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Kinetic dietary exposure model: Integration of half-life of methylmercury in humans for modelling the long term dietary exposure

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Background and hypothesis: The objective of this communication is to introduce a model (Kinetic Dietary Exposure Model - KDEM), integrating the kinetic of elimination of a chemical together with its dietary exposure in order to better simulate the internal human exposure to food contaminants with long half-life.
The dynamic of the model is including the ingestion at each eating occasion of an amount of chemical to be added to the residual quantity not yet eliminated by the organism and a linear differential equation, taking account for the physiological elimination of the chemical. It was well demonstrated (Bertail et al., 2006) that this exposure process moves deterministically at each eating occasion to reach a steady state.

Methodology: Assuming the Tolerable Weekly Intake for methyl mercury established by the US National Research Council at 0.7 µg/kg bw/week and a half life of 6 weeks, we calculated a threshold corresponding to a weekly dietary ingestion of a safe dose on a long term basis and its subsequent elimination by the organism.
A distribution of MeHg intakes in the women subpopulation was built by combining French consumption data with levels of fish contamination.

Results: Results show that approximately 5 years may be thus considered as the time required for the MeHg exposure to reach the 'equilibrium'. Assuming a weekly exposure to MeHg at the PTWI level of 0.7 µg/kg bw would result at the steady state in a level of 6.06 µg/kg bw. The probability to be exposed above this threshold using the French data would be 1.05 E-03 and the average time to reach such a value would be 21 years.