

UNH Research Reveals Problems with Flame Retardants

Chemicals causes metabolic, liver problems

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Chemicals used as synthetic flame retardants that are found in common household items such as couches, carpet padding and electronics have been found to cause metabolic and liver problems that can lead to insulin resistance, which is a major cause of obesity, according to new research from the University of New Hampshire.

"Being obese or overweight increases one's risk of many diseases including Type 2 diabetes, high blood pressure, coronary heart disease, stroke, gall bladder disease, osteoarthritis, sleep apnea and certain cancers," said [Gale Carey](#), professor of nutrition and the lead researcher. In 2003, overweight and obesity-related medical expenses were 9.1 percent of total U.S. medical expenses at about \$80 billion. New Hampshire's portion of this expense was \$302 million.

Carey and her team of researchers found that laboratory rats exposed to polybrominated diphenyl ethers, or PBDEs, experienced a disruption in their metabolism that resulted in

the development of metabolic obesity and enlarged livers.

"Despite the plethora of resources devoted to understanding the roles of diet and exercise in the obesity epidemic, this epidemic continues to escalate, suggesting that other environmental factors may be involved. At the biochemical level there is a growing body of experimental evidence suggesting certain environmental chemicals, or 'obesogens', could disrupt the body's metabolism and contribute to the obesity epidemic," she said.

In Carey's research, fat cells isolated from rats dosed with high levels of flame retardants daily for one month developed a sensitivity to hormones that was similar to the sensitivity experienced by people who are overweight: the fat cells became more sensitive to epinephrine and less sensitive to insulin.

"One of the hallmarks of somebody who is becoming diabetic, and often this accompanies weight gain, is that their fat cells become sluggish in their response to insulin. With epinephrine, the fat cells more easily release the fatty acids into the blood stream and if those fatty acids are not used, they promote insulin resistance," Carey said. Those two features — insulin resistance and epinephrine sensitivity — are two features of fat cells from people who are above normal weight. And that's what we were seeing in our rats. Even though our rats had not gained weight, they were experiencing 'metabolic obesity.' The cause of the flame retardant-induced insulin resistance is unknown but one possibility is the suppression of a key metabolic enzyme — phosphoenolpyruvate carboxykinase, or PEPCK — in the liver. Carey and her students found that the activity of PEPCK, which is responsible for sugar and fat metabolism, dropped by nearly 50 percent in livers of rats exposed to flame retardants for just one month, compared to controls.

"Because PEPCK regulates production of the backbone of the fat molecule, if the backbone isn't made, the fatty acids that usually attach to this backbone have nothing to attach to. Their levels can rise in the liver and the blood. And it is elevated fatty acids that can lead to insulin resistance," Carey explained. Indeed, the lab's most recent findings demonstrated that the ability to create the backbone for the fat molecule was suppressed by 42 percent in liver tissue from rats treated with flame retardants compared to controls. In addition, rats exposed to flame retardants were found to have livers that were significantly larger than livers of rats that had not been exposed.

For more than 10 years, Carey and more than a dozen graduate and undergraduate students have collaborated with researchers from several universities and industries across the nation to examine the persistent organic environmental chemicals that could impact human health. "The average person probably has about 300 chemicals in her body that are manmade," she said.

In a previous study, Carey and a graduate student examined the amount of flame retardant chemicals in breast milk. They found that the levels of these chemicals in breast milk are about two orders of magnitude greater than in European countries that do not allow the use of flame retardant chemicals.

The research is funded by the [N.H. Agricultural Experiment Station](#) at the UNH College of Life Sciences and Agriculture. The results will be presented at the [Experimental Biology](#) annual meeting in Boston March 28-April 1.

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