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○アブストラクトデータ

Results of Several Exposure and Toxicokinetic Parameter Evaluations for Methylmercury from Within the Korean and Japanese Communities (U.S.)

Presenter: Koenraad Mariën

In the general population the major source for methylmercury (MeHg) and n-3 polyunsaturated fatty acids (PUFA) intake is fish. High-end fish consumers who were women of childbearing age from within the Japanese and Korean communities living in the U.S. (n=214) were examined to determine; how PUFA intake related to MeHg exposure, how this relationship along with other factors such as intraindividual variability, temporal exposure, seasonal differences in consumption behavior and species consumed impact mercury (Hg) body-burden levels and fish consumption guidance. Also investigated was if single time estimates of MeHg exposure based on blood-Hg levels could provide reliable estimates of longer-term average exposure. Toenail-Hg levels were also examined as they are being used as a marker in efforts to associate exposure with effects such as cardiovascular disease. Dose-response relationships could be compared across studies if this marker were correlated with more established biomarkers.

Demographic and dietary data, Hg fish tissue concentrations for species consumed, hair-, blood- and toenail-Hg levels and, estimated fish, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) intake levels were obtained.

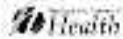
Fish intake approximated the 95th percentile for the US population. Hair-Hg levels were well above the national average. Finfish consumption rates for both populations are similar, but Hg intake is significantly different; suggesting that Asian populations should be treated independently. Further, there may be a percentage within both populations not obtaining their daily dietary requirement of DHA or DHA+EPA. Open-ended survey data better represented MeHg intake as determined from hair-Hg levels than single time-point fish intake survey data. Longitudinal variability of hair-Hg levels changed slowly across the study period indicating that fish species maintaining Hg body-burden levels were available year-round. We identified no fundamental problems with using single time-point fish intake data for deriving health guidance. However, different survey recall time frames may have affected the measured consumption rates, and data derived using a short recall period may produce intake values not representing average exposure. This is significant as health advisories are based on estimated fish and Hg intake without benefit of biological data.

Point estimate blood-Hg results suggest that reliance on single blood samples can make predicting ongoing MeHg exposure highly speculative due to large intra-individual variability. A chronologically matched hair-Hg to toenail-Hg ratio has been identified. However, the use of markers needs to be considered carefully when testing hypotheses as a single biometric value may describe an individual body-burden level not exhibiting steady state approximation.

○発表データ

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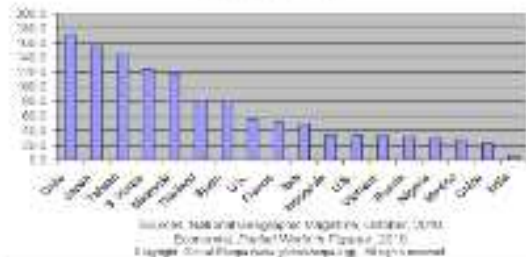


Why Study Asian Pop. in the U.S.?

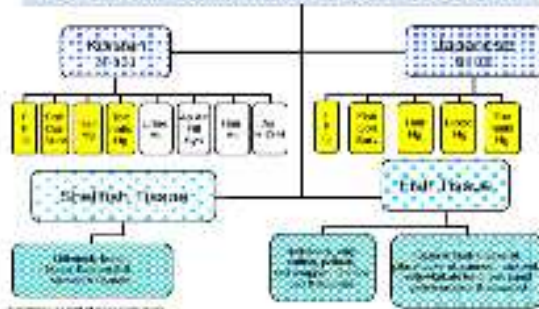
- Consume large amounts of seafood
 - US EPA's estimate for US general population = 0.8 g/kg/day
 - Asian pop. in Seattle area = 1.2 g/kg/day (1,200 persons in 2011)
- Previous studies have indicated Asian pop. have elevated Hg level (Kohler et al 2001, Kozubek et al 2002, Mahony et al 2007)
- In Washington State: 380,000 (10%)
 - 40,000 Japanese (10.5% of total pop.)
 - 20,000 Koreans (5.2% of total pop.)



Annual Seafood Consumption by Country in Pounds Per Person



Arsenic Mercury Intake Biometric Study



Objectives of This Study

- To determine:
 - fish consumption patterns and mercury exposure among high fish consumers
 - how intake of n-3 FAs relates to mercury exposure
 - temporal blood Hg levels
 - toenail-Hg to hair-Hg ratio

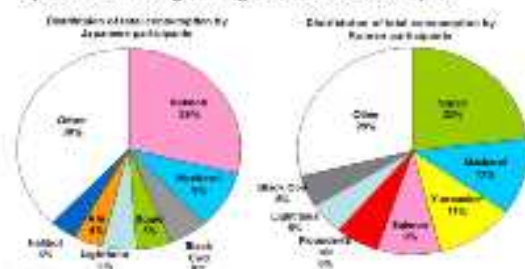


Fish Intake Comparison: to National Statistics

	Finfish		Shellfish		Finfish & Shellfish	
	Mean	100%	Mean	100%	Mean	100%
Japanese (n=185)	50	153	14	50	73	196
Korean (n=100)	44	147	20	81	87	248
US General (COFH)					56	77
US General (NHANES)					117	87
Japanese women (2,489)	74	149				
Korean fish consumers (2,489)	59					

Fish intake- by weight

Species contributing the largest % to total consumption



Country	School-based surveys (100% of schools)				Non-school-based surveys (100% of schools)			
	Year	Age (yr)	Sample size (n)	% of children with elevated Hg	Year	Age (yr)	Sample size (n)	% of children with elevated Hg
Canada	1991	10-12	1,000	10%	1991	10-12	1,000	10%
USA	1991	10-12	1,000	10%	1991	10-12	1,000	10%
Japan	1991	10-12	1,000	10%	1991	10-12	1,000	10%
UK	1991	10-12	1,000	10%	1991	10-12	1,000	10%

DHA intake & Hg exposure



DHA+EPA intake & Hg exposure

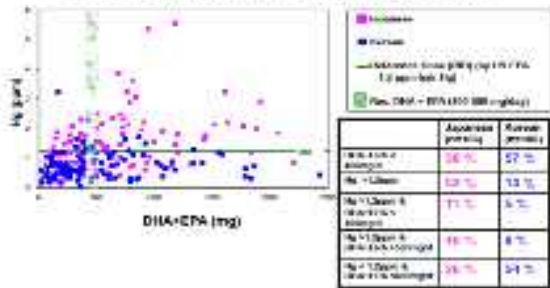


Table 1. Blood mercury, selenium, and selenium:mercury ratio in Japanese children.

Study	n	Se (µg/L)	Hg (ppm)	Selenium:Mercury Ratio			
				< 1.0	1.0-1.5	1.5-2.0	> 2.0
Japan (1991)	1,000	1.75	0.17	51%	47%	2%	0%
USA (1991)	1,000	1.75	0.17	51%	47%	2%	0%
Canada (1991)	1,000	1.75	0.17	51%	47%	2%	0%
UK (1991)	1,000	1.75	0.17	51%	47%	2%	0%

Temporal Blood-Hg levels w/in Japanese Cohort

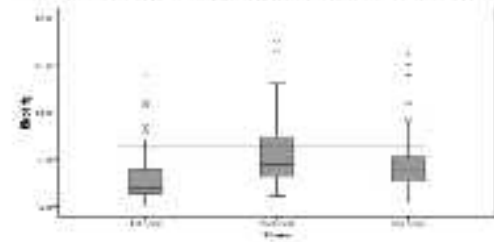


Figure 1. Temporal blood-Hg levels in Japanese children. The figure shows that blood-Hg levels are significantly lower in the High DHA and High DHA + EPA groups compared to the Control group.

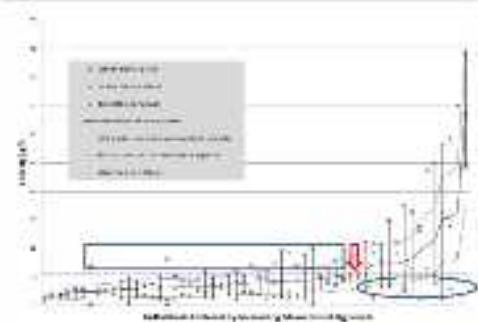


Figure 2. Temporal blood-Hg levels in Japanese children. The figure shows that blood-Hg levels are significantly lower in the High DHA and High DHA + EPA groups compared to the Control group over time.

Hg:Se to I:Se ratio determined from means and regression models

Study	Mean Hg (ppm)	Mean Se (µg/L)	Hg:Se Ratio	Regression Model	Significance
Japan (1991)	0.17	1.75	0.10	Hg = 0.10 * Se	p < 0.001
USA (1991)	0.17	1.75	0.10	Hg = 0.10 * Se	p < 0.001
Canada (1991)	0.17	1.75	0.10	Hg = 0.10 * Se	p < 0.001
UK (1991)	0.17	1.75	0.10	Hg = 0.10 * Se	p < 0.001

Temporal Toenail Hg Levels w/in Japanese Cohort

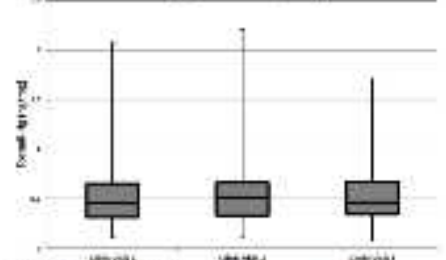
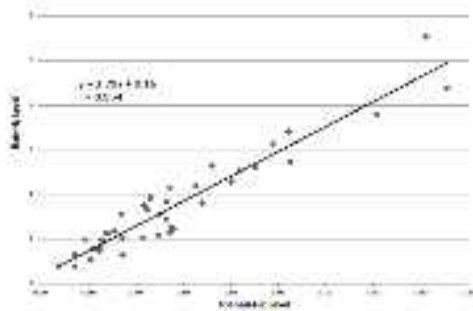


Figure 3. Temporal toenail Hg levels in Japanese children. The figure shows that toenail Hg levels are significantly lower in the High DHA and High DHA + EPA groups compared to the Control group.



Relationship between monthly fish intake (g/day) and hair Hg level (ppm) among participants (n=42).

Summary

- Fish intake and Hg exposure levels were at/above the 95th % levels observed nationally in US.
- Nearly identical amounts of finfish intakes
 - ~ 60 g/assorted fish
 - Consumed **different types of fish**
 - Intakes and exposure similar to those seen in Japan and S. Korea.
- Different Hg exposure levels
 - 50% of Japanese vs. 25% of Korean exceed US EPA's RFD for mercury
- Large % do not obtain recommended DHA or DHA+EPA levels
- Single blood-Hg samples for predicting ongoing exposure: highly speculative.
- Hair Hg to toenail Hg ratio identified for relating MeHg exposure and dose response.

Thank you.

Thank you NIH and EPA.

Thank you to participants.

Thank you co-workers.

And,

A BIG Thank you today,

National Institute For Minamata Disease