Team sees effect of BPA and estradiol on sperm development

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Washington State University geneticist Pat Hunt has found a direct link between the plastics component bisphenol A, or BPA, and disrupted sperm production. Credit: Washington State University

Washington State University researchers have found a direct link between the plastics component bisphenol A, or BPA, and disrupted

sperm production. Writing in the journal *PLOS Genetics*, they say the chemical disrupts the delicate DNA interactions needed to create sperm.

WSU geneticist and principle investigator Pat Hunt says she and her team may have unearthed the physiological mechanism that could account for decreased sperm counts seen in several human studies. It also bolsters the "estrogen hypothesis" that estrogen disruptors in the environment are at play.

"This provides some real insight into what exactly might be going on," Hunt says. "It's kind of bizarre because we got into it through a back door, not really starting out to look at that question."

In addition to seeing BPA effects, Hunt and her colleagues saw an even larger effect on sperm by estradiol, the birth control hormone that passes untreated through sewage plants.

Hunt has a long history of working with BPA, which is often found in plastic bottles, the linings of food and beverage cans, and thermal receipts. Much of her work has documented its effect on female reproduction, from mice to monkeys.

Declining sperm counts have been a subject of concern and conjecture since the early 1990s, when Danish researchers reported "a genuine decline in semen quality over the past 50 years," with possible implications for male fertility. Sperm count studies have often been criticized for being small, having biased populations or questionable statistical methods, but reproductive biologists continue to see data suggesting that endocrine disruptors like BPA, plastic-softening phthalates and estradiol are impairing reproduction. In a 2013 study cited by Hunt and her colleagues, French researchers looked at the partners of more than 26,000 infertile women and saw their semen concentration drop nearly 2 percent a year for 17 years.

In the WSU study, Hunt and her colleagues gave newborn male mice oral doses of BPA. They also exposed mice to the synthetic estrogen ethinyl estradiol. The researchers exposed the developing testis and saw that the sperm of exposed animals did a poorer job of meiosis, the process in which cells combine the genetic information of their parents. As a result, more sperm died.

"We have a window of just a few days and we permanently change the way that the testis makes sperm in the adult," says Hunt.

The study looked at three mice populations: one outbred like humans and two other, very common strains that are inbred. The researchers saw a "very strong effect" on outbred mice and one inbred strain, said Hunt, and no effect on the other inbred strain. Hunt said this would account for earlier researchers not seeing an effect on testes in earlier studies.

"This mouse model would suggest that here's actually a reason why these sperm counts would be falling," Hunt said. "We're actually doing something to this process that's going to cause the death of more cells as they're trying to make sperm. They're going to get culled out by this quality-control mechanism and the upshot of that will be that if you do enough of this, you'll drop sperm counts."

Hunt also worries that sperm counts will continue to go down with each exposed generation.

"We've seen effects over the course of several decades," she said. "What about several generations? Infertility is becoming more common. Are we creating the perfect storm?"

Provided by Washington State University