

Evaluation of Serum Calcium Levels in Pre-eclampsia

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Abstract

Pre-eclampsia is the most common medical complication of pregnancy associated with increased maternal and infant mortality and morbidity. Reduced serum calcium level are found associated with elevated blood pressure in preeclampsia. To evaluate serum calcium level in pre-eclamptic women. This cross sectional study was carried out in among 50 pre-eclamptic patients, aged 20 to 40 years, and gestational age ranges from 20 to 40 weeks and 50 age and gestational age matched normotensive pregnant women having no proteinuria. Serum calcium was measured by Colorimetric method. The mean age and mean gestational age of pre-eclampsia was not significantly different from those of normotensive pregnant women ($p=0.203$ and $p=0.251$ respectively). The mean body mass indexes of the test patients were significantly

different from those of normotensive pregnant women ($p<0.001$). The mean serum calcium level was 7.27 ± 3.01 mg/dl in pre-eclampsia and 7.25 ± 2.59 mg/dl in normal pregnant women; did not differ significantly between the subjects of pre-eclampsia and normal pregnant women ($p=0.963$). Serum calcium has no association in occurrence of pre-eclampsia.

Keywords: Pre-eclampsia, Calcium.

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Introduction

Pre-eclampsia is idiopathic multisystem disorder specific to human pregnancy¹. It is defined as the onset of hypertension and the presence of proteinuria during pregnancy, usually occurring after the 20th week of gestation in a previously normotensive woman and resolving completely by the sixth week after delivery of fetus².

Pre-eclampsia is transient but potentially dangerous complication of pregnancy. Generally, the incidence of pre-eclampsia is in the range of 4 - 8% of all pregnancies³. The incidence of pre-eclampsia has fallen in developed countries due to improved antenatal care, but it's incidence is still high in the developing countries⁴, and pre-eclampsia accounts for about 20-80% of the maternal mortality in developing countries⁵. Pre-eclampsia and eclampsia cause about 16 % of maternal death in Bangladesh⁴.

Despite of pre-eclampsia's prevalence and severity, the pathophysiology of this multisystem disorder is still poorly understood and it's etiology has not yet been fully elucidated. Environmental and nutritional factors may play a role in the development of pre-eclampsia⁶. The epidemiology of pre-eclampsia, being more common in poor women, long ago suggested that nutrients might be involved in the disorder⁷. It is assumed that deficiency of several essential micronutrients may be a predisposing factor in the development of pre-eclampsia because nutrients can modulate oxidative stress by increasing or decreasing free

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radicals or antioxidant and providing substrates for formation of free radicals⁴. Nutritional deficiencies are commonly found in pregnant women and it is well established that the pregnant women from developing countries usually consume diets that are low in minerals and vitamins⁸.

Calcium plays an important role in muscle contraction and regulation of water balance in cells. Modification of plasma calcium concentration leads to the alteration of blood pressure. The lowering of serum calcium and the increase of intracellular calcium can cause an elevation of blood pressure in pre-eclamptic mothers⁹. So the modification of calcium metabolism during pregnancy could be one of the causes of pre-eclampsia¹⁰⁻¹¹. Several studies showed that significantly low serum calcium level in pre-eclamptic women as compare to normal pregnant ($p < 0.05$)¹²⁻¹⁶. But in other studies serum levels of calcium did not differ significantly between pre-eclampsia and comparative group^{17,18}.

Serum calcium level was significantly lower in pre-eclamptic women compare to normal pregnant women in a study in Dhaka Bangladesh. This is not enough to reach valid conclusion. So, this study was conducted to estimate the serum calcium level in pre-eclampsia and normal pregnancy and find out any association between calcium and pre-eclampsia.

Materials and Methods

This cross-sectional study carried out in the Department of Biochemistry, Sylhet MAG Osmani Medical College in collaboration with the Department of Obstetrics and Gynaecology, Sylhet MAG Osmani Medical College Hospital during the period from January 2016 to December 2016. Fifty pre-eclamptic patients, aged 20 to 40 years, and gestational age ranges from 20 to 40 weeks and 50 age and gestational age matched normotensive pregnant women having no proteinuria were included in group-A and Group-B respectively. All subjects were primi. Pregnant women having essential hypertension, systemic or endocrine disorders, malabsorption syndrome, and patients on calcium supplementation were excluded.

Detailed history about present pregnancy regarding pre-eclampsia and exclusion criteria was asked. Gestational age was based on menstrual date and confirmed through ultrasound.

Data were collected from the selected subjects on variables of interest using a semi structured questionnaire by interview, observation, clinical examination, investigation and from the history.

Blood pressure was measured in supine position or sitting position. Urine was tested for gross proteinuria (heat coagulation test). The pre-eclamptic patients were diagnosed by the presence of persistent hypertension (more than 140/90 mm of Hg), gross proteinuria (tested by heat coagulation test of urine), and pathological oedema.

Maternal weight was recorded in kilograms with the subject standing on the weight machine without shoes and minimum clothing. Maternal height was recorded with the subject barefoot, feet together, back against the upright bar of the height scale, head upright in Frankfort horizontal plane - look straight ahead. The height measuring equipment consists of a vertical bar with a horizontal bar of wood which was brought down on examinee's head. Body mass index (BMI) was calculated by the formula ($BMI = \text{Weight in kilogram} / \text{Height in meter}^2$).

Five ml of venous blood was collected from ante-cubital vein under aseptic precaution in a metal-free sterile tube without any anticoagulant. Test tube was coded for identification of sample. The sample was kept at room temperature for about 20-25 minutes to allow it to clot and was sent to the Department of Biochemistry, Sylhet MAG Osmani Medical College, Sylhet where serum calcium was measured by Colorimetric method. Data were analysed with the help of Statistical Package for Social Science (SPSS) Version 21. Quantitative data were expressed as mean \pm SD (standard deviation) and unpaired test was done to see the significance. Qualitative data were expressed as frequency and percentage. The p-value of < 0.05 was considered statistically significant.

Informed written consent was taken from each of the patient or legal guardian and an approval of study protocol was obtained from the ethical committee of Sylhet MAG Osmani Medical College prior to the commencement of the study.

Results

The mean age was 26.70 ± 5.59 years in pre-eclampsia and 25.32 ± 5.17 years in normotensive pregnant women; difference was not significant ($t=1.281$; $p=0.203$) (Figure-1). The mean gestational age was 32.14 ± 3.19 weeks in pre-eclampsia and 32.84 ± 2.86 weeks in normotensive pregnant women; difference was not significant ($t=-1.154$; $p=0.251$) (Figure-1). The mean body mass index was 25.98 ± 2.58 Kg/M² in pre-eclampsia and 22.49 ± 2.72 Kg/M² in normotensive pregnant women. The mean body mass index in pre-eclampsia was significantly higher compared to normotensive pregnant women ($t=6.601$; $p < 0.001$) (Figure-1).

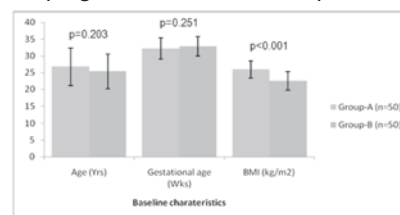


Figure-1: Distribution of the study groups according to baseline characteristics. *unpaired 't' test were used to reach a level of significance. A $p < 0.05$ was the level of significance.

The mean serum calcium level was 7.27 ± 3.01 mg/dl in pre-eclampsia and 7.25 ± 2.59 mg/dl in normal pregnant women. The mean serum calcium level did not differ significantly between the subjects of pre-eclampsia and normal pregnant women ($t=0.046$; $p=0.963$) (Figure-2).

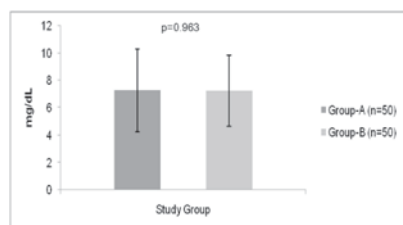


Figure-2: Serum calcium in study groups.

*unpaired 't' test were used to reach a level of significance. A $p < 0.05$ was the level of significance.

Discussion

Serum concentrations of various macrominerals are altered during pregnancy with changes in the mother's physiology and the requirements of growing fetus. Changes on serum level of Calcium (Ca) during pregnancy were estimated. In addition, it has been reported that reduction in serum level of Ca during pregnancy might be possible contributors in etiology of pre-eclampsia (PE), and supplementation of these minerals to diet may be of value to prevent PE¹⁸.

In this study the mean age in pre-eclampsia and normal pregnant women. There was no significant difference of the mean age between two groups ($p=0.203$). This result was consistent with the study of Golmohammad lou et al.¹⁷ that the mean age of the pre-eclamptic women was 25.70 ± 1.20 years. This result was also supported by Akhtar et al.¹⁹ that the mean age of the pre-eclamptic mother was 25.20 ± 4.85 years.

In this study the mean gestational age was 32.14 ± 3.19 weeks in the subjects with pre-eclampsia and was 32.84 ± 2.86 weeks in normal pregnant women. There was no significant difference of mean gestational age between two groups ($p=0.251$). This result was similar to the study of Akhtar et al.¹⁹ that gestational age was 31.53 ± 3.90 weeks in pre-eclampsia group and 32.35 ± 3.53 weeks in normal pregnancy group; the difference was not significant ($p=0.321$). Ephraim et al.²⁰ also reported that the gestational age was 30.72 ± 2.84 weeks in pre-eclampsia and 31.92 ± 4.69 in normal pregnancy; the difference was not significant ($p=0.2518$).

This study showed that the mean body mass index was 22.97 ± 2.62 Kg/M² of the subjects with pre-eclampsia and was 22.49 ± 2.72 Kg/M² of the normal pregnant women. The mean body mass index of the subjects did not differ significantly between the two groups ($p=0.362$). This result was correlated with the study of Lambe et al.¹⁴ that the mean body mass index was 22.75 ± 1.99 Kg/M² in pre-eclampsia and was 23.01 ± 2.02 Kg/M² in normal pregnant women. The mean body mass index of the subjects did not differ significantly between the two groups ($p=0.4854$). Several other studies did not show significant difference of body mass index between the two groups ($p > 0.05$)^{8,17}. But Akhtar et al.¹⁹ found that the

mean body mass index of the subjects with pre-eclampsia was 25.30 (SEM 0.36) Kg/M² and normal pregnant women was 23.48 (SEM 0.28) Kg/M². There was a significant difference of body mass index between the two groups ($p < 0.001$).

In this study the mean serum calcium was 7.27 ± 3.01 mg/dl in mg/L in pre-eclampsia and was 7.25 ± 2.59 mg/L in normal pregnant women. The mean serum calcium did not differ significantly between the subjects of pre-eclampsia and normal pregnant women ($p=0.963$). This was in contrast with several studies,^{5,6,13-15} suggesting hypocalcemia as a possible cause for preeclampsia. All these study reported significantly lower calcium in pre-eclamptic patients than normal pregnancy. However, in corroboration with our study finding, other studies,^{17,19-21} have refuted the suggestion of the involvement of low calcium in the pathogenesis of preeclampsia. On the basis of the physiological role of dietary calcium,²² epidemiologic studies have shown that restricted dietary calcium is associated with increased blood pressure. Such finding led to dietary calcium supplementation trials in normotensive and hypertensive populations. For example, Levine et al.²³ in a prospective study in American population showed that calcium supplementation during pregnancy did not prevent preeclampsia in healthy nulliparous women. Recently Alzate et al.²⁴ reported that calcium supplementation during pregnancy did not have preventive effects on preeclampsia. But calcium plus conjugated linoleic acid provided to adolescents was observed to have preventive effect on pre-eclampsia. Although Herrera et al.²⁵ and Hofmeyr et al.²⁶ reported otherwise.

Conclusion

Macro minerals are very essential during pregnancy. This study showed that serum calcium level did not differ significantly between pre-eclamptic and normal pregnant women. It may be concluded that serum calcium have no association in occurrence of pre-eclampsia. However further multicentre study involving large sample needed should be carried out to find the association between pre-eclampsia and serum calcium.

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