School Pesticide Monitor

A Bi-Monthly Bulletin on Pesticides and Alternatives
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Commonly Used Pyrethroid Pesticide Increases Risk of ADHD

A study led by a Rutgers University research team finds that the commonly used pesticide deltamethrin increases the risk of attention deficit hyperactivity disorder (ADHD) in children, adding to a mounting body of scientific research linking pesticide exposure to the disorder.

Rutgers scientists, along with colleagues from Emory University, the University of Rochester Medical Center, and Wake Forest University discovered that mice exposed to the pyrethroid insecticide deltamethrin in utero and through lactation exhibit several features of ADHD, including dysfunctional dopamine signaling in the brain, hyperactivity, working memory, attention deficits and impulsive-like behavior.

The study, "Developmental pesticide exposure reproduces features of attention deficit hyperactivity disorder," was published late January in the *Journal of the Federation of American Societies for Experimental Biology* (FASEB).

ADHD is estimated to affect 8–12% of school-age children worldwide. ADHD is a complex disorder, and though is strong scientific evidence that genetics play a role in susceptibility to the disorder, no specific gene has been found that causes ADHD and scientists believe that environmental factors, such as pesticide exposure, may contribute to the development of the behavioral condition.

"Although we can't change genetic susceptibility to ADHD, there may be modifiable environmental factors, including exposures to pesticides that we should be examining in more detail," says lead author Jason Richardson, Ph.D., associate professor in the

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More Research Shows Organic Diet Leads to Lower Pesticide Levels in the Body

People who eat an organic diet have lower levels of pesticides in their bodies than those who eat conventional fruits and vegetables grown with pesticides, according to a new study published in February. The study, "Estimating Pesticide Exposure from Dietary Intake and Organic Food Choices: The Multi-Ethnic Study of Atherosclerosis (MESA)," is published in the journal *Environmental Health Perspectives*.

Scientists examined nearly 4,500 people from six U.S. cities, looking at long-term dietary exposure to 14 OPs. This study group was restricted to those who reported rarely or never eating organic food ("conventional consumers"). Scientists looked for signs of organophosphate exposure via urinary dialkylphosphate (DAP) levels and compared these levels to those who reported organic produce consumption habits.

The scientists found that people who reported eating organic fruits and veggies at least occasionally had significantly lower DAP, or organophosphate residue, levels in their urine when compared to people who almost always ate conventionally grown produce.

OPs are the most commonly used insecticides on conventional fruits and veggies, thus making OP exposure extremely prevalent. In fact, metabolites of organophosphate metabolites have been found in the urine of over 75 percent of the U.S. population.

The new "research provides another piece of evidence that consumption of organic foods may reduce pesticide exposure," said Jonathan Chevrier, Ph.D., an epidemiologist at McGill University in Montreal, Canada, who was not involved with the study.

Though the study looks at adult exposure to organophosphate pesticides (OPs), it has important implications for children. The effects of pesticide exposure have been well docu-

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ADHD

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Department and Environmental and Occupational Medicine at Rutgers Robert Wood Johnson Medical School and a member of the Environmental and Occupational Health Sciences Institute (EOHSI).

Using data from the Centers for Disease Control, National Health and Nutrition Examination Survey (NHANES), the study analyzed health care questionnaires and urine samples of 2,123 children and adolescents. Researchers asked parents whether a physician had ever diagnosed their child with ADHD and cross-referenced each child's prescription drug history to determine if any of the most common ADHD medications had been prescribed. Children with higher pyrethroid pesticide metabolite levels in their urine were more than twice as likely to be diagnosed with ADHD.

Deltamethrin is commonly used in the home, and on vegetable crops, gardens, lawns and golf courses. As part of the chemical class of synthetic pyrethroids, it is often touted as a safer alternative to other pesticides, or deemed "as safe as chrysanthemum flowers" by pest control companies. However, there are many recent studies that show significant concern with this class of chemicals. In addition to this new study, pyrethroids have previously been linked to learning problems, and adverse behavioral and emotional development in children.

The prolific use of these chemicals means that exposure is widespread. Recent research has found that residents of New York City are more highly exposed to organophosphates and pyrethroid pesticides than the average American, and another 2008 survey found pyrethroid contamination in 100 percent of urban streams sampled in California. Despite new data on concerning health affects to children, in 2012 EPA expanded the allowed uses of these pesticides and removed an additional protective safety factor for children.

ADHD most often affects children, with an estimated 11 percent of children between the ages of 4-17 –about 6.4 million, diagnosed as of 2011. Boys are three to four times more likely to be diagnosed than girls. Notably, researchers in this study observed that male mice were affected more than the female mice. The ADHD-like behaviors persisted in the mice through adulthood, even when the pesticide was no longer detected in their system.

Young children and pregnant women may be more susceptible to pesticide exposure because their bodies do not metabolize the chemicals as quickly. According to Dr. Richardson, this is why human studies need to be conducted to determine how exposure affects the developing fetus and young children.

With the mounting evidence of the impacts of pesticides to human health, the success of management approaches that do not rely on hazardous pesticides, demonstrates that exposure to these pesticides are unnecessary. Beyond Pesticides has many resources to help avoid and manage unwanted insects without the use of synthetic chemicals. These techniques include exclusion, sanitation and maintenance practices, as well as mechanical and least-toxic controls (which include boric acid and diatomaceous earth). For more information, see the ManageSafe database at www.beyondpesticides.org/pests.

Organic Diet

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mented, particularly for vulnerable segments of the population like children and pregnant women. In 2012, the American Academy of Pediatrics (AAP) weighed in on the organic food debate recognizing that lower pesticide residues in organic foods may be significant for children.

AAP subsequently released a landmark policy statement, Pesticide Exposure in Children, on the effects of pesticide exposure in children. AAP's statement notes that, "Children encounter pesticides daily and have unique susceptibilities to their potential toxicity." The report discusses how kids are exposed to pesticides every day in air, food, dust, and soil. The report also explains how diet is likely a major pathway for pesticide exposure in children, citing a 2006 intervention study, which found that switching children to an all-organic diet had an immediate and substantial decrease in the concentration of pesticides in their bodies.

Organic foods have been shown to reduce dietary pesticide exposure and children who eat a conventional diet of food produced with chemical-intensive practices carry residues of organophosphate pesticides that are reduced or eliminated when they switch to an organic diet.

There are additional health benefits to eating organic. A ten-year University of California study, which compared organic tomatoes with chemically grown produce, found that they have almost double the quantity of disease-fighting antioxidants called flavonoids. A comprehensive review of 97 published studies comparing the nutritional quality of organic and conventional foods shows that organic plant-based foods (fruits, vegetables, grains) contain higher levels of eight of 11 nutrients studied, including significantly greater concentrations of the health-promoting polyphenols and antioxidants. Another study by Newcastle University found that organic farmers who let their cows graze as nature intended are producing better quality milk.

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