Perchlorate and iodine: a novel focus on newborns

For the first time, scientists have compared a woman’s daily intake of iodine and perchlorate with the concentrations of each in her breast milk. They found that a small proportion (about 20%) of iodine enters the breast milk compared with a higher proportion (more than 50%) of perchlorate. Although not definitive, experts say the study, published in ES&T (DOI 10.1021/es801549w), provides further evidence that iodine intake in U.S. mothers is low and that perchlorate could be a problem for newborns.

Perchlorate, a major component of rocket fuel, also forms naturally. Health concerns focus on perchlorate’s ability to disrupt thyroid hormone function by competitively blocking the uptake of iodine to the thyroid gland and to breast milk. Iodine is essential to thyroid hormones, which orchestrate brain development in fetuses and young infants. During breast feeding, the thyroid function of infants depends on iodine in maternal milk.

Previously published in vitro data suggested that other contaminants, notably thiocyanate, found in cigarette smoke and vegetables like cabbage, and nitrate, found in salad greens, also effectively block iodine from the thyroid and breast milk. But this new study, sponsored by the Gerber Foundation, suggests that for women who do not smoke, perchlorate is the contaminant of concern.

In 2005, on the basis of studies of perchlorate dosing in healthy adults, a U.S. National Academy of Sciences (NAS) committee recommended that 0.7 micrograms per kilogram of body weight per day is a safe level. Although the contaminant is found in both food and drinking water, food has emerged as the primary source of low-level exposure for most Americans. Massachusetts and California have set drinking-water standards for perchlorate, but the U.S. EPA is still considering the issue.

In the ES&T paper, chemist Purnendu “Sandy” Dasgupta and colleagues at the University of Texas Arlington recruited non-smoking, mainly Caucasian volunteers, aged 24–34, from the metropolitan Dallas–Fort Worth area. The 13 mothers collected samples of their own urine in a 24 hour (h) period, recorded the volume, and sent the samples to Dasgupta’s lab. They also took four breast milk samples per day for three sets of three consecutive days. “Our study has a small number of women but lots of data,” says Dasgupta, who added that 24 h urine samples are a more reliable measure of iodine nutrition than spot samples are.

Low levels of iodine characterized the results. Only one infant received enough iodine to meet the recommendations of NAS’s Institute of Medicine. Six out of 13 infants received less than 30% of this level. Relatively high levels of perchlorate also characterized the data. Nine out of 13 infants received levels of perchlorate that exceeded the NAS recommendation. In the worst case, levels were 3 times higher than the NAS safety threshold.

The scientists estimate that perchlorate is concentrated in breast milk 3 times more than iodine is. Thiocyanate is not concentrated with respect to iodine. These concentration effects are at least 10 times lower than those from previous in vitro studies, and the relative importance of perchlorate and thiocyanate is also different.

“This work points out some very, very important issues,” says thyroid researcher Thomas Zoeller at the University of Massachusetts Amherst. “It is the first time that someone has figured out what actually gets into the milk and exposes the infant,” he notes. “Contaminant effects in in vitro studies are one thing, but what we need is to figure out what actually gets into the milk and exposes the infant,” he adds.

“I remain concerned about the overall iodine sufficiency of lactating women in the U.S.,” says endocrinologist Elizabeth Pearce at Boston University. “It remains unknown what, if any, effects environmental perchlorate exposure has on the thyroidal function of breast-fed infants,” she adds.

“We must begin to look at infants—babies 2 weeks to 3 months old—in perchlorate studies. What happens to kids in this age range when all they get is milk and the perchlorate level is high?” Zoeller asks.

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