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Mercury distribution from blood to hair in humans and dogs

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Mercury accumulates in hair. Head hair, along with blood, is a matrix for the biological monitoring of total mercury exposure. We compared the levels of blood mercury/hair mercury in humans and in a dog to examine the clinical relevance. Patient 1. A 50-year-old man with hyperglycemia and elevated levels of CD69 (25%) had mercury whole-blood 32.7 Hg µg/L and scalp hair mercury 8.4 Hg µg/g; blood-to-hair mercury ratio was 1:257. Intake of fish was 7 portions per week. Patient 2. A 44-year-old female with anemia, anorexia, high serum beta-2-glycoprotein 1, hyperamylasemia, and tremors had mercury whole-blood 13.4 Hg µg/L and scalp hair mercury 3.1 Hg µg/g; blood-to-hair mercury ratio was 1:231. Fish intake was 3 portions per week. Patient 3. A 57-year-old female with memory impairment and electric shock sensation from head to extremities had mercury whole-blood 24.3 Hg µg/L and scalp hair mercury 6 Hg µg/g; blood-to-hair mercury ratio was 1:276. Fish intake per week was 7. Patient 4. A 54-year-old female with paresthesia, dermatitis, and mycosis had mercury whole-blood 26.5 Hg µg/L and scalp hair mercury 3.2 Hg µg/g; blood-to-hair mercury ratio was 1:121. Intake of fish was 3 per week. Patient 5. A 28-year-old man with abdominal pain, mesenteric lymphadenitis (mercury-related enlarged mesenteric lymph-nodes), and an elevated antistreptolysin-O titers in serum had mercury whole-blood 43.4 Hg µg/L and scalp hair mercury 12 Hg µg/g; blood-to-hair mercury ratio was 1:257. Fish intake was 5 portions per week. In humans, mercury levels in scalp hair are proportional to simultaneous concentrations in blood but are about 250 times higher. Table 1 compares the result of the blood-to-hair mercury ratio in a dark red Toy Poodle with those previously reported in humans. In a dog, the estimates of the blood-to-hair mercury ratio was found to be greater than in humans.

Table 1. Toxicokinetic parameters between to different compartments: mercury in blood and mercury in hair among humans and dog.

Patient No.	Blood Mercury µg/L (µg/L) Range: 10-100 µg/L	Blood Mercury µg/L (µg/L) Range: 10-100 µg/L	Scalp Hair Mercury µg/g (µg/g) Range: 10-100 µg/g	Blood-to-Hair Mercury Ratio
1	32.7 ^a	0.0227 ^a	8.4 ^a	1:257
2	13.4 ^a	0.0234 ^a	3.1 ^a	1:231
3	24.3 ^a	0.0243 ^a	6 ^a	1:247
4	26.5 ^a	0.0205 ^a	3.2 ^a	1:121
5	43.4 ^a	0.0434 ^a	12 ^a	1:276
Animal Dog	0.3	0.0001	6.0 ^b	1:500




Figure 1. A 2-year-old female Toy Poodle, height at the withers 48 centimeters, and weight 1.8 kilograms. The dog hair samples were collected from the first 2 centimeters (2.0 to 2.00 cm) of the dog's hair. The total mercury concentration was 0.3 µg/g (0.3 µg/g) and the mercury concentration was 6.0 µg/g (6.0 µg/g) resulting a blood-to-hair ratio of 1:500.

Table 2. The relationship between the whole-blood concentrations and the corresponding scalp hair mercury in asymptomatic patients with mercury excretion from fish and seafood.

Recent Publications:

- Lieske C L et al. (2011) Toxicokinetics of mercury in blood compartments and hair of fish-fed sled dogs. Acta Vet. Scand. 53:66.
- Guzzi G, C Marsili and P D Pigatto (2010) Mercury in pediatric poisoning. Eur. J. Pediatr. 169(7):907.
- Minoia C, A Ronchi, P D Pigatto and G Guzzi (2008) Measuring mercury exposure in children. Pediatr. Int. 50(6):839-840.
- Nyland J F et al. (2011) Biomarkers of methylmercury exposure immunotoxicity among fish consumers in Amazonian Brazil. Environ. Health Perspect. 119(12):1733-1738.

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5. Magos L and T W Clarkson (2008) The assessment of the contribution of hair to methyl mercury excretion. *Toxicol. Lett.* 182(1-3):48-49.

Biography

Gianpaolo Guzzi is the President - Founder and Clinical Research Coordinator of the Italian Association for Metals and Biocompatibility Research – A.I.R.M.E.B., a Milan-based not-for-profit organization. His field of expertise is toxicology of mercury.

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