Is lead in the US food supply decreasing our IQ?

June 16 2017, by Keri Szejda And Andrew Maynard

Credit: Max Rahubovskiy from Pexels

The environmental advocacy group Environmental Defense Fund (EDF) on June 15 released a study about dietary lead exposure, with a focus on food intended for babies and young children.

Using a Federal Drug Administration (FDA) database of food samples, EDF reported some pretty worrying numbers, most remarkably in fruit juice samples intended for children. For example, 89 percent of the baby food grape juice samples had detectable levels of lead in them.

As researchers who served as independent reviewers on the EDF report, we think it raises important concerns about the safety of our food supply. Since EDF primarily focused on exposure (whether lead was detectable or not), we were interested to see if we could get a better sense of the magnitude of risk. Specifically, we examined potential IQ loss and the percentage of samples with high lead concentrations.

Why is lead in our food and beverages?

Most of us are probably familiar with the dangers of chipping and peeling lead paint. And the Flint water crisis has brought lead pipes to the forefront of our minds.

But food is a source of lead exposure most of us probably aren't thinking about. Soil contamination is a known source of lead in food, but the EDF report also raised the possibility of contamination occurring via the use of lead-containing materials during food processing.

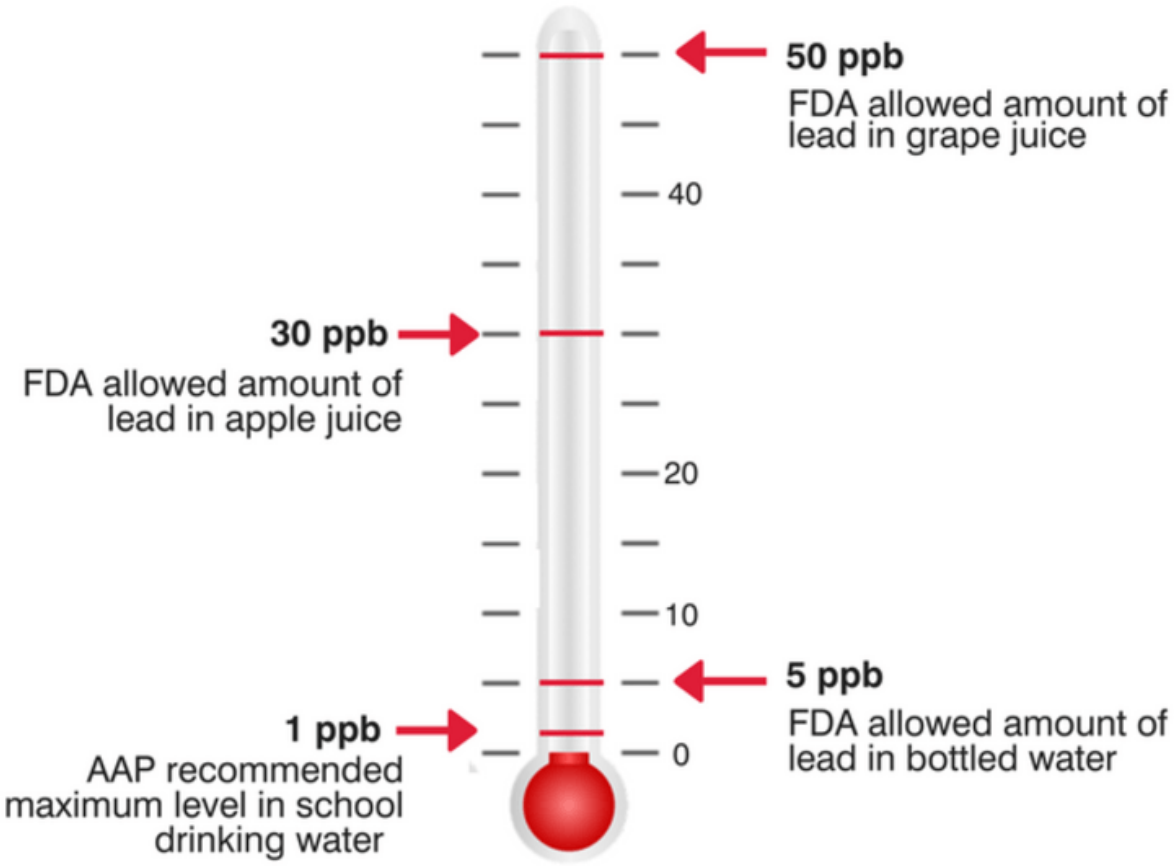
Eating lead-contaminated food increases the level of lead in the blood. Chronic, low-level exposure to lead during childhood can harm mental and physical development. For each microgram (µg) per day of dietary lead intake, blood lead levels increase by about .16 micrograms per deciliter (µg/dL), though there is individual variation in how much lead is absorbed through the gastroinestical tract. A microgram is one millionth of a gram – a very small unit of measure.

There is no known level of lead exposure that is considered safe. Even low blood lead levels can harm child development and behavior. In May

2017, the Centers for Disease Control and Prevention (CDC) reduced the definition of elevated blood levels in children from 10 to 5 μg/dL.

This revised definition reflects findings from a 2012 National Toxicology Program Report that concluded a wide range of adverse health effects are associated with blood lead levels less than 5 μg/dL. These included "decreased academic achievement, IQ, and specific cognitive measures; increased incidence of attention-related behaviors and problem behaviors."

The FDA has set limits for lead in the form of maximum parts per billion (ppb) for certain foods. The FDA reports that these differences in limits are due to what is considered achievable after food processing. The American Academy of Pediatrics has the lowest recommended limit at 1 ppb for school drinking water.



Lead limits in juice and water. Credit: Environmental Defense Fund

How many of the samples had detectable levels of lead?

EDF analyzed more than 12,000 test results from the 2003-2013 FDA national composite food sample data (the Total Diet Study). The Total Diet Study is an FDA "market-basket" survey of typical foods eaten by U.S. consumers and is used to assess average nutrient intake and exposure to chemical contaminants.

EDF did an exposure analysis (detection/nondetection), and reported the percentage of samples within different food types that tested positive for

lead. Twenty percent of the samples designated by the FDA as baby food had detectable levels of lead in them, compared to 14 percent for regular foods.

This type of analysis is similar to measuring accident rates in workplaces, or even visits by children to the medical staff in schools. As with the lead data, increases in these numbers alert organizations to potential problems, but they don't give enough indication to pinpoint the exact nature of the problem.

Even without specifics on the magnitude of the risks involved, when a lead exposure issue is flagged, it's good practice to reduce the exposure – as a way to guard against associated negative health impacts such as decreased intellectual function.

How might this be affecting our IQ?

These data alone aren't enough to indicate what the likely health effects are. Ultimately, the risk depends on how much contaminated food a child will eat through his or her childhood, and how much neurological damage this ends up causing.

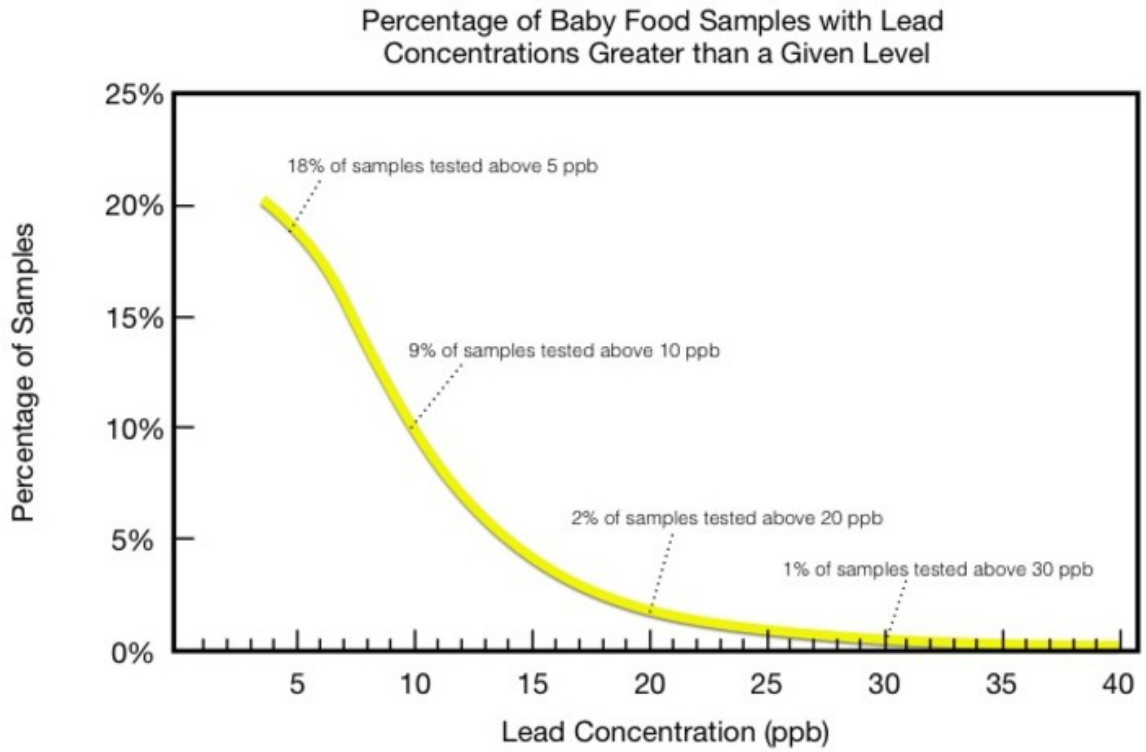
Based on EPA estimates of average childhood dietary lead exposure, we are roughly dealing with a less than 1-point decrease in IQ in the adult population than it might otherwise be.

In its analysis, EDF calculated an 0.38 average IQ loss from dietary lead based on the following assumptions:

- Average dietary lead exposure for young children is 2.9 µg/day. This calculation is based on 2017 EPA dietary lead intake data for children ages 1- 7 years.
- 2.9 µg/day dietary exposure elevates blood lead levels by 0.46

µg/dL. This calculation is based on a ratio of dietary lead intake to the increase in blood lead levels (for every 1 µg/day lead consumed in the diet, lead increases in the blood by 0.16 µg/dL).

- This 0.46 µg/dL elevation in lead in the blood decreases IQ by an estimated 0.38 IQ points. This calculation is based on a 2013 European Food Safety Authority (EFSA) ratio of blood lead level increase to IQ loss (1.2 µg/dL lead in blood to a 1 point IQ loss).



Percentage of baby food samples with lead concentrations greater than a given level.

Recall that the 2012 National Toxicology Program Report cited a wide range of measurable health effects occurring with blood lead levels less than 5 µg/dL. For comparison, we are talking about an average increase of 0.46 µg/dL blood lead levels from dietary exposure alone.

Though the estimated reductions in IQ here may seem low, they are not insignificant – in some cases, small losses in IQ might make the difference, for example, in the type of career one leads and subsequent lifetime earnings.

How many of the samples tested above specific lead concentrations?

We went back to the same FDA data EDF used, looked at the measured amounts of lead, and then plotted the percentage of tested baby food products with lead concentrations above certain amounts.

This type of plot gives a ballpark idea of the percentage of the baby food being sold in the U.S. for certain levels of lead. But the data need to be treated with caution, as many of the measurements were below the Limit of Quantification (LOQ), meaning that they may not be particularly accurate.

Average dietary lead exposure for young children is around 2.9 µg/day, which approximately equates to daily levels in food at about 2.9 ppb (assuming average consumption of about 1 kg of food). Our analysis shows the percentage of baby food samples testing at higher levels. Eighteen percent of the baby food samples tested above 5 ppb lead, which is the amount the FDA allows in drinking water. This percentage decreased in accordance with the lead concentration: 9 percent of the samples tested above 10 ppb lead; 2 percent tested above 20 ppb lead; and less than 1 percent tested above 30 ppb lead.

Where do we go from here?

Even though these are not life-and-death type risks, we believe there is no room for complacency. The FDA sets limits for lead in food, but the current limits are based on levels that can be reliably measured and are considered achievable after manufacturing processes. However, a May 2017 FDA fact sheet on lead in foods states that a Toxic Elements Working Group will be developing a risk-based approach. Establishing limits based on risk would help further curb the impacts of lead on society.

The good news is that this is possible. Many of the samples tested by FDA are already either lead-free (according to the limits of detection in the analyses used) or have low lead content. It should be possible to expand the number of products that fit into these categories, simply by understanding what some companies do right and replicating it.

The bottom line is that, even with relatively few products on the market with relatively high quantities of lead, the health risks from this metal are insidious, which means the more we do to eliminate it from our food supply, the better off we'll be.

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