

Comparison of Serum Zinc Levels in Infants Fed with Breast Milk and with Formula Milk

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ABSTRACT

Zinc has been shown to be involved in many functions of the enzyme system. This study was designed to determine zinc levels in 101 infants aged 0-5 months who were fed only on breast milk (n=53) and only on formula milk (n=48). Infants were divided into subgroups according to their ages in months and comparisons were made between their respective groups. Serum zinc levels were determined using the 5 Br-PAPS method. No significant difference was found between serum zinc levels in one-, two- and three-month-old infants fed only with breast milk and only with formula milk, whereas in four- and five-month-age groups, significant decrease was observed in infants fed with breast milk ($p < 0.05$ and $p < 0.001$, respectively). We speculate that it may be convenient to add zinc-supplemented nutrients to the infants' diet after the fourth month.

Key Words: Breast milk, formula milk, zinc

INTRODUCTION

Zinc is a constituent of many metalloenzymes. This property makes zinc necessary in almost all pathways of cell metabolism. Among those enzymes consisting of zinc are thymidine kinase, RNA polymerase, DNA polymerase and ribonuclease, all of which have a very important function in DNA replication and transcription during cell division. For this reason, zinc is essential in growth and in maintaining tissue development. Zinc deficiency leads to retardation in growth, diffuse symmetrical dermatologic lesions, diarrhea, loss of hair, mental disorders, and infections (1).

This study was designed to determine whether decreased zinc in breast milk affected serum zinc levels in infants and whether there was a need for zinc prophylaxis.

PATIENTS and METHODS

The study included 101 healthy term infants aged between 0 and 5 months at the time of admis-

sion. The infants were divided into two groups depending on the way they were fed, that is, those fed only with breast milk and those fed only with formula milk, respectively. The infants were selected according to the following criteria:

- i. a birth weight over 2500 g and at the time of enrolment, height and weight percentiles between 3 percent and 97 percent;
- ii. not presenting with either a history or signs of fever, diarrhea, vomiting and a chronic disease;
- iii. having being fed with only breast milk or only formula milk and having a healthy mother. Those who received additional food or those who received both breast milk and formula milk were excluded from the study. Considering trace amounts of zinc in fruit juice, infants who were given fruit juice were not excluded.

Infants in both groups were divided into subgroups according to their ages in months. Serum zinc levels were determined using the 5 Br-PAPS

method. Comparison was made between the respective groups according to the months. Statistical analyses were made using Student's t-test.

RESULTS

One hundred and one healthy, term infants were divided into two groups according to the way they were fed. Those fed only with breast milk (n=53) and those fed only with formula milk (n=48) were divided into subgroups according to their ages in months.

There were no significant differences between the subgroups with respect to the average weight and height obtained at the time their blood was collected ($p>0.05$). There was also a decrease in height percentiles in the four- and five-month age groups, but these changes were not significant ($p>0.05$).

Zinc levels obtained in infants receiving breast milk showed a timely decrease, being $78.81\pm 13.6 \mu\text{g/dL}$, $73.17\pm 13.09 \mu\text{g/dL}$, $70.22\pm 10.29 \mu\text{g/dL}$, $69.45\pm 14.52 \mu\text{g/dL}$, and $54.16\pm 12.34 \mu\text{g/dL}$ in the age groups of 0 to 5 months, respectively. Corresponding values for formula milk were $77.87\pm 17 \mu\text{g/dL}$, $70.53\pm 14.34 \mu\text{g/dL}$, $80.37\pm 17.37 \mu\text{g/dL}$, $82.2\pm 11.43 \mu\text{g/dL}$, and $81.37\pm 13.75 \mu\text{g/dL}$ in the age groups of 0 to 5 months, respectively.

No significant difference was found between serum zinc levels in one-, two- and three-month-old infants fed only with breast milk and only with formula milk, whereas in four- and five-month-age groups, significant decreases were observed in infants fed with breast milk ($p<0.05$ and $p<0.001$, respectively) (Figure 1).

DISCUSSION

Studies from many centers have demonstrated the nutritional, protective value of breast milk and its physiologically appropriate content for an infant. There is broad consensus on the fact that no other nutrient is superior to breast milk until the infant reaches 4-6 months of age. However, zinc levels in breast milk exhibit a downward trend with age during the periods of lactation. It has been reported that zinc levels taken with breast milk are 2.3 mg/day, 1 mg/day, 0.81 mg/day, and 0.52 mg/day at ages two weeks, three months, five months, and seven months, respectively, and that growth percentiles show deviations from normal after the fifth month (2,3).

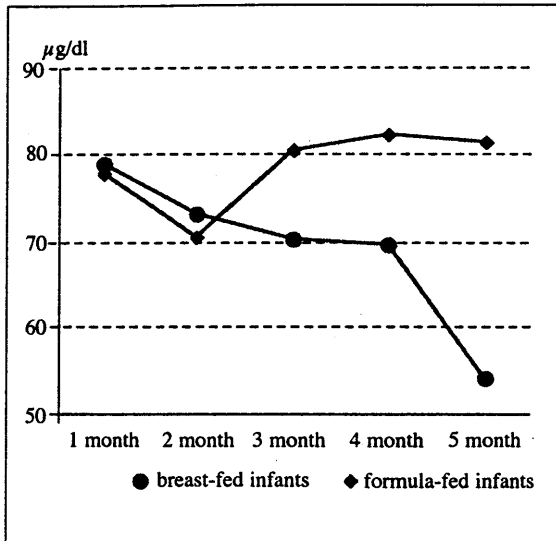


Figure 1. Serum zinc levels in infants receiving only breast milk and only formula milk.

Daily recommended amount of zinc for babies receiving formula milk is 5 milligrams. Since formula milk contains a constant amount of zinc amounting to 3.97 mmol/L, babies fed in this way always receive 0.8 mg/kg/day or more (4). However, zinc levels in breast milk gradually decrease, reaching a minimum amount of 0.08 mg/kg/day in the fourth month.

Different mean levels of zinc have been reported in studies performed in normal infants: Kumar and Rao (5) and Ksarkos and Schuna (6) reported $102.4\pm 4.7 \mu\text{g/dL}$ and $50-150 \mu\text{g/dL}$, respectively. A study from Nigeria reported $56.5\pm 19.3 \mu\text{g/dL}$ (7). Two studies from Turkey by Gürses (8), and Tuna and Haşhaş (9) found $85.06\pm 5.87 \mu\text{g/dL}$ and $81.68\pm 1.36 \mu\text{g/dL}$, respectively.

Hambidge et al. examined zinc levels in 71 infants fed with breast milk and noted that the amount of zinc taken from breast milk decreased with age and that deviations in growth percentiles occurred beginning with the fifth month (3).

In our study we observed that serum zinc levels gradually decreased in breast fed infants between 0 and 5 months of age. This decrease reached statistically significant levels in the fourth and fifth months ($p<0.05$ and $p<0.001$, respectively).

Cassel and Widdawson documented negative zinc values in nine of 10 infants who were fed on breast milk in the first week. On the other hand, Zi-

egler et al. demonstrated an appropriate and consistent balance in zinc values in babies who were given various formula nutrients (4). Similarly, in our study no significant change in zinc values was found with respect to growing age in babies who were fed on formula milk.

We speculate that, in infants who were fed on breast milk after 4-6 months, zinc-supplemented food with a proper nutritional value and absorption should be added in order to prevent any adverse nutritional sequelae and emphasis should be given on prophylaxis with zinc.

REFERENCES

1. O' Dell BL. Bioavailability of and interaction among trace elements. In: Chandre RK, editor. *Trace element in nutrition in children*. New York 1985; 41-51.
2. Hambidge KM. Clinical deficiencies. In: Vincent C, Ley KC, editors. *Trace elements in nutrition*. Brennonns Practice of Pediatrics. Philadelphia: Harper and Row Publishers 1981; 1-15.
3. Krebs NF, Rperdinger CS, Robertson AD, Hambidge KM. Growth and intakes of energy and zinc in infants fed human milk. *J Pediatr* 1994; 124: 32-9.
4. Sievers E, Olding HD, Dörer K, Schaub J. Longitudinal zinc balances in breast-fed and formula fed infants. *Acta Pediatr* 1992; 8(1): 1-6.
5. Kumar S, Rao KS. Plasma and erythrocyte zinc levels in PEM. *Nut Met* 1973; 15: 364-71.
6. Ksarkos EL, Schura A. Serum Ap after treatment of zinc deficiency in human. *Am J Clin Nutr* 1982; 33: 2602-12.
7. Akinmo I, Johnson C. Plasma zinc levels of PEM in Nigeria. *Tropica* 1982; 39: 255-74.
8. Gürses N. D Vitamine dirençli raşitizmde serumda ve idrarda Zn, Cu, Mg düzeyleri. *Türkiye Klinikleri Araştırma Dergisi* 1988; 6: 283-7.
9. Tuna F, Haşhaş H. PEM'li çocuklarda serum çinko düzeyi. *Dr. Sami Ulus Hastanesi Dergisi* 1989; 1-2: 121-6.

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