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Research article

**COPPER, ZINC, VITAMIN-C AND OXIDATIVE STRESS CAN CAUSES IRON
DEFICIENCY ANEMIA IN PREGNANT WOMEN**M.Rajeswari¹, M.Naimisha¹ and B.Suneel²¹Department of Gynecology & Obstetrics, ²Department of Biochemistry, Narayana Medical College & Hospital, Nellore – 524002. AP, India

ABSTRACT: Pregnancy is precious for women it is the most memorable movement in her life. In pregnancy period the Copper, Zinc, vitamin C plays an important role for production of hemoglobin and controls the oxidative stress. The present study under taken to asses the causing Zinc, Copper, vitamin C and ROS, anemia in pregnant period.

METERIALS & METHODS: 40 cases of 4th-8th month pregnant subjects were selected for the present study blood sample collected for estimation of Hemoglobin, Zinc, Copper vitamin C and ROS. Hemoglobin whole blood, Zinc, Copper, ROS serum, vitamin C heparinised blood.

RESULTS: Significantly decreases the Hemoglobin (P<0.001). Zinc (P<0.001), Copper (0.001) vitamin C (P<0.001) MDA significantly elevation observed in pregnant women compare to normal healthy women's are controls.

CONCLUSION: Lowered levels of Zinc, Copper, vitaminC, Hemoglobin and elevated MDA concentration were consistently observed in pregnant women. These by abate the synthesis of hemoglobin for the lack of these biological substance which can leads to increase the oxidative stress.

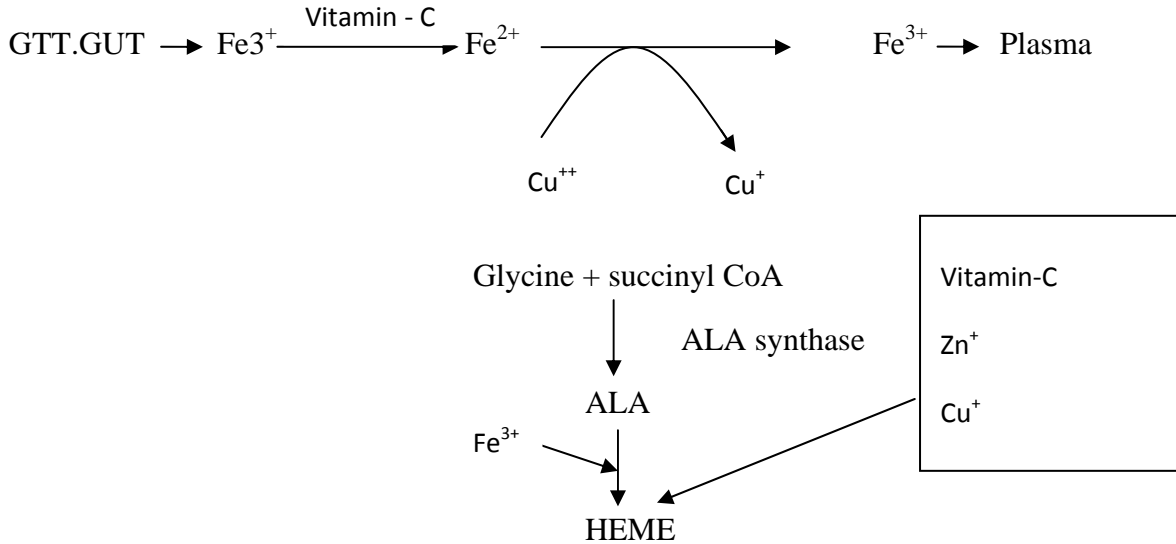
Key words: Hemoglobin, Oxidative stress, Reactive oxygen species, zinc, copper, vitamin

INTRODUCTION

Pregnancy is precious for women it is the most memorable moment in her life. This period of introspection needs essential nutrients for mother and developing fetus(Br J Nutr 2001). In pregnancy Cu, Zn, vitamin C plays an important role for production of hemoglobin and controls the oxidative stress. Pregnancy promotes the generation of free radicals and results in deleterious cellular damages. A physiological increase of oxidative stress has been observed in pregnancy. Oxidative stress enhances the TRBAS lipid peroxidation derivative products.

Most of studies and surveys along WHO reported pregnant women to consume diets with a lower concentration of minerals and vitamins (WHO 1992).

Deficiencies of trace elements like zinc, copper and vitamin C have been implicated in anemia during pregnancy. Zinc is a most abundant trace element after iron having myriad functions in pregnancy. It is therefore required right from the time of conception (J.Am Coll NUTR. 1999). It is very important for all phases of growth, tissue development, heme synthesis, blood formation, wound healing and antioxidant mechanism in pregnancy(J Obstet Gynecol India 2007). A marginal Zn⁺ deficiency during pregnancy can increase the chance of spontaneous abortion, high ischemic of placenta. ¹ Metallothione is a Zn⁺ containing protein essential for absorption copper from intestine(Upadhyaya C, et al, 2004). Thus the impairment of copper absorption due to zinc deficiency ultimately leads to deficient iron absorption (S Mc Gregor and J D Hamadani, 2002).



Copper regulates the synthesis of heme by the activation of ALA synthase in heme metabolism. During pregnancy, imbalance of antioxidant mechanism lowers the levels of vitamin-C which leads to decrease in iron absorption and heme metabolism. Copper is essential in transportation of iron from intestine to plasma.

The essential trace nutrients transportation is supported by hemoglobin. Iron is necessary for heme metabolism. Hemoglobin contains 75% of total iron. The iron metabolism is regulated by Cu^+ , Zn^+ , and vitamin C (Jameson S, 1993). Vitamin C is very important for iron absorption from intestine and acts as a powerful antioxidant against oxidative stress by preventing free radical generation (Rumbold A, Crowther CA, 2010).

Vitamin C, copper, Zinc play an important role in activation of ALA synthase which influences the synthesis of heme. During pregnancy lack of these biologically important trace elements and substances impairs the antioxidant mechanism leading to increase in oxidative stress. Zn^+ can play an important role for the regulation of antioxidant enzyme superoxide dismutase (Keen CL et al, 1998).

Oxygen free radicals play an important role in pathogenesis of tissue damage. The present study investigates the possible relation of serum MDA an index of lipid peroxidation in pregnancy. Most pregnant women having low levels of zinc, loss of appetite, low BMR have low levels of copper metallothione (Upadhyaya C, et al, 2004).

The study indicates low levels of Zinc, Copper, vitamin-C leads during pregnancy causes decrease in iron absorption and synthesis of heme, leading to anemia in pregnancy.

METERIAL & METHODS

The study was conducted over a period of 4 months, using Hb, Zn⁺, Cu⁺, vitamin-C and oxidative parameters among pregnant women attending OBG OP in narayana medical college. The data including personal history and diet intake in pregnancy was taken.

Blood sample were collected during 4-8th month pregnant women at the age (20-26) for estimation of Hb - whole blood; MDA & Cu⁺ -serum; Zn⁺ -plasma; vitamin C- heparinised blood. 25 normal women were taken as controls at age of (21-28)

The same procedure of sample collction and estimation of Hb, Zn⁺, Cu⁺, vitamin C & MDA was done.

1. Hb - challis Method
2. Cu⁺ - Di-Br-PAESA endpoint method¹⁹
3. Zn⁺ - Nitro – PAPS method¹⁸
4. MDA - TBA²¹
5. Vitamin C - 2-4 dinitrophenyl hydrazine method¹⁶

RESULT

The values obtained on analyzing specimens collected form pregnant women and control groups are tabulated. The mean values and standard deviation also have been calculated for comparative study of pregnancy women age 20-26 and controls age (21-28). The values of subject and controls groups are also graphically represented for comparison at a glance. The graph was plotted using values of all the study parameters.

Figure - 1: Correlation of vitamin C, Hemoglobin, Zinc, Copper and MDA mean values between patients and contorls. The graph shows significantly decreases of vitamin C, Hemoglobin, Zinc, Copper levels in subjects were observed compared to the controls. MDA significantly increases in pregnancy. It indicates pregnancy anemia. Table 1 shows mean, standard deviation and p values of all the study parameters in anemic pregnancy.

Table 1 showing the comparable values of Pregnant women and Controls

Sl.no	Parameters	Patients		Controls		P value
		Mean	S.D	Mean	S.D	
1	Hb	7.5	0.308	13.41	0.644	0.0001
2	Copper	48.4	10.610	124.4	23.064	0.0001
3	Zinc	44.23	2.860	107.23	23.992	0.0001
4	Vitamin C	0.17	0.081	0.93	0.284	0.0001
5	MDA	7.65	0.181	6.24	0.652	0.0001

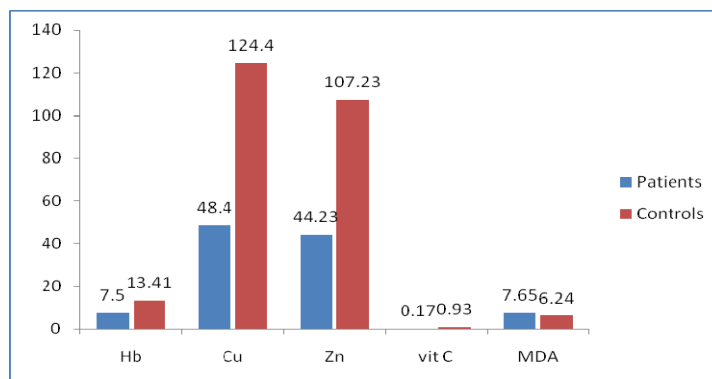


Fig-1: Comparison of vitamin C, Hemoglobin, Zinc, Copper and MDA in anemic pregnant women with controls

DISCUSSION

This study was undertaken to assess the role of essential minerals, nutrients (Zn^{+} , Cu^{++} , and Vitamin C) deficiency which leads to anemia and oxidative stress in pregnancy. Pregnancy is a precious period where Zn^{+} , Cu^{++} , vitamin C plays an important role in regulation of hematopoiesis and increase oxidative stress. The most commonly used method for assessment of anemia during pregnancy is the measurement of Hb concentration. According to the WHO recommendation (WHO 1992). Zinc supplementation is essential during pregnancy as it shows effects on regulation of hematopoiesis, mental development and behavior of infants. Cu^{++} is very important trace element, Cu^{++} can regulate the iron absorption and hematopoiesis in pregnancy. Poor copper diet and decreased absorption of copper is seen in pregnant women. Intestinal irritation during pregnancy causes increased production of gastric acids which lowers the absorption of copper. Vitamin C during pregnancy is required to convert folic acid into active form, iron absorption and controls the free radical generation (J. Am Coll Nutr, 1999, Entela Treska et al, 2012, S Mc Gregor and J D Hamadani 2002). Free radical generation results in decrease vitamin C concentration during pregnancy (Rumbold A, et al, 2010). Vitamin C supplementation during pregnancy is therefore essential. The above results show that serum zinc, copper, vitamin C, Hb concentration is lower and MDA levels are higher in pregnant women than in normal individuals. These trace elements deficiency leads to impairment of iron metabolism that causes impairment in heme synthesis.

Deficiency of these biochemical parameters suggests that the supplementation of trace elements like zinc, copper and vitamin C is essential for the maintenance of proper hemopoietic function and prevention of the reactive oxygen species during pregnancy.

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