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Letter to the Editor

Fish

Biomarkers: blood or hair?

Madam

The timely paper by Brantsæter *et al.*[1] on blood biomarkers of fish intake was based on the rationale for a strong, direct and independent relationship between the biomarker with the fish food group. The results confirm that blood DHA reflects both fatty fish intake and *n*-3 PUFA supplementation. However, blood arsenic was the measured marker that appeared useful to indicate total fish and seafood consumption. Indeed the paper recognised that methylmercury presence in other human tissues is directly related to fish consumption.

I would like to raise the convenience of a specific tissue, Hg levels in hair, as a biomarker with several advantageous characteristics. Hair grows 1 cm a month, and integrates blood concentrations at a time point of at least 1 month (for 1 cm long samples). Therefore transient changes in fish consumption are likely to affect blood arsenic, but not hair-Hg concentrations.

Unlike blood assays, which need experienced personnel for proper venepuncture, hair is much more easily collected, handled, stored, processed and analysed[2]. Unlike any of the blood markers used by Brantsæter *et al.*, integration of hair-Hg levels is superior because of its bio-accumulative properties. Fish-derived methylmercury binds specifically to hair, while Hg from other sources is excreted in urine[3]; this is a unique specificity not shared by other blood biomarkers[1].

Compared with blood-Hg, concentration of Hg levels in the hair is almost 300 times higher[4]. Due to rate of hair growth, hair-Hg will always reflect a delayed average dependent on the sample size and proximity to the scalp. Indeed, Brantsæter *et al.*'s cited values of fish consumption for the Danish, Finnish and Mexican mothers are much lower than those recorded in Amazon subsistence women who, using calculations based on hair-Hg concentrations, consume an average of 170·5 g of fish a day[5].

My group has used hair-Hg as a biomarker of fish intake to survey cardiovascular health in adults[6], and linear growth and neurodevelopment in children[7–9]. Hair-Hg also has been used to trace dietary predominance of fish in spatial studies[10,11] of isolated subsistence communities and to study prehistoric diets in mummies[12]. As a surrogate of fish intake, Arakawa *et al.*[13] used hair-Hg concentrations to study fecundity among Japanese women. Because direct fish consumption can be estimated by hair-Hg[5,14,15], breast-fed babies have hair-Hg well correlated with maternal hair-Hg[16]. It may not be ethically acceptable to draw blood to measure a biomarker in a small baby, but hair-Hg testing is not invasive and within its limits has been used in association with maternal fish intake.

I hope this discussion revives interest in useful biomarkers of fish consumption in order to improve the quality of studies of this unique food group.

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