

Heavy metal intake among Finnish preschool children

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PURPOSE OF THE STUDY

Heavy metal levels in some foods may be high enough to increase the possibility of health risk for people consuming them frequently and in large amounts over a long period of time. Arsenic (As), cadmium (Cd), lead (Pb), mercury (Hg) and methyl mercury (MeHg) intakes from certain foods have previously been assessed on the EU level, but regional differences should also be taken into account in national recommendations.

Children are a susceptible group and therefore the intake of the five metals from foods and tap water provided to Finnish children was assessed.

EFFECTS OF HEAVY METALS ON THE HUMAN BODY

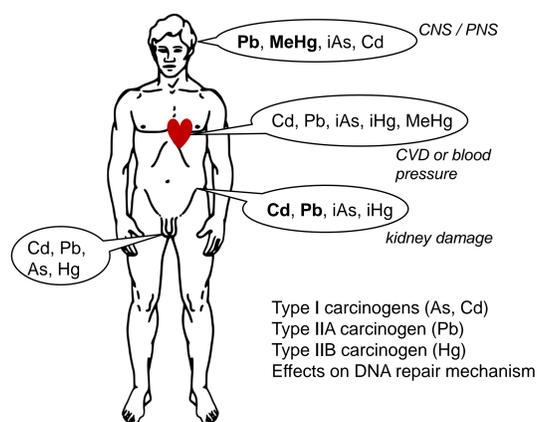


Figure 1. Some of the effects of cadmium, lead, arsenic, methyl mercury and inorganic mercury on the human body. At cell level, the heavy metals cause oxidative stress and disrupt the function of various enzymes. They may also have hormone-like effects.

Dose-response levels on the main health effects of heavy metals have been determined. For cadmium, methyl mercury and arsenic, WHO has decided on a higher reference dose than the one determined by EFSA. In this study, the exposure levels are compared with the levels determined by EFSA, shown in Table 1.

Latest toxicological research has failed to show a threshold level on the harmful effects caused by lead and inorganic arsenic. In the absence of a threshold level, a tolerable weekly intake level cannot be set. Instead, benchmark dose levels have been determined for iAs and Pb. They respond to doses causing a 1% increase of the risk when compared with the unexposed population.

Table 1. Tolerable weekly intakes (TWI) or benchmark doses (BMDL) of the studied heavy metals, as determined by EFSA [1-4].

Metal	Effect	Dose	Type of dose
Cd	Kidney function	2.5 µg/kg bw/week	TWI
Pb	Developmental neurotoxicity	0.5 µg/kg bw/day	BMDL
iAs	Cancer incidence + skin lesions	0.3 – 8.0 µg/kg bw/day	BMDL
iHg	Kidney function	4.0 µg/kg bw/week	TWI
MeHg	Cognitive effects (children)	1.3 µg/kg bw/week	TWI

MATERIALS AND METHODS

The study [5] covered the following food groups, which were considered to be the main sources of heavy metals: cereals and cereal products, vegetables, roots, potatoes, fruit and berries, meat and meat products, fish and seafood, milk and milk products, chocolate, and industrial foods for children. Exposure from tap water was also assessed.

Concentration data on heavy metals, approximately 16 000 results, were mainly from national authorities (Evira, Customs Laboratory, Finnish Environment Institute, Natural Resources Institute), supplemented by industry self-monitoring data, data from published research projects (Evira, University of Helsinki) and literature.

Consumption data of Finnish children of 1, 3 and 6 years were gathered by 3-day food diaries in DIPP study [6] and delivered by the National Institute for Health and Welfare. Age groups were studied separately. Individual consumption data of 1Y (N=1010), 3Y (N=694) and 6Y (N=535) were used in the exposure assessment.

Exposure assessment was run on the MCRA 8.0 program, a Monte Carlo based online tool developed by the RIVM. 100 000 simulations of random consumption times concentration in food item were used.

RESULTS

Using mainly national data, the exposure in Finland was lower than previously estimated in EFSA reports from mainly Central European data. Even so, the exposure to Cd exceeded the TWI in all age groups. The BMDL of Pb (Table 1) was exceeded by a large portion of the 1-year-olds but only by 1% of 6-year-olds. The lower limit of the BMDL for iAs was similarly exceeded in all age groups, but the exposure was below 3 µg/kg bw/day.

The current food use recommendations in Finland aid in decreasing the heavy metal exposure of children.

Figure 2 shows the main sources of exposure for 3-year-olds at age group mean level. The sources are named after the main component but contain also derivatives: e.g. "Milk" includes all dairy products.

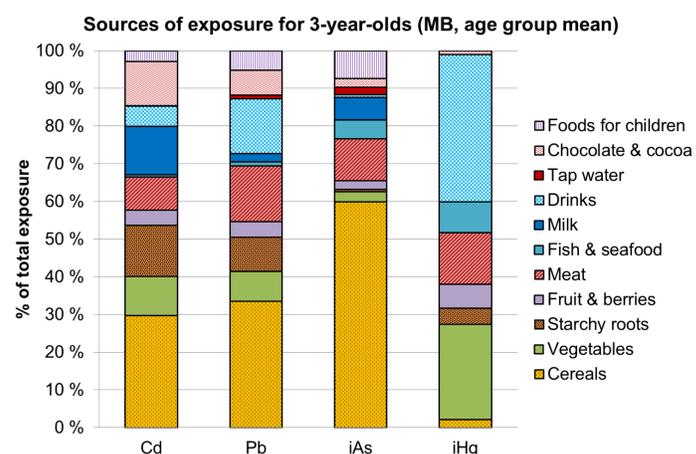


Figure 2. Sources of exposure at age group mean level for 3-year-old Finnish children (middle bound estimation). Hg data on vegetables and drinks (juices and rice drinks) was mainly from literature. Of total mercury in fish, 20% was estimated to be inorganic (shown here).

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