Heavy metal exposure of Finnish children and preliminary cumulative exposure assessment

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Background of assessment

- Dietary exposure of Finnish children of 1 – 6 years to Cd, Pb, As and Hg
  - Probabilistic assessment computed using **MCRA program** (https://mcra8.rivm.nl)
- **Consumption data** from DIPP study
  - children living in SW Finland, nondiabetic but with genetical diabetes risk
  - data collected ca. 10 years ago, but largest study currently available
- **Concentration data**: mainly Finnish control samples or data from previous projects, supplemented by averages in EFSA reports
  - Inorganic arsenic calculated as 70% of total As in other foods unless speciation data available, 2 – 3.5% of total As in fish/seafood, 100% of total As in water
  - Methyl mercury assumed main component only in fish/seafood; inorganic mercury 20% of total Hg in fish, 100% of total Hg in other foods

Part of age group with exposure(* exceeding tolerable weekly intake or benchmark dose values

	TWI / BMDL (EFSA values)	% of 1Y above TWI/BMDL	% of 3Y above TWI/BMDL	% of 6Y above TWI/BMDL
Cd	2.5 µg/kg bw/week	90 (85 – 94)	88 (82 – 93)	64 (50 – 74)
Pb	0.50 µg/kg bw/day	66 (19 – 81)	14 (7 – 22)	1 (0 – 4)
iAs	0.3 – 8.0 µg/kg bw/day(**	79 (72 – 84)	43 (36 – 52)	29 (21 – 37)
iHg	4 µg/kg bw/week	0	0	0
MeHg	1.3 µg/kg bw/week	0.6 (0 – 2)	0	0

(* Middle bound estimates, CI 95% in parentheses.
(** Compared with the lowest value. None exceeded JECFA BMDL for iAs, 3.0 µg/kg bw/day.

Cumulative exposure assessment

- Heavy metals damage many of the same organs/processes in body
  - Lack of directly comparable toxicological dose-response data in literature
  - **Kidney toxicity** and **neurotoxicity** chosen for preliminary study … data for all heavy metals found → relative potency factors to compare toxicity
  - Sum effect of heavy metal mixture assumed to be **additive** (1+1=2), exposure calculated from RPF-weighed concentrations using MCRA v.8
- Neurotoxicity of mixture for children
  - Pb contributed over 70% of total effect
    → decreasing Pb intake has more effect than decreasing MeHg intake

Some of the conclusions of risk assessment

- Youngest children consume more in relation to body weight, therefore have highest risk of exceeding toxicological reference values
  - Median Cd exposure exceeded the TWI for all studied age groups
  - Pb exposure of 1-year-olds high compared with the BMDL, but decreases rapidly with age and changes in dietary habits

- Heavy metal levels in some food groups different in Finland than in EFSA reports
  - E.g. Pb in cereals lower, Pb in tap water much lower, but Cd in oilseeds higher although decreasing
  - Switch to lead-free gasoline in early 1990s → Pb levels in raw agricultural commodities decreasing

Consequences of risk assessment

- Risk management approaches to risk assessment results
  - Some existing recommendations (rice drinks not for young children; fish use recommendations) and effect of new MLs assessed in report → OK
  - Recommendations to follow varied and versatile diet with moderate serving sizes – good nutrition gives better tolerance, deemed better than avoiding totally some food groups

More information:
Suomi et al., Evira Research Reports 2/2015
http://www.evira.fi/portal/en/about+evira/publications/?a=view&productId=426
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