

Serum Zinc Status During Different Trimesters of Gestation

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Abstract

Background: Hypozincemia may be found in different trimesters of pregnancy. Gradual alteration of this micronutrient status during pregnancy is associated with increased maternal and infant mortality and morbidity. **Objective:** To measure serum zinc level of pregnant women in different trimesters in order to find out their micronutrient status. **Method:** This cross sectional study was carried out in the Department of Physiology, Sir Salimullah Medical College, Dhaka between 1st January 2010 to 31st December 2010. 90 normal pregnant women, age ranged from 20 to 30 years were included in the study group (Group-B) which was further divided into group B₁ consisting of 30 different pregnant women in 1st trimester, group B₂ consisting of 30 different pregnant women in 2nd trimester and group B₃ consisting of 30 different pregnant women in 3rd trimester. Age matched 30 apparently healthy non-pregnant women (Group A) were also selected for comparison. Serum zinc level was measured by Spectrophotometric method and serum total protein and albumin levels were estimated by standard laboratory technique. Statistical analysis was done by using ANOVA & Spearman rank Correlation as applicable. **Result:** In this study, serum Zn level was significantly lower in 1st ($p < 0.01$), 2nd and 3rd trimester ($p < 0.001$) of pregnant women in comparison to that of non-pregnant women. Again, this value was significantly ($p < 0.001$) lower in 3rd trimester than those of 1st and 2nd trimesters of pregnant women. Moreover, serum Zn concentration showed negative correlation ($r = -0.621$) with different trimesters of gestation and this correlation was statistically significant ($p < 0.001$). **Conclusion:** This study reveals that gradual hypozincemia was observed in pregnant women from 1st to 3rd trimester of gestation.

Key words: Serum zinc, Trimester, Pregnancy.

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Introduction

Pregnancy is associated with physiological changes that result in increased plasma volume and red blood cells and decreased concentrations of plasma proteins and micronutrients. In many developing countries, these changes can be aggravated by under nutrition which has fatal consequences for both mother and newborn infants¹. Different researchers demonstrated that micro and macro nutrients are essential for the development of fetus. In pregnancy many minerals like zinc, copper, calcium and magnesium are transferred from mother to the fetus².

Zinc (Zn) is an essential micronutrient required during different trimesters of pregnancy for fetal development and growth^{3, 4} and its deficiency may affect pregnancy, delivery and outcome of pregnancy⁵. Zinc is essential for normal cellular growth and differentiation⁶ and has an important role in the development of nervous system⁷. This trace element plays an important role in various functions such as immunity, wound healing, growth, reproduction⁸, protein synthesis and nucleic acid metabolism⁹. The recommended daily allowance of Zn is 15mg during pregnancy and

19mg during the lactation period¹⁰. Plasma zinc concentration begins to decline in early pregnancy and continues till term, which is about 35% below the concentration found in non pregnant women¹¹.

It has been observed that serum zinc level was significantly lower during the first and second trimester of pregnancy as compared to non pregnant controls. But this micronutrient level was increased in the third trimester in comparison to that of first and second trimester¹². Some other group of investigators also reported that serum zinc concentration was significantly higher in non pregnant women than that of pregnant women in all stages of gestation. They also observed that serum zinc concentration in pregnant women decreased gradually from the first to the third trimester of pregnancy¹³. Recently similar type of observation has also been reported by some other researchers¹⁴.

Micronutrient deficiency in women of reproductive age is recognized as a major public health problem in our country. Maternal under nutrition may predispose a mother to poor health and adverse pregnancy outcomes. Although some work on maternal serum zinc status and fetal outcome¹⁵ and role of zinc on preterm delivery¹⁶ were done in our country, but little is known about serum zinc level in different trimesters of gestation in healthy women. Therefore, the present study has been undertaken to estimate serum zinc concentration in different trimesters of gestation in apparently healthy women. It is expected that findings of this study would give a guideline to the obstetrician for better management of the pregnant women which may prevent maternal and fetal morbidity and mortality and reduce the risk of complication during and after the delivery.

Methods

This cross sectional study was carried out in the Department of Physiology, Sir Salimullah Medical College, Dhaka between 1st January 2010 to 31st

December 2010. A total number of 120 subjects were taken in this study, and all of them belonged to lower socioeconomic status. Among them 90 normal pregnant women, age ranged from 20 to 30 years were included in the study group (Group-B) which was further divided into group B₁ consisting of 30 different pregnant women in 1st trimester, group B₂ consisting of 30 different pregnant women in 2nd trimester and group B₃ consisting of 30 pregnant women in 3rd trimester. Age matched 30 apparently healthy non-pregnant women (Group A) were also taken for comparison. Protocol of this study was approved by the Institutional Ethics Committee (IEC) of Sir Salimullah Medical College, Dhaka. All the pregnant women were collected from Out Patient Department (OPD) of Gynaecology and Obstetrics of Sir Salimullah Medical College and Mitford Hospital and non-pregnant were selected from personal contact. Subjects having history of any microbial and metabolic diseases, eclampsia/pre-eclampsia, smokers, tobacco/alcohol users, drug abusers and using prescribed medicine were excluded from this study. After selection of the subjects, the objectives and benefits of the study were explained to each subject and written informed consents were taken from the subjects. Detail personal, dietary, medical, family, socioeconomic, occupational and drug history of each subject were recorded in a prefixed questionnaire and thorough physical examinations were also done and documented. Height and weight of the subjects were measured for the calculation of BMI. With all aseptic precautions, 5 ml of venous blood was drawn from median cubital vein by disposable syringe. Then blood sample was drawn directly into the deionized test tube. The whole blood was centrifuged at 3000 rpm for 25 minutes. After that supernatant serum was collected in labeled eppendroff tube and from it 1 ml of serum was taken in plain glass test tube for estimation of serum total protein and albumin by standard laboratory technique¹⁷ in the Department of Physiology, SSMC, Dhaka. Another 1 ml was taken in de-ionized eppendroff tube for estimation of

serum Zn level by Atomic Absorption Spectrophotometric method¹⁸ in the laboratory of Biochemistry Department of Bangabandhu Sheikh Mujib Medical University (BSMMU). The statistical analysis was done by One- way ANOVA (Post Hoc), Bonferroni and Spearman's rank correlation test by using SPSS, version- 16.

Result

All the groups were matched for age. But the mean BMI was significantly ($p < 0.001$) higher in group B₁, B₂ and B₃ than that of group A and also in B₃ than that of B₁. Again no significant difference of this value was observed between group B₁ vs B₂ and B₂ vs B₃ (Table I).

Table I: Mean \pm SD of Age and Body Mass Index (BMI) in different groups (n=120)

Groups	n	Age(years)	BMI(kg/m ²)
A	30	25.43 \pm 3.24	23.94 \pm 1.15
B ₁	30	24.60 \pm 3.11	27.72 \pm 3.27
B ₂	30	24.43 \pm 3.32	29.11 \pm 2.75
B ₃	30	24.63 \pm 3.52	30.82 \pm 2.54

Statistical analysis

Groups	Age (p value)	BMI (p value)
A vs B ₁ vs B ₂ vs B ₃	0.648 ^{ns}	0.000 ^{***}
A vs B ₁	0.999 ^{ns}	0.000 ^{***}
A vs B ₂	0.999 ^{ns}	0.000 ^{***}
A vs B ₃	0.999 ^{ns}	0.000 ^{***}
B ₁ vs B ₂	0.999 ^{ns}	0.223 ^{ns}
B ₁ vs B ₃	0.999 ^{ns}	0.000 ^{***}
B ₂ vs B ₃	0.999 ^{ns}	0.064 ^{ns}

Group A: Apparently healthy non pregnant (Control)
 Group B₁: 1st trimester of gestation.
 Group B₂: 2nd trimester of gestation.
 Group B₃: 3rd trimester of gestation.
 *** = Significant at $p < 0.001$, ns = Not significant

The mean serum Zn level was significantly lower in group B₁ ($p < 0.01$), B₂ ($p < 0.001$) and B₃ ($p < 0.001$) in comparison to that of group A. Again, this value was significantly ($p < 0.001$) lower in group B₃ than those of group B₁ and B₂. Similarly this value was lower in group B₂ in comparison to that of group B₁, but the difference was not statistically significant (Figure 1).

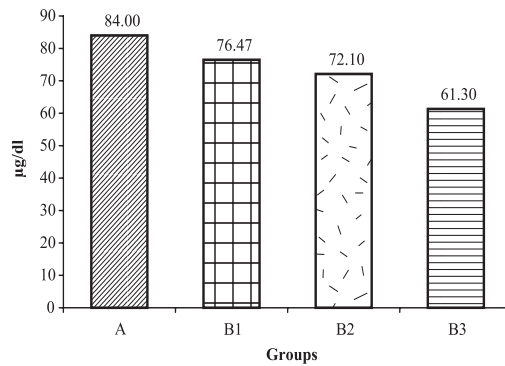


Figure 1: Mean Serum Zinc concentration in different groups (n=120)

The mean serum total protein level was significantly ($p < 0.01$) lower in group B₃ than that of group A. Whereas, this level was almost similar and showed no statistically significant differences among the other groups. Again, mean serum albumin level was significantly lower in group B₂ and B₃ than that of group A ($p < 0.001$) and also of group B₁ ($p < 0.05$). Whereas mean serum globulin level was almost similar and showed no statistically significant difference among the groups. On the other hand, A/G ratio was significantly ($p < 0.05$) lower only in group B₂ in comparison to that of group A (Table II).

Again, serum Zn concentration was negatively correlated ($r = -0.621$) with different trimesters of gestation and this relationship was statistically significant ($p < 0.001$) (Figure 2).

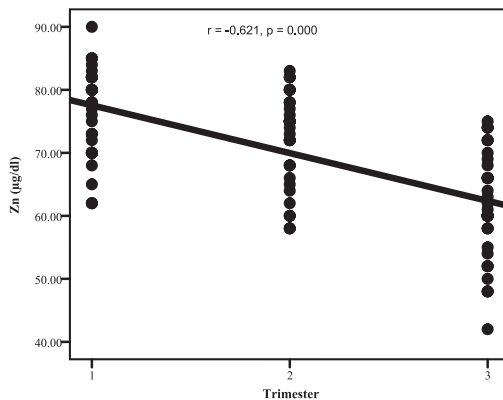
Table II: Mean \pm SD of Serum Total Protein, Albumin, Globulin levels and A/G ratio in different groups (n=120)

Groups	n	Total Protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	A/G ratio
A	30	6.92 \pm 0.98	4.30 \pm 0.71	2.61 \pm 0.88	1.89 \pm 0.90
B ₁	30	6.61 \pm 1.00	3.97 \pm 0.64	2.64 \pm 0.75	1.64 \pm 0.64
B ₂	30	6.31 \pm 1.02	3.53 \pm 0.53	2.78 \pm 0.77	1.38 \pm 0.52
B ₃	30	6.01 \pm 0.94	3.53 \pm 0.54	2.49 \pm 0.70	1.52 \pm 0.47

Statistical analysis

Groups	Total Protein (p value)	Albumin (p value)	Globulin (p value)	A/G ratio (p value)
A vs B ₁ vs B ₂ vs B ₃	0.004**	0.000***	0.553 ^{ns}	0.023*
A vs B ₁	0.999 ^{ns}	0.230 ^{ns}	0.999 ^{ns}	0.843 ^{ns}
A vs B ₂	0.111 ^{ns}	0.000***	0.999 ^{ns}	0.018*
A vs B ₃	0.003**	0.000***	0.999 ^{ns}	0.182 ^{ns}
B ₁ vs B ₂	0.999 ^{ns}	0.037*	0.999 ^{ns}	0.736 ^{ns}
B ₁ vs B ₃	0.123 ^{ns}	0.032*	0.999 ^{ns}	0.999 ^{ns}
B ₂ vs B ₃	0.999 ^{ns}	0.999 ^{ns}	0.907 ^{ns}	0.999 ^{ns}

*** Significant at p<0.001, ** Significant at p<0.01, * Significant at p<0.05, ns Not significant, P > 0.05

**Figure 2:** Correlation of Serum Zinc concentration with different trimesters of gestation (n=90)**Discussion**

In this study, decreased serum Zn level has been found during different trimesters of pregnant women and maximum decreased value was observed in 3rd trimester. This finding is in consistent with that of some other researchers^{19, 20}. On the contrary, serum Zn level was also found higher in the 3rd trimester in comparison to those of 1st and 2nd trimester of pregnant

women¹². This discrepancy might be due to serum Zn level was measured near full term of pregnancy in that study. But in the present study this micronutrient level was measured within 32 weeks of gestation. Again, serum Zn concentration has shown significant (p< 0.001) negative correlation with different trimesters of gestation in present study. Similar observation is also made by other investigators²¹.

Some researchers suggested that decrease in serum albumin, albumin-bound zinc and α -2 macroglobulin-bound zinc contribute to low serum zinc level in pregnancy. The affinity of albumin for Zn of pregnant women is less than that of non-pregnant women, this may be the primary reason of hypozincaemia in pregnancy²². It has also been reported that poor nutritional status, low dietary intake and increased body demand during pregnancy may be responsible for lower level of serum Zn in different trimester of gestation²¹.

Moreover, it has also been suggested that increased urinary Zn excretion decreases serum

Zn level during 1st trimester may be due to increased glomerular filtration rate²³ and decreased availability of Zn binding protein during pregnancy²². Again, lower level of serum Zn in 2nd and 3rd trimester may be due to 30-40% increase in blood volume and increased demand for the fetal development²⁴. Again, serum Zn level become lower during 3rd trimester may be due to several factors such as increased transfer of plasma Zn to maternal erythrocyte²⁵, increased Zn uptake by the fetus and placenta²¹. In addition, high copper intake can decrease zinc absorption by competing at absorption sites causes hypozincemia in pregnancy²⁶. Moreover, it has been suggested that excessive amount of iron and folate supplementation during 2nd and 3rd trimester causes reduction of plasma Zn concentration by inhibiting Zn absorption²⁷. In the light of present accepted views, gradual decrease in serum zinc level in different trimesters of pregnancy may be due to haemodilution, decreased availability of zinc binding protein level, hormonal changes during pregnancy²⁸ and active transport of zinc from mother to the fetus²⁹.

In the present study, a gradual decrease in serum zinc level was observed in pregnant women in different trimesters, which was more pronounced in third trimester. This low serum Zn level in pregnant women of the present series are most likely due to decreased availability of binding protein as their measured value was lower. Furthermore, significant negative correlation of serum Zn level with different trimesters of gestation indicating the requirements of this micronutrient on each trimester of gestation which is more marked in 3rd trimester.

Conclusion

From this study, it can be concluded that gradual hypozincemia was observed in pregnant women from 1st to 3rd trimester of gestation. Hypozincemia may be due to poor nutritional status during pregnancy as serum total protein and albumin

levels were lower in this group of subjects. So, in pregnant women routine screening of serum zinc level during antenatal period is suggested which may reduce pregnancy related complication.

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