



Original Research Article

Study of Serum Calcium, Magnesium and Uric Acid in Pre-Eclamptic and Normal Pregnant Women

Deepak Kumar Garg¹, Roshan Kumar Mahat², Manisha Arora², Sudeep Kumar³, Shashank Tyagi², Rajiv Nehra⁴,
Jyoti Batra³

¹Department of Physiology, Gold Field Institute of Medical Sciences and Research, Chhainsa, Faridabad, Haryana.

²Department of Biochemistry, Muzaffarnagar Medical College, Muzaffarnagar (U.P), India

³Department of Biochemistry, Santosh Medical College, Ghaziabad, NCR, India

⁴Department of Biochemistry, LLRM Medical College, Merrut (U.P), India

Corresponding Author: Deepak Kumar Garg

Received: 18/04/2015

Revised: 22/04/2015

Accepted: 12/05/2015

ABSTRACT

Background: Preeclampsia is a hypertensive disorder unique to pregnancy and is one of the most leading cause for maternal and fetal mortality

Aim: The present study was aimed to estimate the levels of serum calcium, magnesium and uric acid in pre-eclamptic and normal pregnant women.

Methods: The study included 60 subjects of age group 18-35 years, attending antenatal clinic of Obstetrics & Gynecology Department, out of which 30 were pre-eclamptic women with gestational age of ≥ 20 weeks (Case group) and rest 30 were normal pregnant women of same gestational age (Control group).

Result: In the pre-eclamptic group, serum calcium and magnesium were significantly decreased ($p < 0.001$), while serum uric acid was significantly increased ($p < 0.001$).

Conclusion: Serum calcium, magnesium and uric acid can be considered as factors having a role in the etiopathogenesis of the disease. Thus, assessment of these parameters is useful in the early diagnosis of pre-eclampsia.

Key Words: Calcium, Magnesium, Uric acid, Pre-eclampsia.

INTRODUCTION

Pregnancy is a physiological stress in which many changes occur in the milieu interior of the body, more and more stress is being laid on the biochemical changes, which occur in the blood during normal pregnancy becomes exaggerated in complications of pregnancy like pre-eclampsia. [1] Preeclampsia is a hypertensive disorder unique to pregnancy. It is one of the

most leading cause for maternal and fetal mortality and it occurs in approximately 0.4% - 2.8% of all pregnancies in developed countries and many more in developing countries, leading to as many as 83,70,000 cases worldwide per year. [2]

According to WHO's World Health Report 1998, Preeclampsia is defined as "the development of hypertension ($>140/90$ mm of Hg) after 20 weeks of pregnancy in a

woman with proteinuria with or without oedema and without previous history of hypertension".^[3] It may be associated with complications like visual disturbances, oliguria, eclampsia, hemolysis, elevated liver enzymes, thrombocytopenia, pulmonary oedema and fetal growth restriction.^[4] 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.^[5]

Hypertensive disorders account for 40,000 maternal deaths annually.^[6] Due to this, methods to reduce the risk of hypertensive disorders in pregnancy have received considerable attention. Research is focusing on prevention rather than treatment. There is evidence that indicates a role for micronutrients supplementation in preventing some pregnancy disorders. Among these, increasing calcium and magnesium intake can reduce the risk of pregnancy induced hypertensive disorders.^[7] Low serum calcium may cause high blood pressure by stimulating parathyroid hormone and renin release and also by inducing vasoconstriction by increasing its level in vascular smooth muscle.^[8] Calcium might also have an indirect effect on smooth muscle function by increasing magnesium levels.^[6] Magnesium plays an important role in peripheral vasodilatation.^[9] Besides serum calcium and magnesium, pregnancy related changes in serum uric acid levels are primarily the result of altered renal handling. Increased serum uric acid in women with preeclampsia has been consistently described which has been secondary to reduce renal urate clearance because of renal dysfunction.^[10] Hyperuricemia induces endothelial dysfunction and may induce hypertension and muscular disease.^[11] Therefore, the modification of calcium,

magnesium and uric acid metabolism during pregnancy could be one of the potential causes of preeclampsia. Thus, the present study aimed to study the levels of serum calcium, magnesium and uric acid in pre-eclamptic and normal women.

MATERIALS AND METHODS

The present study was conducted in the Department of Physiology in collaboration with Department of Obstetrics and Gynecology at Gold Field Institute of Medical Sciences and Research, Chhainsa, Faridabad, Haryana, India. Informed consent was taken from all subjects. The study was conducted from April 2014 to March 2015.

Subjects:

A total of 60 study subjects ranging in age from 18-35 years, attending antenatal clinic of Obstetrics & Gynecology Department were enrolled in the present study. Out of 60 subjects, 30 were pre-eclamptic women and 30 were normal pregnant women.

Inclusion Criteria:

Group-I (Cases):-The study includes 30 pre-eclamptic women with gestational age of ≥ 20 weeks. The diagnosis of pre-eclampsia was based on the definition of American College of Obstetrics and Gynecologists.^[12] (A) Systolic blood pressure greater than 140 mm Hg or a rise of at least 30 mmHg or (B) Diastolic blood pressure greater than 90 mm Hg or a rise of at least 15 mmHg (manifested on two occasions at least 6 hours apart) and (C) Proteinuria of 300 mg or greater in 24 hours urine collection or protein concentration of 1 gm/L (on two occasions of at least 6 hours apart).

Group-II (Controls):-30 normal pregnant women of same gestational age without a history of any systemic illness belonging to the same socio-economic status were considered as controls. Subjects with normal pregnancy were normotensive and had no proteinuria.

Exclusion criteria:

Women having renal disease, liver disease, cardiovascular disease, severe anemia, diabetes, systemic or endocrine disorders, twin pregnancies, known hypertension, women who are taking medication, or other pre-existing medical conditions which alter study parameters were excluded from the study.

Collection of Blood Sample:

About 3-5 ml of venous blood from all subjects was collected in clean, disposable plastic tubes aseptically from anterior antecubital vein. It was allowed to clot for few minutes and was subjected to centrifugation for 10 minutes at 3000 rpm to separate the serum and kept at -20°C until analysis was carried out.

RESULT

Table No. - 1: Showing mean values of different parameters pre-eclamptic women and normal pregnant women.

| Biochemical Parameters | Pre-eclamptic Women (n=30) | Normal Pregnant Women (n=30) | p-value |
|------------------------|----------------------------|------------------------------|---------|
| Calcium (mg/dl) | 8.47±0.27 | 9.60±0.41 | <0.001S |
| Magnesium (mg/dl) | 1.56±0.21 | 2.10±0.10 | <0.001S |
| Uric Acid (mg/dl) | 7.06±0.79 | 4.7±0.31 | <0.001S |

S=statistically significant

The mean calcium levels in pre-eclamptic women and normal pregnant women are 8.47 ± 0.27 mg/dl and 9.60 ± 0.41 mg/dl respectively. Calcium is significantly low in pre-eclamptic women compared to normal pregnant women ($P<0.001$). The mean magnesium levels in pre-eclamptic women and normal pregnant women are 1.56 ± 0.21 mg/dl and 2.10 ± 0.10 mg/dl respectively. There is significant decrease in magnesium levels ($P<0.001$) in pre-eclamptic women as compared to normal pregnant women. The mean uric acid levels in pre-eclamptic women and normal pregnant women are 7.06 ± 0.79 mg/dl and 4.7 ± 0.31 mg/dl respectively. There is significant elevation of uric acid ($P<0.001$) in study group in comparison to normal pregnant women.

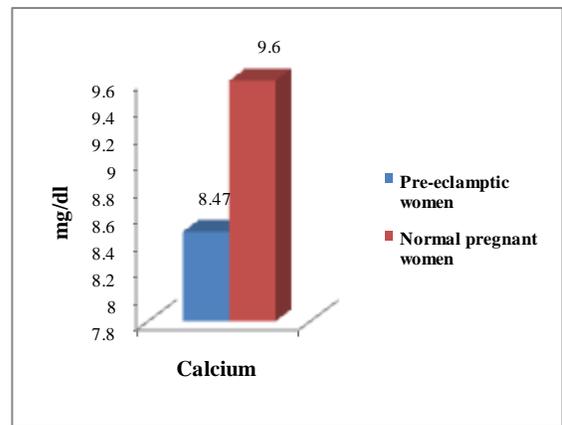
Parameters Measured:

The following parameters were estimated in the present study-

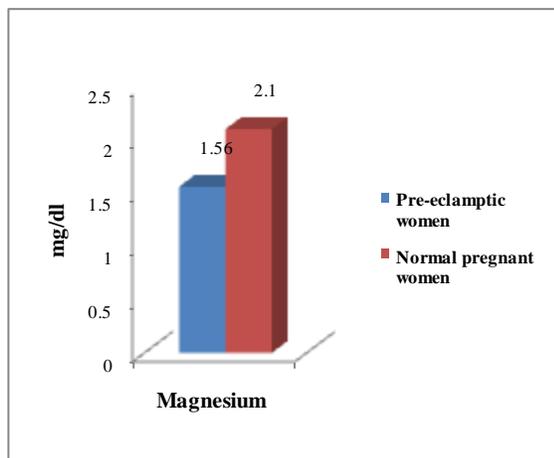
1. Serum Calcium by O-CresolphthaleinComplexone [OCPC] method. [13]
2. Serum Magnesium by Calmagite colorimetric method. [14]
3. Serum Uric acid by uricase method. [15]

Statistical analysis:

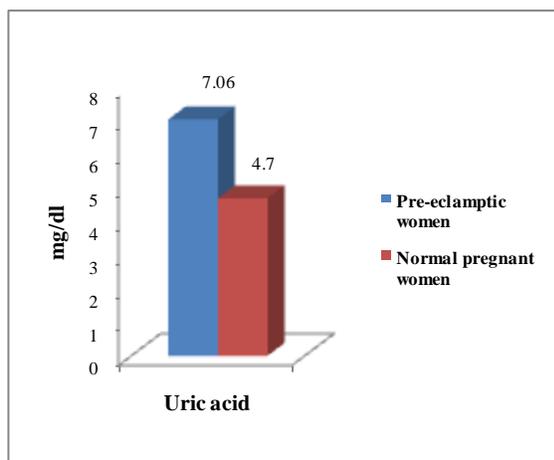
Results were statistically analyzed by 'GraphPadQuickCals t-test calculator'. Student's t-test was used to assess the significance of difference between the groups. All results are presented as mean \pm S.D. A 'p' value of less than 0.001 was considered significant.



Bar Diagram No. 1: Showing comparison of mean serum Calcium level between Pre-eclamptic women and Normal pregnant women.



Bar Diagram No. 2: Showing comparison of mean serum Magnesium level between Pre-eclamptic women and Normal pregnant women.



Bar Diagram No. 3: Showing comparison of mean serum Uric acid level between Pre-eclamptic women and Normal pregnant women.

DISCUSSION

The present study was undertaken to compare the changes which may occur in the levels of serum calcium, magnesium and uric acid in pre-eclamptic patients and normal pregnant women.

In the present study, level of serum calcium in the pre-eclamptic women was decreased significantly ($p < 0.001$) when compared to normal pregnant women. Studies conducted by Patel et al, [16] Akhtaret al, [17] Mohieldein et al [18] and Indumati et al [19] and Lambe et al [20] also showed significant reduction in serum

calcium in the preeclampsia patients. Decreased serum calcium leads to increase in parathyroid hormone level and increase in the membrane permeability. This leads to shift of calcium intracellularly and increase in the vascular smooth muscle contraction. [17,21] Low calcium in the serum also elicits 1, 25-dihydroxy cholecalciferol response which stimulates calcium influx into vascular endothelial cells thus increasing the blood pressure. [18]

Serum magnesium level in pre-eclampsia patients in our study was decreased significantly ($p < 0.001$) compared to healthy pregnant women. This was in agreement with Sandip et al [22] and Lambe et al. [20] Reduction in the level of extracellular magnesium causes partial membrane depolarization and decreased repolarization along with opening of membrane calcium channels leading to shift of calcium intracellularly. This phenomenon produces vasoconstriction and rise in the blood pressure. [19,23] Further it has been said that low serum magnesium increases endothelin-1 mediated smooth muscle contraction and hampers the release of prostacyclin from the endothelial cells of the umbilical arteries again manifesting as increase in the blood pressure. [24]

In the present study, there was significant increase in the levels of serum uric acid in pre-eclamptic women as compared to normal pregnant women. This was in agreement with previous studies done by Sandip et al, [22] Bhaskar et al. [25] The increase in serum uric acid has been mainly secondary to reduced renal urate clearance because of renal dysfunction. Soluble uric acid impairs nitric oxide generation in endothelial cells. Thus, hyperuricemia can induce endothelial dysfunction. [25]

CONCLUSION

In the present study, there was decrease in the levels of calcium and

magnesium in pre-eclamptic women where as there was increase in the level of uric acid in pre-eclamptic women. Serum calcium, magnesium and uric acid can be considered as factors having a role in the etiopathogenesis of the disease. Thus, assessment of these parameters is useful in the early diagnosis of pre-eclampsia. However, further studies with adequate sample size are needed for proper conclusion.

REFERENCES

1. Kashinakunti SV, Sunitha H, Gurupadappa K, Shankarprasad DS, Suryaprakash G, Ingin JB. Lipid peroxidation and antioxidant status in pre-eclampsia. *Al Ameen J Med Sci* 2010;3(1):38-41.
2. Patil SB, Kodliwadmath MV, Kodliwadmath SM, Patil MB. Lipid peroxidation and non-enzymatic antioxidants status in preeclamptic and postpartum preeclamptic women. *National J Basic Med Sci*;3(1):39-43. Available from www.njbms.com
3. World Health Organization. The World Health Report. Life in the 21st century; a vision for all. Geneva: WHO 1998, pp.97, 1998.
4. Cunningham FG, Leveno KJ, Bloom SL, Hauth JC, Gilstrap LC III, Wenstrom KD. *Williams Obstetrics*. 22nd ed. New York: McGraw – Hill:761-808.
5. Sukonpan K, Phupong V. Serum calcium and serum magnesium in normal and pre-eclamptic pregnancy. *Arch GynecolObste*2005;273:12-6.
6. Hofmeyr GJ, Duley L, Atallah A. Dietary calcium supplementation for prevention of pre-eclampsia and related problems: a systematic review and commentary. *BJOG*2007;114:933-43.
7. Cetin I, Berti C and Calabrese S. Role of micronutrients in the periconceptional period. *Human Reprod Update*2010; 16(1):80-95.
8. Kanagal DV, Rajesh A, Rao K, Devi UH, Shetty H, Kumari S, Shetty PK. Levels of serum calcium and magnesium in pre-eclamptic and normal pregnancy: A study from coastal India. *J ClinDiag Res* 2014;8(7):1-4.
9. Punthumapol C, Kittichotpanich B. Serum Calcium, Magnesium and Uric Acid in Pre-eclampsia and Normal Pregnancy. *J Med Assoc Thai*2008; 91(7):968-72.
10. Kumru S, Aydin S, Simsek M, Sahin K, Yaman M, Ay G. Comparison of SerumCopper, Zinc, Calcium and Magnesium Levels in Pre-eclamptic and Healthy Pregnant Women. *Biol Trace Elem Res*2003;94:105-12.
11. Ziael S, Ranjkesh F, Faghihzadeh S. Evaluation of 24-hour copper in preeclampticvs normotensive pregnant and non-pregnant women. *Int J FertilSteril*2008;2:9-12.
12. American college of obstetrics and gynecologists. Management of pre-eclampsia. Technical Bulletin No. 1. Washington, DC; American college of Obstetrics and Gynecologists, 1986.
13. Giteman HJ. An improved procedure for determination of calcium in biological specimens. *Anal Biochem* 1967;18:521-31.
14. Gindler EM, Heth DA. Colorimetric determination with bound “Calmagite” of magnesium in human blood serum. *ClinChem* 1971;17:662.
15. Henry RJ. Estimation of uric acid. *Am J ClinPathol* 1957; 28:645-7.
16. Patel A, Singh B, Patel A, Sharma M, Serum calcium level in pregnancy induced hypertension, *Int J Biol Med Res* 2012;(3):1914-8.
17. Akhtar S, Begum S, Ferdousi S, Calcium and Zinc Deficiency in Pre-eclamptic Women, *J Bangladesh SocPhysiol* 2011;6(2):94-9.
18. Mohieldein AH, Dokem AA, Osman YHM, Idris HMA, Serum calcium level as a marker of pregnancy induced hypertension, *Sudan JMS* 2007;2 (4):245-8.

19. Indumati V, Kodliwadmath MV, Sheela MK, The Role of Serum Electrolytes in Pregnancy Induced Hypertension, J ClinDiagn Res 2011;5(1):66-9.
20. Lambe S, Mahajan B, Muddeshwar M. Comparative study of serum calcium, magnesium and zinc levels in preeclampsia and normal pregnancy. Int J Recent Trends Sci Tech 2014;9(3): 422-426.
21. Adamova Z, Ozkan S, Khalil RA, Vascular and Cellular Calcium in Normal and Hypertensive Pregnancy, CurrClinPharmacol 2009;4(3):172-90.
22. Sandip S, Asha K, Paulin G, Hiren S, Gagandeep S, Amit V. A comparative study of serum uric acid, calcium and magnesium in pre-eclampsia and normal pregnancy. J Advance Res BiolSci 2013;5(1):55-58.
23. Farzin L, Sajadi F, Comparison of serum trace element levels in patients with or without pre-eclampsia, J Res Med Sci 2012;17:938-41.
24. Maksane S, Ranka R, Maksane N, Sharma A, Study of Serum Lipid Profile and Magnesium in Normal Pregnancy and in Preeclampsia: A Case Control Study, Asian J Biochem 2011;6(3):228-39.
25. Bhaskar N, Kaur H, Qazi N. Serum Calcium, Magnesium and Uric Acid in Preeclamptic and Normal Pregnancies in a Tertiary Care Hospital: A Comparative Analysis. Indian J Maternal Child Health 2011;13(3):1-7.

How to cite this article: Garg DK, Mahat RK, Arora M et. al. Study of serum calcium, magnesium and uric acid in pre-eclamptic and normal pregnant women. Int J Health Sci Res. 2015; 5(6):263-268.

International Journal of Health Sciences & Research (IJHSR)

Publish your work in this journal

The International Journal of Health Sciences & Research is a multidisciplinary indexed open access double-blind peer-reviewed international journal that publishes original research articles from all areas of health sciences and allied branches. This monthly journal is characterised by rapid publication of reviews, original research and case reports across all the fields of health sciences. The details of journal are available on its official website (www.ijhsr.org).

Submit your manuscript by email: editor.ijhsr@gmail.com OR editor.ijhsr@yahoo.com