

Estimation of methylmercury intake doses in the South Korea population using a PBPK model

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Recently, South Korea has measured total mercury (Hg) in blood as part of the Korean National Environmental Health Survey (koNEHS) in 6311 subjects representing Korean general population. About 25% of the biomarker measurements were above the Germany HBM1 of 5 µg Hg/L; and about 1% was above the HBM2 of 15 µg Hg/L. Among the various mercury-containing compounds, methylmercury (MeHg) is the most toxic one because of its ability to be readily absorbed and to accumulate in the body. It has been linked to developmental deficits in children and increased risk of cardiovascular disease in adults. US EPA has set a guidance value for MeHg exposure, but it is reported as a daily intake dose, requiring an exposure reconstruction step in order to compare the measured biomarker concentrations with average intake. Thus, the current study used these biomarker data to further investigate the potential of this population being exposed to MeHg at or above the U.S. Reference Dose (RfD) of 0.1 µg MeHg/kg/day. First, total blood Hg concentrations were converted to MeHg using a randomly selected MeHg/Hg ratio from a previously reported distribution measured among South Korean. Next, these estimated blood MeHg concentrations were used to reconstruct MeHg intake amounts using a published physiologically based pharmacokinetic (PBPK) model for MeHg. Monte Carlo analysis was conducted to account for variability in physiology and pharmacokinetics in estimating the distribution of MeHg intake. The resulting mean amount was 2.88 µg/day, which is comparable to the estimate from the South Korean environmental monitoring report in 2011 based on MeHg residues in fish (2.8 µg/day). The estimated mean dose was 0.045 µg/kg/day, which was approximately half of the RfD; and above 10% of the estimated doses were above the RfD. Future work will examine organic vs. inorganic mercury exposure in the Korean population.