Rapport 1 – 2013

Contaminants and minerals in foods for infants and young children

Part 1: Analytical results

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Contents

Abbreviations and special terms used in the report

"Baby foods" are, according to Directive 2006/125/EC, foods other than PCBF used as part of a diversified diet which do not constitute the sole source of nourishment of infants and young children (1).
Examples: Meals and fruit-based dishes.

Contaminants – arsenic (As), cadmium (Cd) and lead (Pb) are considered in this report.

Follow-on formulae – foodstuffs which according to Directive 2006/141/EC are intended for particular nutritional use by infants when appropriate complementary feeding is introduced and which constitute the principal liquid element in a progressively diversified diet of such infants (2).

"Foodstuffs for normal consumption" - food that is not specifically intended for infants and young children, but which they may consume (see Directive 2009/39/EC).
Examples: soy-, rice-, and oat-based drinks as alternatives to milk.

FSMP – foods for special medical purposes. Specially processed or formulated foods intended for the dietary management of patients and to be used under medical supervision, according to Directive 1999/21/EC (3).
Examples: products intended for children with allergy or inborn metabolic disorders, and enteral formula.

ICP-MS – inductively coupled plasma mass spectrometry. The analytical technique used for the analysis of contaminants and minerals in the food products.

Gruel – a type of PCBF consisting of some type of cereal boiled in milk, water or other liquids. Could be described as a thinner version of porridge that is more commonly drunk than eaten.

Infants – children under the age of 12 months (2).

Infant formulae – foodstuffs which according to Directive 2006/141/EC are intended for particular nutritional use by infants during the first months of life and fulfil the nutritional requirements of such infants until the introduction of appropriate complementary feeding (2).

LOQ - limit of quantification. The lowest concentration that could be quantified with a specific analytical method.

Minerals – copper (Cu), iron (Fe), and manganese (Mn) are considered in this report.

PCBF - processed cereal-based foods. Cereal-based foodstuffs which according to Directive 2006/125/EC are used as part of a diversified diet and which do not constitute the sole source of nourishment of infants and young children (1).

PRI – population reference intake.

Porridge – a type of PCBF consisting of some type of cereal boiled in milk, water or other liquids.

SD – standard deviation.

Young children – children aged between one and three years (2).

Summary

During 2011 and 2012 a project was carried out by the National Food Agency to analyse and assess contaminants and minerals in foods for infants and young children. Essential minerals (copper, iron, and manganese) and unintentionally present metals, so called contaminants (arsenic, cadmium and lead), were analysed in close to 100 different products intended for infants and young children. A limited number of "foodstuffs for normal consumption" that infants and young children might consume were also analysed. For comparison, a composite sample of human breast milk from 90 women was analysed as well. The samples were analysed by ICP-MS (inductively coupled plasma mass spectrometry) using two different methods. One method is accredited for the analysed contaminants and minerals, and fulfils the criteria for official control of levels of contaminants (lead and cadmium) in foodstuffs. The other method is not accredited but has a higher sensitivity and thus lower concentrations could be quantified.

The concentration of the contaminants ranged from below 0.001 up to 0.04 milligrams per kilogram 'ready for use' product. The highest concentrations of arsenic (0.04 mg/kg) were found in rice-based products whereas processed cereal-based foods (PCBF) contained the largest amounts of cadmium (up to 0.01 mg/kg). The highest lead concentrations (up to 0.02 mg/kg) were found in foods for special medical purposes (FSMP, e.g. products intended for children with allergy or inborn errors of metabolism). Minerals had been intentionally added to most products intended for infants and young children. The highest average concentrations of minerals were found in FSMP for young children. For copper the concentration was close to 160 µg/100 g, which is three times higher than in the other product categories. The average concentration of manganese was close to 250 µg/100 g in FSMP for young children as well as in PCBF (porridge). Regarding iron, the average concentration was around 1 mg/100 g for most of the product categories. The lowest average concentration of iron was 0.31 mg/100 g in "foodstuffs for normal consumption".

Sammanfattning

Under 2011 och 2012 genomförde Livsmedelsverket ett projekt där halter av metaller i barnmatsprodukter analyserades och bedömdes. Mineraler (koppar, järn och mangan) samt metallföroreningar, så kallade ”främmande ämnen” (arsenik, bly och kadmium) analyserades i närmare 100 olika produkter avsedda för spädbarn (0-12 månader) och småbarn (1-3 år). Även ett begränsat antal av andra produkter som spädbarn och småbarn kan tänkas konsumera ingick i studien (eng. “foodstuffs for normal consumption”). Som jämförelse analyserades ett samlingsprov av bröstmjölk som bestod av mjölk från 90 kvinnor. Alla prov analyserades med ICP-MS (inductively coupled plasma mass spectrometry) med två olika metoder beroende på olika krav av analytisk kvalitet. En av analysmetoderna är ackrediterad för de främmande ämnen och mineraler som ingick i projektet och uppfyller de krav som ställs för offentlig kontroll av bly och kadmium i mat. Den andra metoden är inte ackrediterad men har högre känslighet och ger därför möjlighet att mäta lägre koncentrationer.

Halterna av de främmande ämnena; arsenik, bly och kadmium varierade från mindre än 0,001 upp till 0,04 milligram/per kilogram ätfärdig produkt. De högsta halterna av arsenik (0,04 mg/kg) påträffades i risbaserade produkter, medan gröt- och vällingprodukter (”processed cereal-based products”, PCBF) innehöll de största mängderna av kadmium (upp till 0,01 mg/kg). De högsta halterna av bly (0,02 mg/kg) påvisades i livsmedel för särskilda medicinska ändamål (”food for special medical purposes”, FSMP; t ex produkter för barn med allergi eller medfödda fel i metabolismen). De flesta produkterna för spädbarn och småbarn var berikade med mineraler. De högsta halterna av mineraler återfanns i produktkategorin FSMP för småbarn. Medelhalten av koppar, 160 µg/100 g, i denna produktkategori, var tre gånger högre än i övriga produkter. Medelhalten av mangan var nära 250 µg/100g i både FSMP för småbarn och i PCBF (gröt). Medelhalten av järn låg runt 1 mg/100 g för de flesta produktkategorierna. Lägsta medelhalten av järn, 0,31 mg/100 g, återfanns i produktkategorin med övriga produkter (eng. “foodstuffs for normal consumption”).

Introduction

The National Food Agency has the task of protecting the interests of the consumer by working for safe food of good quality, fair practices in the food trade, and healthy eating habits.

Concerns with regard to adverse health effects of high concentrations of manganese and possibly also iron in infant formulae were raised in a study by Ljung et al, 2011 (4). The authors also found that foods intended for infants and young children contained arsenic, cadmium and lead. This is of particular concern as absorption is higher and excretion is less effective in infants and young children compared to adults (5).

Copper was not included in the study by Ljung et al (4) but the Scientific Committee for Food stated as early as 1997 that ”fortification of weaning foods with copper is not only unnecessary, but it is also inadvisable. For all these reasons the Committee recommends to limit strictly the addition of copper to weaning foods and to set an upper limit which not exceed one tenth the PRI of 1-3 year-old children, i.e. 40 µg/100 kcal of the ‘ready for use’ product.” (6).

The National Food Agency therefore started a project with the aim of determining the levels of arsenic, cadmium, lead, copper, iron, and manganese in products for infants and young children, and also of estimating the intake of these elements from these products. This report provides analytical data on levels of contaminants and minerals in foods that healthy and non-healthy infants and young children normally consume.

The results from the analysis of minerals and contaminants performed within the project are presented here, while the risk and benefit assessments and the risk management are presented in a report with three parts:

- Contaminants and minerals in foods for infants and young children – Analytical results, Rapport 1/2013, Part 1
- Contaminants and minerals in foods for infants and young children – risk and benefit assessment, Rapport 1/2013, Part 2
- Contaminants and minerals in foods for infants and young children – risk and benefit management, Rapport 1/2013, Part 3. Also available in Swedish – Tungmetaller och mineraler i livsmedel för spädbarn och småbarn – Risk- och nyttohantering, Rapport 1/2013, Del 3

Materials and methods

Terminology

In this report the term *elements* normally used in chemistry will not be used. Instead the terms *contaminants* and *minerals* used in legislation will be used to simplify comparison with food legislation.

Identification of foods for infants and young children

The aim of the project was to determine the levels of contaminants and minerals in foods that infants and young children might consume. Previous findings indicate that cereal- and soy-based products are of particular concern, for example reference 4. Hence, such products were prioritised in this study.

The following food categories (as defined by legislation) were included in the project:

- Foods for special medical purposes (FSMP)
  - Foods for special medical purposes for infants
  - Foods for special medical purposes for young children
- Infant formulae
- Follow-on formulae
- Processed cereal-based foods for infants and young children (PCBF)
  - Porridge
  - Gruel
- Breast milk and "foodstuffs for normal consumption"

The scope of the project does not cover the category "baby foods", such as meals and fruit-based dishes for infants and young children.

To identify available products from each category several sources of information were used (7) including sales data from Apoteket AB and the National Food Agency´s notification details for FSMP and infant formulae. Websites of the distributing companies in Sweden were screened in March 2011. In total, more than 200 products (excluding different flavourings) were identified. Products were selected based on the following criteria: (A) producer – the project intended to include products from all producers present on the Swedish market in spring 2011; (B) type of product - the project intended to cover as many different types

of foods as possible that infants and young children might consume, except for the category “baby foods”.

Products were prioritised according to:

- Most commonly used FSMP for infants and young children according to sales data from Apoteket Service AB (units of FSMP sold by pharmacies in Sweden in 2009 and 2010. For newly launched products sales data between January and March 2011 were used).
- Most commonly prescribed/recommended products according to paediatric dieticians (personal communication).
- Highest content of wholegrain, i.e. if two products were similar the product with the highest amount of wholegrain was selected, since the cadmium content tends to be higher in wholegrain.
- Highest content of rice, i.e. if two products were similar the product with the highest amount of rice was selected, since the arsenic content tends to be higher in rice.
- Levels of added minerals (copper, iron, manganese), i.e. if two products were similar the product with the highest added amount of manganese was selected.

Sampling

Samples were purchased at supermarkets and pharmacies in the counties of Uppsala, Stockholm and Gävleborg, in Sweden, as well as from websites marketing the products. FSMPs were ordered from Apoteket AB (Livsmedels-apoteket). Sampling was carried out between 4 May 2011 and 13 October 2011.

In total 253 samples of 92 different products were collected. In addition, a composite sample of human breast milk collected week 3 post-partum from 30 volunteers during 2008, 2009 and 2010 (total n=90) was analysed. The human breast milk samples were collected as part of the ongoing biomonitoring project “POPup” at the National Food Agency. For details about sampling procedures for the human milk see reference 8.

In Appendix I, Tables 1-7, information on the packages of the products is listed, such as producer, intended use and age group, energy content, mineral content, main ingredient, and if the product is sold ‘ready for use’ or as powder. Not all packages included information on every one of the listed categories. In Tables 1 and 2 information about whether the FSMP can be used as the sole source of nutrition is also given.

For each product, samples from three different production occasions (batches) were included, unless only two batches (21 products) or one batch (5 products)

were available during the period of sampling (May to October 2011). Details regarding the number of batches used for each product are presented in Appendix II, Tables 1-7.

All samples were intact, without any visible damage upon arrival at the National Food Agency. Samples were all given a unique number. Prior to analysis samples sold as powder were stored in a dark room at room temperature. Liquid and 'ready for use' samples were stored at +4 °C (see Appendix I, Tables 1-7 for information about products sold as 'ready for use').

Determination of total levels of contaminants and minerals

Method and accreditation

The samples were analysed by ICP-MS (inductively coupled plasma mass spectrometry) using two different methods due to various analytical quality demands. Copper, iron and manganese were determined at the National Food Agency using an accredited method (ISO/IEC 17025 by SWEDAC, Swedish Board for Accreditation and Conformity Assessment) based on the standard method EN15763 and NMKL method No. 186 (National Food Agency id: SLV K2-m373.3). Arsenic, cadmium and lead were determined both at the National Food Agency using the above-mentioned accredited method and at ALS Scandinavia AB, Luleå, Sweden, using a method with a higher sensitivity. The method at ALS was the same as their accredited method for routine analysis of these types of samples, with the exception of a lower dilution. Detailed information about the accredited method at ALS can be found in reference 9. The results from ALS with the higher sensitivity were used for the risk assessment and are presented in this report. The method at the National Food Agency fulfils the criteria for methods used in official control of levels of lead and cadmium set out in Regulation (EC) No 333/2007 (10) and Regulation (EC) No 1881/2006 (11). The analyses at the National Food Agency were performed during October and November 2011, and at ALS in April 2012.

Sample preparation

Products were analysed as composite samples from 3 different batches unless otherwise indicated (see Appendix II, Tables 1-7). The products were carefully stirred and from each of the three batches 100 grams were added into a large container and thoroughly mixed with 100 grams from the two other batches of that particular product. Each composite sample was given a specific code (the letter M plus a number) in order to anonymise the origin before the analysis. In Appendices I, II, and III both the M-number and product name are listed. The composite sample was transferred into 2 tubes, of which one was used for the analysis at the National Food Agency, and the other was sent to be analyzed at ALS. All samples were stored either at room temperature or in a refrigerator (‘ready for use’ samples) until the day of analysis. The tubes containing ‘ready for use’ products for storage were frozen directly.

Products were analysed ‘as sold’, i.e. either as dry powders or in liquid form. The sample preparation included microwave digestion. At the National Food Agency approximately 0.3 g of dry samples and 1.5 g of liquid samples were digested with 6 ml of nitric acid and 1 ml of hydro chloric acid, in a CEM Mars 5 microwave digestion system (CEM Corporation, Matthews, North Carolina, USA). The samples were dissolved completely, resulting in clear solutions that were diluted with water (Q-POD Element, Millipore Corporation, Billerica,

Massachusetts, USA) to a final volume of 25 ml in plastic test tubes. Before the analysis the samples were diluted 1/10 with water. At ALS nitric acid was used as the digestion media (9), and the samples were only slightly diluted before analysis.

Instrumental conditions and method performance

The analytical instrument used at the National Food Agency was an Agilent 7700x ICP-MS (Agilent Technologies, Inc., Loveland, Colorado, USA). Helium was used as collision gas for all elements to remove possible polyatomic interferences. On-line addition of the internal standards scandium, rhodium, and lutetium was employed. Detailed information about the method is summarised in Table 1. At ALS an ELEMENT ICP-SFMS (Thermo Finnigan, Bremen, Germany) was used. This instrument has sufficient mass resolution to eliminate interferences for many analytes, and very low reporting limits (comparable to limit of quantification, LOQ). The reporting limits for the applied method with a low dilution factor are for solid samples in µg/kg product 'as sold': 0.5-1 for arsenic, 0.2-0.5 for cadmium, and 0.4-0.8 for lead, and for liquid samples in µg/l product 'as sold': 0.1-0.2 for arsenic, 0.01-0.02 for cadmium, and 0.03-0.06 for lead. The estimated combined measurement uncertainty is 25-40 %.

Table 1. Method performance of the accredited method at the National Food Agency

Analyte Total levels	**Isotopes**	**Internal standard***	**LOQ dry sample mg/kg**	**LOQ liquid sample mg/kg**	**Expanded measurement uncertainty**
Manganese	^{55}Mn	^{45}Sc	0.020	0.004	15 %
Iron	^{56}Fe	^{45}Sc	0.57	0.11	16 %
Copper	^{63}Cu	^{45}Sc	0.060	0.012	15 %
Arsenic	^{75}As	^{45}Sc	0.020	0.004	20 %
Cadmium	^{111}Cd	^{103}Rh	0.006	0.001	26 %
Lead	^{206}Pb + ^{207}Pb + ^{208}Pb	^{175}Lu	0.008	0.002	28 %

* Sc = scandium, Rh = rhodium, and Lu = lutetium

Quality control

Results from analysis of reference materials at the National Food Agency are presented in Table 2. The milk reference material is routinely used to monitor the performance of the analytical method by control charts at the National Food Agency. In this reference material, the concentration of arsenic, cadmium and lead, respectively, is close to 0.1 mg/kg, which is a much higher level than can normally be found in milk. Results from analysis of reference materials at ALS Scandinavia using the applied method of low dilution are presented in Table 3.

Table 2. Results from analysis of reference materials in mg/kg, using the accredited method at the National Food Agency.

Reference material			Arsenic		Cadmium		Lead	
	n	mg/kg	Conc.	SD	Conc.	SD	Conc.	SD
Durum Wheat Flour NIST SRM 8436	7[1]	Average	<0.02		0.11	0.004	0.024	0.002
		Certified	*0.03*[2]		0.11	0.05	0.023	0.006
Spiked Milk, in house reference material	7	Average	0.096	0.003	0.098	0.004	0.094	0.002
		Assigned value	0.10		0.103		0.098	

			Manganese		Iron		Copper	
		mg/kg	Conc.	SD	Conc.	SD	Conc.	SD
Durum Wheat Flour NIST SRM 8436	7	Average	15.2	0.5	40.5	1.1	4.13	0.19
		Certified	16	1	41.5	4	4.3	0.69
Spiked Milk, in house reference material	7	Average	0.11	0.005	0.28	0.06	0.14	0.01
		Assigned value	0.12		0.31		0.14	

n – number of replicates; Conc. Concentration, SD – standard deviation of the measured average, and for certified concentrations the uncertainty (95 % confidence) is given.

[1] The average of lead is calculated from 6 replicates.

[2] Values in italics are not certified, only indicative for information.

Table 3. Results from analysis of reference materials in µg/kg, using the high sensitivity method at ALS Scandinavia, Sweden.

Reference material[1]			Arsenic		Cadmium		Lead	
	n	µg/kg	Conc.	SD	Conc.	SD	Conc.	SD
Wheat Flour NIST SRM 1567a[2]	2	Average	4.0	0.3	22.2	0.2	6.5	1.2
		Certified	*6.0*[3]		26	2	*not certified*	
Whole Milk Powder NIST SRM 1549[2]	2	Average	2.9	0.2	0.7	0.1	12.7	0.2
		Certified	*1.9*[3]		0.5	0.2	19	3
Baby Food Formula IMEP-113	3	Average	5.1	0.2	10.8	0.02	3.7	0.4
		Certified	*not certified*		11.8	1.5	6.5	0.8
Durum Wheat Flour NIST SRM 8436[2]	1	Measured	11.7		97.7		19.9	
		Certified	*30*[3]		110	50	23	6

n – number of replicates; Conc. Concentration, SD – standard deviation of the measured average, and for certified concentrations the uncertainty (95 % confidence) is given.
[1] Wheat Flour NIST SRM 1567a and Whole Milk Powder NIST SRM 15492 were used in quality control by ALS, whereas Baby Food Formula IMEP-113 and Durum Wheat Flour NIST SRM 84362 were analysed as blind samples.
[2] ALS results are not corrected for moisture content, which otherwise would increase found concentrations presented as µg/kg TS by 3-8%.
[3] Values in italics are not certified, only indicative for information.

Conversion from the concentration in the product 'as sold' to the concentration in the 'ready for use' product

The analyses were performed on the products as they were sold, and the concentration in the 'ready for use' product is calculated by employing the dilution recipe given by the producer on the package. For the products that were intended to be diluted with water or other liquids before consumption, dilution factors were calculated on a weight to weight basis according to instructions on the packages:

$$\text{Dilution factor} = \frac{weight\ of\ powder\ per\ portion\ (g)}{weight\ of\ powder\ per\ portion\ (g) + weight\ of\ water\ per\ portion\ (g)}$$

For products which should be diluted with the ‘baby´s usual milk’ (according to recipe on the package) the density of cow´s milk (1.035 kg/l (average of 1.02-1.05 kg/l)) was used to calculate the dilution factor. Cow´s milk was chosen as the ‘baby´s usual milk’ because the density is well standardised and within the range of densities for infant formulae reported by others (1.02-1.04 kg/l, reference 4). For products which according to instructions on the packages could be diluted with water or any type of milk, water was selected. For products which should be diluted with infant formula the density of 1.03 kg/l was used for the calculation of concentrations in ‘ready for use’ products.

Any contributions of contaminants and minerals from water, milk or infant formula that should be used for dilution of the powders, according to the instructions on the package, were not taken into account.

Results and discussion

The results from the analysis of contaminants and minerals in the different products 'as sold' are presented in Appendix II, Tables 1-7. In Appendix III, Tables 1-7, the results have been converted to corresponding concentrations in the 'ready for use' product. The dilution factors used are presented as well. In the appendices the products are presented in alphabetical order by category, except in Appendix I, Tables 5 and 6, where porridge and gruel are sorted based on main cereal component. The following discussion of results refers to the concentrations in the 'ready for use' products.

Contaminants in food products consumed by infants and young children

Around three quarters of the samples contained concentrations of arsenic and lead below the LOQ of the accredited method. The concentration of cadmium was below the LOQ in 50 % of the samples. The non-accredited high sensitivity method generates values below, and in a few cases around, the LOQ of the accredited method. In Figure 1 the results from the high sensitivity method for arsenic, cadmium and lead (black columns) are presented together with the LOQ values from the accredited method (red horizontal lines). It should be noted that there is more than one LOQ value presented for each contaminant. This is due to the fact that the dilution recipes differ between the products. The LOQ values presented in Figure 1 are recalculated according to the dilution recipes from the LOQs in the analysed products 'as sold' (Table 1). The food products are identified by their M-number and Appendix I, Tables 1 to 7.

Only one sample for lead, ('*Mild wholegrain gruel oat*', M21), gave substantially higher values with the high sensitivity method than with the accredited method. Regarding the samples in which the contaminants were quantified by both methods, the analytical results were comparable and within the measurement uncertainty for nearly all results (90 %). In Appendix III, Tables 1-7, the concentration of the contaminants in the products 'ready for use' is presented individually. For each food category the average concentration and the standard deviation of contaminants are summarised in Table 4.

As expected, products that contained the highest amounts of arsenic were rice-based (i.e. have rice listed as the main ingredient) or contained rice. The highest amounts of cadmium were found mainly in cereal-based products (including rice), but also in soy-based products. Regarding the highest levels of lead, various products are represented, and several of the samples belong to the product category FSMP for young children. In the following section, the content of the contaminants in each food category is discussed separately, and some examples are given.

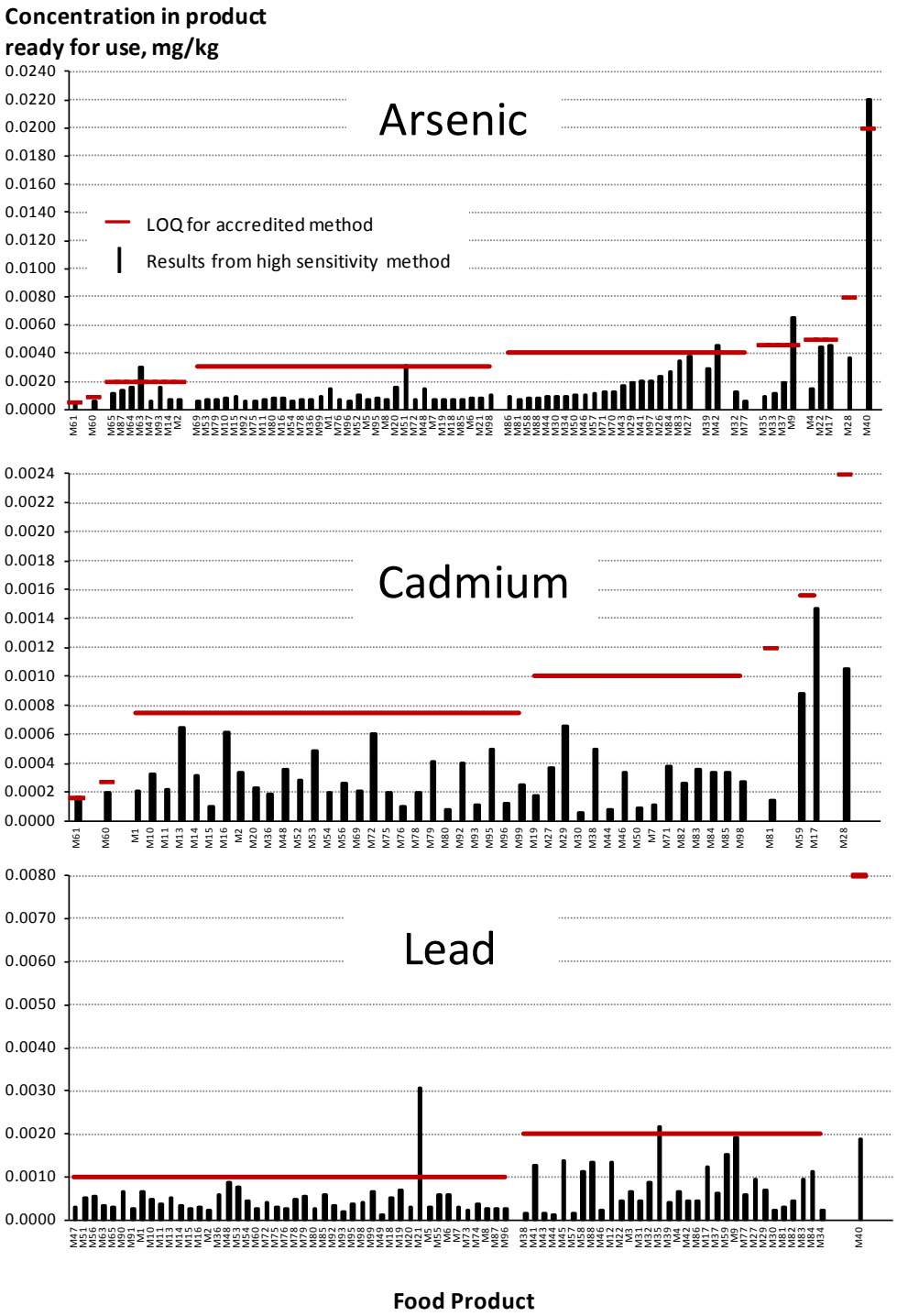

Figure 1. Results from analysis of food consumed by infants and young children. Samples reported *below the LOQ* using the accredited method at the National Food Agency, Sweden, (red line) are presented together with the results obtained with the non-accredited high sensitivity method at ALS Scandinavia, Luleå, Sweden (black columns).

The food products are identified by their M-number and Appendix III, where the results from the high sensitivity method are also presented. The samples were analysed 'as sold' and the original LOQ values for the analytical method (Table 1) are recalculated for the 'ready for use' product. There is more than one LOQ value presented for each contaminant since the dilution recipes to make the 'ready for use' products differ between the products

FSMP for infants (0-12 months) and young children (1-3 years)
The concentrations of cadmium and lead in FSMP for infants are all below 0.001 mg/kg whereas the concentration of arsenic varies more: from below 0.001 mg/kg up to 0.011 mg/kg. In FSMP for young children the levels of all contaminants are higher than in FSMP for infants in most products. The highest concentration of lead, 0.0226 mg/kg, was found in *'PKU gel'* (M28), which is more than ten times higher than in the other products in the same category (Appendix III, Table 1).

Infant formulae and follow-on formulae
The contents of contaminants were all below limit of quantification when using the accredited method at the NFA. Using the non-accredited high sensitivity method particularly arsenic in follow-on formulae was detected. The highest concentration of arsenic found in this category was 0.0046 mg/kg in '*BabySemp 3 follow-on-formula'* (M13) while most of the other products gave results around 0.001 mg/kg (Appendix III, Table 1).

Processed cereal-based foods for infants and young children (PCBF)
Among all the products analysed the highest average concentration of arsenic in Table 4 is found in PCBF and in "foodstuffs for normal consumption". The standard deviation of the mean for arsenic in these two groups is also larger than in the other groups, describing a substantial spread in concentration. The spread is explained by the divergence of the arsenic content in the main ingredients of the products. As mentioned above arsenic is mainly found in rice-based products. '*First organic wholegrain baby rice*' (M56) contains 0.041 mg/kg whereas *'Sinlac special porridge'* (M12), *'Cerelac risgröt'* (M31), *'Risdryck naturell'* (M45), *'Pama minute rice'* (M49), and *'Organic rice porridge'* (M91) contain around 0.03 mg/kg. These food categories, PCBF and 'foodstuffs for normal consumption', also give high average concentrations of cadmium, particularly in cereal-based products. Compared to oat porridge for normal consumption, PCBF contained less cadmium except for *'Banana porridge dairy free'* (M23), *'Sinlac special porridge'* (M12) and *'Good night! Rice porridge with vegetables'* (M40). *'Banana porridge dairy free'* also contains a high concentration of lead (0.0126 mg/kg), the second highest lead concentration of all products in the study.

Table 4. The average concentration of contaminants in each category of product 'ready for use' (mean ± SD). See Appendix III, Tables 1-7 for individual results.

Category	Number of analysed products	Arsenic[1] mg/kg	Cadmium[1] mg/kg	Lead[1] mg/kg
FSMP (0-12 months)	16	0.0015±0.0026	0.0003±0.0001	0.0005±0.0002
FSMP (1-3 years)	11	0.0021±0.0011	0.0008±0.0007	0.0031±0.0065
Infant formulae	9	0.0008±0.0001	0.0003±0.0002	0.0003±0.0001
Follow-on formulae	4	0.0018±0.0019	0.0003±0.0002	0.0006±0.0004
PCBF: Porridge	26	0.0098±0.0117	0.0028±0.0014	0.0013±0.0024
PCBF: Gruel	14	0.0050±0.0072	0.0017±0.0019	0.0010±0.0018
Foodstuffs for normal consumption	13	0.0070±0.0118	0.0035±0.0035	0.0007±0.0007

N – number of products (each analysed as composite sample of three batches); FSMP –Food for Special Medical Purposes; PCBF – Processed Cereal-Based Foods.
[1] The ready for use concentration originates from conversion of the analytical value for the product 'as sold' (Appendix II, Tables 1-7), by use of an appropriate dilution factor.

Minerals in food products consumed by infants and young children

Most of the products were fortified with iron, and several products with manganese and copper as well (see Appendix I, Tables 1-6). The results from analysis of the mineral content in the food products are presented in Appendix II ('as sold') and Appendix III ('ready for use'). The concentration of the minerals varied greatly between the products within the same food category. This may be due to the different levels of minerals added, but may also depend on differences in the natural mineral content of the ingredients. The average concentration of the minerals for each food category is presented in Table 5. Among the product categories analysed, FSMP for young children shows the highest average concentration for all three minerals. The average concentration of copper is three times higher compared to the other products.

Table 5. The average concentration of minerals in each category of product 'ready for use' (mean ± SD). See Appendix III, Tables 1-7 for individual results.

Category	N	Copper[1] µg/100g	Manganese[1] µg/100g	Iron[1] mg/100g
FSMP (0-12 months)	16	53.1±18.0	36.1±22.6	0.85±0.27
FSMP (1-3 years)	11	158±90.0	249±212	1.66±1.50
Infant formulae	9	38.4±6.0	8.5±4.3	0.51±0.13
Follow-on formulae	4	38.8±5.7	17.7±13.4	0.85±0.08
PCBF: Porridge	26	42.6±21.7	245±107	1.13±0.81
PCBF: Gruel	14	18.3±12.1	87.5±57.9	0.99±0.44
Foodstuffs for normal consumption	13	62.9±48.2	202±247	0.31±0.30

N – number of products (each analysed as composite sample of three batches); FSMP –Food for Special Medical Purposes; PCBF – Processed Cereal-Based Foods

[1] The ready for use concentration originates from conversion of the analytical value for the product 'as sold' (Appendix II, Tables 1-7), by use of an appropriate dilution factor.

FSMP for infants (0-12 months) and young children (1-3 years)

According to the labelling information on the products copper and iron were added as ingredients to all FSMP. Manganese was added to all FSMP except to *'Enfalac premature'* (M98) and *'Althera'* (M75) (see Appendix I, Tables 1 and 2). Mineral concentrations varied greatly within the category FSMP for young children (Figure 2). Several of the FSMP products for infants (0-12 months) are infant formulae adapted for specific allergies (see Appendix I, Table 1).

Compared to human breast milk (see Appendix III, Table 7) the average concentrations in FSMP for infants were lower for copper (<50 %) but more than 25 times higher for iron. Results on iron content in the analysed breast milk are in line with previous results for milk from Swedish women (12), whereas the copper content reported by others tends to be substantially lower (13, 14) than the results in this project. Manganese concentrations were higher in the FSMP products than in breast milk, in which the concentration was below the limit of quantification (0.4 µg/100 g). Concentrations of some minerals, e.g. copper in breast milk, have been shown to decrease over the lactation period (15). The breast milk analysed in this project, collected 3 weeks post-partum (8), cannot therefore be considered representative of the whole lactation period.

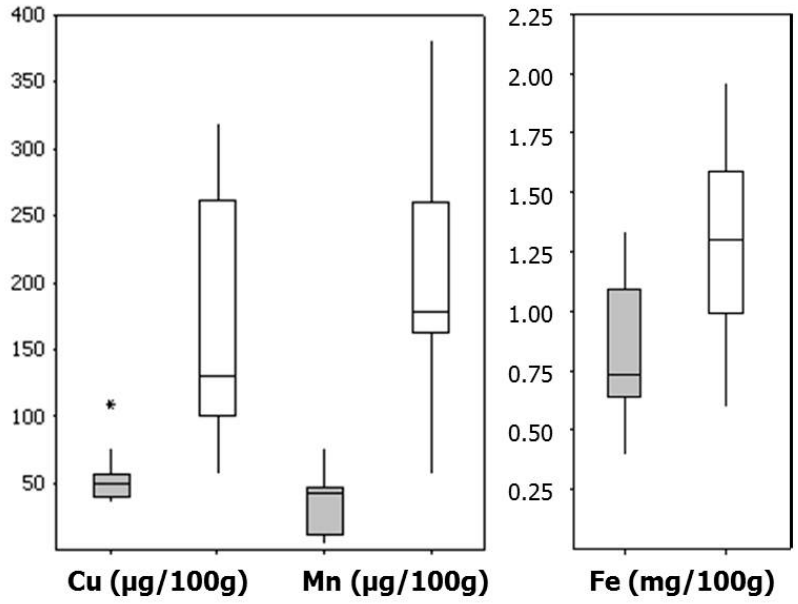

Figure 2. Concentrations of minerals in Food for Special Medical Purposes for infants (grey boxes, 16 different products analysed as composite sample of three batches) and young children (white boxes, 11 different products analysed as composite sample of three batches).
The horizontal lines represent the lower quartile (25th percentile), median (50th percentile) and upper quartile (75th percentile), whereas the vertical line represents the spread from the lowest to the highest observation. *Indicates the outlier *'Minimax enteral formula for children'* (M82). The product *'PKU gel'* (M28) was an outlier outside the graph for all minerals (Mn:830 µg/100g; Fe:6.0 mg/100g) except for copper.

Infant formulae and follow-on formulae

According to the labelling information on the products copper and iron were added as ingredients to all infant formulae and follow-on formulae. The labelling indicated that manganese was added to all formulae except the products from Semper (n=4) and the follow-on formulae '*NAN Pro 2*'. The results (Figure 3, Table 5) were in agreement with previously published studies on infant formulae (1, 12). Average concentrations of iron in infant formulae were nearly 20 times higher compared to human breast milk from Swedish mothers as reported in this project (n=90, 3 week post-partum, see Appendix III, Table 7) and by others (n=86, 9 months post-partum, reference 12).

Copper content in infant formulae was one third of the copper content in the analysed breast milk. Data on copper content in breast milk from the early lactation period is scarce. However, the assessed content in the infant formulae was similar to that previously reported in milk from e.g. Finnish (600 µg/L, n=27, 13) and Libyan women (400 µg/L, n=25, 14). Manganese concentrations were substantially higher in the analysed products than in breast milk, in which the concentration was below the limit of quantification (0.4 µg/100 g).

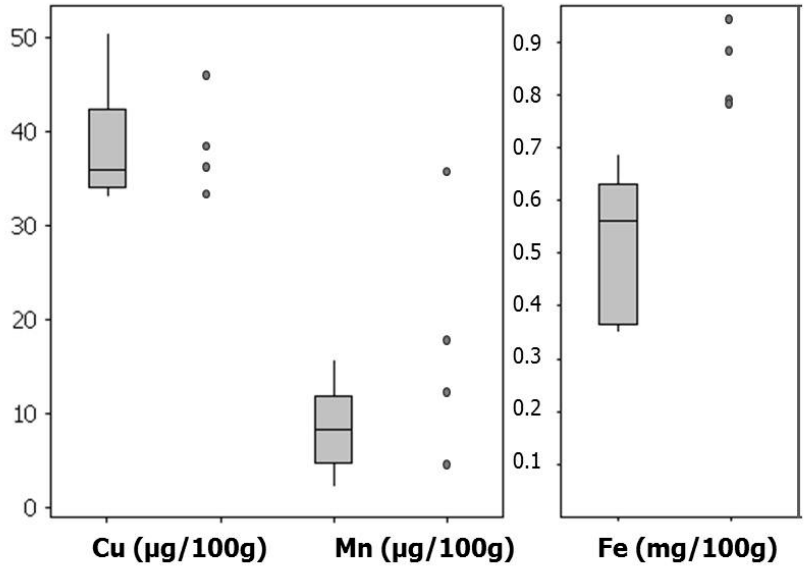

Figure 3. Concentrations of minerals in infant formulae (grey boxes, 9 different products analysed as composite sample of three batches) and follow-on formulae (individual dots, 4 different products analysed as composite sample of three batches)
The horizontal lines represents the lower quartile (25th percentile), median (50th percentile) and upper quartile (75th percentile), whereas the vertical line represent the smallest and largest observations.

Processed cereal-based foods for infants and young children (PCBF)
Among PCBF, manganese was added as an ingredient to products from HiPP (n=6) only. Copper was added to four of the products from HiPP. Iron was added to PCBF from Semper, Nestlé and HiPP (see Appendix I, Tables 5 and 6). However, the highest concentrations of copper were found in PCBF not fortified with copper. For related products, such as wholegrain porridge, manganese concentrations were similar independent of whether manganese was added or not. The results (see Figure 4, and Appendix III, Tables 5 and 6) were similar to those in the previously published study on porridge for infants and young children (1, 16).

Minerals were added to some of the rice porridges intended for infants and young children (see Appendix I, Table 5). These contained similar amounts of copper and manganese and 85 times higher amounts of iron compared to the rice porridge among "foodstuffs for normal consumption", *'Pama 'minute rice'*, (M49), to which minerals were not added. The oat porridges intended for infants and young children contained slightly lower amounts of copper and manganese, and nearly three times more iron than the oat porridges among "foodstuffs for normal consumption" (*'Rolled* oats', M47, and *'Oat toasted and milled'*, M77). Oat is naturally rich in manganese, which explains the high concentration of manganese in M47 and M77 as well as some of the non-fortified PCBF oat porridge e.g. *'Organic oat porridge'* (M63).

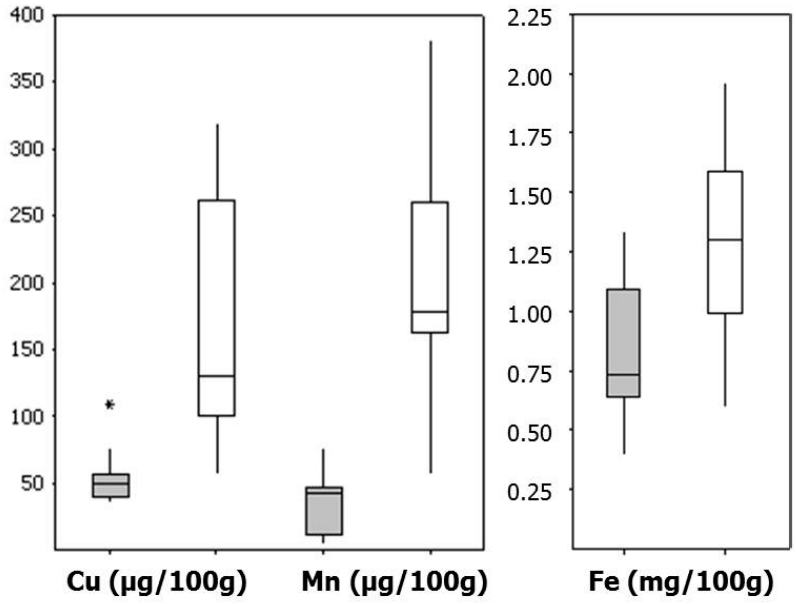

Figure 4. Concentrations of minerals in PCBF: porridge (grey boxes, 26 different products analysed as composite sample of three batches) and gruel (white boxes, 14 different products analysed as composite sample of three batches)

The horizontal lines represent the lower quartile (25th percentile), median (50th percentile) and upper quartile (75th percentile), whereas the vertical line represents the smallest and largest observations.; *Indicate an outlier: for copper '*Sinlac special porridge'* (M12), *'Banana porridge dairy free'* (M23) and '*Organic millet porridge' (100 %)* (M64); for iron the gruels '*First flavour'* (M73) and '*Céréales Cacao'* (M74).

Conclusions

There are food products consumed by infants and young children that contain contaminants and minerals in concentrations that might be debatable. It remains to be elucidated whether these concentrations of contaminants and minerals are harmful to health.

Appendices

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Table 2. Food for Special Medical Purposes for young children (1-3 years)
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Table 4. Follow-on formulae ‘as sold’
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Table 7. Breast milk and foodstuffs for normal consumption

Appendix II.
Results from analysis of the products ‘as sold’ - total concentration of contaminants and minerals
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Appendix III.
Concentration of contaminants and minerals in ‘ready for use’ products
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Table 2. FSMP for young children (1-3 years), ‘ready for use’
Table 3. Infant formulae, ‘ready for use’
Table 4. Follow-on formulae, ‘ready for use’
Table 5. PCBF: porridge, ‘ready for use’
Table 6. PCBF: gruel (välling), ‘ready for use’
Table 7. Breast milk and “foodstuffs for normal consumption”, ‘ready for use’

References

1. Commission Directive 2006/125/EC of 5 December 2006 on processed cereal-based foods and baby foods for infants and young children, implemented by the ordinance SLVFS 1997:27.
2. Commission Directive 2006/141/EC of 22 December 2006 on infant formulae and follow-on formulae and amending Directive 1999/21/EC, implemented by the ordinance LIVSFS 2008:2.
3. Commission Directive 1999/21/EC of 25 March 1999 on dietary foods for special medical purposes, with amendment in article 16 of 2006/141/EC, implemented by the ordinance LIVSFS 2000:15.
4. Ljung K, Palm B, Grandér M and Vahter M (2011) High Concentrations of essential and toxic elements in infant formula and infant foods - A Matter of Concern. Food Chemistry 127: 943-951.
5. Oskarsson A, Palminger Hallén I, Sundberg K and Petersson Grawé K (1998) Risk assessment in relation to neonatal metal exposure. Analyst 123: 19-23.
6. Scientific Committee for Foods Opinion on maximum limits for vitamins and minerals in processed cereal-based foods and baby foods (expressed on 13 December 1996) CS/NUT/CBF (10-FINAL-Rev 1. March 1997, paragraph 20).
7. Notified FSMPs according to directive 1999/21/EC last update 2011-03-21 and notified infant formulae according to directive 2006/141/EC last update 2011-03-21 (Anmälningsprodukter FMSP (SLVFS 2000:15) och moders-mjöksersättning (LIVFS 2008:2)) (National Food Agency 2011); Food list "FSMP, chapter prematurity, phenylketonuria and special nutrition for children – cow milk allergy" (Livsmedel för speciella medicinska ändamål, kapitel prematuritet, fenylketonuri och specialnäring till barn – komjölks-proteinallergi) (Apoteket farmaci 2011); sales data FSMP from January 2007 to March 2011 (Apotekets service AB 2011); Faktaboken, Semper baby foods and special diets (Semper barnmat och specialkoster) (Semper, 2009); www.vitaflo.net, accessed 2011-03-24; www.meadjohnson.se, accessed 2011-03-23; www.fresenius-kabi.se, accessed 2011-03-23; www.nutricia.se, accessed 2011-03-23; www.nestlenutrition.se (FSMP), accessed 2011-03-23; www.nestlebaby.com (follow-on formulae, baby foods) accessed 2011-03-24; http://webbutik.barnmatsbutiken.se, accessed 2011-03-28; www.babynat. co.uk accessed 2011-03-25; Holle baby food. Product folder for import (Kung Markatta 2010).
8. Lignell S, Aune M, Darnerud P.O., Cnattingius S and Glynn A (2009) Persistent organochlorine and organobromine compounds in mother´s milk from Sweden 1996-2006: Compound-specific temporal trend. Environmental Research 109:760-767.
9. Engström E, Stenberg A, Senioukh S, Edelbro R, Baxter D C, Rodushkin I (2004) Multi-elemental characterization of soft biological tissues by

inductively coupled plasma–sector field mass spectrometry. Analytica Chimica Acta. 521(2):123-135.
10. Commission Regulation (EC) No 333/2007 of 28 March 2007 laying down the methods of sampling and analysis for the official control of the levels of lead, cadmium, mercury, inorganic tin, 3-MCPD and benzo(a)pyrene in foodstuffs.
11. Commission Regulation (EC) No 1881/2006 of 19 December 2006 setting maximum levels for certain contaminants in foodstuffs.
12. Domellöf M, Lönnerdal B, Dewey KG, Cohen RJ and Hernell O (2004) Iron, zinc, and copper concentrations in breast milk are independent of maternal mineral status. Am J Clin Nutr 79: 111-115.
13. Vuori E and Kuitunen P (1979) The concentrations of copper and zinc in human milk. A longitudinal study. Acta Paediatr Scand 68:33-7.
14. Hannan MA, Dogadkin NN, Ashur IA and Markus WM (2005) Copper, selenium, and zinc concentrations in human milk during the first three weeks of lactation. Biol Trace Elem Res 107:11-20.
15. Silvestre D, Martìnez-Costa C, Lagarda MJ, Brines J, Farré R and Clemente G (2001) Copper, iron, and zinc contents in human milk during the first three months of lactation: a longitudinal study. Biological Trace Element Research 80:1-11.
16. Melø R, Gellein K, Evje L and Syversen T (2008) Minerals and trace elements in commercial infant food. Food Chem Toxicol. 46: 3339-42.

Appendix I. Labelling information on products included in the project

Table 1. Food for Special Medical Purposes for infants (0-12 months)

Product *(English translation)*	Id	Producer	Age group	Intended use	Labelled energy kcal/100 g	Labelled Copper µg/100g[1]	Labelled Manganese µg/100g[1]	Labelled Iron mg/100g[1]	Main ingredient	Sole source of nutrition	Product sold as
Althéra	M75	Nestlé	>1 w	Allergy	510	410		5.5	Lactose	X	P
Enfalac premature	M98	Mead Johnson	w 23-40[2]	Prenatal	490	515		8.3	Glucose syrup	X	P
Enfamil AR lipil	M78	Mead Johnson	>1 w	Reflux	500	330	300	5.5	Skimmed milk powder	X	P
Enfamil Human Milk Fortifier[4]	M61	Mead Johnson	w 23-40[2]	Prenatal	14[3]	44[3]	10[3]	1.4[3]	Medium chain tryglycerides		P
FM 85[4]	M60	Nestlé	w 23-40[2]	Prenatal	347	900	130	26	Maltodextrin		P
Galactomin 19 formula	M69	SHS	< 1y	Intolerance	534	380	440	3.9	Fructose	X	P
Minimax barnsondnäring *(Minimax enteral formula for children)*	M82	Nestlé	>6 mo	Malnutrition	120[5]	110[5]	70[5]	1.0[5]	Skimmed milk	X	RFU
Neocate LCP	M72	Nutricia	<1 y	Allergy	475	380	380	7.0	Glucose syrup	X	P
Nutramigen 1 lipil	M1	Mead Johnson	<6 mo	Allergy	500	380	300	9	Glucose syrup (corn)	X	P
Nutramigen 2 lipil	M48	Mead Johnson	>6 mo	Allergy	466	349	279	8.2	Glucose syrup (corn)		P
Pepti junior	M79	Nutricia	< 1 y	Allergy	515	314	327	6.0	Glucose syrup (corn)	X	P
Pepticate	M54	Nutricia	<1 y	Allergy	484	294	55	3.9	Whey protein	X	P
PKU anamix infant lcp+	M85	SHS	<1 y	PKU	457	430	430	8.1	Glucose syrup		P
Pregestimil lipil	M99	Mead Johnson	<6 mo	Allergy	500	380	300	9	Glucose syrup (corn)	X	P
PreNAN discharge	M95	Nestlé	w 23-40[2]	Prenatal	510	410	80	5.3	Whey protein	X	P
Profylac	M103	Semper	>1 w	Allergy	500	300	320	5.5	Maltodextrin	X	P

Id – identification of composite sample; w – week; mo-month; PKU – phenylketonuria; y – year; P – powder; RFU – ready for use

[1] Only presented if the mineral is labelled as an ingredient.

[2] Information from paediatric dieticians (not labelling).

[3] Per 100 ml product when reconstituted, i.e. four packets of Enfamil Human Milk Fortifier, the amount usually added to 100 ml of preterm human milk.

[4] The product should be diluted with breast milk.

[5] Per 100 ml ready for use product.

Appendix I. Labelling information on products included in the project

Table 2. Food for Special Medical Purposes for young children (1-3 years)

Product	Id	Producer	Age group	Intended use	Labelled energy kcal/100 ml	Labelled Copper µg/100ml[1]	Labelled Manganese µg/100ml[1]	Labelled Iron mg/100ml[1]	Main ingredient	Sole source of nutrition	Product sold as
Frebini energy fiber drink (chocolate flavour)	M97	Fresenius Kabi	1-12 y	Malnutrition	150	150	180	1.5	Maltodextrin		RFU
Fresubin energy fibre (pooled sample different flavours)	M26	Fresenius Kabi	>1 y	Malnutrition	150	300	400	2.0	Maltodextrin	X	RFU
Fresubin soya fibre	M70	Fresenius Kabi	>1 y	Malnutrition	100	130	270	1.3	Maltodextrin	X	RFU
Isosource junior	M71	Nestlé	>1 y	Malnutrition	122	100	200	0.8	Maltodextrin	X	RFU
Neocate advance	M81	SHS	>1 y	Allergy	400[2]	240[2]	200[2]	2.5[2]	Glucose syrup	X	P
Nutrini energy multi fiber	M83	Nutricia	1-6 y	Malnutrition	150	122	230	1.5	Maltodextrin	X	RFU
Nutrini multi fiber	M84	Nutricia	1-6 y	Malnutrition	100	81	150	1.0	Maltodextrin	X	RFU
NutriniKid multi fibre (pooled sample different flavours)	M27	Nutricia	1-6 y	Malnutrition	150	135	230	1.5	Maltodextrin	X	RFU
PKU gel (pooled sample different flavours)	M28	Vitaflo	> 1 y	PKU	342[2]	700[2]	1700[2]	10[2]	Sugar		P
Resource minimax (pooled sample different flavours)	M29	Nestlé	>1 y	Malnutrition	120	100	70	1.0	Skimmed milk	X	RFU
XP Maxamaid (pooled sample different flavours)	M53	SHS	1-8 y	PKU	309[2]	1800[2]	1600[2]	12[2]	Glucose syrup		P

Id – identification of composite sample; PKU – phenylketonuria;y – year; P – powder; RFU – ready for use

[1] Only presented if the mineral is labelled as an ingredient.

[2] Per 100 g in products sold as powder.

Appendix I. Labelling information on products included in the project

Table 3. Infant formulae

Product *(English translation)*	Id	Producer	Age group	Labelled energy kcal/100g	Labelled Copper µg/100g[1]	Labelled Manganese µg/100g[1]	Labelled Iron mg/100g[1]	Main ingredient[2]	Product sold as
BabySemp 1 Modersmjölksersättning *(BabySemp 1 infant formula)*	M30	Semper	0-6 mo	63[3]	401[3]		0.4[3]	Demineralized whey powder	RFU
BabySemp 1 Modersmjölksersättning *(BabySemp 1 infant formula)*	M2	Semper	0-6 mo	510	320		3.3	Demineralized whey powder	P
BabySemp 2 Lemolac modersmjölksersättning *(BabySemp 2 Lemolac infant formula)*	M14	Semper	4-12 mo	516	320		5.7	Demineralized whey powder	P
ECO 1 Modersmjölksersättning *(ECO 1 infant formula)*	M15	HiPP	> 0 mo	507	280	80	4.1	Whey (partly demineralized)	P
ECO 2 Modersmjölksersättning *(ECO 2 infant formula)*	M16	HiPP	>4 mo	496	285	51	5.3	Skimmed milk	P
Organic Infant milk	M80	BabyNat	0-6 mo	517	330	30	5.5	Demineralized whey powder	P
Eko Modersmjölksersättning 1 *(Organic Infant formula 1)*	M92	Holle	> 0 mo	519	290	88	3.2	Skimmed milk	P
NAN 1 Modersmjölksersättning *(NAN 1 infant formula)*	M10	Nestlé	> 0 mo	513	310	115	3.2	Demineralized whey powder	P
NAN HA 1 Modersmjölksersättning *(NAN HA 1 infant formula)*	M11	Nestlé	> 0 mo	510	410	125	5.5	Lactose	P

Id – identification of composite sample; mo – months; P – powder; RFU – ready for use

[1] Only presented if the mineral is labelled as an ingredient.

[2] All infant formulae were manufactured from cow's milk proteins.

[3] Per 100 ml ready for use product.

Appendix I. Labelling information on products included in the project

Table 4. Follow-on formulae

Product *(English translation)*	Id	Producer	Age group	Labelled energy kcal/100g	Labelled Copper µg/100g[1]	Labelled Manganese µg/100g[1]	Labelled Iron mg/100g[1]	Main ingredient[2]	Product sold as
BabySemp 3 Tillskottsnäring *(BabySemp 3 follow-on-formula)*	M13	Semper	>8 mo	480	290		7.3	Demineralized whey powder	P
Eko tillskottsnäring 2 (Organic *follow-on-formula 2)*	M52	Holle	>6 mo	494	300	97	6.1	Skimmed milk	P
NAN Pro 2 Tillskottsnäring *(NAN Pro 2 follow-on-formula)*	M36	Nestlé	>6 mo	495	370		7.3	Maltodextrin	P
Optima organic Follow-on-milk	M76	BabyNat	>6 mo	490	325	33	6	Maltodextrin	P

Id – identification of composite sample; mo – months; P – powder

[1] Only presented if the mineral is labelled as an ingredient.

[2] All infant formulae were manufactured from cow's milk proteins.

Appendix I. Labelling information on products included in the project

Table 5. Processed Cereal-based Foods for infants and young children: porridge

Product *(English translation)*	Id	Producer	Age group	Labelled energy kcal/100g	Labelled Copper µg/100g[1]	Labelled Manganese µg/100g[1]	Labelled Iron mg/100g[1]	Main ingredient *(content of wholegrain in percent)*	Product sold as
Wholegrain									
Bio-Babybrei Grieβ *(Wheat porridge)*	M87	Holle	4 mo	359				Wholegrain wheat *(100 %)*	P
Eko dinkelgröt *(Organic spelt porridge)*	M65	Holle	6 mo	354				Wholegrain spelt *(100 %)*	P
Eko havregröt *(Organic Oat porridge)*	M63	Holle	6 mo	386				Wholegrain oat *(100 %)*	P
Fruktgröt fullkorn *(Fruit porridge wholegrain)*	M4	Semper	12 mo	450			8.5	Wholegrain flour *(40 %)*	P
Fullkornsgröt med äpple *(Wholegrain porridge with apple)*	M17	HiPP	8 mo	432	142	670	3.9	Whey powder partly demineralized *(20 %)*	P
Fullkornsgröt multikorn *(Wholegrain porridge multigrain)*	M39	HiPP	12 mo	422	Missing[2]	980	4.2	Whey powder partly demineralized *(41 %)*	P
Mild fullkornsgröt *(Mild wholegrain porridge)*	M32	Nestlé	8 mo	410			10	Skimmed milk powder *(37 %)*	P
Mild fullkornsgröt *(Mild wholegrain porridge)*	M42	HiPP	8 mo	424		1300	4.9	Whey powder partly demineralized *(38 %)*	P
Mild fullkornsgröt *(Mild wholegrain porridge)*	M33	Semper	8 mo	460			8.5	Demineralized whey powder *(47 %)*	P
Mild havregröt *(Mild oat porridge)*	M22	HiPP	6 mo	434	140	1060	4	Whey powder partly demineralized *(28 %)*	P
Musligröt päron-banan *(Musli porridge pear-banana)*	M9	Nestlé	12 mo	390			10	Oat meal *(39 %)*	P
Eko hirsgröt *(Organic millet porridge)*	M64	Holle	4 mo	393				Wholegrain millet *(100 %)*	P
Organic seven grain cereal[3]	M51	Organix	7 mo	374				Wholegrain wheat *(100 %)*	P
Rice porridge									
Baby´s first food The ultimate four grain porridge[3]	M90	Plum	4 mo	376				Quinoa and wholegrain rice *(100 %)*	P
Banangröt *(Banana porridge)*	M3	Semper	4 mo	460			8.5	Rice flour	P
Banangröt mjölkfri *(Banana porridge dairy free)*	M23	EnaGo	6 mo	450				Banana purée	P
Cerelac risgröt *(Cerelac rice porridge)*	M31	Nestlé	4 mo	420			7.5	Rice flour	P
First organic wholegrain baby rice[3]	M56	Organix	4 mo	374				Wholegrain rice *(100 %)*	P
God Natt! Risgröt med grönsaker *(Good night! Rice porridge with vegetables)*	M40	HiPP	4 mo	83[4]				Milk	RFU
Eko risgröt *(Organic rice porridge)*	M91	Holle	4 mo	382				Wholegrain rice *(100 %)*	P

Product ***(English translation)***	**Id**	**Producer**	**Age group**	**Labelled energy kcal/100g**	**Labelled Copper µg/100g**[1]	**Labelled Manganese µg/100g**[1]	**Labelled Iron mg/100g**[1]	**Main ingredient** ***(content of wholegrain in percent)***	**Product sold as**
Risgröt med banan och persika *(Rice porridge with banana and peach)*	M59	HiPP	4 mo	429	130	329	3.3	Whey powder partly demineralized	P
Risgröt med äpple och mango *(Rice porridge with apple and mango)*	M25	Semper	5 mo	460			8.5	Rice flour	P
Sinlac specialgröt *(Sinlac special porridge)*	M12	Nestlé	4 mo	420			10	Rice flour	P
Others									
Cerelac fruktgröt banan apelsin *(Cerelac fruit porridge banana orange)*	M37	Nestlé	6 mo	420			7.5	Wheat flour	P
Dinkelgröt naturell *(Spelt porridge natural)*	M86	Nestlé	6 mo	410			10	Spelt flour	P
Mild havregröt *(Mild oat porridge)*	M35	Semper	4 mo	460			8.5	Skimmed milk powder	P

(%) – content of main ingredient (wholegrain or rice); Id – identification of composite sample; mo – months; P – powder; RFU – ready for use

[1] Only presented if the mineral is labelled as an ingredient.

[2] According to the list of ingredients copper was added, but the content of copper is not declared in the nutrient declaration.

[3] The product could/should be diluted with other liquids than water.

[4] Per 100 ml ready for use product.

Appendix I. Labelling information on products included in the project

Table 6. Processed Cereal-based Foods for infants and young children: gruel (välling)

Product *(English translation)*	Id	Producer	Age group	Labelled energy kcal/100g	Labelled Copper µg/100g[1]	Labelled Manganese µg/100g[1]	Labelled Iron mg/100g[1]	Main ingredient *(content of wholegrain in percent)*	Product sold as
Gruel									
Drickfärdig mild fullkornsvälling *(Ready-to-drink mild wholegrain gruel)*	M34	Semper	8 mo	70[2]			1.2[2]	Skimmed milk	RFU
Fullkornsvälling *(Wholegrain gruel)*	M18	Nestlé	12 mo	450			10	Wholemeal flour *(44 %)*	P
Fullkornsvälling havre vete råg *(Wholegrain gruel oat wheat rye)*	M5	Semper	12 mo	450			8.5	Skimmed milk powder *(34 %)*	P
Mild fullkornsvälling *(Mild wholegrain gruel)*	M8	Semper	8 mo	460			8.5	Skimmed milk powder *(18 %)*	P
Mild fullkornsvälling havre *(Mild wholegrain gruel oat)*	M21	Nestlé	8 mo	460			10	Skimmed milk powder *(33 %)*	P
Corn gruel									
Låglaktos majsvälling *(Low lactose corn gruel)*	M19	Nestlé	6 mo	480			8	Cornstarch	P
Majsvälling *(Corn gruel)*	M20	Semper	6 mo	470			8.5	Corn flour	P
Majsvälling *(Corn gruel)*	M96	HiPP	6 mo	496	255	50	4	Skimmed milk	P
Majsvälling *(Corn gruel)*	M7	Nestlé	6 mo	470			10	Skimmed milk powder	P
Rice gruel									
Céréales Cacao[3]	M74	Babybio	8 mo	389				Rice flour 84 %	P
First flavour[3]	M73	Babynat	6 mo	386				Rice flour 89 %	P
Kvällsvälling ris och vete *(Evening gruel rice and wheat)*	M55	Semper	6 mo	460			8.5	Skimmed milk powder	P
Välling mjölkfri *(Gruel dairy free)*	M24	EnaGo	6 mo	463			12	Flour (rice-. oat-. wheat-)	P
Oat gruel									
God natt mild havrevälling *(Good night mild oat gruel)*	M6	Nestlé	6 mo	470			10	Cornstarch	P

Id – identification of composite sample; mo – months; P – powder; RFU – ready for use.
[1] Only presented if the mineral is labelled as an ingredient.
[2] Per 100 ml ready for use product.
[3] The product could/should be diluted with other liquids than water.

Appendix I. Labelling information on products included in the project

Table 7. Breast milk and "foodstuffs for normal consumption"

Product *(English translation)*	Id	Producer	Intended use	Main ingredient *(content of main ingredient in percent)*	Product sold as
Breast milk (w 3 post-partum. n=90)[1]	M50		Breastfeeding	Human breast milk	RFU
Havredryck apelsin & mango *(Oat drink orange & mango)*	M46	Oatly	Oat drink	Oat base (oat 10 %)	RFU
Havredryck naturell *(Oat drink natural)*	M41	Carlshamn	Oat drink	Rolled oats (8.5 %)	RFU
Havregryn *(Rolled oats)*	M47	Lantmännen	Porridge	Rolled oats	P
Pama minutris *(Pama 'minute rice')*	M49	Quaker	Porridge	Rice, polished	P
Rice drink organic	M38	Rice Dream	Rice drink	Rice (14 %)	RFU
Risdryck naturell *(Rice drink natural)*	M45	Carlshamn	Rice drink	Rice (13 %)	RFU
Skrädmjöl *(Oat toasted and milled)*	M77	Saltå kvarn	Gruel or porridge	Oat, toasted & milled	P
Sojadryck *(Soya drink)*	M88	Garant	Soya drink	Soya beans (7.5 %)	RFU
Sojadryck original + Kalcium *(Soya drink original + calcium)*	M58	GoGreen	Soya drink	Soya beans (6.5 %)	RFU
Solhavre naturell *(Oat drink natural)*	M44	ICA Gott liv	Oat drink	Oat (10 %)	RFU
Soya drink natural fresh	M43	Alpro	Soya drink	Soya beans (6 %)	RFU
Soya natural	M57	Provamel	Soya drink	Soya beans (7.2 %)	RFU

Id – identification of composite sample; P – powder; RFU – ready for use

[1] Composite sample from 2008 (n=30), 2009 (n=30) and 2010 (n=30) from the ongoing biomonitoring project at the National Food Agency 'POPup'(personal communication with project leader Sanna Lignell). For details about sampling see Lignell S, Aune M, Darnerud P.O., Cnattingius S, and Glynn A (2009) Persistent organochlorine and organobromine compounds in mother´s milk from Sweden 1996-2006: Compound-specific temporal trend. Environmental Research 109:760-767.

Appendix II. Results from analysis of the products 'as sold' - total concentration of contaminants and minerals

Table 1. Food for Special Medical Purposes for infants (0-12 months) 'as sold'

Product *(English translation)*	Id	Product sold as	N	Arsenic mg/kg	Cadmium mg/kg	Lead mg/kg	Copper mg/kg	Manganese mg/kg	Iron mg/kg
Althéra	M75	P	2	0.0046	0.0015	0.0023	4.45	0.38	51.2
Enfalac premature	M98	P	1	0.0063	0.0018	0.0026	4.87	0.68	65.5
Enfamil AR lipil	M78	P	2	0.0052	0.0015	0.0038	3.78	3.18	55.9
Enfamil Human Milk Fortifier[1]	M61	P	1	0.0183	0.0060	0.0175	20.3	5.38	500
FM 85[1]	M60	P	1	0.0135	0.0042	0.0060	7.54	2.61	226
Galactomin 19 formula	M69	P	2	0.0044	0.0016	0.0064	3.08	3.14	31.3
Minimax barnsondnäring *(Minimax enteral formula for children)*	M82	RFU	2	0.0111	0.0003	0.0005	1.09	0.76	9.02
Neocate LCP	M72	P	2	0.0049	0.0043	0.0030	3.30	3.21	52.4
Nutramigen 1 lipil	M1	P	3	0.0112	0.0016	0.0051	3.55	3.68	87.6
Nutramigen 2 lipil	M48	P	3	0.0101	0.0026	0.0062	3.83	4.58	86.0
Pepti junior	M79	P	2	0.0055	0.0033	0.0043	2.94	3.38	56.4
Pepticate	M54	P	3	0.0044	0.0015	0.0036	3.41	0.80	38.0
PKU anamix infant lcp+	M85	P	2	0.0050	0.0024	0.0040	3.96	4.66	51.3
Pregestimil lipil	M99	P	1	0.0069	0.0020	0.0050	3.94	3.53	87.9
PreNAN discharge	M95	P	2	0.0061	0.0036	0.0028	4.07	0.87	54.0
Profylac	M103[2]	P	2	0.0110	0.0011	0.0021	3.34	3.74	51.92

Id – identification of composite sample; P – powder; RFU – ready for use; N- number of batches in composite sample

[1] The product should be diluted with breast milk.

[2] Analysed as individual batches (M93 and M94) but presented as mean value of the two batches.

Appendix II. Results from analysis of the products 'as sold' - total concentration of contaminants and minerals

Table 2. Food for Special Medical Purposes for young children (1-3 years) 'as sold'

Product	Id	Product sold as	N	Arsenic mg/kg	Cadmium mg/kg	Lead mg/kg	Copper mg/kg	Manganese mg/kg	Iron mg/kg
Frebini energy fiber drink (chocolate flavour)	M97	RFU	1	0.0020	0.0021	0.0022	1.54	1.76	14.0
Fresubin energy fibre (pooled sample different flavours)	M26	RFU	3	0.0023	0.0011	0.0019	2.90	3.82	19.7
Fresubin soya fibre	M70	RFU	2	0.0013	0.0022	0.0012	1.37	2.51	11.6
Isosource junior	M71	RFU	2	0.0013	0.0004	0.0015	1.02	1.65	8.21
Neocate advance	M81	P	2	0.0032	0.0007	0.0016	2.84	2.82	30.0
Nutrini energy multi fiber	M83	RFU	2	0.0034	0.0004	0.0009	1.11	2.01	13.0
Nutrini multi fiber	M84	RFU	2	0.0027	0.0003	0.0011	0.76	1.62	9.89
NutriniKid multi fibre (pooled sample different flavours)	M27	RFU	3	0.0037	0.0004	0.0009	1.30	1.79	13.4
PKU gel (pooled sample different flavours)	M28	P	3	0.0091	0.0026	0.0565	7.98	20.8	151
Resource minimax (pooled sample different flavours)	M29	RFU	3	0.0019	0.0007	0.0007	1.01	0.76	10.7
XP Maxamaid (pooled sample different flavours)	M53	P	3	0.0054	0.0039	0.0060	21.0	20.8	127

Id – identification of composite sample; P – powder; RFU – ready for use; N - number of batches in composite sample

Table 3. Infant formulae 'as sold'

Product *(English translation)*	Id	Product sold as	N	Arsenic mg/kg	Cadmium mg/kg	Lead mg/kg	Copper mg/kg	Manganese mg/kg	Iron mg/kg
BabySemp 1 Modersmjölksersättning *(BabySemp 1 infant formula)* '	M30	RFU	3	0.0009	0.0001	0.0002	0.38	0.05	4.08
BabySemp 1 Modersmjölksersättning *(BabySemp 1 infant formula)*	M2	P	3	0.0058	0.0028	0.0018	2.84	0.18	29.3
BabySemp 2 Lemolac modersmjölksersättning *(BabySemp 2 Lemolac infant formula)*	M14	P	3	0.0058	0.0027	0.0029	3.84	0.59	46.8
ECO 1 Modersmjölksersättning *(ECO 1 infant formula)*	M15	P	3	0.0070	0.0008	0.0021	2.62	0.77	45.5
ECO 2 Modersmjölksersättning *(ECO 2 infant formula)*	M16	P	3	0.0060	0.0048	0.0023	2.99	0.64	50.0
Organic Infant milk	M80	P	2	0.0065	0.0006	0.0020	2.82	0.39	53.8
Eko Modersmjölksersättning 1 *(Organic infant formula 1)*	M92	P	3	0.0042	0.0031	0.0026	2.67	0.85	27.4
NAN 1 Modersmjölksersättning *(NAN 1 infant formula)*	M10	P	3	0.0062	0.0026	0.0039	2.80	1.26	30.4
NAN HA 1 Modersmjölksersättning *(NAN HA 1 infant formula)*	M11	P	3	0.0055	0.0017	0.0029	3.95	1.01	48.2

Id – identification of composite sample; P – powder; RFU – ready for use; N- number of batches in composite sample

Appendix II. Results from analysis of the products 'as sold'- total concentration of contaminants and minerals

Table 4. Follow-on formulae 'as sold'

Product *(English translation)*	Id	Product sold as	N	Arsenic mg/kg	Cadmium mg/kg	Lead mg/kg	Copper mg/kg	Manganese mg/kg	Iron mg/kg
BabySemp 3 Tillskottsnäring *(BabySemp 3 follow-on-formula)*	M13	P	3	0.0336	0.0047	0.0038	2.40	2.61	68.0
Eko tillskottsnäring 2 *(Organic follow-on-formula 2)*	M52	P	3	0.0078	0.0021	0.0087	2.69	1.33	58.7
NAN Pro 2 Tillskottsnäring *(NAN Pro 2 follow-on-formula)*	M36	P	3	0.0055	0.0014	0.0047	3.57	0.95	67.2
Optima Organic Follow-on-milk	M76	P	2	0.0054	0.0008	0.0021	2.97	0.33	58.8

Id – identification of composite sample; P – powder; RFU – ready for use; N - number of batches in composite sample

Appendix II. Results from analysis of the products 'as sold'- total concentration of contaminants and minerals

Table 5. PCBF: porridge 'as sold'

Product *(English translation)*	Id	Product sold as	N	Arsenic mg/kg	Cadmium mg/kg	Lead mg/kg	Copper mg/kg	Manganese mg/kg	Iron mg/kg
Baby´s first food The ultimate four grain porridge[1]	M90	P	2	0.1400	0.0240	0.0073	4.18	16.4	30.4
Banangröt *(Banana porridge)*	M3	P	3	0.0555	0.0143	0.0028	1.07	4.82	81.6
Banangröt mjölkfri *(Banana porridge dairy free)*	M23	P	3	0.0545	0.0289	0.0603	4.02	15.7	63.2
Bio-Babybrei Grieβ *(Wheat porridge)*	M87	P	2	0.0121	0.0196	0.0024	3.42	25.3	24.0
Cerelac fruktgröt banan apelsin *(Cerelac fruit porridge banana orange)*	M37	P	3	0.0082	0.0068	0.0027	1.68	7.10	71.7
Cerelac risgröt *(Cerelac rice porridge)*	M31	P	3	0.1240	0.0165	0.0020	0.96	6.63	74.4
Dinkelgröt naturell *(Spelt porridge)*	M86	P	2	0.0044	0.0098	0.0024	1.75	16.7	98.6
Eko dinkelgröt *(Organic spelt porridge)*	M65	P	3	0.0105	0.0312	0.0027	5.19	28.9	32.1
Eko havregröt (*Organic oat porridge*)	M63	P	3	0.0271	0.0242	0.0029	3.66	39.6	32.7
First organic wholegrain baby rice[1]	M56	P	3	0.3635	0.0023	0.0048	2.84	22.7	18.1
Fruktgröt fullkorn *(Fruit porridge wholegrain)*	M4	P	3	0.0058	0.0175	0.0027	1.56	9.10	84.7
Fullkornsgröt med äpple *(Wholegrain porridge with apple)*	M17	P	3	0.0176	0.0056	0.0048	1.73	8.94	46.0
Fullkornsgröt multikorn *(Wholegrain porridge multigrain)*	M39	P	3	0.0136	0.0107	0.0019	1.75	12.0	25.8
God natt! Risgröt med grönsaker *(Rice porridge with vegetables)*	M40	RFU	3	0.0220	0.0054	0.0019	0.35	1.24	1.53
Mild fullkornsgröt *(Mild wholegrain porridge)*	M32	P	3	0.0058	0.0168	0.0040	1.53	11.7	102
Mild fullkornsgröt *(Mild wholegrain porridge)*	M42	P	3	0.0219	0.0105	0.0021	1.80	12.9	53.8
Mild fullkornsgröt *(Mild wholegrain porridge)*	M33	P	3	0.0047	0.0166	0.0023	1.97	14.4	80.9
Mild havregröt *(Mild oat porridge)*	M35	P	3	0.0040	0.0100	0.0094	1.11	7.62	87.4
Mild havregröt *(Mild oat porridge)*	M22	P	3	0.0174	0.0100	0.0018	1.36	8.93	24.5
Musligröt päron-banan *(Musli porridge pear-banana)*	M9	P	3	0.0283	0.0097	0.0084	2.00	16.3	84.3
Eko hirsgröt *(Organic millet porridge)*	M64	P	3	0.0137	0.0190	0.0077	6.33	8.05	29.8
Organic seven grain cereal[1]	M51	P	3	0.0225	0.0156	0.0037	3.81	25.9	30.9
Eko risgröt *(Organic rice porridge)*	M91	P	3	0.2820	0.0114	0.0025	2.01	26.4	10.1
Risgröt med banan och persika *(Rice porridge with banana and peach)*	M59	P	3	0.0158	0.0035	0.0061	1.29	2.97	12.8
Risgröt med äpple och mango *(Rice porridge with apple and mango)*	M25	P	3	0.1000	0.0106	0.0055	0.83	3.80	93.8
Sinlac specialgröt *(Sinlac special porridge)*	M12	P	3	0.1160	0.0219	0.0056	5.03	19.1	98.1

(%) – wholegrain content; Id – identification of composite sample; P – powder; RFU – ready for use; N - number of batches in composite sample

[1] The product could/should be diluted with other liquids than water.

Appendix II. Results from analysis of the products 'as sold' - total concentration of contaminants and minerals

Table 6. PCBF: gruel (välling) 'as sold'

Product *(English translation)*	Id	Product sold as	N	Arsenic mg/kg	Cadmium mg/kg	Lead mg/kg	Copper mg/kg	Manganese mg/kg	Iron mg/kg
Céréales Cacao[1]	M74	P	3	0.1670	0.0695	0.0038	4.03	13.3	17.6
Drickfärdig mild fullkornsvälling *(Ready for use mild wholegrain gruel)*	M34	RFU	3	0.0009	0.0007	0.0002	0.11	0.74	9.43
First flavor[1]	M73	P	3	0.1910	0.0323	0.0023	2.24	11.9	6.72
Fullkornsvälling *(Wholegrain gruel)*	M18	P	3	0.0048	0.0165	0.0037	1.63	9.95	79.5
Fullkornsvälling havre vete råg *(Wholegrain gruel oat wheat rye)*	M5	P	3	0.0048	0.0146	0.0023	1.54	10.1	94.6
God natt mild havrevälling *(Good night mild oat gruel)*	M6	P	3	0.0052	0.0068	0.0041	0.86	8.26	83.6
Kvällsvälling ris och vete *(Evening gruel rice and wheat)*	M55	P	3	0.0602	0.0043	0.0043	0.74	3.63	82.5
Låglaktos majsvälling *(Low lactose corn gruel)*	M19	P	3	0.0045	0.0012	0.0050	0.27	0.48	75.8
Majsvälling *(Corn gruel)* (Nestlé)	M7	P	3	0.0044	0.0008	0.0022	0.13	0.26	70.5
Majsvälling *(Corn gruel)* (Semper)	M20	P	3	0.0109	0.0017	0.0021	0.47	1.50	86.9
Majsvälling *(Corn gruel)* (HiPP)	M96	P	2	0.0040	0.0009	0.0021	2.45	0.61	40.1
Mild fullkornsvälling *(Mild wholegrain gruel)*	M8	P	3	0.0046	0.0095	0.0018	1.17	9.17	92.1
Mild fullkornsvälling havre *(Mild wholegrain gruel oat)*	M21	P	3	0.0052	0.0086	0.0215	1.19	9.99	77.7
Välling mjölkfri *(Gruel dairy free)*	M24	P	3	0.1350	0.0272	0.0485	2.70	10.6	114

(%) – wholegrain content; Id – identification of composite sample; P – powder; RFU – ready for use; N - number of batches in composite sample

[1] The product could/should be diluted with other liquids than water.

Appendix II. Results from analysis of the products 'as sold' - total concentration of contaminants and minerals

Table 7. Breast milk and "foodstuffs for normal consumption" 'as sold'

Product *(English translation)*	Id	Product sold as	N	Arsenic mg/kg	Cadmium mg/kg	Lead mg/kg	Copper mg/kg	Manganese mg/kg	Iron mg/kg
Breast milk (w 3 post-partum. n=90)[1]	M50	RFU	3	0.0010	0.0001	0.0021	1.12	<0.004	0.28
Havredryck apelsin & mango *(Oat drink orange & mango)*	M46	RFU	3	0.0010	0.0003	0.0002	0.27	0.80	0.93
Havredryck naturell *(Oat drink natural)*	M41	RFU	3	0.0020	0.0024	0.0013	0.22	0.67	0.85
Pama minutris *(Pama 'minute rice')*	M49	P	3	0.2500	0.0213	0.0010	1.82	8.22	1.52
Havregryn *(Rolled oats)*	M47	P	3	0.0045	0.0419	0.0025	4.75	39.8	46.6
Rice drink organic	M38	RFU	3	0.0183	0.0005	0.0002	0.05	0.22	<0.11
Risdryck naturell *(Rice drink natural)*	M45	RFU	3	0.0304	0.0045	0.0014	0.09	0.70	0.78
Skrädmjöl *(Oat, toasted and milled)*	M77	P	3	0.0028	0.0493	0.0027	4.62	40.3	42.6
Sojadryck *(Soya drink)*	M88	RFU	2	0.0008	0.0083	0.0013	1.43	1.95	6.52
Sojadryck original + Kalcium *(Soya drink original + calcium)*	M58	RFU	3	0.0008	0.0073	0.0011	1.10	1.56	4.96
Solhavre naturell *(Oat drink natural)*	M44	RFU	3	0.0009	0.0001	0.0001	0.15	0.16	0.54
Soya drink natural fresh	M43	RFU	3	0.0017	0.0019	0.0002	1.02	1.57	4.23
Soya natural	M57	RFU	3	0.0011	0.0019	0.0001	0.90	1.98	3.26

Id – identification of composite sample; P – powder; RFU – ready for use; N - number of batches in composite sample

[1]Composite sample from 2008 (n=30), 2009 (n=30) and 2010 (n=30) from the ongoing biomonitoring project at the National Food Agency 'POPup' (personal communication with project leader Sanna Lignell). For details about sampling see Lignell S, Aune M, Darnerud P.O., Cnattingius S, and Glynn A (2009) Persistent organochlorine and organobromine compounds in mother´s milk from Sweden 1996-2006: Compound-specific temporal trend. Environmental Research 109:760-767.

Appendix III. Concentration of contaminants and minerals in 'ready for use' products

Table 1. FSMP for infants (0-12 months), ready for use[1]

Product *(English translation)*	Id	N	Dilution factor	Arsenic mg/kg	Cadmium mg/kg	Lead mg/kg	Copper µg/100g	Manganese µg/100g	Iron mg/100g
Althéra	M75	2	0.128	0.0006	0.0002	0.0003	57	5	0.65
Enfalac premature	M98	1	0.155	0.0010	0.0003	0.0004	76	11	1.02
Enfamil AR lipil	M78	2	0.130	0.0007	0.0002	0.0005	49	41	0.73
Enfamil Human Milk Fortifier[2]	M61	1	0.027	0.0005	0.0002	0.0005	54	14	1.34
FM 85[2]	M60	1	0.046	0.0006	0.0002	0.0003	35	12	1.04
Galactomin 19 formula	M69	2	0.125	0.0006	0.0002	0.0008	39	39	0.39
Minimax barnsondnäring *(Minimax enteral formula for children)*	M82	2	NA	0.0111	0.0003	0.0005	109	76	0.90
Neocate LCP	M72	2	0.140	0.0007	0.0006	0.0004	46	45	0.74
Nutramigen 1 lipil	M1	3	0.130	0.0015	0.0002	0.0007	46	48	1.14
Nutramigen 2 lipil	M48	3	0.140	0.0014	0.0004	0.0009	54	64	1.21
Pepti junior	M79	2	0.125	0.0007	0.0004	0.0005	37	42	0.71
Pepticate	M54	3	0.130	0.0006	0.0002	0.0005	44	10	0.50
PKU anamix infant lcp+	M85	2	0.143	0.0007	0.0003	0.0006	57	67	0.73
Pregestimil lipil	M99	1	0.130	0.0009	0.0003	0.0006	51	46	1.15
PreNAN discharge	M95	2	0.138	0.0008	0.0005	0.0004	56	12	0.75
Profylac	M103[3]	2	0.119	0.0013	0.0001	0.0003	40	45	0.62

Id – identification of composite sample; N - number of batches in composite sample; NA - not applicable;

[1] The ready for use concentration originates from converting the analytical values for the product 'as sold' in Appendix II by using the appropriate dilution factor.

[2] The product should be diluted with breast milk and the potential contribution of contaminants and minerals from the breast milk has not been taken into account.

[3] Analysed as individual batches (M93 and M94) but presented as mean value of the two batches.

Appendix III. Concentration of contaminants and minerals in 'ready for use' products

Table 2. FSMP for young children (1-3 years), ready for use[1]

Product	Id	N	Dilution factor	Arsenic mg/kg	Cadmium mg/kg	Lead mg/kg	Copper µg/100g	Manganese µg/100g	Iron mg/100g
Frebini energy fiber drink (chocolate flavour)	M97	1	NA	0.0020	0.0021	0.0022	154	176	1.40
Fresubin energy fibre (pooled sample different flavours)	M26	3	NA	0.0023	0.0011	0.0019	290	382	1.97
Fresubin soya fibre	M70	2	NA	0.0013	0.0022	0.0012	137	251	1.16
Isosource junior	M71	2	NA	0.0013	0.0004	0.0015	102	165	0.82
Neocate advance	M81	2	0.200	0.0006	0.0001	0.0003	57	56	0.60
Nutrini energy multi fiber	M83	2	NA	0.0034	0.0004	0.0009	111	201	1.30
Nutrini multi fiber	M84	2	NA	0.0027	0.0003	0.0011	76	162	0.99
NutriniKid multi fibre (pooled sample different flavours)	M27	3	NA	0.0037	0.0004	0.0009	130	179	1.34
PKU gel (pooled sample different flavours)	M28	3	0.400	0.0037	0.0011	0.0226	319	830	6.03
Resource minimax (pooled sample different flavours)	M29	3	NA	0.0019	0.0007	0.0007	101	76	1.07
XP Maxamaid (pooled sample different flavours)	M53	3	0.125	0.0007	0.0005	0.0008	262	260	1.59

Id – identification of composite sample; N - number of batches in composite sample; NA - not applicable;

[1] The ready for use concentration originates from converting the analytical values for the product 'as sold' in Appendix II by using the appropriate dilution factor.

Appendix III. Concentration of contaminants and minerals in 'ready for use' products

Table 3. Infant formulae, ready for use[1]

Product *(English translation)*	Id	N	Dilution factor	Arsenic mg/kg	Cadmium mg/kg	Lead mg/kg	Copper µg/100g	Manganese µg/100g	Iron mg/100g
BabySemp 1 Modersmjölksersättning*(BabySemp 1 infant formula)*	M30	3	NA	0.0009	0.0001	0.0002	38	5	0.41
BabySemp 1 Modersmjölksersättning *(BabySemp 1 infant formula)*	M2	3	0.120	0.0007	0.0003	0.0002	34	2	0.35
BabySemp 2 Lemolac modersmjölksersättning *(BabySemp 2 Lemolac infant formula)*	M14	3	0.120	0.0007	0.0003	0.0004	46	7	0.56
ECO 1 Modersmjölksersättning *(ECO 1 infant formula)*	M15	3	0.126	0.0009	0.0001	0.0003	33	10	0.57
ECO 2 Modersmjölksersättning *(ECO 2 infant formula)*	M16	3	0.129	0.0008	0.0006	0.0003	39	8	0.64
Eko Modersmjölksersättning 1 *(Organic infant formula 1)*	M92	3	0.128	0.0005	0.0004	0.0003	34	11	0.35
NAN 1 Modersmjölksersättning *(NAN 1 infant formula)*	M10	3	0.125	0.0008	0.0003	0.0005	35	16	0.38
NAN HA 1 Modersmjölksersättning *(NAN HA 1 infant formula)*	M11	3	0.128	0.0007	0.0002	0.0004	51	13	0.62
Organic Infant milk	M80	2	0.128	0.0008	0.0001	0.0003	36	5	0.69

Id – identification of composite sample; N - number of batches in composite sample; NA - not applicable

[1] The ready for use concentration originates from converting the analytical values for the product 'as sold' in Appendix II by using the appropriate dilution factor.

Table 4. Follow-on formulae, ready for use[1]

Product *(English translation)*	Id	N	Dilution factor	Arsenic mg/kg	Cadmium mg/kg	Lead mg/kg	Copper µg/100g	Manganese µg/100g	Iron mg/100g
BabySemp 3 Tillskottsnäring *(BabySemp 3 follow-on-formula)*	M13	3	0.138	0.0046	0.0006	0.0005	33	36	0.94
Eko tillskottsnäring 2 *(Organic follow-on-formula 2)*	M52	3	0.135	0.0011	0.0003	0.0012	36	18	0.79
NAN Pro 2 Tillskottsnäring *(NAN Pro 2 follow-on-formula)*	M36	3	0.130	0.0007	0.0002	0.0006	47	12	0.88
Optima Organic Follow-on-milk	M76	2	0.132	0.0007	0.0001	0.0003	39	4	0.78

Id – identification of composite sample; N - number of batches in composite sample

[1] The ready for use concentration originates from converting the analytical values for the product 'as sold' in Appendix II by using the appropriate dilution factor.

Appendix III. Concentration of contaminants and minerals in 'ready for use' products

Table 5. PCBF: porridge, ready for use[1]

Product *(English translation)*	Id	N	Dilution factor	Arsenic mg/kg	Cadmium mg/kg	Lead mg/kg	Copper µg/100g	Manganese µg/100g	Iron mg/100g
Baby´s first food The ultimate four grain porridge [2]	M90	2	0.089	0.0125	0.0021	0.0006	37	147	0.27
Banangröt *(Banana porridge)*	M3	3	0.231	0.0128	0.0033	0.0006	25	111	1.88
Banangröt mjölkfri *(Banana porridge dairy free)*	M23	3	0.209	0.0114	0.0060	0.0126	84	327	1.32
Bio-Babybrei Grieβ (Wheat porridge)	M87	2	0.111	0.0013	0.0022	0.0003	38	281	0.27
Cerelac fruktgröt banan apelsin *(Cerelac fruit porridge banana orange)*	M37	3	0.231	0.0019	0.0016	0.0006	39	164	1.65
Cerelac risgröt *(Cerelac rice porridge)*	M31	3	0.231	0.0286	0.0038	0.0005	22	153	1.72
Dinkelgröt naturell *(Spelt porridge)*	M86	2	0.194	0.0009	0.0019	0.0005	34	324	1.91
Eko dinkelgröt *(Organic spelt porridge)*	M65	3	0.111	0.0012	0.0035	0.0003	58	321	0.36
Eko havregröt (*Organic oat porridge*)	M63	3	0.111	0.0030	0.0027	0.0003	41	440	0.36
First organic wholegrain baby rice[2]	M56	3	0.114	0.0414	0.0003	0.0005	32	259	0.21
Fruktgröt fullkorn *(Fruit porridge wholegrain)*	M4	3	0.248	0.0014	0.0043	0.0007	39	226	2.10
Fullkornsgröt med äpple *(Wholegrain porridge with apple)*	M17	3	0.260	0.0046	0.0015	0.0013	45	233	1.20
Fullkornsgröt multikorn *(Wholegrain porridge multigrain)*	M39	3	0.209	0.0028	0.0022	0.0004	37	251	0.54
God natt! Risgröt med grönsaker *(Rice porridge with vegetables)*	M40	3	NA	0.0220	0.0054	0.0019	35	124	0.15
Mild fullkornsgröt *(Mild wholegrain porridge)*	M32	3	0.219	0.0013	0.0037	0.0009	33	257	2.23
Mild fullkornsgröt *(Mild wholegrain porridge)*	M42	3	0.209	0.0046	0.0022	0.0004	38	270	1.12
Mild fullkornsgröt *(Mild wholegrain porridge)*	M33	3	0.231	0.0011	0.0038	0.0005	46	332	1.87
Mild havregröt *(Mild oat porridge)*	M35	3	0.231	0.0009	0.0023	0.0022	26	176	2.02
Mild havregröt *(Mild oat porridge)*	M22	3	0.251	0.0044	0.0025	0.0005	34	225	0.62
Musligröt päron-banan *(Musli porridge pear-banana)*	M9	3	0.231	0.0065	0.0022	0.0019	46	376	1.95
Eko hirsgröt *(Organic millet porridge)*	M64	3	0.111	0.0015	0.0021	0.0009	70	89	0.33
Organic seven grain cereal[2]	M51	3	0.139	0.0031	0.0022	0.0005	53	359	0.43
Eko risgröt *(Organic rice porridge)*	M91	3	0.111	0.0313	0.0013	0.0003	22	293	0.11
Risgröt med banan och persika *(Rice porridge with banana and peach)*	M59	3	0.251	0.0040	0.0009	0.0015	32	75	0.32
Risgröt med äpple och mango *(Rice porridge with apple and mango)*	M25	3	0.231	0.0231	0.0024	0.0013	19	88	2.16
Sinlac specialgröt *(Sinlac special porridge)*	M12	3	0.242	0.0281	0.0053	0.0014	122	463	2.38

Id – identification of composite sample; N - number of batches in composite sample; NA - not applicable

[1] The ready for use concentration originates from converting the analytical values for the product 'as sold' in Appendix II by using the appropriate dilution factor.

[2] The product could/should be diluted with other liquids than water. The potential contribution of contaminants and minerals from the milk or the water has not been taken into account.

Appendix III. Concentration of contaminants and minerals in 'ready for use' products

Table 6. PCBF: gruel (välling), ready for use[1]

Product *(English translation)*	Id	N	Dilution factor	Arsenic mg/kg	Cadmium mg/kg	Lead mg/kg	Copper µg/100g	Manganese µg/100g	Iron mg/100g
Céréales Cacao[2]	M74	3	0.099	0.0165	0.0069	0.0004	40	132	0.18
Drickfärdig mild fullkornsvälling *(Ready for use mild wholegrain gruel)*	M34	3	NA	0.0009	0.0007	0.0002	11	74	0.94
First flavor[2]	M73	3	0.092	0.0176	0.0030	0.0002	21	109	0.06
Fullkornsvälling *(Wholegrain gruel)*	M18	3	0.143	0.0007	0.0024	0.0005	23	142	1.14
Fullkornsvälling havre vete råg *(Wholegrain gruel oat wheat rye)*	M5	3	0.138	0.0007	0.0020	0.0003	21	139	1.30
God natt mild havrevälling *(Good night mild oat gruel)*	M6	3	0.143	0.0007	0.0010	0.0006	12	118	1.19
Kvällsvälling ris och vete *(Evening gruel rice and wheat)*	M55	3	0.139	0.0084	0.0006	0.0006	10	50	1.14
Låglaktos majsvälling *(Low lactose corn gruel)*	M19	3	0.143	0.0006	0.0002	0.0007	4	7	1.08
Majsvälling *(Corn gruel)* (Nestlé)	M7	3	0.143	0.0006	0.0001	0.0003	2	4	1.01
Majsvälling *(Corn gruel)* (Semper)	M20	3	0.139	0.0015	0.0002	0.0003	6	21	1.21
Majsvälling *(Corn gruel)* (HiPP)	M96	2	0.135	0.0005	0.0001	0.0003	33	8	0.54
Mild fullkornsvälling *(Mild wholegrain gruel)*	M8	3	0.139	0.0006	0.0013	0.0003	16	127	1.28
Mild fullkornsvälling *(Mild wholegrain gruel)*	M21	3	0.143	0.0007	0.0012	0.0031	17	143	1.11
Välling mjölkfri *(Gruel dairy free)*	M24	3	0.142	0.0192	0.0039	0.0069	38	151	1.62

Id – identification of composite sample; N - number of batches in composite sample; NA - not applicable

[1]The ready for use concentration originates from converting the analytical values for the product 'as sold' in Appendix II by using the appropriate dilution factor.

[2] The product could/should be diluted with other liquids than water. The potential contribution of contaminants and minerals from the breast milk has not been taken into account.

Appendix III. Concentration of contaminants and minerals in 'ready for use' products

Table 7. Breast milk and "foodstuffs for normal consumption", ready for use[1]

Product *(English translation)*	Id	N	Dilution factor	Arsenic mg/kg	Cadmium mg/kg	Lead mg/kg	Copper µg/100g	Manganese µg/100g	Iron mg/100g
Breast milk (w 3 post-partum. n=90)[2]	M50	3	NA	0.0010	0.0001	0.0021	112	<0.4	0.03
Havredryck apelsin & mango *(Oat drink orange & mango)*	M46	3	NA	0.0010	0.0003	0.0002	27	80	0.09
Havredryck naturell *(Oat drink natural)*	M41	3	NA	0.0020	0.0024	0.0013	22	67	0.08
Havregryn *(Rolled oats)*	M47	3	0.117	0.0005	0.0049	0.0003	56	465	0.55
Pama minutris *(Pama 'minute rice)*	M49	3	0.129	0.0323	0.0027	0.0001	24	106	0.02
Rice drink organic	M38	3	NA	0.0183	0.0005	0.0002	<5	22	0.001
Risdryck naturell *(Rice drink natural)*	M45	3	NA	0.0304	0.0045	0.0014	9	70	0.08
Skrädmjöl *(Oat, toasted and milled)*	M77	3	0.220	0.0006	0.0108	0.0006	102	887	0.94
Sojadryck *(Soya drink)*	M88	2	NA	0.0008	0.0083	0.0013	143	195	0.65
Sojadryck original + Kalcium *(Soya drink original + calcium)*	M58	3	NA	0.0008	0.0073	0.0011	110	156	0.50
Solhavre naturell *(Oat drink natural)*	M44	3	NA	0.0009	0.0001	0.0001	15	16	0.05
Soya drink natural fresh	M43	3	NA	0.0017	0.0019	0.0002	102	157	0.42
Soya natural	M57	3	NA	0.0011	0.0019	0.0001	90	198	0.33

Id – identification of composite sample; N - number of batches in composite sample; NA - not applicable; < below limit of quantification

[1] The ready for use concentration originates from converting the analytical values for the product 'as sold' in Appendix II by using the appropriate dilution factor.

[2] Composite sample from 2008 (n=30), 2009 (n=30) and 2010 (n=30) from the on-going biomonitoring project at the National Food Agency 'POPup' (personal communication with project leader Sanna Lignell). For details about sampling see Lignell S, Aune M., Darnerud P.O., Cnattingius S, and Glynn A (2009) Persistent organochlorine and organobromine compounds in mother´s milk from Sweden 1996-2006: Compound-specific temporal trend. Environmental Research 109:760-767.

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