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Are You Exposed To BPA, And Does It Matter?

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For quite a few years, one of the most popular chemicals for scientific inquiry has been bisphenol A (BPA). Scientists around the world have been conducting a diverse array of studies aimed at understanding whether BPA poses a risk to human health.

Based on the weight of evidence from these many studies, the U.S. Food and Drug Administration (FDA) recently answered the question "Is BPA safe?" with a simple and unambiguous answer - "Yes."

By far, the majority of the studies conducted on BPA provide information on potential hazards, which are intrinsic properties of the chemical. Since risk describes the probability that exposure to a hazard will cause harm, information is also needed on human exposure to BPA.

Considering that BPA is a commonly used chemical, primarily as a raw material to make polycarbonate plastic and epoxy resins, it is not surprising to find that people are exposed to BPA.
Of critical importance, though, is the magnitude of exposure. If there is no exposure, there can be no risk and, conversely, only when exposure is sufficiently high would risks potentially be present.

An increasingly accepted way to assess human exposure is through biomonitoring studies, which measure the level of a chemical in biological samples such as urine or blood. For BPA, analyzing urine is most appropriate since BPA is converted in the body to a biologically inactive metabolite and excreted in urine within hours of exposure. Urine biomonitoring thus measures short-term exposure to BPA over the last day or so.

When applied to a representative group of people, urine biomonitoring can provide a reasonable measure of average exposure to BPA across a population.

Recent U.S. and Canadian Data

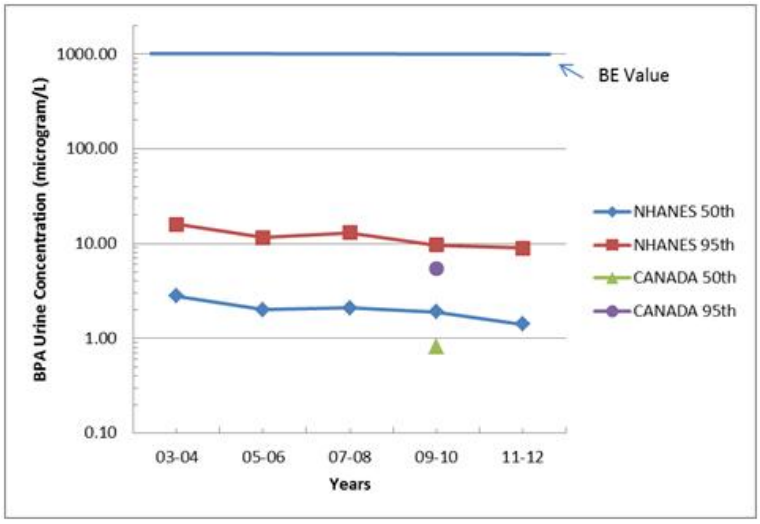
Two recently published large-scale urine biomonitoring studies provide up-to-date exposure data for the U.S. population (age 6 years and above) and Canadian pregnant women, respectively. The U.S. data is from a long-standing program run by the Centers for Disease Control and Prevention (CDC)

and known as the National Health and Nutrition Examination Survey (NHANES).
The most recent data, from samples collected in 2011-2012, is contained in the fifth set of biennial data over a 10-year period, which allows temporal exposure trends to be assessed.

The Canadian data is from the Maternal-Infant Research on Environmental Chemicals (MIREC) study, which is sponsored by Health Canada and other Canadian government agencies. The study provides exposure data for a large population ofwomenin the first trimester of pregnancy, with samples collected in the 2008-2011 timeframe. The MIREC data is particularly valuable since pregnant women might generally be considered to be one of the most vulnerable subpopulations.

＊MIREC : Maternal-Infant Research on Environmental Chemicals

The median and 95th percentile urinary BPA concentrations from both new studies are shown in the figure below. Also shown for assessment of temporal trends are NHANES data from four earlier biennial studies in the 2003-2010 timeframe.



A quick way to understand this type of data in a safety context is to compare the measured urinary concentration values with a Biomonitoring Equivalent (BE) value. A BE is defined as “the concentration or range of concentrations of chemical in a biological medium (blood, urine, or other medium) that is consistent with an existing health-based exposure guidance value such as a reference dose (RfD) or tolerable daily intake (TDI).” Essentially a BE value is an estimated safe limit.

Several years ago, Health Canada sponsored a project to calculate a BE value for BPA in urine. Based on Health Canada’s TDI for BPA, the BE value was calculated as 1,000 micrograms/L, which is shown as a bar across the top of the figure.

Casual inspection of the figure reveals that even 95th percentile urine concentrations of BPA are approximately 2 orders of magnitude below the BE value. Typical human exposure, in the range of the median values, is hundreds of times below the BE value and Health Canada's safe intake limit. Although BE values are primarily useful as screening tools, the large margin of safety between the BE value and the recent biomonitoring data clearly indicates that the U.S.population and pregnant women in Canada are not at risk from real-lifeexposures to BPA.

Accordingly, in its announcement of the MIREC data, Health Canada stated "Based on the overall weight of evidence, Health Canada continues to conclude that dietary exposure to BPA through food packaging is not expected to pose a health risk to the general population, including newborns and young children."

A second interesting feature in the figure is the apparent downward trend in exposure to BPA from 2003-2004 to 2011-2012. The trend might best be described as suggestive since the decrease in urine concentrations is small and we cannot be certain whether the decrease is due to subtle changes in the NHANES program (e.g., analytical methodology, participant selection, urine sampling) or is due to decreased exposure in the US population.

Although biomonitoring data are a very useful measure of exposure levels, the data provide no information on sources of exposure, which makes it difficult to determine if the sources have changed over time.

In spite of the clear statements of safety from government agencies such as FDA and Health Canada, it would nevertheless not be surprising if some limited deselection of BPA has taken place in certain markets. In that case, it would be of particular interest to know what is being used to replace BPA.

That's a fascinating subject, but one that will discussed another day in the near future.

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