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**FIRST PERSON**

# Toxic Breast Milk?

**By FLORENCE WILLIAMS**

If human breast milk came stamped with an ingredients label, it might read something like this: 4 percent fat, vitamins A, C, E and K, lactose, essential minerals, growth hormones, proteins, enzymes and antibodies. In a healthy woman, it contains 100 percent of virtually everything a baby needs to survive, plus a solid hedge of extras to help ward off a lifetime of diseases like diabetes and cancer. Breast milk helps disarm salmonella and E. coli. Its unique recipe of fatty acids boosts brain growth and results in babies with higher I.Q.'s than their formula-slurping counterparts. Nursing babies suffer from fewer infections, hospitalizations and cases of sudden infant death syndrome. For the mother, too, breast-feeding and its delicate plumbing of hormones afford protection against breast and ovarian cancers and stress. Despite exhaustion, the in-laws and dirty laundry, every time we nurse our babies, the love hormone oxytocin courses out of our pituitaries like a warm bath. Human milk is like ice cream, Valium and Ecstasy all wrapped up in two pretty packages.

But read down the label, and the fine print, at least for some women, sounds considerably less appetizing: DDT (the banned but stubbornly persistent pesticide famous for nearly wiping out the bald eagle), PCB's, dioxin, trichloroethylene, perchlorate, mercury, lead, benzene, arsenic. When we nurse our babies, we feed them not only the fats, sugars and proteins that fire their immune systems, metabolisms and cerebral synapses. We also feed them, albeit in minuscule amounts, paint thinners, dry-cleaning fluids, wood preservatives, toilet deodorizers, cosmetic additives, gasoline byproducts, rocket fuel, termite poisons, fungicides and flame retardants.

If, as Cicero said, your face tells the story of your mind, your breast milk tells the decades-old story of your diet, your neighborhood and, increasingly, your household decor. Your old shag-carpet padding? It's there. That cool blue paint in your pantry? There. The chemical cloud your landlord used to kill cockroaches? There. Ditto, the mercury in last week's sushi, the benzene from your gas station, the preservative parabens from your face cream, the chromium from your neighborhood smokestack. One property of breast milk is that its high-fat and -protein content attracts heavy metals and other contaminants. Most of these chemicals are found in microscopic amounts, but if human milk were sold at the local Piggly Wiggly, some stock would exceed federal food-safety levels for DDT residues and PCB's.

Some of the chemicals I'm mainlining to my 1-year-old daughter will stay in her body long enough for her to pass them on to her own offspring. PCB's, for example, can remain in human tissue for decades. On a body-weight basis, the dietary doses my baby gets are much higher than the doses I get. This is not only because she is smaller, but also because her food -- my milk -- contains more concentrated contaminants than my food. It's the law of the food chain, and it's called biomagnification.

To refresh that lesson from seventh grade, here's how it works: Animals at the top of the food chain receive the concentrated energy and persistent chemicals of all the biota underneath them. Each member up the food chain takes in exponentially more fat-loving toxins than its counterpart below. This is why a slab of shark contains more mercury than its weight in plankton. Ocean food chains are longer than

terrestrial ones, so people who eat many marine carnivores carry higher body concentrations of some chemicals than the vegan at your local salad bar. When it comes to these fat-soluble toxins, the Inuit are among the most contaminated populations on earth, even though they live in the remote Arctic. But don't picture Eskimo Woman in sealskin on the top of the food chain. Picture her suckling baby.

For a mother and child, nursing is perhaps the most intimate of acts. Evolutionary biologists call it matrotropy: eating one's mother. My daughter is not only physically attached to me; she is taking from me all that I can give her. Each time I lift my shirt, she pants and flaps her arms and legs as if it were Christmas. Then she settles in, both of us wholly reassured that this is the best, safest and most satisfying food she could eat. I nurse because, like many women, this is what I've been told by contemporary pregnancy books and my pediatrician. I want to give her the best possible start in an uncertain world.

I take this responsibility seriously, as most of us do; for her sake, I don't drink much alcohol or caffeine. I avoid spicy foods, strawberries and cruciferous vegetables, which are believed to cause gas in babies. I take my vitamins to ensure that I have enough calcium and iron. I don't smoke. I'm aware of concerns about pesticides and heavy metals, and I try to take precautions. Since I have been pregnant with or nursing two children for almost four years, I have been buying mostly organic food. Several years ago we installed a three-stage reverse-osmosis filter on our tap water and ice maker. I live in a leafy, scenic town in the Rocky Mountains far from brown clouds and belching diesel freeways.

So it was with increasing discomfort that I scanned recent headlines about pervasive toxic chemicals, the ones you can't easily avoid. There were articles about elevated mercury levels in women of child-bearing age, federal actions against the makers of Teflon and flame retardants accumulating in breast milk. This last one especially frightened me. Not only was nature's purest food tainted by chemicals, but the act of breast-feeding itself, an act of love and nurture, was also now marred by fear. Had I been wrong to be so smug about the superiority of breast-feeding? Should I switch to formula, which contains plant-based fats and therefore lower levels of some contaminants (although it may contain higher levels of others, like aluminum and manganese, as well as the pathogens and pesticides found in tap water)? I learned that in general, older women have stored up more toxins than younger ones. Scientists believe that mothers siphon off to their baby a significant amount of their lifelong store of chemicals in the course of breast-feeding. Nursing a baby, it turns out, is the ultimate detox diet. I'm 37. What toxins have I passed on to my son and daughter?

To find out, I sent my breast milk off to be tested for certain flame retardants called PBDE's, reputed in some press reports to be "the next PCB," a class of industrial chemicals banned in the late 70's. I knew some PBDE's would turn up; they are found in virtually every animal and human tested so far. The milk of American women has the highest levels in the world, although still mostly lower (we think and hope) than levels at which health effects might be seen in us or our children. What these levels tell us is that our world is full of unhappy and improbable surprises, like the fact that the plastic in our computers and TV's somehow ends up inside us. Our collective levels tell us that the chemicals are increasing over time, that someone should be paying attention and that it would be helpful to know what havoc may be wreaked in our cells if present trends continue.

Waiting for results over the next two months, I learned more about chemicals in my everyday life. I began eyeing my degrading foam mouse pad: was I ingesting it? I read the ingredients label on my sunscreen. I noticed the little white pesticide-notification flags on my neighbors' lawns. I watched my 3-year-old son. Was he meeting his development targets? How was his attention span? I recognized that in its incremental way, alarm over toxic contamination creates a perfect storm for the overanxious parent. Now in addition to worrying about the right schools, dirty bombs and car-seat recalls, we get to wonder if our mattresses are emitting developmental neurotoxins.

During this time, one thing became clear to me: we live in a flame-retardant nation. The reason is polyurethane. Originally used by the German Army in World War II, by the mid-50's the polymer was transforming everything from refrigeration insulation to upholstered foam furniture to car bumpers. It

was an industrial miracle: cheap, soft and malleable. As one industry Web site puts it, "Today, polyurethanes can be found in virtually everything we touch -- our desks, chairs, cars, clothes, footwear, appliances, beds, the insulation in our walls, roof and moldings on our homes."

It has just one problem: it's highly flammable. Responding to strong consumer-protection laws dating from the 70's, manufacturers increasingly treated household foam and plastics with brominated flame retardants. The National Association of State Fire Marshals says that such fire retardants have saved hundred of lives from house fires. They also help prevent the release of combustion byproducts like dioxin, a known human carcinogen. PBDE's reflect a wholly modern conundrum: they are one toxic solution most of us didn't know existed to a toxic problem most of us didn't know we had.

For the flame retardant to work, foams, plastics and fabrics are mixed with, or coated in, PBDE's, polybrominated diphenylethers, but in such a way that the chemical is not molecularly bound to anything. It appears to migrate out of its product and attach to household dust. A class of so-called organic compounds, PBDE's have as one of their signature properties fat-solubility. Hence their unwelcome appearance in our breast milk. They may remain in humans for several months to at least several years. Semi-volatile in the environment, certain PBDE's have lately been found in soil sediments; in chicken, pork, sausage and dairy products; in sewage sludge and crop fertilizer; in fresh and saltwater fish; in wild birds; on computer and desk surfaces; in clothes-dryer lint; on the insides of residential windows; and in human fetal liver tissue.

Persistent toxins were first discovered in breast milk in 1951, when black mothers in Washington were tested for the pesticide DDT. In 1966, a Swedish researcher thought to test his wife's breast milk for PCB's, or polychlorinated biphenyls, after he discovered them in the tissue of a dead eagle. Five years later, Sweden banned PCB's, with the United States following a few years later. But because of those chemicals' widespread use and persistence, they are still the highest-concentration toxins in breast milk, even in mothers born after the 1978 ban. Most scientists maintain that prenatal exposure to PCB's -- considered by the Environmental Protection Agency to be a probable human carcinogen -- can do real damage. Researchers in the Great Lakes region, the Arctic and the Netherlands found that babies born to mothers with mid- to upper-range background levels of PCB contamination (probably because of diets rich in contaminated fish and animal products) have delayed learning capabilities, lower I.Q.'s and reduced immunities against infections. The longitudinal studies on which these findings were based showed that some problems persisted at least into early adolescence.

The message from these studies about breast-feeding, however, was not what you might expect. Although the children who were breast-fed had higher PCB levels than children who were exposed only in utero, they consistently performed better than those who drank formula. When researchers controlled for socioeconomic factors, the differences were more subtle but still there. In other words, breast milk appears to be at least partly protective against the effects of toxic chemicals. In fact, the World Health Organization and other groups continue to recommend breast-feeding for all women. At first this sounds reassuring, until you wonder how much better the breast milk would be without the companion chemicals. We'll never know, since an uncontaminated control group doesn't exist.

Swedish researchers first discovered the PBDE flame retardants in pike in 1981. Like PCB's, they concentrated in fat and stuck around. But unlike PCB's, whose levels were gradually declining worldwide, the flame-retardant levels were rising. The Swedes decided to look for the chemicals in stored human milk samples, and what they found rocked the scientific community: from the early 70's, when they first appeared commercially, to 1998, levels of PBDE's in breast milk were doubling every five years, a rate unmatched by any known chemical in the last 25 years.

"No one had ever heard of them -- we thought it was just a European problem," said Kim Hooper, a specialist with the California Department of Toxic Substances Control. "So our lab looked in San Francisco Bay seal blubber, and found a 100-fold increase over 10 years." When European scientists first saw the test results of American women, they thought there must be a mistake. Our levels were 10 to 100

times higher than those of women in Europe and Japan.

So far, little is known about the health effects of PBDE's in humans. It's difficult to experiment with human subjects, and so to estimate toxicity scientists look to laboratory animals. What they have found is that in rats, exposure to PBDE's has resulted in damage to the thyroid and its ability to orchestrate proper brain development, although the exact mechanism remains unclear. We know that the offspring of exposed rats suffer reduced motor function, and that some develop tumors at high doses of one type of PBDE. Several recent animal studies indicate that PCB's and PBDE's may act in unison to block protein receptors and affect thyroid and endocrine functioning.

Such observations can be useful in helping us determine toxic chains of events but not in predicting at what dose the bad effects occur in humans. And, as Paracelsus put it, the dose makes the poison. The dose required to harm a developing fetus or small baby is likely to be much lower than to harm an adult.

"No one at this time knows at what levels nursing is not the best approach and in fact becomes harmful to babies," said Arnold Schecter, at the University of Texas School of Public Health, the researcher to whom I sent my samples. "But such levels must exist."

Aake Bergman, head of the department of environmental chemistry at Stockholm University, whose data was instrumental in influencing the European Union to ban two formulations of PBDE's, said: "I hope I never will be able to tell you about effects in humans. We will so totally have failed if we see effects in humans."

When Congress ordered the banning of PCB's in 1976, it also passed the Toxic Substances Control Act, which authorized the U.S. Environmental Protection Agency to approve and regulate new chemicals. Approximately 58,000 existing chemicals were grandfathered in, no questions asked, including PBDE's. Today, about 15,000 chemicals are used commercially in the United States. Under the law, manufacturers are required to submit any available information on the health and safety of new chemicals, and the Environmental Protection Agency has 90 days to assess it. Manufacturers are also required to submit available toxicity information as it becomes available on older substances. But with 2,000 new chemicals proposed every year and limited data to review, the agency is seriously behind the curve. Of chemicals used by children and families in consumer products, only about 25 percent have registered complete toxicity data. In nearly 30 years, the E.P.A. has required manufacturers to test about 1,500 chemicals, or 10 percent of the total, and flat-out rejected only a handful of chemicals.

"We don't like to see a chemical building up in the tissues of people," said Charlie Auer, director of the E.P.A.'s Office of Pollution Prevention and Toxics. With PBDE's, he said, "there certainly is a basis for some level of concern, but we don't have enough information." Still, in 2003 his office reached an agreement with the biggest manufacturer of PBDE's, Great Lakes Chemical Corporation, to stop producing two of three formulations by the end of 2004. Existing stocks of those two forms of the chemical will be used and eliminated "over time," he said.

And so I do what any mother would: I try to gain a sense of control. Not entirely happy about the exposed foam in my husband's old pick-up, I cover the rips with duct tape. I retire my son's adorable airplane-print foam chair to the garage. I even replace his questionable polystyrene beanbag with one made out of organic buckwheat hulls. But there's not much I can do about the television sets, computers, printers, coffee makers, carpets, roof insulation and the rest of it short of moving my family into a tree and sleeping on a horse-hair mattress.

To get a reality check, I call David Ropeik, a former environmental journalist now with the Harvard Center for Risk Analysis. "We're developing new and better tests to allow us to do more biomonitoring, but so what?" he asked. "It's really dicey to know what that means for human babies. The mom who lets her kids get sunburned and worries about PBDE's is worrying about the wrong thing."

Knowing what we carry inside us, rather than making anyone feel better, may in fact be making us feel

worse. "Biomonitoring is now so refined that you can detect pretty much anything," said Peter O'Toole, a spokesman for the industry-financed Bromine Science and Environmental Forum. "It's become a cottage business. We just want to see it done right, and not used as a scare tactic."

Fewer than 200 women have been tested in the United States for flame retardants in their breast milk, many of them for a study by Arnold Schecter. When he called with my PBDE results from the lab, he had mixed news. The good news in relative terms is that at 36 parts per billion, my levels are only 2 points above what Schecter's work suggests is the U.S. median. This means that roughly half of women tested have levels above mine and half below. The bad news is that my levels are presumed to be rising with the current trend and are still an order of magnitude higher than those of the rest of the industrialized world. At current rates of increase, my levels could reach 300 parts per billion in 10 to 15 years. That's the level that Tom McDonald, at the California Office of Environmental Health Hazard Assessment, says corresponds to endocrine and thyroid dysfunction in lab animals. What this means, though, in human terms, remains unclear. Talking about PBDE's, Schecter said, "We know less than one-tenth of one percent of what we know about PCB toxicity. Your level, and that of other American women, suggests to me that the E.P.A. still has a lot of work to do."

I called Michael Dourson, a toxicology consultant who is very familiar with the current research on PBDE's and children, to get a read on my own numbers. He translated my PBDE levels -- 36 parts per billion -- into an exposure estimate for my breast-feeding daughter and then compared that with the best-known safe level that scientists can more or less agree on. What it comes down to is that, roughly and with some uncertainty, my baby is receiving one-seventh the exposure of the maximum level believed to be safe. "Above that level, we're not sure, but we become less confident," he said. "And at some point, it becomes not safe."

After countries in Northern Europe began restricting certain flame retardants in the 90's, levels in breast milk there declined. That is what we hope to see here now that production of the two most worrisome flame retardants has ceased.

I'm relieved that my exposure levels aren't higher. I'm relieved that some of the substances are going off the market. And I'm relieved, frankly, to get back to worrying about trans fats and car seats. But there is a lingering unease that more toxic surprises await us. A few years ago, many American toxicologists had never heard of polybrominated diphenylethers. Already, another chemical is ready to claim "the next PCB" label: PFOA, or perfluorooctanoic acid (used to make nonstick frying pans), believed by some to be an even bigger problem.

Ultimately, though, the question for me as a mother is not at what threshold of exposure will my baby be harmed, but why are we manufacturing common products made with these toxins at all? "There is almost no example of a toxic chemical in breast milk that doesn't have a nontoxic substitute," said Sandra Steingraber, a visiting scholar at Ithaca College and author of "Having Faith: An Ecologist's Journey to Motherhood." "We haven't yet compromised breast milk to such an extent that it's a worse food than infant formula, but why get to that point?"

For now, I will continue to breast-feed my daughter. As for PBDE's, McDonald said, "My hope is that we caught it early enough."

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