

What is the Relationship Between Zinc Status and Pregnancy Outcome?

T. Tamura and R. Goldenberg (1996). *Zinc Nutrition and Pregnancy Outcome. Nutrition Research* 16(1): 139-181.

Introduction

Zinc deficiency in humans has been associated with low birthweight (LBW), preterm delivery and obstetric complications. However, the relationship between zinc and pregnancy outcomes is not clear. Tamura and Goldenberg (1996) provide a comprehensive review of the research on the relationship between zinc and pregnancy outcome in an attempt to look at what is known about zinc and pregnancy and the questions that still remain.

Methods

The Tamura and Goldenberg overview includes research on zinc metabolism during pregnancy, dietary intake of zinc and other topics related to the association between zinc and pregnancy outcome. However, this MotherCare review article will focus on the nine zinc supplementation studies of pregnant women discussed by Tamura and Goldenberg. The results of these studies are organized here—but not by Tamura and Goldenberg—by three different groupings: women with sub-optimal zinc status (<70 µg/dL in fasting subjects, <60 µg/dL in non-fasting subjects, or values as defined by the authors) where dietary zinc intake is reported; women with sub-optimal zinc status where dietary zinc intake is not reported; and women whose zinc status was not determined and zinc intake may or may not have been reported.

Results

Women with sub-optimal zinc status /Dietary intake reported—

- ◆ In a randomized, case-control study, Goldenberg, *et al.* (1995) found that

women given 25 mg zinc (recommended RDA is 11-15 mg/day) from 19 weeks gestation until delivery had babies with significantly higher birth weights (126g) than newborns of mothers given a placebo.

- ◆ In a randomized, double-blind trial, Cherry, *et al.* (1989) found that underweight and multiparous teenagers, receiving 30 mg of zinc/day, had infants with longer gestational ages (2.8 weeks longer) and significantly heavier babies (average of 362 g) than girls receiving no supplements. Girls with normal weights taking zinc had a 32% reduction in preterm delivery and their newborns had fewer respiratory problems.
- ◆ Hunt, *et al.* (1984) found that low-income, Mexican-American women who had received a daily vitamin supplement containing 20 mg of zinc starting at 19 weeks of gestation had a lower incidence of pregnancy-induced hypertension (PIH) than women who received a vitamin supplement with no zinc. There were no significant differences in birth weights among compliers in the two groups.
- ◆ In a similar study by Hunt, *et al.* (1985), Mexican-American teenagers were randomized at week 17 of pregnancy to receive either a vitamin supplement containing 20 mg of zinc or a vitamin supplement without zinc. There was no significant difference in birth weights between treatment and control groups and no decrease in the incidence of PIH. Zinc supplementation significantly reduced the number of girls with low zinc levels in late pregnancy.

Women with sub-optimal zinc status /No dietary zinc intake information—

- ◆ Simmer, *et al.* (1991) detected no significant difference in birthweights between the zinc supplemented group (22.5 mg/day) and the placebo group in their study of women in the United Kingdom. However, researchers did find a signifi-

cantly lower incidence of fetal growth retardation, Cesarean section, and induced labor in the zinc supplemented group. It was suggested that there was no impact on birthweight due to the small sample size of the study. Height, weight, weight gain, age, iron/folate supplementation and social class were controlled for the two groups.

- ◆ In a study by Jameson (1982), Swedish women with low plasma and serum zinc were randomized to receive 45 mg of zinc/day at 14 weeks gestation. Observations showed that 63% of women receiving zinc had normal blood pressure and hemoglobin, labor times of less than 20 hours, no proteinuria and normal blood loss (<300 ml), while only 48% of women without zinc and 55% of women with high serum zinc levels had these results. The author also observed that bleeding at delivery, the number of long labors and gestation and the number of postmature babies and Cesarean sections performed were all lower in the treatment group. Jameson did not report whether the differences were significant.

Zinc status not determined /Dietary intake reported or not reported—

- ◆ In a study in the United Kingdom, Mahomed, *et al.*, 1989, gave 20 mg zinc/day or a placebo starting at the 20th week of pregnancy to 494 women. There were no significant differences in pregnancy and birth complications, neonatal condition and the amount of leukocyte zinc concentrations in maternal blood and cord blood. The authors suggest that this is because the study population was relatively healthy, at low risk for pregnancy complications and had adequate zinc stores. There was no difference in dietary zinc intake between the two groups. Both groups were consuming only half of the recommended intake for zinc.
- ◆ Kynast and Saling, 1986, found that the 179 healthy German women given 20 mg of zinc/day had significantly fewer preg-

nancy and labor complications (premature separation of the placenta, preterm labor and vaginal bleeding), and less frequent large and small-for-date infants. Zinc-supplemented women had heavier infants than those women receiving a placebo; however, this difference was not significant. The authors did not provide any dietary zinc information.

- ◆ Ross, *et al.* (1985) examined the effects of giving zinc supplements (4.6-12.9 mg zinc/day) to Zulu women in South Africa. No dietary information was reported. Women who received zinc had, on average, infants who weighed less (3,088 g) than infants of women in the placebo group (3,171 g), but this difference was not significant. The authors suggest that the low birth weights in the zinc supplement group could be attributed to the lower body weights of the mothers (66 kg versus 71-73 kg) prior to supplementation. Zinc supplemented women gained less weight between 20 weeks and delivery than women in the placebo group (7.2 kg versus 8.8 kg). Also, the amount of zinc given may not have been adequate for this population.

Conclusions

While zinc supplementation has been associated with a number of positive birth and delivery outcomes, Tamura and Goldenberg conclude that these supplementation trials are “**mainly inconclusive due to inconsistent study conditions, insufficient sample size, and lack of specific and sensitive test(s) to accurately assess zinc nutriture.**” The role of zinc supplementation in pregnancy and its impact on outcomes remain unclear. **The authors recommend that future research concentrate on developing sensitive and specific methods to assess zinc status, investigate the mechanisms of altered zinc metabolism during pregnancy and determine whether antenatal zinc supplementation leads to positive birth and delivery outcomes in a number of different ethnic groups.**

Commentary

Zinc is a trace mineral important to many enzymatic and non-enzymatic processes in the body. It is also a component of cell membranes and helps stabilize several entities and complexes within the cell. A number of clinical signs are associated with severe zinc deficiency, including growth retardation, delayed sexual maturation and impotence, epithelial lesions, anorexia, immune deficiencies, delayed healing, behavioral disturbances, poor taste acuity, dermatitis, absence or loss of hair and skeletal abnormalities. Because of its role in the maintenance and reproduction of cells, zinc is considered an important micronutrient for sexual reproduction and is vital for the developing fetus and young infant.

Although there is no good test to assess zinc status in humans, it is believed that many pregnant and lactating women (and consequently the developing fetus and newborn) in developing countries are at risk for zinc deficiency because their diets are low in absolute amounts of zinc and typically high in fiber and phytates that

inhibit the absorption of zinc, particularly in maize and rice consumers (Gibson, 1994). Studies of zinc and pregnancy outcome in developing countries have been mainly observational, and there appears to be no conclusive findings to recommend that pregnant women receive zinc supplements. Currently, there are five maternal zinc supplementation trials in progress in Bangladesh, Chile, Ecuador, Indonesia and Peru (Caufield, personal communication, 6-96). Results from both developed and developing countries should be used to determine zinc requirements for pregnant women and the daily doses of zinc that pregnant women should take if they are at risk for zinc deficiency. What can be done to promote zinc intake in the meantime? Like iron, animal products provide the best sources of bioavailable zinc. Therefore, because of the cost of meat, advising women in developing countries to increase dietary zinc intake is probably not a viable option. A reduction in the interaction with phytates and competition with other micronutrients, such as iron pills, may be possible alternatives. **(See Box 6 of the center pullout).**

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