Section: Biochemistry

Original Research Article

SERUM ZINC LEVEL IN PREGNANT WOMEN WITH AND WITHOUT PREECLAMPSIA: A CROSS-SECTIONAL STUDY CONDUCTED IN NORTHEAST INDIA

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ABSTRACT

Background: Preeclampsia is defined as the new onset of hypertension and significant proteinuria in a previously normotensive women on or after 20th week of gestation with or without pathological edema. It is characterized by an increased in systolic blood pressure of ≥ 140 mmHg and diastolic blood pressure of ≥ 90 mmHg measured on two occasions with a gap of at least 6 hours. Studies have shown that the pathogenesis of adverse pregnancy outcomes, such as preeclampsia and fetal growth restriction, is linked to oxidative stress. Deficiencies of essential trace elements like zinc which plays an important role in regulating balance between free radicals and antioxidants in the body play a role in the development of preeclampsia. This study aims to investigate serum zinc level in pregnant women with and without preeclampsia and to determine the relationship between serum zinc level and preeclampsia. **Materials and Methods:** This is a cross-sectional study conducted in Department of Biochemistry in collaboration with Department of Obstetrics & Gynaecology, RIMS, Imphal. The study includes 50 preeclamptic women as cases and 50 normotensive women as controls who were admitted in Obstetrics & Gynaecology Ward in RIMS. Blood samples were collected after taking informed consent. Serum Zn was estimated using Beckman Coulter DxC 700 AU autoanalyzer. **Results:** In this study, it is found that serum zinc were much lower in cases (24.95±12.63 µg/dL) than that of controls (35.61±22.39 µg/dL) and the difference was statistically significant (p-value<0.05). A negative correlation between serum zinc and systolic and diastolic blood pressure were observed in preeclamptic women, which was found to be statistically significant. **Conclusion:** Serum zinc level was found to be significantly lower in preeclamptic women compared to normal controls. Early identification and correction of trace element deficiency serves as a simple and cost effective strategy in resource limited settings.

INTRODUCTION

Preeclampsia is defined as the new onset of hypertension and significant proteinuria in a previously normotensive women on or after 20th week of gestation with or without pathological edema. It is characterized by an increased in systolic blood pressure of ≥ 140 mmHg and diastolic blood pressure of ≥ 90 mmHg measured on two occasions with a gap of at least 6 hours.[1,2] It complicates 2-8

% of all pregnancies and is considered as one of the leading causes of maternal mortality and preterm delivery throughout the world.[3] However, the incidence of preeclampsia is found to be much higher in the developing countries when compared with developed countries where it accounts for 20-80 % of maternal mortality.[4,5] In India, the incidence of preeclampsia is reported to be 15.2 % of total pregnancies.[6]

The etiology and pathophysiology of preeclampsia remain unknown but it is believed to be related to the placental and maternal vascular dysfunction,[7,8] Some studies have also shown that, changes in the levels of serum trace elements in preeclamptic women play a role in its pathogenesis while others have failed to shown any association.[9]

Micronutrients such as copper, zinc, magnesium, manganese and selenium are involved in antioxidant defense in the body by acting as cofactors of various enzymes and they also play a pivotal role in metabolism and in the preservation of tissue function.[10,11] Deficiency of bio-elements essential for antioxidant defense mechanisms and exposure to excess toxic metals in the environment causes oxidative stress leading to preeclampsia.[12]

Zinc which is the second most abundant trace element in the body is crucial for maintaining normal reproductive health.8 It is also required for the proper functioning of antioxidant enzymes which protect cells from free radicals injury.[13] Zn deficiency during pregnancy may also cause impairment of antioxidant potential of cells by decreasing superoxide dismutase activity and increasing lipid peroxidation which are associated with detrimental pregnancy outcomes such as fetal malformation, fetal growth restriction, preterm delivery, preeclampsia and bleeding after delivery.[3,14]

Zinc level has been shown to fluctuate during pregnancy with important implications for the fetus as well as mother.[3,5] Few studies have shown that depleted level of zinc acts as a contributing factor in the physiological events of preeclampsia. Thus, this study was carried out to evaluate the level of zinc in preeclamptic patients and compare it with normal pregnant women.

MATERIALS AND METHODS

It was a hospital based analytical cross-sectional study conducted in the Department of Biochemistry and Department of Obstetrics & Gynaecology, Regional Institute of Medical Sciences (RIMS), Imphal, Manipur, India, from March 2022 to March 2025. The study involved two groups of subject-Group I (cases) comprising 50 preeclamptic women and Group II (controls) which included 50 normotensive women. The participants were recruited by consecutive sampling. The study was approved by the Research Ethics Board, RIMS, Imphal.

Inclusion Criteria

- Women of age 18 years or above
- Diagnosed cases of preeclamptic women and pregnant women without preeclampsia who were admitted in Antenatal Ward, RIMS, Imphal.

Exclusion Criteria

- Pre-existing hypertension
- Multiple pregnancies
- Gestational diabetes mellitus
- Renal diseases
- Neoplastic diseases
- Thyroid diseases
- History of taking Zn supplement

Blood sample collection and laboratory methods

3ml of venous blood was collected in plain vial and serum was collected after centrifugation for 10 minutes at 3000 rpm and stored at -20℃ till analysis. Serum zinc was measured using Beckman Coulter DxC AU 700 autoanalyser.

Statistical analysis

The collected data was analysed using IBM SPSS version 26.0 for windows. Descriptive statistics like mean and standard deviation (SD) was used to summarize the findings. Continuous data like age, SBP, DBP, serum zinc level were analysed and expressed in mean and Standard Deviation. To compare the levels of serum zinc level in pregnant women with and without preeclampsia student's t-test was used. P value <0.05 was considered as statistically significant. Maternal serum zinc level during pregnancy was divided into two groups: serum zinc concentration less than 56 µ g/dL for zinc deficiency and serum zinc concentration more than 56 µ g/dL for zinc sufficiency.[15]

RESULTS

Table 1: Demographic and clinical characteristics of preeclamptic women (Cases) and healthy pregnant women (Controls)

Characteristics	Case (n=50) M±SD	Control (n=50)	p-value
Age	31.8±5.5	29.9±5.5	0.088
Gestational age	34.8±2.9	35.3±3.0	0.347
SPB	152.72±7.21	119.16±2.86	<0.001
DBP	106.92±4.77	81.20±3.08	<0.001

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[Table 1] shows that there was no significant difference in age distribution and gestational age between the cases and the control groups. However, SBP and DBP were significantly higher in the case group as compared to the control group. And the difference was statistically significant with p-value <0.001.

Table 2: Mean maternal zinc level in cases and controls

Mean maternal zinc level (µg/dl)	Cases (n=50)	Control (n=50)	p-value
Mean ± SD	24.95±12.63	35.61±22.39	0.033

[Table 2] shows that serum zinc level was found to be lower in cases group (24.95±12.63 µg/dL) as compared to the control group (35.61±22.39 µg/dL). And the difference was found to be statistically significant with p-value <0.05.

Table 3: Odds ratio (OR) and 95% confidence intervals (CI) for preeclampsia

Maternal serum zinc level (µg/dl)	Case (n=50)	Control (n=50)	p-value	Odd's Ratio	95% CI (lower upper value)
<56 µg/dl	50	40	<0.05	26.19	1.49-460.47
>56 µg/dl	0	10			

[Table 3] shows that the pregnant women with zinc level <56 µg/dL had 26.19 times more chance to have preeclampsia compared to those of the pregnant women with zinc level ≥56 µg/dL (p-value <0.05; OR=26.19; 95% CI=1.49-460.47).

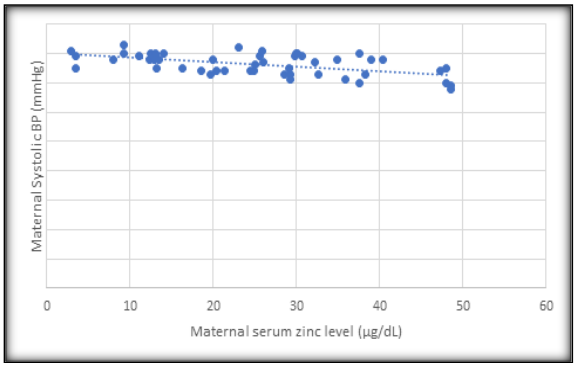

Figure 1: Scatterplot diagram showing correlation between serum zinc level and systolic blood pressure (SBP) in patients with preeclampsia (cases group)

[Figure 1] shows a negative correlation (r=-0.534) between maternal serum zinc level and systolic blood pressure among the case group, which was found to be statistically significant (p-value=0.001).

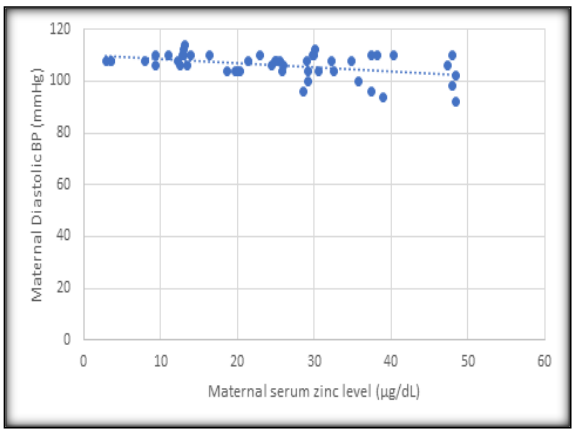

Figure 2: Scatterplot diagram showing correlation between serum zinc level and diastolic blood pressure in patients with preeclampsia (cases group)

[Figure 2] shows a negative correlation (r=-0.446) between maternal serum zinc level and diastolic blood pressure among the cases group, which was found to be statistically significant (p-value<0.001).

DISCUSSION

The study showed that there was no significant difference in the maternal age between the cases and control group (p-value > 0.05) which was consistent with the finding from a study conducted by Mohamed AS et al,[16] However, these findings contrast with the results of Kanagal DV, et al,[5] which found out that the mean age of women with preeclampsia was higher than normotensive controls (p-value <0.05).

The gestational age between cases and controls were also not found to be significant (p-value >0.05) in this study. This is in contrast with a study conducted by Sarwar MS3 where the gestational age was significantly lower in preeclampsia group than the control group (p-value<0.05).

The mean SBP and DBP were found to be significantly higher in the cases than the control group and this was consistent with the findings from the study by Backacak M et al,[17] Gilbert JS et al,[18] stated that placental hypoxia and poor placental perfusion results in imbalance of all the angiogenic factors like vascular endothelial growth factor (VEGF), placental growth factor (PlGF) and sFlt-1 leading to the development of preeclamptic symptoms like hypertension and endothelial dysfunction.

The study showed a significant decreased in serum zinc level among the cases (24.95±12.63 µg/dL) as compared to the controls (35.61±22.39 µg/dL) with a p-value < 0.05. These findings were supported by studies done by Parvin M,[14] Al-Jameil N et al,[19] who found out in their study that the mean serum zinc level in preeclamptic wome4n was significantly lower than the normotensive women, supporting the role of micronutrient deficiency in the development of preeclampsia.

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The exact pathophysiology of preeclampsia is not known, but it is believed to originate from impaired placentation, leading to widespread endothelial dysfunction and systemic inflammation. Oxidative stress plays a central role in this process, with increased production of reactive oxygen species (ROS) and reduced antioxidant capacity. Zinc is an essential trace element involved in antioxidative defense mechanisms of the body and also in immune regulation. And zinc is a key component of antioxidant enzymes like superoxide dismutase. Hence its deficiency may contribute to the pathogenesis of preeclampsia. Thus, disturbances in zinc level could exacerbate the inflammatory and oxidative damage seen in preeclampsia.[20,21]

The lower level of zinc in preeclamptic women may also be due to intake of diet poor in zinc and also may be due to decreased level of zinc binding protein. It may also be the result of hemodilution due to fluid retention in preeclampsia, endogenous steroid production and fetal uptake of zinc from maternal circulation. The findings highlight the potential role of micronutrient assessment during Antenatal Care.

Limitations

The study has certain limitations which include small sample size and was done in single center which may limit its generalizability. Also, the dietary intake of zinc and longitudinal follow up were not assessed. So, studies with larger sample size is recommended.

CONCLUSION

Serum zinc level was found to be significantly lower in preeclamptic women compared to normal controls. The assessment of this trace element is important in Antenatal Care. Early identification and correction of trace element deficiency serves as a simple and cost effective strategy in resource limited settings.

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