

Toxicity from plastic drinking bottles, review study

السموم من بطل الماء البلاستيك

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Abstract

Bisphenol-A (BPA), is a chemical used for the production of industrial epoxies, polycarbonate plastics, fungicides, flame-retardants, antioxidants, and other products. First synthesized in 1891, in

the last few years, concerns about this chemical leaching into our food supply through canned goods and plastic containers have increased as scientists have begun linking BPA to serious health risks.

BPA is used to produce almost all of our disposable drinking bottles from water to soft drinks and juice. They are labeled 'do not reuse' as once you open the lid and consume the contents, they begin to break down. If you rinse these bottles out and refill them, BPA will leach into the contents

gradually and over time, as the plastic deteriorates, more BPA will leach into the contents. If you leave a polycarbonate bottle in the car to warm, the levels of BPA that leach into the contents are even higher.

BPA is associated with a number of health problems and diseases that are on the rise in the U.S. population, including breast and prostate cancer and infertility. BPA is a potent hormone disruptor. It can impair the reproductive organs and have adverse effects on breast tissue and prostate development. It is clear that BPA exposure can pose health risks to babies first which they are more vulnerable, and to humans in general, but the important question is, should we be worried enough to change our consumption habits?

المستخلص

البسفينول-أي مادة كيميائية تستعمل للإنتاج الأوكسي التجاري (اللوحات البلاستيكية), البوليكاربونيت البلاستيكي, الفنجيسايد, فليم-ريتاردنس, انتي اوكسيدنت, ومواد اخرى. تمت صنعها اولاً في 1891, وفي السنوات الاخيره الماضيه, بدأت المخاوف من دخول هذه الماده الى تجهيزاتنا الغذائيه من خلال المعلبات, والعلب البلاستيكيه وذلك عندما بدأ العلماء يربطون بين مادة البسفينول-أي وظهور الامراض الصحيه الخطيره.

تقريباً يستعمل البسفينول-أي لإنتاج معظم قناني مياه الشرب, والمشروبات والعصائر. ان القناني معلمه ب (عدم استعمالها مرة اخرى), وحين فتح غطاء القنينه واستهلاك محتواها, تبدأ بالتكسر. وعند غسل هذه القناني واعادة استعمالها, فان مادة البسفينول-أي سوف تترشح تدريجياً من القنينه الى المحتويات التي بداخل العلبه. وعند ترك القنينه المصنوعه من البوليكاربونيت في جو السياره الحر, فان نسبة البسفينول-أي الذي يترشح الى محتويات القنينه تكون نسبتها اعلى .

مادة البسفينول-أي مرتبطه بمجموعه من المشاكل الصحيه والامراض التي بدأت بالازدياد في الولايات المتحده الامريكيه, ومن ضمنها سرطان الثدي والبروستات والعقم. ان مادة البسفينول-أي لها تأثير سلبي على الهرمونات, انها تسبب في تاخر نمو الاعضاء ولها عمل مضاد لانسجة الثدي وبناء البروستات. لقد بدأ واضحا بان التعرض الى البسفينول-أي يؤدي اولاً الى مشاكل صحيه للاطفال لانهم الحلقه الاضعف, وكذلك تسبب لنا مشاكل بصورة عامه. لكن السؤال المهم هو, هل نحن قلقون بما فيه الكفايه لتغيير عادة الشرب لدينا؟

Introduction

Bisphenol A was synthesized in the 1890s and discovered in the 1930s to be an estrogen mimic. Later in the 1950s it was discovered to be a useful compound that can be bounded together to produce commercially valuable plastics (1). Bisphenol A is used to make polycarbonated plastics; a clear, thick and resilient material found in products such as baby bottles, reusable water bottles, CDs, DVDs, and eyewear.

Other products containing bisphenol A include dental sealants, and epoxy resins used in the lining of some food and beverage containers. Bisphenol A is one of the highest volume chemicals produced worldwide.

With over six billion pounds of Bisphenol A imported and used by Canadian industries (1), and more than hundred time of this quantity in the United state and other countries, we are widely exposed to bisphenol A in our daily lives. In the last few years, concerns about this chemical leaching into our food supply through canned goods and plastic containers have increased as scientists have begun linking BPA to serious health risks.

In a country like Iraq where tape water is not recommended as safe source of water, most people use their drinking water through the plastic bottles, we wanted to raise the flag of warning about the toxicity involved. Here, we have outlined studies that address the levels of BPA in human tissues and fluids. We have reviewed the few epidemiological studies available that explore biological markers of BPA exposure and human health outcomes and the effect of these bottles on the environment.

Materials and methods

Different reports and studies has been examined the effect of bisphenol A on our bodies. Some of these studies has been conducted to examine the concentration of BPA in urine, or human tissues, others has been studying the effect of BPA presence on different parts. Other study has been done on animals to find the effect of this product on these animals. All reports have been studied to come up with this important paper which reflects the danger of BPA in our life. To make this paper as short as possible, Intention was made to focus on the new and recent research have been done on this subject

Results

In 1998 Patricia Hunt (2), a geneticist was investigating the link between hormones and reproduction in the eggs of laboratory mice, when she tested the control group of mice and found that 40% had egg defects. These mice had been kept in plastic cage and looked after. When Hunt investigated she found that a chemical used to clean the base of the cage had caused some abrasions in the plastic allowing BPA to leach out and infected the mice. Rodent studies (3), have associated prenatal and neonatal exposure to BPA with early onset of sexual maturation, reproductive tract lesions, and altered development of the mammary gland, among other reproductive abnormalities. Experiments on mice and rats noted a reduced body weight was considered a direct adverse effect of exposure to bisphenol A (4).

Human exposure to bisphenol A also received special attention. A BPA migration study (5) was conducted using a variety of plastic containers, including polycarbonate (PC) baby bottles, non-PC baby bottles; baby bottles liners, and reusable PC drinking bottles. This study has found that residue of BPA in water been detected, and amount of BPA in water has been increased due to the increase in bottle temperature (5). Exposure to boiling water (100c) increased the rate of BPA migration by up to 55-fold (6).

Other study (6), also noted that bisphenol A is released from polycarbonated drinking bottles.

In a laboratory study (7), using fresh human fat tissues, a team from University of Cincinnati found that BPA suppresses a key hormone, adiponectin, which is responsible for regulating insulin sensitivity in the body and puts people at a substantially higher risk for metabolic syndrome.

Metabolic syndrome is a combination of risk factors that include lower responsiveness to insulin and higher blood levels of sugar and lipids. According to the American Heart Association, about 25 percent of Americans have metabolic syndrome. Left untreated, the disorder can lead to life-threatening health problems such as coronary artery disease, stroke and type two diabetes (7).

UC team (7), collected fresh fat tissue from Cincinnati patients undergoing several types of breast or abdominal surgery, these samples included three types of fat tissue: breast, subcutaneous and visceral (around the organs).

Tissue was immediately taken to the laboratory and incubated with different concentrations of BPA or estrogen for six hours to observe how the varied amounts of BPA affected adiponectin levels. The effects of BPA were then compared to those of estradiol, a natural form of human estrogen. BPA is a potent hormone disruptor (8), it can impair the reproductive organs and have adverse effects on breast tissue and prostate.

One week of polycarbonate bottle use increased urinary BPA concentrations by two-thirds. Regular consumption of cold beverages from polycarbonate bottles is associated with a substantial increase in urinary BPA concentrations irrespective of exposure to BPA from other sources (9).

However, limited information is available on human health effects. Nevertheless, human exposure to BPA is widespread: the chemical was detected in the urine of more than 92% of the participants aged 6 years and older in the 2003–2004 National Health and Nutrition Examination Study (NHANES).

The impact of endocrine disrupting chemical (EDC) exposure on human health is receiving increasingly focused attention (6). The prototypical EDC bisphenol A (BPA) is an estrogenic high-production chemical used primarily as a monomer for the production of polycarbonate and epoxy resins. It is now well established that there is ubiquitous human exposure to BPA. In the general population, exposure to BPA occurs mainly by consumption of contaminated foods and beverages that have contacted epoxy resins or polycarbonate plastics. To test the hypothesis that bioactive BPA was released from polycarbonate bottles used for consumption of water and other beverages, we evaluated whether BPA migrated into water stored in new or used high-quality polycarbonate bottles used by consumers. Using a sensitive and quantitative competitive enzyme-linked immunosorbent assay, BPA was found to migrate from polycarbonate water bottles at rates ranging from 0.20 ng/h to 0.79 ng/h. At room temperature the migration of BPA was independent of whether or not the bottle had been previously used (6).

Vandinberg (10) found that the levels of BPA in human fluids are higher than the BPA concentrations reported to stimulate molecular endpoints in vitro and appear to be within an order of magnitude of the levels needed to induce effects in animal models.

In a recent study by V. McGovern (3), anticipate higher urinary BPA concentrations would result from drinking hot beverages stored in the same bottles. In his study, 77 college students aged 18–22 underwent a weeklong “washout” to minimize any preexisting BPA load that could have arisen from the use of polycarbonate drinking bottles. During the washout, participants were instructed to drink any cold beverages only from stainless steel bottles and to avoid drinking water from the polycarbonate dispensers in the college dining halls. After the washout, the group switched to drinking cold drinks only from 2 new researcher-provided polycarbonate bottles for 1 week. Exposure to other BPA sources was not controlled; thus, the study yielded a conservative estimate of the potential for BPA exposure via polycarbonate drinking bottles. Comparison of urine samples collected throughout the study showed that after using polycarbonate bottles for 1 week, participant’s mean urinary BPA concentrations increased by more than two-thirds to 2.1 µg/L, compared with the mean of 2.6 µg/L observed in the NHANES 2003–2004 study (10). Over all, the urinary BPA level is higher according to the Japanese study (11).

Environment concern:

Aside from the toxicity problem with BPA and its effect on human health, plastic is also not good for the environment. Americans alone use about 10 million tons of plastic every year, but they recycle only about two percent of it. A plastic milk juke takes about one million years to biodegrade (8).

Discussion

Many studies (2)&(12) on the effects of BPA on laboratory animals have concluded that it is linked to breast and prostate cancer, early onset of puberty, brain damage, birth defects, heart disease, hyperactivity, obesity and erectile dysfunction.

Amongst men working in a BPA factory in China, erectile dysfunction was almost seven times as prevalent as the general community - the first study of its kind on humans.

Bisphenol-A acts as a 'xenoestrogen' which mimics the female hormone, estrogen (2). It is far more dangerous than estrogen to both males and females and a high amount of xenoestrogens in the body is a causal factor in breast cancer. Higher levels of androgens noted in women with higher level of BPA (13).

Thus, not only does early exposure to BPA lead to an increased risk for development of breast tumors, but exposure to BPA during chemotherapy treatment for breast cancer may make the treatment less effective (14).

Conclusion

BPA is a heavily produced industrial compound. Despite its toxicity, in 2002 about 107 billion pounds of plastic were produced in North America (15), BPA remains entirely without safety standard (16). It is allowed in unlimited amounts in consumer products, drinking water, and food, the top exposure source for most people.

Based on our recent findings of BPA, regulation should focus on making consumer products safe for next generation (17) & (18).

Public and scientific concerns about exposure to bisphenol A (BPA) have risen in the last few years, with Canada and some U.S. states and cities banning BPA from polycarbonate baby bottles and other products sold for use by infants and children (1).

The best way to avoid BPA consumption is taking food and drink by glass vessel.

As an alternative to BPA plastic drink bottles, stainless steel, drink bottles are a great alternative. There are BPA free plastic bottles available. Tupperware declares their plastic bottles are BPA free.

Last year, US baby bottle manufacturers removed BPA from their products. The Canadian government, and some US states and cities banning BPA from polycarbonated baby bottles and other products (3), the French government has introduced legislation to have it banned and European scientists are lobbying to have it banned in Europe due to 'compelling' evidence the chemical is linked to breast cancer, sex hormone imbalances and has adverse affects on babies and children. If canned goods or clear plastic bottles are a must, such containers should never be micro waved, used to store heated liquid or foods, or washed in hot water (19).

Now it is time to raise the public awareness of the danger involve by using this product, and to switch to any other safe product.

In Iraq, we have more serious situation due to the hot weather which is a factor which increases level of BPA in water, taking in consideration the big number of pilgrimages to Imam Hussein every year. Add to that, firstly uncivilized seen for these empty bottles every where, and secondly, these millions of bottles are thrown on road side every year will create an environmental catastrophe if we take in consideration that these plastic bottles is staying a another million year before it is going to be biodegraded (8).

Using the common sense and choosing the greatest benefit will save our children a lot of problems and give them safer future.

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