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Commercially Sold Baby Foods Investigation of Heavy Metal Residue Risks

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Abstract

In this study, commercial baby foods produced for the first six months of life were examined for heavy metal risk. The samples (number 1) recommended to be used in 0-6 months old infants belonging to four different brands commonly preferred in the market were taken; heavy metal residue analysis was completed by applying wet combustion and atomic absorption spectrometry to these samples, respectively. For example, the contents of foods that meet the nutritional needs of a child born at the age of 5.5 months and term are compared with the tolerable upper limit intake level, recommended dietary intake and label information. According to the results, the high content of Cu in three of the analyzed foods was found to be high in terms of dietary intake of 2.5 times in dietary intake in A and D foods and approximately 2 fold in C food in terms of Cu upper limit intake level for infants in 0-6 months period. The amount of Zn contained in foods B and C exceeds the tolerable intake level. Awareness should be raised about the health problems that may occur in the long term and the economic losses that may occur in our country for the treatment of heavy metal residues through infant formula. However, the manufacturer companies; It is important to take necessary measures such as enlarging and increasing the number of toxic dose detection studies and in fact, by making small corrections, approaching the issue with sensitivity and informing them that they can make important contributions in order to prevent this chain risk.

Key Words: Baby food, heavy metal residue, awareness.

Introduction

Nutritional processes of children, especially for 0-6 months; growth, physical / mental development, and especially for the prevention of future health problems. Infants in this period may have to be fed with some additional foods or commercially prepared foods other than breast milk for various reasons. Such additional food or food also poses certain hazards to infants. It has been shown in many studies that the presence of heavy metals in the dietary supplements of infants can cause numerous health problems with highly complex mechanisms.

Different formulas can be used to feed the baby in the absence or insufficient breast milk or in the presence of some metabolic diseases (Kültürsay et al., 2018). Commercial baby food used in the market is divided into 4 groups. In the first group, there are foods that are used between 0-6 months, which is called a number. The number one food produced for the first six months of life is marketed under names such as baby milk, baby food, baby formula, bottle food or formula milk. In the second group, there are formula 2 and 3 follow-on formula, follow-on

formula and follow-on formula produced after the 6th month. Another group of spoon formulas and finally baby food and jar formulas are available. The most important reason for such diversity is that consumption in the first 6 months has reached saturation point and the consumer wants diversity. In our country, foods are marketed with the permission of the Ministry of Agriculture and Rural Affairs (Gokcay G, 2012). Heavy metal is defined as metals or semi-metals that are associated with contamination and potential toxicity. More than sixty elements are known as heavy metal. Mercury (Hg), manganese (Mn), Iron (Fe), Cobalt (Co), nickel (Ni), copper (Cu), zinc (Zn), cadmium (Cd), arsenic (As), chromium (Sn), lead (Pb), Silver (Ag) and selenium (Se) are the most common fractions. Heavy metals are taken to the organism by mouth, respiration and skin, and most cannot be excreted by the body's excretory pathways (kidney, liver, bowel, lung, skin) without special support. For this reason, a large proportion of heavy metals accumulate in various tissues or organs in the body. As a result of this accumulation, these metals, concentrated in the body of living things, can cause serious diseases (such as thyroid, neurological, autism and infertility) and even death when they reach effective doses (Özbolat G and Tuli A, 2016). Heavy metals taken into the body by consuming a metallic contaminated nutrient, such as the concentration of exposure, adipose tissue, bone, and so on. Depending on the amount of tissue retention, various irregularities in the body and various types of cancer, organ failure, cardiovascular diseases, such as chronic health problems, such as leads to important (Turkozu D and Şanlıer N, 2012). There are many passageways of heavy metals to the body such as food, soil, chemical agricultural materials, fertilizer, air, wastewater, processing equipment. Food processing equipment has been recognized as a source of metal contamination in food for many years, and high-quality metal materials, which have recently been approved for use in modern enterprises, largely prevent these contaminations. In addition, some types of detergents used to clean equipment may cause As, Pb and Cd dissolution in stainless steel and cause contamination. Today, contamination problem has been solved to a great extent as a result of the use of various advanced techniques related to packaging and packaging of foods and the risk continues to be at a minimum (Türközü D and Şanlıer N, 2012). Iron is an indispensable mineral for the circulation of oxygen in the organism. It is responsible for the circulation of oxygen in the body. The average iron in our body is 4 grams. However, iron, which is necessary for human nutrition, is involved in the

structure of hemoglobin and various enzymes in the body. Iron also acts as a cofactor in many enzymatic reactions necessary for human and animal. For this reason, iron is one of the essential elements that are essential for the human organism. Excessive iron intake causes damage to the body tissues, but also causes structural disorders, cirrhosis and pancreatic diabetes. increases the risk of cancer and heart disease (Yalcin O, 2009). The amount of copper in the body varies between 50-150 mg. The importance of copper for the body is due to the role of enzyme inactivator in critical reactions. While the trace amounts of the element are sufficient to perform this task, it may be toxic to take more than the dietary requirement. On a regular diet, an average of 2-4 mg of copper is taken per day. This is a sufficient amount for adults. The requirement for infants and children is 0.05 mg / kg. Excess copper is toxic to the body and hinders the functioning of certain enzymes in the body. Inhibition of the activity of vital enzymes by copper can lead to impaired liver function. This can lead to liver necrosis and ultimately death. In addition, symptoms such as epigastric pain, nausea, vomiting and diarrhea are seen due to copper consumption. Excessive copper accumulation damages brain, kidney and cornea and also affects nervous system and causes dementia. The most important symptoms of copper poisoning are weakness, weakness, loss of appetite, weight loss and cough (Yalcin O, 2009). Zinc is an essential element in terms of nutrition. It is a metal found in many nutrients, in water, in short, everywhere in the air. They can be found in seafood, meat, cereals, poultry products and nuts. Zinc levels in the atmosphere are more visible in industrial areas. It can be found in the human body up to 2-3 g. They are found in blood, red blood cells, liver, pancreas, some muscles and bones. It helps to activate up to 100 enzymes that are important for growth. It plays a role in the synthesis of DNA and RNA, cell renewal, tissue development and renewal, is effective in repairing, but high zinc intake can lead to serious consequences. It should be remembered that anorexia can lead to nervous problems. Intoxications may include diarrhea, hair loss, nail fracture, fatigue, involuntary movements in the nervous system. Anemia, skin and tissue disorders, heart failure, tumor formation, kidney disorders and jaundice are also seen. Daily zinc requirement is 10 mg in children aged 1-10 years, 15 mg in men aged 11-51 and older, and 12 mg in women. In a human, 300-600 mcg (micrograms) of zinc can be discarded daily through the kidneys (Yalcin O, 2009). This study will investigate possible heavy metal contamination from commercially available food processing

equipment used in the production of food and from any source previously.

Materials and Methods

In order to investigate the presence of iron, copper and zinc heavy metals (accredited) from 0-6 months food offered in the market, 4 pieces of baby food belonging to different numbers were purchased and named as A-Food, B-Food, C-Food and D-Food. 0.5 g of sample was taken from each formula and added to incineration tubes. 5 ml of nitric acid and 2 ml of peroxide were added. These tubes were placed in the microwave and the food was burned. Inorganic parts of the organic materials were separated by this process. As a result of burning, 10 ml samples were taken from these tubes and added to plastic flasks and filled with pure water. The obtained samples were

added to the AAS (Atomic Absorption) instrument and calibration curves of 0.05, 0.1, 0.25, 0.5, 1 and 2 ppm were plotted for each run (Fe, Cu, Zn). Then, reading was made according to the absorbance resulting from concentration. The amount of dilution and sample name were entered into the program and the values were obtained. This study was conducted according to TS 3606 method.

Results

100 ml formula A contains 0.52 mg of Fe mineral. There are 3 parts of Powder A in 100 ml formula. 1 Scale Food A contains 0.17 mg Fe. A baby consuming 25 Scale A formula received 4.25 mg Fe. Meets the recommended Dietary Intake Level of 0.27 mg / day and does not exceed the Tolerable Upper Limit Intake of 40 mg (Table 1).

Table 1. Heavy Metals in Baby Food A

Heavy metal	Content Specified in Package	Result of Analysis
Iron (Fe)	0.53 mg	0.52mg
Copper (Cu)	0.41mg	0.59mg
Zinc (Zn)	0.52 mg	0.41mg

100 ml of formula A contains 0.59 mcg Cu. There are 3 parts of Powder A in 100 ml formula. 1 Scale Food A contains 0.196 mg of Cu mineral. A baby consuming 25 Scale Foods received 0.49 mg Cu. Meets the recommended Dietary Intake Level of 0.20 mg / day. Tolerable Upper Limit Intake for Copper could not be determined due to lack of data. Therefore, an intake up to 2.5 times the recommended Cu intake may be risky. Further research is needed.

100 ml of formula A contains 0.41 mg of Zn mineral. There are 3 parts of Powder A in 100 ml formula. 1 Scale Food A contains 0.13 mg of Zn mineral. A baby consuming 25 Scale A formula received 3.25 mg Zn. It does not meet the recommended Dietary Intake Level of 2 mg / day and does not exceed the Tolerable Upper Limit Intake Level of 4 mg.

100 ml B contains 0.53 mg Fe mineral. 100 ml of food contains 3 parts of powdered B food. 1 Scale B contains 0.17 mg of Fe mineral. A baby consuming 27 Scale B Food received 4.59 mg Fe. Meets the recommended Dietary Intake Level of 0.27 mg / day and does not exceed the Tolerable Upper Limit Intake of 40 mg (Table 2).

Table 2. Heavy Metals in Baby Food B

Heavy metal	Content Specified in Package	Result of Analysis
Iron (Fe)	0,53 mg	0.53mg
Copper (Cu)	40 mcg(0.04mg)	30mcg(0.03mg)
Zinc (Zn)	0,51 mg	0.46mg

100 ml of formula B contains 30 mcg of Cu mineral. 100 ml of food contains 3 parts of powdered B food. 1 Scale B contains 10 mcg Cu mineral. A baby consuming 27 Scale B Food received 270 mcg Cu. It does not meet the recommended Dietary Intake Level of 200 mcg / day. Tolerable Upper Limit Intake for Copper could not be determined due to lack of data. Further research is needed.

100 ml B contains 0.46 mg of Zn mineral. 100 ml of food contains 3 parts of powdered B food. 1 Scale B contains 0.15 mg of Zn mineral. A baby consuming 27 Scale B Food received 4.05 mg Zn. Meets the

recommended Dietary Intake Level of 2 mg / day and exceeds the Tolerable Upper Limit Intake Level of 4 mg.

100 g of powder C contains 4.38 mg of Fe mineral. 1 Scale powder C Food 4.2 g. 1 Scale C Food contains 0.18 mg Fe mineral. A baby consuming 25 Scale C Food received 4.5 mg of Fe. Meets the recommended Dietary Intake Level of 0.27 mg / day and does not exceed the Tolerable Upper Limit Intake of 40 mg (Table 3)

Table 3. Heavy Metals in Baby Food C

Heavy metal	Content Specified in Package	Result of Analysis
Iron (Fe)	5.1 mg	4.38mg
Copper (Cu)	266 mcg (0.26 mg)	370mcg(0.37mg)
Zinc (Zn)	4.8 mg	4.28mg

100 g of powder C contains 370 mcg of Cu mineral. 1 Scale powder C Food 4.2 g. There is 15.5 mcg Cu mineral in 1 Scale C Food. A baby consuming 25 Scale C Food received 387.5 mcg Cu. It does not meet the recommended Dietary Intake Level of 200 mcg / day. Tolerable Upper Limit Intake for Copper could not be determined due to lack of data. Therefore, an intake up to twice the recommended Cu intake may be risky. Further research is needed.

100 g of powder C contains 4.28 mg of Zn mineral. 1 Scale powder C Food 4.2 g. 1 Scale C Food contains 0.17 mg of Zn mineral. A baby consuming 25 Scale C Food received 4.25 mg Zn. Meets the recommended Dietary Intake Level of 2 mg / day and exceeds the Tolerable Upper Limit Intake Level of 4 mg.

100 g of formula D contains 3.83 mg of Fe mineral. 1 Scale powder of formula D is 4.4 g. 1 Scale D contains 0.16 mg Fe mineral. A baby consuming 24 Scale D Formula received 3.84 mg Fe. Meets the recommended Dietary Intake Level of 0.27 mg / day and does not exceed the Tolerable Upper Limit Intake of 40 mg (Table 4)

Table 4. Heavy Metals in Baby Food D

Heavy metal	Content Specified in Package	Result of Analysis
Iron (Fe)	3.9 mg	3.83 mg
Copper (Cu)	0.31 mg	470 mcg (0.47 mg)
Zinc (Zn)	3.9 mg	3.63 mg

100 grams of formula D contains 470 mcg Cu mineral. 1 Scale powder D Food 4.4 g. 1 Scale D contains 20.6 mcg Cu mineral. A baby consuming 24 Scale D Formula received 494.4 mcg Cu. It does not meet the recommended Dietary Intake Level of 200 mcg / day. Tolerable Upper Limit Intake for Copper could not be determined due to lack of data. Therefore, a intake up to 2.5 times the recommended Cu intake may be risky. Further research is needed.

100 g of formula D contains 3.63 mg of Zn mineral. 1 Scale powder D Food 4.4 g. 1 Scale D contains 0.15 mg of Zn mineral. A baby consuming 24 Scale D Formula received 3.6 mg Zn. Meets the recommended Dietary Intake Level of 2 mg / day and does not exceed the Tolerable Upper Limit Intake Level of 4 mg.

Discussion and Conclusion

In this study, the sample model for the evaluation of foods; In this study, a baby who was born on time and at ideal weight and who was at 5.5 months, who did not take breast milk and fed only 0-6 months formula was evaluated. Food A: Adequate dietary intake for Fe and Zn was met and the tolerable upper limit did not exceed intake. For the Cu element,

sufficient dietary intake was met. However, the upper limit of Cu for 0-6 months is not yet known. As a result of the evaluation, when the baby consumes the required amount of food, it will consume approximately 2.5 times the recommended intake of Cu. As there is no limitation on this subject, it has been concluded that it may pose a risk. The amount of Cu for food A was found to be risky. Food B: Meets adequate dietary intake for the element Fe and did not exceed the tolerable upper limit intake.

For the Cu element, sufficient dietary intake was met. However, the upper limit of Cu for 0-6 months is not yet known. It has exceeded adequate intake, but its toxicity could not be determined because the tolerable upper limit of Cu is unknown. Adequate dietary intake was provided for Zn element and upper limit intake level was exceeded. Cu and Zn amounts were found to be risky for B food.

Food C: Meets adequate dietary uptake for Fe and did not exceed tolerable upper limit. For the Cu element, sufficient dietary intake was met. However, the upper limit intake level of Cu element for 0-6 months is not known yet. As a result of the evaluation, when the baby consumes the required amount of food, it will consume approximately 2 times the recommended intake. As there is no limitation on this subject, it has been concluded that it may pose a risk. Adequate dietary intake was provided for Zn element and upper limit intake level was exceeded. Cu and Zn amounts were found to be risky for C food.

Food D: Meets adequate dietary intake for Fe and Zn and did not exceed tolerable upper limit. For the Cu element, sufficient dietary intake was met. However, the upper limit of Cu for 0-6 months is not yet known. As a result of the evaluation, when the baby consumes the required amount of food, it will consume approximately 2.5 times the recommended intake of Cu. As there is no limitation on this subject, it has been concluded that it may pose a risk. The amount of Cu for food D was found to be risky.

When the label information and our analysis are compared;

- Food A: The amount of Cu it contains is 18 mcg more than the information on the label.
- Food B: The values obtained correspond to the label.
- Food C: The amount of Cu it contains is 104 mcg more than the information on the label.
- Food D: The amount of Cu contained is 160 mcg more than the information on the label.

There is an overdose, although the 5.5-month-old baby weighs the required weight in all calculations. Considering that babies may have more body weight in this period and calorie restriction cannot be made during these sensitive periods, the table may be riskier. In this study, the risk of heavy metal residues which may be included in the food used in the production and packaging stages of the food is taken into consideration. Although it is stated that it is below the toxic intake dose according to the information given in the packages, it has been observed that it can exceed these ratios in these

commercial foods. As a result of our study, the toxic dose of copper, which is heavy metals, is not known and the calculation results of all of the analyzed foods are above the recommended dietary intake is an indication that copper intake is risky. Further research is needed on the toxic dose of copper metal. As a result of toxic uptake, it was seen that there is a lack of data on toxic uptake levels of heavy metals which cause such important health problems for 0-6 months. It is concluded that the toxic intake level is not known, no matter how much the labeling of the products we produce is produced, and as a result of the analyzes, it can pose a great risk due to the intake of 2-2.5 times of the recommended amounts.

Suggestions

Awareness should be raised about the health problems that may occur in the long term and the economic losses that may occur in our country for the treatment of heavy metal residues through infant formula. Manufacturer companies; It is emphasized that taking these necessary measures such as enlarging and increasing the number of toxic dose detection studies and approaching the subject with sensitivity with small corrections can prevent this chaining risk. As a result of the data obtained, parents should be informed about the importance of breastmilk and that they should not give any nutrients other than breastmilk until the 6th month, which is the period of starting to take additional nutrients as much as possible; It was concluded that the inspections in the production of food should be increased for the children who are obliged to take formula due to both the disease and insufficient breast milk.

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