Original Research Paper

Biochemistry

STUDY OF NUTRITIONAL TRACE ELEMENTS IN VARIOUS TRIMESTERS OF PREGNANCY.

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ABSTRACT **Background:** Trace elements are essential for a variety of cellular process and their deficiency have been documented to play an important role in determine to maternal and fetal health. **Objectives:** Objective of this study is change in trace elements levels in pregnant women and their association with adverse pregnancy outcomes. **Methodology:** In this study involving one 300 pregnant, in which patients ranging within age 18- 30 years, they were further categorized according to the trimesters of pregnancy. Group 1 this group consist of 1st trimester patients between ages 18-30 years. (n=100). Group 2 this group consist of 2nd trimester patients between ages 18-30 years. (n=100). Group 3 this group consist of 3rd trimester patients between ages 18-30 years. (n=100). 10 ml blood was drawn through vein puncture. From all collected blood samples S. Iron, Zinc and Copper tests were measured. All collected data were analysed statistically to calculate p values to see the difference of significance. **Results:** Results showed that mean serum Iron and Zinc levels were significantly decreased (P <0.024) (P <0.0001) in pregnancy. The levels decreased as gestation progressed, with the lowest concentration of iron and serum zinc obtained during the third trimester. The mean serum Copper levels were significantly increased (P <0.0001) in pregnancy. The levels increased as gestation progressed, with the highest concentration of copper obtained during the third trimester. **Conclusion:** This study reports on the influence of Fe, Cu, and Zn on the course of single and multiple pregnancies, and to discuss the interdependencies and mechanisms occurring between Fe, Cu, and Zn. The results should be approached with caution, but most studies indicate the influence of metals on the parameters of mother and child. Moreover, Fe, Cu, and Zn may be promising biomarkers in predicting complications in pregnancy.

KEYWORDS :

INTRODUCTION

Pregnancy is the period in which an egg cell is fertilized by a sperm to from a new cell call zygote, that eventually develop into a new human organism to be born. Pregnancy is divided into three trimesters corresponding to specific stages of fetal growth and development. Regular antenatal care and proper dietary supplementation can help to avoid complications of pregnancy. Vitamins and minerals are regularly needed throughout the pregnancy to reduce the risk of developing abnormalities in mother and developing baby.

During pregnancy the requirement of essential nutrients like iron, folic acid vitamin B12, vitamin D zinc and copper increase and if adequate quantities are not provided, result into their deficiencies and malnutrition. Therefore, nutritional vitamins and mineral balance during pregnancy is very important for maternal and fetal health [1].

Iron (Fe), copper (Cu), and zinc (Zn) are microelements essential for the proper functioning of living organisms. These elements participate in many processes, including cellular metabolism and antioxidant and anti-inflammatory defences, and influence enzyme activity, regulate gene expression, and take part in protein synthesis. Fe, Cu, and Zn have a significant impact on the health of pregnant women and in the development of the fetus, as well as on the health of the newborn. A proper concentration of these elements in the body of women during pregnancy reduces the risk of complications such as anemia, induced hypertension, low birth weight, preeclampsia, and postnatal complications. The interactions between Fe, Cu, and Zn influence their availability due to their similar physicochemical properties. This most often occurs during intestinal absorption, where metal ions compete for binding sites with transport compounds. Additionally, the relationships between these ions have a great influence on the course of reactions in the tissues, as well as on their excretion, which can be stimulated or delayed [2].

Iron is also involved, inter alia, in oxygen transport, in the production of ATP, in the synthesis of nucleic acids, in the maintenance of mitochondrial fusion and protection of cellular structures against oxidative damage, in the transcriptional activation pathway of hypoxia-inducible factor (HIF) playing a significant role in the development of the placenta, in the growth and proliferation of cells, as well as in the activity of numerous enzymes [3].

Copper (Cu) and zinc (Zn) are very important in human health. Both (copper and zinc) are involved, inter alia, in the oxidative balance, in division and differentiation cells, in inflammatory and immune processes and in the activation or inhibition of numerous enzymes. Both are part of the Cu, Zn-DOS enzyme (superoxide dismutase), which is the enzyme of the first line of antioxidant Defence [4].

The involvement of copper and zinc in the oxidative balance suggests the possibility of their association with pregnancy-induced hypertension, in which oxidative stress plays a key role. Early identification of women at risk of developing pregnancy-induced hypertension is among the most important objectives of prenatal care.

Thus, the present study was planned to estimate serum iron, zinc, and copper in pregnant women an aim to find out utility of these parameters in better accessing to improve maternal health and pregnancy outcomes.

MATERIAL AND METHODS

The present study was conducted on 300 pregnant women in department of biochemistry. Index medical college, hospital and research center, Indore. The ages of the patients ranged from 18-30 years of age.

An informed consent was taken from all the patients or their attendants who participated in the study after apprising them the nature and objective of study.

After getting informed consents from the subjects, 5ml of blood

was collected in a red plain vacutainer tube devoid of anticoagulant under aseptic condition from the subject after overnight fasting of 12 to 14 hours. Samples were centrifuged at 3000 rpm to separate within 1 hours and following parameters were estimated.

1. Serum Iron – Photometric test using Ferene [5].
2. Serum Zinc end point colorimetric Nitro-PAPS method [6].
3. Serum Copper 3,5-DiBr-PAESA Chromogenic Method [7].
4. Statistical method descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented as mean ± standard deviation (SD) and student's t-test (two-tailed independent) has been used to find the significance of study parameters on continuous scale between the three groups.

Observation Table
Table: 1 Mean S. Iron, Zinc And Copper Concentration Of The Subject Studied During Different Trimester Of Pregnancy

S. No	Trimester of pregnancy	Iron (μgm/dl) Mean ± SD (Range)	ZINC (μg/dl) Mean ± SD (Range)	COPPER (μg/dl) Mean ± SD (Range)
1.	FIRST	104.98 ± 47.60 (28.54-304.03)	210.10 ± 5.26 (200.12-220.24)	61.84 ± 4.54 (54.67-68.93)
2.	SECOND	94.50 ± 23.31 (48.82-190.25)	207.62 ± 8.45 (189.25-220.25)	67.08 ± 6.89 (51.25-75.98)
3.	THIRD	93.38 ± 19.01 (18.28-141-13)	172.23 ± 8.09 (155.74-182.27)	77.36 ± 7.91 (65.92-87.98)

Table: 2 Statistical Evaluation Of S. Iron, Zinc And Copper Concentration Among Different Trimesters Of Pregnancy

S. NO	Trimester Compared	S. Iron		Zinc		Copper	
		t-value	p-value	t-value	p-value	t-value	p-value
1.	1st vs 2nd	1.97	p<0.049*	2.49	p<0.0135*	6.34	p<0.0001*
2.	1st vs 3rd	2.26	p<0.024*	39.21	p<0.0001*	16.99	p<0.0001*
3.	2nd vs 3rd	0.37	p>0.71**	30.23	p<0.0001*	9.79	p<0.0001*

- *-Highly-significant
- **-Non-significant

RESULTS AND DISCUSSION
The mean serum iron concentration of pregnant female in 1st trimester is 104.98 ± 47.60 μgm/dl, in 2nd trimester is 94.50 ± 23.31 μgm/dl and in 3rd trimester is 93.38 ± 19.01μgm/dl. There is statistically significant difference in mean serum iron in 1st vs 2nd (P-value <0.049) and 1st vs 3rd (P-value <0.024) but no significant difference in 2nd vs 3rd (P-value 0.71)

The mean serum Zinc concentration of pregnant female in 1st trimester is 210.10 ± 5.26 μg/dl, in 2nd trimester is 207.62 ± 8.45 μg/dl and in 3rd trimester is 172.23 ± 8.09 μg/dl. There is statistically significant difference in mean serum Zinc in 1st vs 2nd (P-value <0.0135) and in 1st vs 3rd (P-value <0.0001) and 2nd vs 3rd (P-value 0.0001).

The mean serum copper concentration of pregnant female in 1st trimester is 61.84 ± 4.54 μg/dl, in 2nd trimester is 67.08 ± 6.89 μg/dl and in 3rd trimester is 77.36 ± 7.91 μg/dl. There is statistically significant difference in mean serum copper in 1st vs 2nd (P-value <0.0001), 1st vs 3rd (P-value <0.0001) and 2nd vs 3rd (P-value 0.0001).

Thus, we found that there is significant decrease in serum Iron and Zinc as trimesters of pregnancy increases and there is significant increase in copper level as trimesters of pregnancy increases.

In Narasamma et al (2021) study statistically significant difference was observed in the values of haemoglobin and serum iron concentration amongst the three trimesters of pregnancy, highest value of haemoglobin and serum iron being observed amongst subjects in the first trimester and lowest value of haemoglobin and serum iron amongst subjects in the third trimesters of pregnancy [8].

Fatemeh Moghaddam Tabrizi Firouz Ghaderi Pakdel et al (2014) Significant difference was shown in zinc levels 79.5 ± 15, 74.5 ± 16.1, and 65.3 ± 14.9 lg/dl during three trimesters. Copper levels during pregnancy were significantly different (130.9 ± 43.5, 172.0 ± 38.94, 193.2 ±28.5 lg/dl [9].

CONCLUSION
Fe, Cu, and Zn play a key role in the homeostasis of the body, and any changes in their concentrations can cause interactions that are dangerous to the health of the mother and fetus. A proper concentration of these elements in the body of women during pregnancy reduces the risk of complications such as anemia, induced hypertension, low birth weight, preeclampsia, and postnatal complications.

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