Micronutrients in Human Breast Milk

Jessica Moody, Nutrition Science
Dr. Douglas Lewis, Department of Human Nutrition
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Abstract

The American Academy of Pediatrics states that human breast milk possesses the ideal form and concentration of nutrients needed to support an infant . However, limited data was available on the mineral composition. This study determined the mineral composition of mature (<30 days) breast milk. 159 breast milk samples from 144 distinct donors were analyzed for concentrations of the following 9 minerals: Calcium, Copper, Iron, Potassium, Magnesium, Phosphorus, Sodium, Zinc, and Manganese. Mineral concentrations of Zinc, Iron, Sodium, and Magnesium fell below adequate intake concentrations recommended by the Institute of Medicine.

Introduction

Breast milk is the ideal food for infants. Research supports clinical efforts made to encourage mothers to breastfeed. The Institute of Medicine used the average content of minerals in human milk published in literature to determine the adequate intake of infants. However, limited data has been available on the mineral composition of mature breast milk. Previous studies are based on a small collection of samples, often from a single region or specific milk bank, and the data shows significant variation between studies.

Prolacta Bioscience processes milk collected by a nationwide network of milk banks into formulated human milk products for premature infants. Given the variation in mineral values published and the limited sample size, the purpose of this study was to determine the mineral content of mature banked human breast milk from a large nationwide sample population.

Methods

All samples were collected by Prolacta Bioscience from a nationwide network of milk banks from August 2011 to December 2011. There were 159 samples from 144 unique donors collected and analyzed . Samples were digested with HNO_3 in a microwave system . Cobalt and yttrium were added into the digestion vessel as internal standards. After digestion, samples were diluted with nanopure water (> 18 MΩ) and analyzed by ICP-OES. Two repetitions of each sample were analyzed and averaged together. Descriptive statistics were computed utilizing NCSS 2007 included mean, coefficient of variation, median, and range.
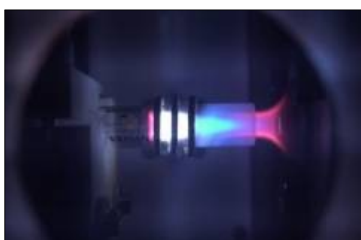
Results

Mineral	Mean	AI infants 0-6 months
Calcium	208.9	200
Copper	0.16	0.2
Iron	0.16	0.27
Potassium	359.9	400
Magnesium	24.3	30
Phosphorus	100.4	100
Sodium	81.9	120
Zinc	0.88	2

Table 1. Mean mineral concentrations (mg/day)

Figure 1. Iron, Copper and Zinc concentrations from individual subjects demonstrates a positive correlation between minerals suggesting cooperative regulation.
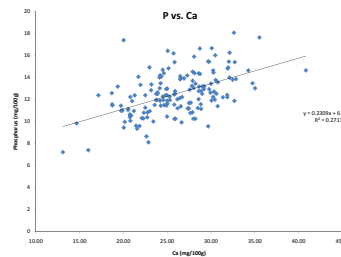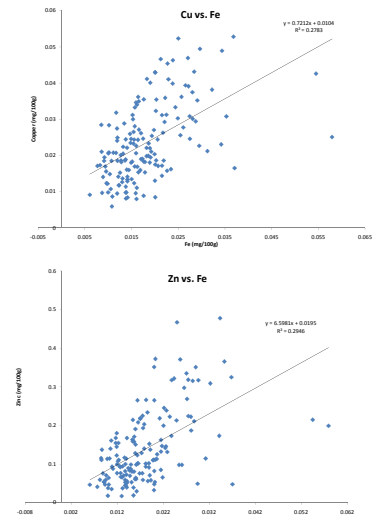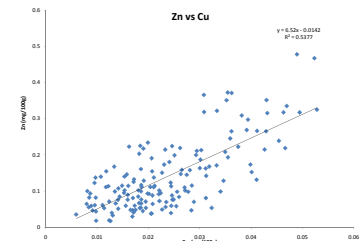

Figure 2. Calcium and Phosphorus concentrations from individual subjects demonstrates a positive correlation between minerals suggesting cooperative regulation.

Conclusion

Human breast milk is the optimum food for infants. Concentrations of Calcium, Copper, Potassium, and Phosphorus were consistent with AI values. Concentrations of Iron, Magnesium, Sodium, and Zinc were not consistent with AI values, however, were supported by previous research.

Given that mineral deficiency are rare in healthy exclusively breastfed infants, it is appropriate to suggest reevaluation of current infant mineral recommendations. Furthermore, future research is needed regarding correlations between zinc, iron, and copper as well as calcium and phosphorus concentrations in human breast milk. The positive correlations seen suggest tight cooperative regulation between minerals in breast milk.

References

1) American Academy of Pediatrics, Section on Breastfeeding. Breastfeeding and the use of human milk. *Pediatrics*. 2005;115:496-506.
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