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Original Article

A comparative study on serum calcium and magnesium levels in women with preeclampsia and normal pregnancy

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ABSTRACT

Objective: To compare serum calcium and magnesium in preeclamptic women and normal pregnant women.
Materials and methods: A cross sectional study was conducted on normal pregnant women (n=30) and pre-eclamptic women (n=30) in Gayathri Hospital (GVPIHCMT) attended Gynecology and Obstetrics' department. The blood samples were collected and analyzed for calcium, medica on easyra fully automatic biochemistry and magnesium by semi- automatic analyzer lab life chemmaster in central laboratory. The data was analyzed using SPSS version 15. The p-value <0.05 was considered to be statistically significant.
Results: The serum calcium and magnesium in preeclamptic women were (8.6±0.4mg/dl vs. 9.9±0.7 mg/dl, p<0.0001) and (0.65±0.08 mmol/l vs.0.95±0.09 mmol/l, p=0.001) respectively, significantly lower than that in normal pregnant women.
Conclusion: These findings support the hypothesis that hypocalcaemia and hypomagnesaemia are possible etiologies of preeclampsia.

Keywords: Serum calcium, Serum magnesium, Preeclampsia, Normal pregnancy

INTRODUCTION

Preeclampsia is defined as the triad of hypertension, proteinuria and edema occurring after 20 weeks gestation in a previously normotensive woman[1]. It is specific to human pregnancy and complicate 6 – 8 % of gestation after week 20[1]. Preeclampsia is still one of the leading causes of maternal and fetal morbidity and mortality[2]. The pathophysiological mechanism is characterized by a failure of the trophoblastic invasion of the spiral arteries which may be associated with an increased vascular resistance of the uterine artery and a decreased perfusion of the placenta[3]. Despite active research for many years, the etiology of this disorder remains unknown, although contributory factors include obesity, diabetes, calcium deficiency, older maternal age and job stress[4,5,6]. Previous clinical studies show contradictory results in levels of serum calcium and magnesium in preeclamptic pregnancies[7,8]. Therefore, the altered calcium and magnesium metabolism during pregnancy could be one of the potential causes of preeclampsia. On the physiological basis, 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 preeclamptic mothers. The serum magnesium also decreases in women with preeclampsia[9]. Generally, magnesium has been known as an essential cofactor for many enzyme systems. It also plays an important role in neurochemical transmission and peripheral vasodilatation[10].

On the basis of some studies' claim that blood calcium and magnesium have a relaxant effect on the blood vessels of pregnant women,[11] we tried to find out whether there is a correlation between pre-eclampsia and the serum levels of calcium and magnesium in pregnant women.

Limited data are available on the role and status of serum levels of magnesium and calcium among pregnant women from the rural community. The present study was to measure serum calcium and magnesium levels in preeclamptic pregnancy and to compare with those in normal pregnancy.

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MATERIALS AND METHODS

This cross sectional study was conducted on total 60 women (30 pregnant women with diagnosis of preeclampsia, and 30 normal pregnant women) who were in their third trimester, primi or multigravida, without any history of chronic or transient hypertension, renal disease or cardiovascular disease, thyrotoxicosis, hemophilia, diabetes mellitus and attended the Department of Obstetrics and Gynecology, Gayathri Hospital. A written informed consent was obtained from the participants in the study. Study was approved by the Institutional Ethics Committee. Preeclampsia is defined as a blood pressure of at least 140/90 mmHg measured on two occasions each 6 hours apart, accompanied by proteinuria of at least 300 mg per 24 h, or at least 1+ on dipstick testing. Severe pre-eclampsia is defined as having one or more of the following criteria: blood pressure of at least 160 /110 mmHg measured on two occasions each 6 h apart, proteinuria of at least 5 g per 24 h, or at least 3+ on dipstick testing, oliguria of less than 500 ml per 24 h, cerebral or visual disturbances, pulmonary edema or cyanosis, epigastric or right upper quadrant pain, impaired liver function, thrombocytopenia, fetal growth restriction [12].

Data collection: The venous blood was aspirated from the participant's antecubital vein, collected in a plain, EDTA and citrate vaccumtainer tube before the initiation of intravenous therapy. Blood samples were allowed to clot at room temperature and then centrifuged at 3,000 rpm for 5 mins and stored at -20°C until analysis. Serum calcium was measured by medica test kits and for magnesium using blue spectrophotometric method on semi autoanalyzer lab life chemmaster. Normal values of serum magnesium is 0.65-1.11 mmol/l and serum calcium level is 9-11 mg/dl [13]. Pedal and pretibial edema were assessed by palpation and related on a scale of 0 to 4+ (0, none; 1+, generalized pu ness; 2+, indentation depth up to 1 cm with immediate recovery; 3+, indentation depth 1–1.5 cm with slow recovery; 4+, indentation depth greater than 1.5cm)[14.] Body mass index (BMI) was calculated as ratio of weight in kilogram to height in meter square Blood pressure was measured by mercury sphygmomanometer on left arm of participants in lying down position and classified according to Joint national committee VII. Korotkoff sound 1 and 5 will be considered as systolic and diastolic blood pressure respectively[15].

Data analysis: The data were analyzed with the SPSS software package version 11. Continuous variables were expressed as mean ± SD. The p-value <0.05 was considered to be statistically significance.

RESULTS

A total of 60 pregnant women in their third trimester of pregnancy enrolled in the study. The mean of ages and parity of the two groups were not significantly different. In preeclamptic women gestational age was significantly lesser than that of normal pregnant women ($p<0.05$), while total weight gain, body mass index, systolic and diastolic blood pressure were higher in preeclamptic group with statistical significance (Table 1) than normal pregnancy.

Table 1: Clinical characteristics of Participants (n=60)

Variables		Normal pregnant women (n=30)	Preeclamptic pregnant women (n=30)
Age (yrs)		24.0± 4.8 NS	26.4± 4.7 NS
Parity	Primiparous	18 NS	17 NS
	Multiparous	11 NS	14 NS
Gestational age (wk)		38.2±2.0	37.1±3.0*
Total weight gain(kg)		14.7±5.4	19.9±5.7*
BMI (KG/M2)		26.3±3.7	29.2±4.3*
Blood pressure	Systolic (mmHg)	110.5±7.0	158.4±13.1*
	Diastolic (mmHg)	72.3±6.0	97.3±16.3*

Table 2: Serum levels of calcium and magnesium according to participants:-

	pregnancy (n=30)	**(n=30)**
Serum Calcium (mg/dl)	9.9±0.7	8.6±0.4*
Serum Magnesium (mmol/l)	0.95±0.09 **Normal**	065±0.08* **Preeclampsia**

Table 1 & 2:-p value: <0.05 * Significant, NS Not significant

DISCUSSION

The objective of present study was to compare serum level of calcium and magnesium in normal pregnant and preeclamptic women. We found a decrease in both serum calcium and magnesium in preeclamptic pregnant women as compared to normal pregnant women. These findings confirmed the hypothesis that hypocalcaemia and hypomagnesaemia may be the etiologies of preeclampsia 7,16. The mean serum calcium levels in these normal pregnant women (9.9±0. 7 mg/ dl) were within the range (9.5– 11.1 mg/ dl) given by previous reports 12. The serum calcium concentration in preeclamptic pregnant women was significantly lower than that of normal pregnant women (Table 2). The data supported the hypothesis that calcium might be a cause in the development of preeclampsia. The effect of serum calcium on changes in blood pressure could be explained by the level of cellular concentration of calcium. The increase of cellular calcium concentration level when serum calcium went lower lead to constriction of smooth muscles in blood vessels and increase of vascular resistance 10. Serum magnesium concentration in preeclamptic women was significantly lower than that of normal pregnant women (Table 2). The mean serum magnesium levels in these normal pregnant women (0 .95±0.09 mmol/l) was within the range (0.65 –1.11 mmol/l) given by previous studies 7, 10, 1). The serum magnesium level decreased significantly during pregnancy12, 14. Generally, it is associated with hemodilution, altered renal clearance and consumption of minerals by the growing fetus10. Magnesium is essential cofactor for enzymes and plays an important role in neurochemical transmission and peripheral vasodilatation.

Limitations of the study: The dietary pattern of both the groups related to consumption of calcium and magnesium in their diet is unavailable.

CONCLUSION

Our study shows that both serum calcium and serum magnesium in preeclamptic pregnant women were lower than in normal pregnant women. These findings support the hypothesis that hypocalcaemia and hypomagnesaemia are possible etiologies of preeclampsia. However, calcium and magnesium supplement in pregnant women for the prevention of preeclampsia requires further study.

REFERENCES

1. Redman CWG, Jefferis M. Revised definition of preelcampsia. *Lancet* 1988; 1:809 – 812.
2. Pridjan G. Puschett JB. Preeclampsia. Part 1 clinical and pathophysiologic considerations. *Obstet Gynecol Surv* 2002; 57: 598 – 618.
3. Phupong V, Dejthevaporn T, Tanawattanacharoen S, Mano-taya S, Tannirandorn Y, Charoenvidhya D Predicting the risk of preeclampsia and small for gestational age infants by uterine artery Doppler in low-risk women. *Arch Gynecol Ob-stet* 2003.68:158–161
4. Sibai B. Prevention of preeclampsia: a big disappointment. *Am J Obstet Gynecol* 1998;179:1275-1278.
5. Hojo M, August P. Calcium Metabolism in Preeclampsia: Supplementation may help. *Medscape Womens Health* 1997;2:5.
6. Marcoux S, Berube S, Brisson C, Mondor M. Job strain and pregnancy-induced hypertension. *Epidemiology* 1999; 10: 376-382.
7. Malas NO, Shurideh ZM Does serum calcium in pre-eclampsia and normal pregnancy di er? *Saudi Med J* 2001. 22:868–871
8. Kisters K, Barenbrock M, Louwen F, Hausberg M, Rahn KH, Kosch M. Membrane, intracellular, and plasma magnesium and calcium concentrations in preeclampsia. *Am J Hypertens* 2000; 13: 765-769.
9. Ray J, Vasishta K, Kaur S, Majumdar S, Sawhney H. Calcium metabolism in pre-eclampsia. *Int J Gynaecol Obstet* 1999; 66: 245-250.
10. Kisters K, Barenbrock M, Louwen F, Hausberg M, Rahn KH, Kosch M. Membrane, intracellular, and plasma magnesium and calcium concentrations in preeclampsia. *Am J Hypertens* 2000; 13: 765-769.
11. Skjaerven R, Wilcox A, Lie RT. The interval between pregnancies and the risk of preeclampsia. *N Engl J Med* 2002; 346:33-8.
12. Sukonpan K, Phupong V. Serum calcium and serum magnesium in normal and preeclamptic pregnancy. Arch Gynecol Obstet 2005; 273: 12-16.
13. Chanvitya P, Boonsri K Serum Calcium, Magnesium and Uric Acid in Preeclampsia and Normal Pregnancy *J Med Assoc Thai 2008; 91 (7): 968-73*
14. ACOG Diagnosis and management of preeclampsia and eclampsia. ACOG practical bulletin. Clinical management guidelines for obstetrician gynecologists Number 33, January 2002. Obstet Gynecol 2002; 99:159–166.
15. Wilkins K, Norman R, Joffers R, McAllister F, Nichol M, Quach S et al. Blood pressure in Canadian adults statistics Canada, catalogue no. 82-003-XPE, Health Reports, march 2010; 21(1): 1-10
16. Kosch M, Hausberg M, Louwen F, Barenbrock M, Rahn KH, Kisters K Alterations of plasma calcium and intracel-lular and membrane calcium in erythrocytes of patients with pre-eclampsia. *J Hum Hypertens* 2000; 14:333–336