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Atrazine herbicide causes prostate inflammation in male rats and delays puberty

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A new study shows that male rats prenatally exposed to low doses of atrazine, a widely used herbicide, are more likely to develop prostate inflammation and to go through puberty later than non-exposed animals. The research adds to a growing body of literature on atrazine, an herbicide predominantly used to control weeds and grasses in crops such as corn and sugar cane. Atrazine and its byproducts are known to be relatively persistent in the environment, potentially finding their way into water supplies.

The research, which is available online and will be featured on the cover of *Reproductive Toxicology* (Volume 30, Issue 4), found that the incidence of prostate inflammation went from 48 percent in the control group to 81 percent in the male offspring who were exposed to a mixture of atrazine and its breakdown products prenatally. The severity of the inflammation increased with the strength of the doses. Puberty was also delayed in the animals who received atrazine.

The doses of atrazine mixture given to the rats during the last five days of their pregnancy are close to the regulated levels in drinking water sources. The current maximum contamination level of atrazine allowed in drinking water is 3 parts per billion. The doses given to the animals were 0.09 (or 2.5 parts per million), 0.87, or 8.73 milligrams per kilogram body weight.

The research was led by Suzanne Fenton, Ph.D., and Jason Stanko, Ph.D., of the National Institute of Environmental Health Sciences

(NIEHS), part of the National Institutes of Health. Fenton began the work as a researcher at the United States Environmental Protection Agency (EPA), but completed the research at NIEHS, working closely with NIEHS pathologists. Both NIEHS and EPA provided financial support for the study.

"We didn't expect to see these kinds of effects at such low levels," Fenton said. She adds that this is the second paper to show low dose effects of atrazine metabolite mixtures. Fenton was the senior author on a 2007 paper which demonstrated low doses of the atrazine mix delayed mammary development in female siblings from the same litters used in this current study.

"It was noteworthy that the prostate inflammation decreased over time, suggesting the effects may not be permanent," said David Malarkey, D.V.M., Ph.D., an NIEHS pathologist and co-author on the paper.

Fenton points out that these findings may extend beyond atrazine alone, and may be relevant to other herbicides found in the same chlorotriazine family, including propazine and simazine. All three of the herbicides create the same set of breakdown products.

Fenton says more research is needed to understand the mechanism of action of the chlorotriazines and their metabolites on mammary and prostate tissue. "These tissues seem to be particularly sensitive to the effects of atrazine and its breakdown products," Fenton added. "The effects may be due to the stage of fetal development at the time the animals were exposed."

"We hope that this information will be useful to the EPA, as it completes its risk assessment of atrazine," said Linda Birnbaum, Ph.D., director of NIEHS and the National Toxicology Program.

Fenton will be presenting her research findings in September to the EPA, as part of its reassessment of atrazine. EPA announced in 2009 that it had begun a comprehensive new evaluation of atrazine to determine its effects on humans. At the end of this process, the agency will decide whether to revise its current risk assessment of atrazine and whether new restrictions are necessary to better protect public health.

More information: For more information about the EPA risk assessment, please visit http://www.epa.gov/pesticides/reregistration/atrazine/atrazine_update.htm.

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