*]	90 $\pm$ 30 ^{***}

^{\$}p < 0.01 control as compared to pre-eclamptic pregnancies

^{\$\$}p < 0.05 control as compared to pre-eclamptic pregnancies

^{\$\$\$}p < 0.001 control as compared to pre-eclamptic pregnancies

^{*}p < 0.01 normal pregnancies as compared to pre-eclamptic pregnancies

^{**}p < 0.05 normal pregnancies as compared to pre-eclamptic pregnancies

^{***}p < 0.001 normal pregnancies as compared to pre-eclamptic pregnancies

Table 3: Serum Calcium, Magnesium & Microalbumin Levels in Group A,B and C:

	Group A (n=150)	Group B (n=210)	Group C (n=203)
Calcium	9.5 $\pm$ 1.0	8.99 $\pm$ 0.31	7.7 $\pm$ 0.59
Magnesium	2.2 $\pm$ 0.3	2.0 $\pm$ 0.1	1.93 $\pm$ 0.2
Microalbumin	24 $\pm$ 6	28 $\pm$ 4	90 $\pm$ 30

CALCIUM: The mean $\pm$ SD Calcium Values in Group A, B & C are 9.5 $\pm$ 1.0, 8.99 $\pm$ 0.31, 7.7 $\pm$ 0.59 (mg/dl) respectively. There is a decrease in serum Calcium values in both Group B And Group C as compared to Group A. But the decrease is statistically significant (p < 0.05) in Group C only.

Our study showed that serum total calcium level significantly decrease in pre-eclamptic women than in healthy pregnant women.

MAGNESIUM: The mean $\pm$ SD Magnesium values in Group A, B & C are 2.2 $\pm$ 0.3, 2.0 $\pm$ 0.1, 1.93 $\pm$ 0.2 (mg/dl) respectively. There is a statistically significant decrease in serum Magnesium values in both Group B & Group C as compared to Group A.

Serum total magnesium concentrations were significantly lower in women with preeclampsia relative to normal pregnant controls.

MICROALBUMIN: The mean $\pm$ SD Microalbumin values in Group A, B & C are 24 ± 6 , 28 ± 4 , 90 ± 30 (mg/dl) respectively. There is a statistically significant increase in Microalbumin values in Group C as compared to Group A.

DISCUSSION: Kisters et al. [4] showed significantly decreased plasma calcium content in preeclampsia compared to healthy pregnant women and our finding also agreed with that study. The underlying facts of decreased serum total calcium concentration in preeclampsia may be an alteration of the plasma protein concentration (primarily albumin but globulin also bind calcium) results in parallel changes in total plasma calcium. The role of plasma calcium status in normal pregnancy is still discussed controversially, as well as a calcium supplementation in preeclampsia [5].

This can be attributed to the fact the reduction was attributed to the expanded intravascular space occurring during pregnancy which was reflected by the reduction of serum albumin as Ca bound to plasma protein mainly Albumin represents about 30-45% of total Ca.[1, 2].

A pregnant woman's body requires 25-30 g of Ca to support the developing fetal skeleton which may contribute for this reduction.[6, 7] In contrast, other reports showed that maternal serum total Ca does not vary with increased in gestational age. While other reports have shown that there is increase in serum Ca in pregnant women compared to non-pregnant women.[8] However, it should be noted that this observation was made in the Western (developed) countries where there is sufficient Ca and vitamin D intake during pregnancy since there is a direct linear relationship between dietary intake of Ca and its serum concentration.[9, 10]

The role of magnesium appears to be associated with its function as an activator of enzymes involved in membrane transport and integrity, and with its relationship to prostaglandins - specifically, the ratio of prostacyclins (vasodilators) and thromboxanes (some of which are vasoconstrictors), which is dramatically altered in the case of low serum magnesium[11]. Both prostacyclin and thromboxane substances are increased during a normal pregnancy. However, women who develop preeclampsia have much smaller increases in prostacyclin production than other women, while thromboxane continues to rise at the same rate, thus increasing vasoconstriction and raising blood pressure [12]. We also agree with this theory. Therefore, low serum total magnesium concentration in preeclampsia may be a factor in the etiology of this disease.

Albumin is smaller and therefore more likely to escape through the filters of the kidney, called glomeruli. Albumin's function in the body includes retention of fluid in the blood. It acts like a sponge, soaking up fluid from body tissues. Hypertension may cause renal insufficiency, which may cause proteinuria. In normal pregnancy total protein level in mother is low due to supply to foetus. Plasma albumin levels are also decreased [13]. In preeclampsia group total protein and albumin level but not globulin is lower than uncomplicated pregnancy. It may be due to loss of protein in the urine. Lower protein and albumin level in preeclampsia subjects was also found by Anne Barden et al. [14].

CONCLUSION:

Hence, it can be concluded that:

- Statistically significant decrease is seen in serum Calcium and Magnesium in Pre eclamptic women as compared to normal pregnant and non-pregnant women.
- Statistically significant increase is seen in Urine Microalbumin in Preeclamptic women as compared to normal pregnant women.

Reduction in serum levels of calcium and, magnesium, during pregnancy might be possible contributors in etiology of pre-eclampsia, and supplementation of these elements to diet may be of value to prevent pre-eclampsia .

This study revealed that serum magnesium level in preeclampsia is lower than that of the Normal pregnant women. This result may support the hypothesis on the role of magnesium deficiency in preeclampsia pathophysiology and suggest the usefulness of its assessment in the early diagnosis of the disorder.

As proteinuria is one of the classic signs of preeclampsia, the presence of microalbuminuria in some otherwise symptom-free patient confirms that changes in renal function are present in whom preeclampsia as will eventually develop. Early pregnancy levels of microalbuminuria can be used as predictors of PE with high negative predictive value.

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