

## Determination of Fe, Se and Zn in Milk Formulas Commercialized in São Paulo City- Brazil

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There are biological requirements, especially from the nutritional and immune point of view, which make breast milk the most appropriate food for newborn babies and infants. However, in cases where mothers are not able to maintain breastfeeding, the best alternative to meet an infant's nutritional needs is the pediatric industrialized milk, which are produced with cow or soy-based milk and enriched with vitamins, minerals, trace elements etc, to substitute maternal milk. There are several maternal milk substitutes offered in the market. According to the Brazilian Trade Standards of Food for Breastfeeding Infants (NBCAL), the infant formulas are classified as: milk formula for newborns of high risk; formula for infants aged 0 to 6 months; formula for infant with special requirements and formula for infants aged over six months. In this study, Fe, Se and Zn were determined by Instrumental Neutron Activation Analysis (INAA) in seventeen different milk formulas: 3 samples of soy-based; 5 samples of cow milk for 0-6 aged infants; 4 cow-milk samples for infants over 6 months; 2 samples of cow milk for newborns of high risk and 3 formulas for special requirements. The samples were acquired in São Paulo city during 2005 - 2007. About 200 mg of these powdered samples and the element standards were irradiated in the IEA-R1 nuclear research reactor at IPEN / CNEN-SP for 8 hours under a thermal neutrons flux  $10^{12} \text{ cm}^{-2} \text{ s}^{-1}$ . After the 15 day decay period, the irradiated samples and standards were measured in a gamma spectrometer coupled to an Hiperpure Ge detector, with 20% efficiency and resolution of 1.9 keV to the peak of 1332.49 keV <sup>60</sup>Co. For quality control of the results, NIST RM 8435 Whole Milk Powder and NIST SRM 1549 Non Fat Milk Powder reference materials were analyzed. The values obtained for  $|Z|$  score  $< 2$  indicated that the results are satisfactory at a 95% confidence level. Most of the obtained

results agreed with the certified values, resulting in relatively good accuracy, except for Se whose values were slightly higher than those presented in the certified reference materials. Fe, Se and Zn concentrations obtained in the infant milk formula samples agreed with those levels printed on the infant milk product labels. The concentration ranges varied: Fe (mg/100kcal) from 0.6 (formula with special requirement) to 1.7 (for infants over 6 months), Zn (mg/100kcal) from 0.5 (soy-based) to 1.3 (for infants over 6 months) and Se ( $\mu\text{g}/100\text{kcal}$ ) from 1.0 (special requirements) to 13.8 (soy-based formula). The findings of this study indicated that most infant milk formulas analyzed are within the dietary recommendation by the National Health Surveillance Agency (ANVISA) and of the Codex Alimentarius. Only Fe concentration for one sample (special requirements) was lower than the ANVISA recommendation. The results showed that soy-based infant formulas generally present higher Se concentrations than those of cow-milk based formulas.