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The Association of Serum Zinc Levels with Socio Demographic Factors, Red and White Blood Cells Count in Pregnant Women

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Abstract: This study was done to identify the relation of demographic factors, Zn > 70 and < 70 mg dL^{-1} in pregnant women with, red and white blood cells count (RBC, WBC) in 22 weeks of gestation. The pregnant women selected from Reproductive Research Center, Imam Hospital in Tehran, Iran. The subjects selected were recruited into the study after obtaining informed consent. A questionnaire was filled by participant in this study. Sixty five pregnant women were randomly selected after analyze their serum Zn level, divided 2 group with Zn > 70 and < 70 mg dL^{-1} both group were consist from viewpoint of age, social economic situation and BMI. The blood serum samples were analyzed to assess zinc status and antioxidant and Hb, RBC, WBC. The results of this study revealed that, the pregnant women had mean age of 20.5±3.6, with first pregnancy 22.3±3.53 age, BMI 23.2± 5.52. About 32.6% of them had high school and 56.8% had diploma and only 10.6% had university education. However, none of the socio-demographic factors were significantly associated with the rate of Zn in 2 groups. The mean of zinc in group of Zn < 70 and Zn > 70 was 58.8±10.1 and 112.7±21.8 mg dL^{-1}, respectively. There was significant ($p<0.05$) relation in total antioxidant and Zn level in both groups. Micronutrient interactions are particularly important on antioxidant during pregnancy. In view of this, there is need for proper, adequate and balanced micronutrient supplementation during pregnancy to affect a healthy outcome.

Key words: Pregnancy, zinc, demographic factors, RBC, WBC

INTRODUCTION

Vitamins and Minerals collectively referred to as micronutrients, have important influence on the health of pregnant women and the growing fetus (Black, 2001). Pregnancy is associated with increased demand of all the nutrients like iron, zinc, vitamin B12, folic acid and ascorbic acid (Sachdeva and Mann, 1994) and deficiency of any of these could affect pregnancy, delivery and out come of pregnancy.

Zinc is necessary for the functioning of more than 300 different enzymes and plays a vital role in an enormous number of biological processes. Oxidative stress is caused by a relative overload of oxidants, i.e., reactive oxygen species (Hanachi *et al*., 2006). Zinc is a cofactor for the antioxidant enzyme superoxide dismutase (SOD) and is in a number of enzymatic reactions involved in carbohydrate and protein metabolism (Anderson *et al*., 2001).

Taking a multiple vitamin and mineral supplement with zinc during gestation is one way to ensure a healthy baby. Adverse fetal outcomes associated with maternal zinc status include congenital anomalies, reduced birth weight for gestational age, neural tube defects and fetal brain function. Maternal complications such as preeclampsia, prolonged labor and pre-term delivery have also been associated with zinc status (Yong *et al*., 2000; King, 2000).

Maternal zinc deficiency during pregnancy has been related to adverse pregnancy outcomes. Most studies in which pregnant women have been supplemented with zinc to examine effects on pregnancy outcome have been carried out in industrialized countries and the results have been inconclusive (Saskia *et al*., 2003).

Iron deficiency results in anemia, which may increase the risk of death from hemorrhage during delivery, however, its effects on fetal development and birth outcomes still needs further elucidation (Hanachi *et al*., 2006). It is a common experience that anemia of pregnancy is sometimes not corrected despite Iron supplementation (Sharma *et al*., 1994), which may be due to underlying deficiency of other micronutrients, which affects pregnancy, childbirth orfetal development (Perveen *et al*., 2002). Recently Kolesteren *et al*. (1999)

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suggested supplementation of zinc along with Iron improves hemoglobin level and is beneficial in iron deficiency anemia (Kolsteren *et al*., 1999).

Lean red meat, whole-grain cereals, pulses and legumes provide the highest concentrations of zinc concentrations in such foods are generally in the range of 25-50 mg kg^{-1} (380-760 mmol kg^{-1}) raw weight. Processed cereals with low extraction rates, polished rice and chicken or meat with high fat content have a moderate zinc content, typically between 10 and 25 mg kg^{-1} (150-380 mmol kg^{-1}). Fish, roots and tubers, green leafy vegetables and fruits are only modest sources of zinc, having concentrations <10 mg kg^{-1} (Caulfield, 1998).

The total amount of zinc retained during pregnancy has been estimated to be 1.5 mmol (100 mg). During the third trimester, the physiological requirement of zinc is approximately twice as high as that in women who are not pregnant (WHO, 1996).

Majority of Iranian women consume cereal based diet rich in phytates, oxalates, phosphates, fibers etc. which affect the absorptions of micronutrients like Iron (Sharma *et al*., 1999) and zinc (Salgneiro *et al*., 1999).

Foods of plant origin not only provide us with important antioxidant vitamins (e.g.,vitamin C, vitamin E or provitamin A), but also a complex mixture of other natural substances with antioxidant capacity. Reactive Oxygen Species (ROS) free radicals production in the body can initiate lipid peroxidation. Antioxidant supplementation can provide extra protection against these ROS (Diplock, 1991; Hanachi *et al*., 2004). In Tehran, where this study was conducted, one can expect micronutrient deficiencies due to Iranian diet conditions with prevalent carbohydrate habits and the situation could be worse in pregnancy. The objective of this study was to identify the relation of demographic factors, Zn > 70 and < 70 mg dL^{-1} in pregnant women with, RBC, WBC and antioxidant level in 22 weeks of gestation.

MATERIALS AND METHODS

Study design: Before the data collection started, a conceptual framework was designed to identify the factors that will contribute to the research project. After all the factors had been identified, case register, pre-tested structured questionnaires and performa were used as research instruments to obtain the socio-demographic information.

The pregnant women selected from Reproductive Research Center, Imam hospital in Tehran, Iran, on 2007. Written informed consent was obtained from all subjects. The study was approved by the Committee for the Women Research Center and Tehran Medical University by the Ethical Committee. The study was based on 65 (case) pregnant randomly selected in mean age 20.5±3.6 in 22 weeks of gestation. The case were healthy, nonsmoking, physically inactive multigravidae and they had no health problems or complications during pregnancy. Iron supplements (30-50 mg Fe day^{-1}) were given to all of the women during the second half of pregnancy (14-35 weeks of gestation) as part of their routine prenatal care.

Fasting blood samples were obtained by venipuncture to measure the total antioxidant, Zn, Hb, RBC and WBC count. The serum was separated by centrifugation (500 g, 10 min) and kept under refrigeration (-20°C) until needed for analysis. The samples were analyzed for Zn and total antioxidant concentrations using an Cecil, CE, 2501 model, 2000, series spectrophotometer. The Hemoglobin was measured according to Dacie and Lewis (1994), method. White blood cell and RBC counts were measured using cell counter model Culter, T 860.

After analyze their serum Zn level, divided 2 groups with Zn > 70 and < 70 mg dL^{-1} both group were consist from viewpoint of age, social economic situation BMI and last pregnancy.

Total antioxidant assay: Total antioxidant status (TAS) of serum in two groups were measured using the ferric reducing ability of plasma (FRAP) assay (Benzieand Strain, 1996). The FRAP assay, which depends upon the reduction of ferric tripyridyltriazine (Fe (III)-TPTZ) complex to the ferrous tripyridyltriazine (Fe(II)-TPTZ) by a reductant at low pH. Fe (II)-TPTZ has an intensive blue color and can be monitored at 593 nm. The products of this reaction FRAP level was calculated by plotting a standard curve of absorbance against mol L^{-1} concentration of Fe (II) standard solution.

Zinc concentration assay: Serum zinc levels were estimated using kit supplied following established literature procedures by Randox, Co kit, UK. The principle of this kit is when the zinc present in the sample is chelated by 5-Br-PAPS-2-(5-bromo-2-pyridylazo)-5-(N-propyl-N-sulfopropylamino)-phenol in the regent. The formation of this complex is measured at a wavelength of 550 nm.

Statistical analysis: All statistical analyses were performed with using SPSS 11.0 (Statistical Package for Social Science). Descriptive statistics including means and SDs for the outcome variables of interest were computed. The probability levels of significance reported are based on the 2-tailed t-test. Correlations test were used to determine the association between antioxidant, Hb, RBC and WBC in 2 groups. The level of significance was 0.05 or difference with a $p<0.05$ were considered to be significant.

RESULTS AND DISCUSSION

The result of this study revealed that the pregnant women had mean age of 20.5±3.6, with first pregnancy 22.3±3.53 age, BMI 23.2±5.52, with blood group of 31.7% A^+, 9.8% A^-, 19.5% B^+, 2.4% B^-, 4.8%AB, 22%O^+, 9.8%O^-. The parentage of zinc in group of Zn < 70 and Zn > 70 mg dL^{-1} was 52.3 and 47.7%, respectively.

About 32.6% of them had high school and 56.8% had diploma and only 10.6% had university education (Table 1). Majority of them had diploma (56.8%) and do not have any source of income (96.1%). However, none of the socio-demographic factors were significantly associated with the rate of Zn in 2 groups.

The mean of zinc in group of Zn < 70 and Zn > 70 was 58.8±10.1 and 112.7±21.8 mg dL^{-1}, respectively. There was significant relation in total antioxidant and Zn level in both group. The result shows that the total antioxidant level was 704.8±107.1 μmol L^{-1} in a group of Zn higher than 70 mg dL^{-1} in comparison with group that had Zn < 70 mg dL^{-1} had high total antioxidant level (576.2 ± 130.6 μmol L^{-1}) in 22 weeks of gestation. This study was initiated to assess the contribution of Zn on elevation of antioxidant. Increased of Zn was associated with a marked increase (22.3%) in total antioxidant in group of Zn > 70 mg dL^{-1} (Fig. 1).

The result indicated that there was not significant relation among Hb, RBC and WBC in both groups of Zn < 70 and Zn > 70 mg dL^{-1} (Fig. 2-4).

Table 1: Distribution of socio-demographic factors in 2 group with Zn > 70 and < 70 mg dL^{-1}

Variables	Total population	Parentage
Occupation	n = 65	
House worker	63	96.1*
Office worker	2	3.1
Husband occupation		
Non government	41	63.1
Employee	13	18.5
Worker	11	15.4
Age	20.5±3.6	
First pregnancy	22.3±3.53	
Weight before delivery	60.1±14.5	
BMI	23.2± 5.5	
Education		
Before high school	21	32.6
Diploma	37	56.8*
University	7	10.6
Husband education		
Before high school	34	52.7
Diploma	23	35.6
University	8	11.7

*Significant at p-value <0.05. Data were expressed as mean±SD

Pregnancy is associated with increased demand of all the nutrients like Iron, zinc and antioxidant and deficiency of any of these could affect pregnancy, delivery and out come of pregnancy. Micronutrient interactions are particularly important during pregnancy, when the developing fetus is very vulnerable to inappropriate micronutrient status (Gambling *et al.*, 2003).

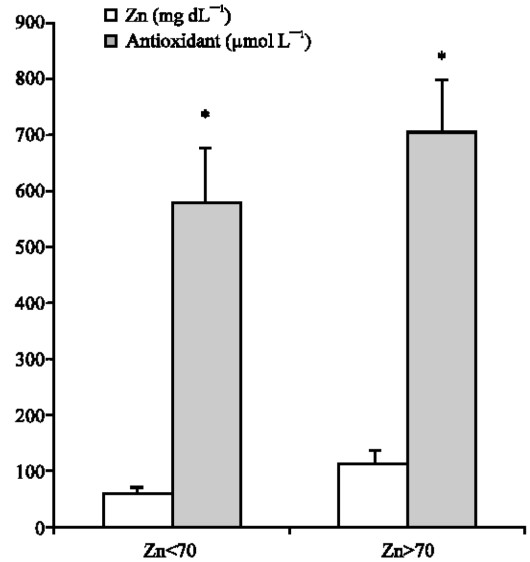

Fig. 1: Serum total antioxidant level in pregnant women Zn < 70 and >70 mg dL^{-1}. Data are mean±SEM and *p< 0.05 was considering significant

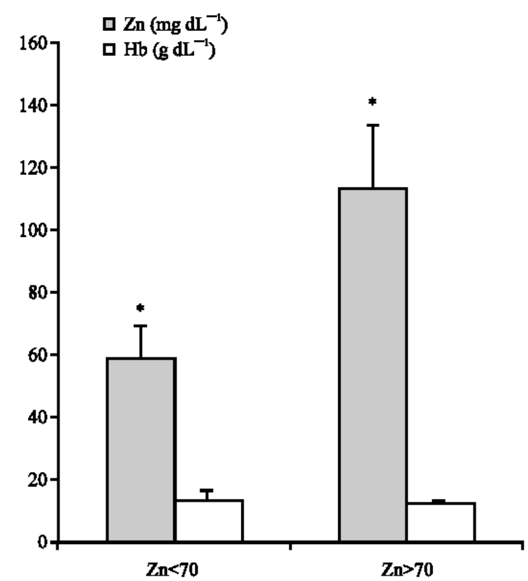

Fig. 2: Hb (g dL^{-1}) level in pregnant women zn < 70 and >70 mg dL^{-1}. Data are mean±SEM and *p<0.05 was considering significant

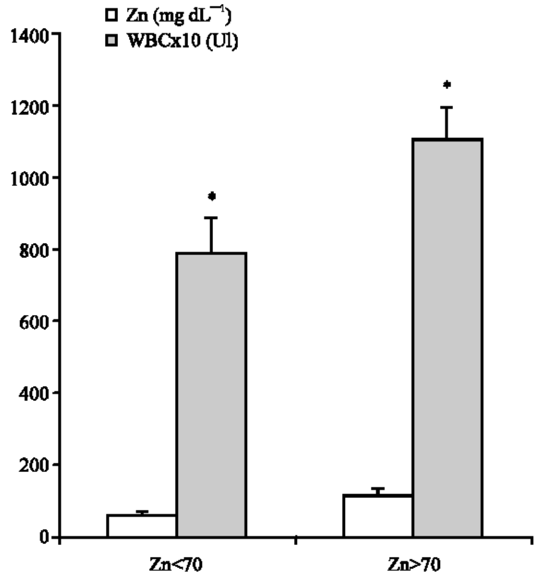

Fig. 3: WBC level in pregnant women Zn < 70 and >70 mg dL^{-1}. Data are mean±SEM and *p<0.05 was considering significant

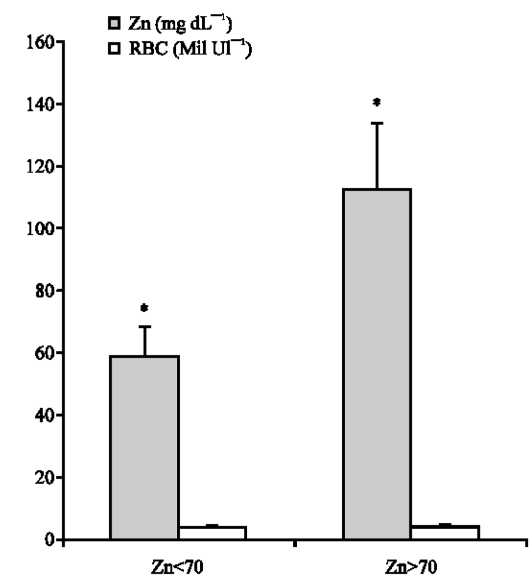

Fig. 4: RBC level in pregnant women Zn < 70 and >70 mg dL^{-1}. Data are mean±SEM and *p<0.05 was considering significant

Further, in developing countries over enthusiastic and uncontrolled supplementation of micronutrients especially Iron during pregnancy could unfavorably affect other micronutrients because of competitive interaction among trace elements (Yadric *et al*., 1998). In the recent years, there is a tendency to add minerals along with vitamin preparations, which may further exacerbate imbalances.

Free radicals occur naturally in the body, but environmental toxins (including ultraviolet light, radiation, cigarette smoking and air pollution) can also increase the number of these damaging particles. Free radicals are believed to contribute to the aging process as well as the development of a number of health problems (Vanden Langenberg *et al*., 1998). Antioxidant such as zinc can neutralize free radicals and may reduce or even help prevent some of the damage they cause during the pregnancy. Although results of studies have been somewhat mixed, the antioxidant properties of Zn that indicates in pregnant women had Zn < 70 mg dL^{-1} significantly ($p<0.05$) lower total antioxidant compared to the groups that had Zn > 70 mg dL^{-1}. These results demonstrate that Zn also had some antioxidant properties, which means that it helps protect cells in the body from the potential damage caused by free radicals during the pregnancy.

CONCLUSION

We expected a significant change in WBC, RBC count and Hb in two groups. To our surprise, results demonstrated that there was not any significant change in two groups. This could be due to the duration of study. In future more research is needed to be have done studies, to determine the more antioxidant assay, antioxidant enzyme activities in blood sample and to include one more group of first week of gestation required to compare the results.

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