

## SELENIUM IN STANDARD AND PLANT-BASED INFANT FORMULAE AND IN MILK: TOTAL CONTENT, SPECIATION AND ESTIMATED INTAKE

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### INTRODUCTION

Selenium (Se) is an essential component for human health, as selenoenzymes play an essential role in the human body, but excessive Se intake has also been associated with negative health effects. Nevertheless, in several regions of the world, the content of Se in the diet is estimated to be insufficient. Some authors have highlighted the possible benefits as being particularly important in the first years of life since infant formulae and baby foods are relevant sources of this toxic element in the children's diet. The main source of Se in breastmilk-replacing infant food comes from cow milk or as a fortified supplement in the infant formulae. Speciation of Se can influence its bioavailability, selenomethionine (SeMet) represents the main chemical form of Se in the human diet, but supplementation is mostly done using inorganic forms even though their absorption is not as high as that of SeMet. As diets are moving towards plant-based alternatives for dairy products, which present variable and sometimes unknown nutritional characteristics, it is important to pay attention to their nutritional composition.

### METHODOLOGY

This study aims i) to quantify Se and the main Se species, including selenite (SeIV), selenate (SeVI) and SeMet in standard milk-based infant formulae, specialised infant formulae and plant-based infant formulae and ii) to estimate the daily Se intake through infant formula consumption and compare this with reference levels. Fifty samples of infant formulae and milk were acquired in different grocery stores and pharmacies in Brazil and Belgium. In addition, milk samples (n=15) were analysed; these included cow's milk and plant-based milk. Digestion of Se was based on the AOAC Official Method 2015.06. Total Se determination is performed by ICP-MS (Agilent 8800). Speciation analysis was performed after a double enzymatic extraction method (4 mg protease L-1 and 2 mg lipase L-1, pH 7.5) to evaluate the following Se species: SeMet, Se(IV) and Se(VI), through HPLC-ICP-MS (Varian 720MS). An anion exchange column (PRP-X 100, Hamilton) was employed for separation of the Se species, using a mobile phase containing 10 mM citric acid and 2 % (v/v) methanol at pH 5.

## RESULTS

Selenium concentrations ranged in standard starters and follow-up samples between 11-30  $\mu\text{g L}^{-1}$ , in specialised starters and follow-up samples from <10  $\mu\text{g L}^{-1}$ -16  $\mu\text{g L}^{-1}$  and in plant-based formulae between 9-18  $\mu\text{g L}^{-1}$ . Selenium concentrations in infant formulae are not markedly different from concentrations in milk. However, no Se was measured in the plant-based milks (except one sample) while it was measured in the plant-based formulae after supplementation. The daily intake (DI) of Se via infant formula consumption was calculated and compared with the Adequate Intake (AI) value established by the EFSA NDA Panel. The DI of Se via starter infant formulae was more than the AI (up to 202 %). The follow-up formulae contributed for 48-104 % of the AI and specialised formulae for 40-115 %. All of the plant-based infant formulas, such as soy and rice, contributed to Se intakes below the AI (42-71 %). As follow-up formulae are not the only source of food, there are other sources of Se for these infants. SeMet was the main species found in milks, while in infant formulae the species concentrations varied according to the source of protein and the source of supplementation.

## DISCUSSION

Infant formulae are indicated to be an important source of Se supply, compared to the supply provided by breast milk which is recognised as the primary source of nutrition for babies and recommended as the main source of nourishment during their first year of life. Se in breast milk is generally lower compared to infant formulae, nevertheless Se status is greater in breast-fed than in formula-fed infants. More research is needed to clarify the role of Se species composition. This study gives some information about the species distribution in the supplemented infant formulae and makes clear that special attention is needed when replacing milk with plant-based alternatives, as Se need to come entirely from supplementation.