Original Article

Zinc Level in Pregnancy

Serum Concentration of Zinc in Healthy Pregnant Women Versus Pre-Eclamptic Pregnant Women: A case Control Study in Lahore, Pakistan

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ABSTRACT

Objective: To find out serum zinc level in healthy pregnant women and pre-eclemptic pregnant women.
Study Design: Ramdomized controlled trial study
Place and Duration of Study: This study was conducted at Department of Pathology, Lady Willingdon Hospital, Lahore and at Lahore College for Women University, Lahore from March 2015 to September 2015.
Materials and Methods: Size of sample was determined statistically by using table and119 (102 experimental group(51 pre-eclamptic pregnant women and 51 normal pregnant women) and 17 control group) blood samples were collected randomly.
Results: The average zinc concentration in healthy pregnant group was found 1.44 ± 0.14 mg/l as compared to pre-eclamptic pregnant group 0.25 ± 0.02 mg/l. In pregnant women average zinc concentration was found to be decreasing with trimester. The average systolic blood pressure in healthy pregnant women was 113.83±1.74 mm/Hg as compared to the pre-eclamptic pregnant women was 145.34±1.68 mm/Hg. Average diastolic blood pressure in healthy pregnant women, was found 75.23±1.46 mm/Hg as compared to pre-eclamptic pregnant women, which was 92.76±1.80 mm/Hg.
Conclusion: Zinc level in the blood serum of pre-eclamptic pregnant women was found lower as compared to healthy pregnant women. Low blood serum zinc level is associated with the elevated systolic and diastolic blood pressure also.
Key Words: Zinc, pre-eclampsia, pregnant women, Lahore

Citation of article: Latif AA, Manzoor F, Mushtaq S, Noureen T, Fatima S, Nisar N, Ashfaq F, Fazal S, Mansha M, Rana MS. Serum Concentration of Zinc in Healthy Pregnant Women Versus Pre-Eclamptic Pregnant Women: A case Control Study in Lahore, Pakistan. Med Forum 2016;27(10):30-34.

INTRODUCTION

Although, pregnancy is a normal physiological state in the maternal environment, but its complications are the cause of about 600,000 women death every year in the word.[1] Pre-eclampsia (PE), as a risky pregnancy, is a systemic disease characterized by hypertension, proteinuria and edema, which are thought to be the result of diffuse endothelial activation and dysfunction.[2-5]

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Received: July 23, 2016; Accepted: August 12, 2016

Pre-eclampsia affects 5-7% of pregnancies. It is responsible for greater number of fetal and maternal mortality and morbidity because it is a multisystem disease.[6] According to world health organization (WHO) 10% maternal mortality is due to pre-eclampsia. Pre-eclampsia in Asian women causes bad pregnancy outcomes.[7] Prevalence of pre-eclampsia varies in different regions.[8] In states there is 3.4% prevalence of pre-eclampsia.[9] Whereas in Australia and Brazil prevalence is 3.3% and 8.9% respectively.[10-11]
Minerals have important influence on the health of pregnant women and growing fetus. Among them, serum or placental zinc (Zn) concentrations have been reported to be low or unchanged in Pre-eclamptic women.[12] Zinc plays a role of communicator between the cells and converts intra-cellular stimuli into intercellular stimuli.[13-14] More than 300 enzymes require zinc for their proper functioning, thus zincplays significant role in reproductive health [15-16]. Zinc deficiency causes many pregnancy related problems such as growth restriction of fetus, bleeding after delivery and preeclampsia [17-18].82% of pregnant women in the world are bearing insufficient intake of dietary

zinc, which is associated with pre-eclampsia [19-20]. In developing countries intake of minerals is low due to which prevalence of pre-eclampsia is high in these counties[17].

MATERIALS AND METHODS

A case control study was designed and 119 blood samples (102 experimental subjects and 17 control) were collected from the department of pathology, Lady Willingdon hospital Lahore from March 2015 to September 2015. From experimental group 102 blood samples of pregnant females (51 pre-eclamptic pregnant women and 51 normal pregnant women) were collected. From control group only 17 blood samples of non-pregnant females were collected. All demographic data was entered in questionnaire by researcher personally.

Inclusion criteria:

- Normal Pregnant women
- Pre-eclemptic pregnant women
- Non pregnant women

Exclusion criteria:

- Any kind of pathological infection
- HIV +ve
- HCV +ve
- HBC +ve
- Anemia +ve
- Insufficient information
- Genetic disorder e.g. thalassemia +ve

All samples were analyzed on the polarized Zeeman atomic absorption spectrophotometer (Z 5000) in following steps.[21]

Dilution of serum sample:

For the dilution of serum sample 500µl of serum sample was mixed with 2.5ml of de-ionized sample.

Deproteinization of serum:

Diluted serum sample was than deproteinized by the addition of 5 drops of 5% TCA (Tricarboxylic acid) and centrifuged for 2-3 minutes. Supernatant fluid was separated from the sedimented layer.

Acid digestion:

4 drops of HNO_3 was added to each sample after filtration for acid digestion.

Filtration of serum:

All the serum samples were filtered thorough SS filtration assembly (Whatman filter paper).

Analysis:

Preparation of the standard solutions and stock:

Standard solutions and stock solutions were freshly prepared every time for the analysis. Thus different concentrations of standard solution were made from the stock solution of 1000 ppm provided by the ISO certified company. Standard of salt of 1000 mg/l concentration was used for the preparation of stock solution. Few drops of concentrated HCl were added.

RESULTS

Serum zinc concentration (mg/l) in subject groups (S1, S2 and S3):

The average zinc concentration in experimental group1 (1st trimester), 2 (2nd trimester) and3 (3rd trimester)was found 0.78 ± 0.25 mg/l, 0.53±0.09 mg/l, 0.56 ± 0.08 mg/l respectively. Whereas average serum zinc concentration in control group (non-pregnant) was found 0.61 ± 0.12 mg/l (table no. 1). ANOVA test indicated a non- significant ($p>0.05$) decrease in blood zinc level in blood serum of pre-eclamptic pregnant women.

Measurement and comparison of zinc (mg/l) among healthy pregnant and pre-eclamptic pregnant women:

The average zinc concentration in healthy pregnant group, which was 1.44 ± 0.14 mg/l as compared to pre-eclamptic pregnant group, which was 0.25 ± 0.02 mg/l. ANOVA test showed significant ($p<0.05$) decrease in blood zinc level in blood serum of pre-eclamptic pregnant women.

Systolic and diastolic blood pressure (mm/Hg) among control group and experimental groups:

The average systolic blood pressure in subject group 1, 2 and 3 was found 123.5 ± 3.80 mm/ Hg, 123.3 ± 2.83 mm/ Hg and 125.9 ± 1.90 mm/ Hg respectively as compared to the control group (non-pregnant), which was 118.9 ± 2.75 mm/Hg. The average diastolic blood pressure in subject group 1, 2 and 3 was found 82.16 ± 2.88 mm/Hg, 85.96 ± 2.86 mm/Hg and 89.78±2.12 mm/Hg respectively as compared to the control group (non-pregnant), which was 97.16 ± 1.70 mm/Hg (table no. 1).

The average systolic blood pressure in subject group of healthy women, was found 113.83±1.74 mm/Hg as compared to the subject group of pre-eclamptic pregnant women, which was 129.34±1.68 mm/Hg. ANOVA test which showed significant ($p<0.05$) increase in blood pressure.The average diastolic blood pressure in subject group of healthy women, was found 75.23±1.46 mm/Hg as compared to the subject group of pre-eclamptic pregnant women, which was 92.76±1.80 mm/Hg. ANOVA test which showed significant ($p<0.05$) increase in blood pressure.

Figures-1 showing comparison of No. of cases in Pre-eclamptic pregnant and Healthy pregnant, figure-2 showing serum zinc level (mg/l) Zinc conc. (mg/l) in Pre-eclamptic pregnant and Healthy pregnant, figure-3 showing Systolic BP (mm/Hg) in Pre-eclamptic pregnant and Healthy pregnant and figure-4 showing the Diastolic BP (mm/Hg) in Pre-eclamptic pregnant and Healthy pregnant.

Table No.1: Comparison of serum zinc level (mg/l) among healthy pregnant groups and control group

Groups	No. of cases	Zinc conc. (mg/l)	Systolic BP (mm/Hg)	Diastolic BP (mm/Hg)
S1 group	17	0.78 ± 0.25	123.5 ± 3.80	90.16 ± 2.88
S2 group	17	0.53±0.09	123.3 ± 2.83	95.96 ± 2.86
S3 group	17	0.56 ± 0.08	125.9 ± 1.90	97.78±2.12
Control group	17	0.61 ± 0.12	118.9 ± 2.75	82.16 ± 1.70

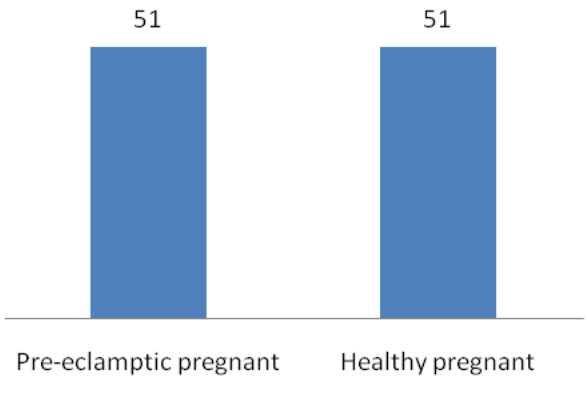

Figure No. 1 : No. of cases in Pre-eclamptic pregnant and Healthy pregnant

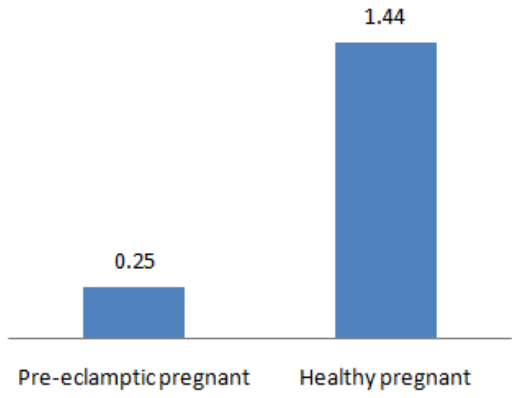

Figure No. 2: Zinc conc. (mg/l) in Pre-eclamptic pregnant and Healthy pregnant

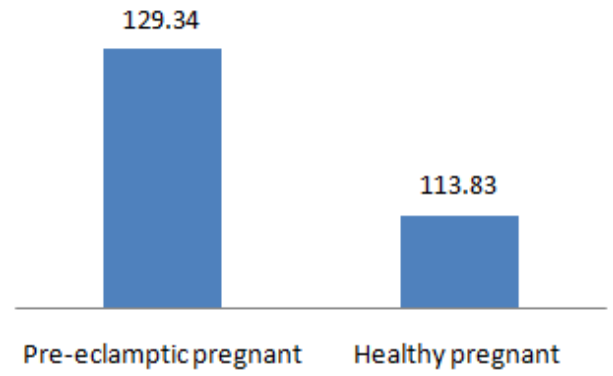

Figure No. 3: Systolic BP (mm/Hg) in Pre-eclamptic pregnant and Healthy pregnant

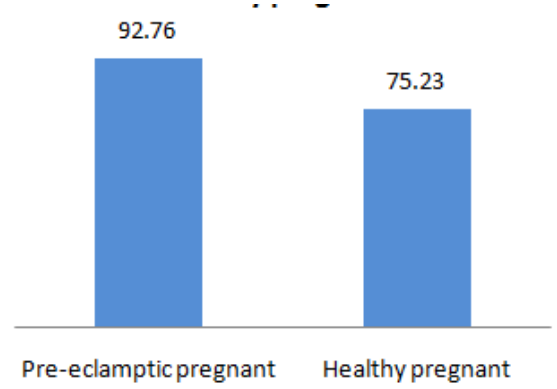

Figure No. 4: Diastolic BP (mm/Hg) in Pre-eclamptic pregnant and Healthy pregnant

DISCUSSION

It was observed from the results, that the serum zinc level was gradually decreased with the increasing trimester. At the end of the 2nd trimester and in 3rd trimester there was basically a decrease in the serum concentration of zinc. This result was according to the findings of Ilhan *et al*. (2002),who showed that pre-eclampsia occur in the late second or third trimesters and gestational product is hardly affected.[21]

In this study it was found that the serum zinc level of pre-eclamptic pregnant woman was 0.25 mg/L was lower as compared to the healthy pregnant women, which had concentration of 1.10 mg/L. This result was compared with the Ahsan *et al.* (2010) which had higher serum zinc concentration among the pre-eclamptic pregnant and control healthy pregnant women. [22]

Serum zinc concentration in pre-eclampsia 0.25 ± 0.02 mg/l and it was 0.61 ± 0.12 mg/l in non-pregnant controls. These results show that zinc deficiency is not bounded to the only pregnant women. It can be occurred in the non-pregnant control group, due to the inadequate intake of zinc dietary components. It is little bit different from the results of Ahsan *et al.* (2010). Serum zinc level of pregnant women is lower as compared to non-pregnant women. This is attributed to the fact that during pregnancy need of zinc increases because of crucial requirements of zinc. That is why a pregnant woman need to take more amount of zinc as compare to non- pregnant woman.

In this study the prevalence of systolic and diastolic blood pressure among the pre-eclamptic pregnant women was found 129.34 mm/Hg and 92.76 mm/Hg respectively. Our observed value was lower than the study of the Gifford *et al*. (2000) who reported a systolic blood pressure of 140 mmHg. The slight difference in Gifford *et al.* (2000) result and ours may be due to ethnic differences. [23]

CONCLUSION

In developing countries like Pakistan health of women is badly neglected, which affectsthe health of both mother as well as child. In the present study zinc level in the blood serum of pre-eclamptic pregnant women were found lower as compared to the control, which is effect of poor consumption of zinc containing dietary substances. Low blood serum zinc level is associated with the elevated systolic and diastolic blood pressure and proves that pre-eclamptic pregnant women is highly prone to hypertension which is seriously hazardous to the health of women and also for his offspring.

Recommendation:

- Health education and public awareness is necessary to prevent the zinc deficiency in pre-eclamptic pregnant women
- Medical community should continue research regarding to the pre-eclampsia especially in Pakistan

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. Nestel P. Strategies, policies and programs to improve the nutrition of women and girls. [Online] 2000. Available from: URL: www.fantapraject.org/
2. Kauma S, Takacs P, Scordalakes C, Walsh S, Green K, Peng T. Increased endothelial monocyte chemoattractant protein-1 and inter- leukin-8 in preeclampsia. Obstet Gynecol 2002;100:706-14.
3. .Diaz E, Halhali A, Luna C, Diaz L, Avila E, Larrea F. Newborn birth weight correlates with placental zinc, umbilical insulin-like growth factor I, and leptin levels in preeclampsia. Arch Med Res 2002;33:(1):40-7.
4. Serdar Z, Gur E, Develioglu O, Colakogullari M, Dirican M. Placental and decidual lipid peroxidation and antioxidant defenses in preeclampsia lipid peroxidation in preeclampsia. Pathophysiol 2002;9:21–5.
5. Kumar CA, Das UN. Lipid peroxides, antioxidants and nitric oxide in patients with preeclampsia and essential hypertension. Med Sci Monit 2000;6: 901–7.
6. Wagner LK. Diagnosis and management of preeclampsia. Am Fam Physician 2004; 70(12): 2317- 24.
7. Cripe S, OBrien W, Gelaye B, Williams M. Perinatal Outcomes of Southeast Asians with Pregnancies Complicated by Gestational Diabetes Mellitus or Preeclampsia. J Immigr Minor Health 2012;14:747-753.
8. Ota E, Ganchimeg T, Mori R, Souza JP. Risk factors of pre-eclampsia/eclampsia and its adverse outcomes in low-and middle-income countries: a WHO secondary analysis. PloS one 2014; 9: e91198.
9. Ananth CV, Keyes KM, Wapner RJ. Pre-eclampsia rates in the United States, 1980-2010: age-period-cohort analysis. BMJ 2013;347:f6564.
10. Bergamo AC, Zeiger BB, Vidal DHB, Marcal VMG, David MLDC, Ribeiro ACL, et al. The epidemiology of preeclampsia in a reference hospital. Pregnancy Hypertension: An International Journal of Women's Cardiovascular Health 2015; 5:114.
11. Thornton C, Dahlen H, Korda A, Hennessy A. The incidence of preeclampsia and eclampsia and associated maternal mortality in Australia from population-linked datasets: 2000-2008 Am J Obstet and Gynecol 2013;208:476, e471 – 475.
12. Ilhan N, Ilhan N, Simsek M. The changes of trace elements, malondialdehyde levels and superoxide dismutase activities in pregnancy with or without preeclampsia. Clin Biochem 2002;35:393–397.
13. Fukada T, Yamasaki S, Nishida K, Murakami M, Hirano I. Zinc homeostasis and signaling in health and diseases: zinc signaling. J BiolInorg Chem 2011; 16:1123-1134.
14. Frederickson CJ, Koh J, Bush AI. The neurobiology of zinc in health and disease. Nat Rev Neurosci 2005; 6:449-462.
15. Bader AA, Hussain T, Mosawi MA, Otaibi M, Abul H, Khalifa D, et al. Serum zinc and copper concentrations in pregnant women from Kuwait. J Trace Elem Exp Med 1997;10:209-215.
16. Ashraf M, Nasarullah M, Salam A, Khurshid R, Ahmed Z. Maternal serum zinc concentration in gravidae suffering from preeclampsia. APMC 2007;1(1):24-27.
17. Jain S, Sharma P, Kulshreshtha S, Mohan G, Singh S. The role of serum calcium, magnesium, and zinc in pre-eclampsia. Biol Trace Elem Res 2010; 133(2):162–170.
18. Bahadoran P, Zendehdel M, Movahedian A, Zahraee RH. The relationship between serum zinc level and pre-eclampsia. Iran J Nurs Midwifery Res 2010;15:120–124.

19. Pathak P, Kapoor SK, Kapil U, Dwivedi SN. Serum magnesium level among pregnant women in a rural community of Haryana state. Ind Eur J Clin Nutr 2003;57: 1504- 06.
20. Nourmohammadi I, Akbaryan A, Fatemi Sh, Meamarzadeh AR Nourmohammadi. Serum zinc concentration in Iranian preeclamptic and normotensive pregnant women. Middle East J Fam Med 2008; 6(4): 30-32.
21. Bahadoran P, Zendehdel M, Movahedian A, Zahraee RH. The relationship between serum zinc level and preeclampsia. Iran J Nurs Midwif Res 2010;15:120–124.
22. Ahsan T, Begum RS, Islam SN. Serum Zinc Level in Pre-eclamptic Pregnancies: Association with Clinical Complication. Bangladesh Med J 2010; 39(1):7-10.
23. Gifford RW, August PA, Cunningham G, Green LA, Lindheimer MD, McNellis D, et al. Report of the national high blood pressure education program working group on high blood pressure in pregnancy. Am J Obstet Gynecol 2000;183:1-22.