

Evaluation of Serum Copper Level in Pregnant Women with High Hemoglobin

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Abstract

Adverse outcomes of pregnancy increase among women with high density of hemoglobin. This study evaluates the effects of iron supplementation on serum copper level in pregnant women with hemoglobin higher than 13.2 g/dl. Sixty two pregnant women with Hemoglobin >13.2 g/dl and normal serum copper levels in their 13-18 weeks of gestation were randomized into case and control groups. From 20th week till the end of the pregnancy ferrous sulfate tablets (150 mg tablet, containing 50 mg elemental iron) were given to the case group whereas, the controls received daily placebo tablets. Hemoglobin and serum copper levels were measured during the weeks of 24 to 28 (first trimester) and 32 to 36 (second trimester). Serum copper level of the case group during the second and third trimester was significantly lower than of the control group. It is concluded that, iron supplementation in pregnant women with hemoglobin above 13.2 g/dl possibility increases the risk of copper deficiency.

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Keywords • Pregnancy • hemoglobin • copper

Introduction

Iron deficiency anemia, particularly in developing countries, is a major problem in children and women. To overcome this problem during pregnancy iron supplementation has been used to constitute the main measure in the process of prenatal care.^{1,2} Pregnant women need perceptible amount of iron that can not be acquired from diet, therefore in women with low risk for nutritional deficiency daily supplementation of 30-60 mg elemental iron is recommended to prevent iron deficiency anemia.^{3,4} Variation of each bivalent metal ion concentrations such as iron, zinc, copper and magnesium may change the concentration of other ion metals.^{1,5}

Almost all of the supplemental programs in developing countries mainly focus on iron supplementation.⁶ It has clinical side effects such as abdominal cramps, nausea, heart burn, diarrhea and constipation. It also interacts with intestinal absorption of bivalent metals such as copper.^{3,7} Reports have indicated that during the first trimester of pregnancy the plasma level of copper increases from 18 to 26 μ M to about 35 μ M by end of the third trimester.⁸

Numerous studies have indicated a U-shape relationship between the level of hemoglobin (Hb) and adverse pregnancy outcomes such as stillbirth, pregnancy induced hypertension, intrauterine growth retardation etc. Moreover, these risks increase when the level of Hb is more than 13.2 g/dl.⁹ High levels of Hb have been reported to increase blood viscosity due to

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failure of plasma volume expansion.^{4,9} Copper and Hb levels are inversely correlated. This correlation is more significant in anemic pregnant women.¹⁰ Therefore, this study was designed to evaluate the effects of iron supplementation on serum copper level in women with Hb higher than 13.2 g/dl.

Subjects and Methods

The study is a single blinded clinical trial performed on pregnant women receiving maternity care in Hafez hospital, Shiraz University of Medical Sciences. After approval of the study design by the Ethical Committee of the University a written consent was obtained from each participant. The individuals' characteristics included the age, weight, body mass index (BMI) and gravid. Moreover, social and financial status was clarified by the level of education and the income.

The study included 62 pregnant women who randomly divided into control and case groups. The inclusion criteria consisted of women in their 13-18 weeks of pregnancy with Hb levels higher than 13.2 g/dl and copper serum levels at normal range of 80-155 µg/dl. The exclusion criteria consisted of those who had taken oral contraceptives up to six months or taken iron supplement in the last three months prior to pregnancy, or had diseases such as cardiac, respiratory, renal, gastrointestinal, thyroid, neoplastic, hyperemesis gravidarum, diabetes, lupus erythematosi, convulsion, or had abnormal BMI. Moreover, women with Hb lower than 10.5 g/dl in their second trimester or 11 g/dl in their third trimester were also excluded.

The women in the case or control groups were assigned to receive 150 mg ferrous sulfate tablets or placebo daily. The ferrous sulfate and placebo tablets used in the study were manufactured by the Darupakhsh Company, Tehran, Iran had similar shapes and colors, therefore, the participants were not aware of the contents. In 24 to 28 and 32 to 36 weeks of gestation a blood samples was taken and the levels of Hb and serum copper were measured using Hb analyzer and atomic absorption spectrophotometry.

Data are presented as mean±SD. Paired Student t-test was used to compare the obtained variables between two groups and $P < 0.05$ was considered significant.

Results

No significant differences were observed for age, weight, BMI, gravid, serum levels of Hb and copper between the two groups in the first

trimester of pregnancy. In the case group, during the second and third trimesters of pregnancy, the Hb concentration was significantly higher and copper serum levels were significantly lower than control group (Table 1).

Table 1: Mean±SD of age, weight, BMI, gravid and concentrations of Hb and serum copper in case and control groups.

Variables	Cases(n=31)	Controls(n=31)
Age (yrs)	23.74±3.3	23.40±3.5
Weight (Kg)	57.67±8.2	60.21±9.1
BMI (Kg/m ²)	22.94±2.1	23.28±2.3
Gravid	1.48±0.6	1.57±0.7
1 st Hb (g/dl)	13.76±0.53	13.80±0.55
2 nd Hb (g/dl)	12.84±0.58	11.86±0.44
3 rd Hb (g/dl)	13.05±0.5	12.30±0.38
1 st Copper (µg/dl)	184.0±36.1	182.*±24.7
2 nd Copper (µg/dl)	192.3±40.2	216.2±31.9
3 rd Copper (µg/dl)	198.9±36.7	232.8±30.1

Discussion

It was reported that serum levels of copper in pregnant women taking iron supplement is lower than that of pregnant women not taking the supplement.^{11,12} However, limited data are available about the serum copper level in pregnant women with high Hb.

High maternal hemoglobin levels have been reported to increase adverse fetal outcomes such as small for gestational age, pre-term birth, and prenatal death.^{2,9} The relationship between serum levels of iron and copper has been studied by several groups, which showed increased iron intake due to decreased copper.¹³ Some studies have reported that serum copper deficiency during pregnancy is associated with low birth weight, neurological and skeletal abnormalities as well as abnormal lung development, fetal and early neonatal death.^{14,15} The present study showed that in placebo group the serum copper level was higher than that of case group during the period of second and third trimesters. Subjects of both groups had sufficient copper resource nutritional diet. In pregnant women with high Hb, iron supplementation may reduce serum copper level. The results of this study failed to show such a correlation. Therefore, further studies are needed to assess these effects on pregnancy outcome until we can select the best iron supplementation program for these women during pregnancy.

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References

- 1 Kathleen M, Sylvia ES. Food, nutrition & diet therapy, 11th ed. United states of Americans: Sanders; 2004. p. 101-9.
- 2 Bothwell TH. Iron requirements in pregnancy & strategies to meet them. *Am J Clin Nutr* 2000; 72: 257s-64s.
- 3 Cunningham G, Kenneth JL, Steven LB, et al. Williams obstetrics, 22th ed. United states of Americans: MacGrow-Hill; 2005. p. 130-132.
- 4 Costello AM, Osrin D. Micronutrient status during pregnancy and outcomes for newborn infants in developing countries. *J Nutr* 2003; 133:1757s-64s.
- 5 Tietz N, Bhagavan NV, Caraway W, et al. Text book of clinical chemistry, 4th ed. United states of Americans: Sanders; 1999. p. 975-81.
- 6 Galloway R, Dusch E, Elder L, et al. Women s perceptions of iron deficiency and anemia prevention and control in eight developing countries. *Soc Sci Med* 2002; 55: 529-44.
- 7 Yu S, West CE, Beynen AC. Increasing intakes of iron reduce status absorption & biliary excretion of copper in rat. *Br J Nutr* 2001; 71: 887-95.
- 8 Garrow JS, James WP, Ralph A. Human nutrition & dietetics, 6th ed. United Kingdom; 2000. p. 725-726.
- 9 Stephansson O, Dickman PW, Johansson A, Cnattingius S. Maternal hemoglobin concentration during pregnancy & risk of still-birth. *JAMA* 2000; 284: 2611-7.
- 10 Ma AG, Chen XC, Xu RX, et al. Comparison of serum levels of iron, zinc and copper in anemic and non-anemic pregnant women in China. *Asia Pac J Clin Nutr* 2004; 13: 348-52.
- 11 Danzeisen R, McArdle HJ. Identification & location of a placenta copper oxidase in a human choriocarcinoma cell line. *J Physiol London* 2000; 523: 172-5.
- 12 Burns J, Paterson CR. Effect o Iron-Folate supplementation on serum copper concentration in late pregnancy. *Acta Obstet Gynecol Scand* 1993; 72: 616-8.
- 13 McArdle HJ, Danzeisen R, Fosset C, et al. The role of the placenta in iron transfer from mother to fetus & the relationship between iron status & fetal outcome. *Bio-metals* 2003; 16: 161-7.
- 14 Kumar S, Aydin S, Simsek M, et al. Comparison of serum copper, zinc, calcium and magnesium levels in preeclamptic and healthy pregnant woman. *Biol Trace Elem Res* 2003; 94: 105-12.
- 15 Pathak P, Kapil U. Role of trace elements zinc, copper and magnesium during pregnancy and its outcome. *Indian J Pediar* 2004; 71:1003-5.