PFOA exposure in utero linked to child adiposity and faster BMI gain

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Juan Carreño de Miranda's "La monstrua desnuda" (The Nude Monster) painting.

Children whose mothers were exposed to relatively high levels of the chemical PFOA during pregnancy experienced more rapid body fat gain and higher body fat by age 8 than children whose mothers were less exposed, according to a new analysis in the journal *Obesity*.

PFOA—perfluorooctanoic acid—is a suspected "obesogen," because lab studies suggest exposure to its broader family of PFAS chemicals may

alter the body's metabolism and fat cell development.

This study of 204 Cincinnati mothers and their children looked at potential childhood effects of PFOA, an industrial chemical used in the manufacture oil/water repellant textiles, firefighting foam, and nonstick coatings. The substance was used for years at a chemical plant upstream of the city along the Ohio River in West Virginia.

The new analysis derives from the HOME study (Health Outcomes and Measures of the Environment), a cohort of 389 mothers and their children in Cincinnati who have been followed since pregnancy. The HOME study found that the average exposure measured among the mothers in the cohort was more than twice that of a representative sample of pregnant women from the United States.

The researchers, led by Joseph Braun, assistant professor of epidemiology at Brown University, found that relatively high exposure had a statistically significant association with the amount and pace of body fat gain in children during the first eight years of life. The mothers and children in the new study were classified into three subgroups, or terciles, based on the mother's exposure level during pregnancy.

"The increase in body fat we observed among children born to women in the second and third PFOA terciles was equivalent to a 0.4 to 1.1 kilogram (0.9 to 2.4 pounds) increase in body fat for a child of average weight in the cohort at 8 years of age," the scientists wrote.

While the extra adipose correlated with PFOA exposure may seem subtle, Braun said, it's still enough to be a significant public health concern. Excess body fat may increase the risk of type 2 diabetes later in life.

"There isn't a threshold at which we say you shouldn't add more fat

mass—any more fat mass is bad fat mass," Braun said. "When you look at the risk of diabetes in adults, the risk is pretty much linear across the whole range of BMI."

Given its observational nature, the study only shows an association between prenatal PFOA levels and childhood adiposity. It does not prove that the exposure caused the effect. More research is required, Braun said.

Parsing PFOA

Overall studies of PFOA and weight gain have been mixed, the researchers acknowledged. In this study, children were not only weighed and measured to calculate BMI, but also their quantity of fat tissue, or adiposity, was measured. Braun said this makes the study data possibly more reliable than a larger prior study, done closer to the West Virginia plant, that relied on self-reports of weight. That study found no effect.

Also the new study is rare in that reports the BMI gain of children over a long period of time. The researchers found that children born to women with higher levels of PFOA in their blood during pregnancy gain BMI more rapidly between 2 and 8 years of age. Children in the highest PFOA tercile had the lowest BMI at age 2, but by age 8 they had a BMI similar to the children in the first tercile.

The finding that children of more highly exposed mothers start smaller and then gain weight faster could explain why studies that look at only one moment in time might find an association with PFOA and higher fat, while another study that looked at an earlier time might find the opposite.

In the analysis, Braun and his colleagues statistically controlled for a wide variety of potentially confounding factors, including the mothers'

education, income, race, BMI, diet, smoking, and exposure to other potential obesogens like bisphenol A and phthalates. But the study did not account for the diets of the children or for water intake of either mothers or children. Water intake is one of the presumed means of PFOA exposure and is something Braun hopes to measure in the future.

The study raises concerns about potential effects of PFOA exposure that should be pursued further, Braun said.

"I think it's significant enough to warrant additional investigation to see if the trends continue as these children get older," Braun said, "and to see if other markers of either fetal growth or rapid early infancy growth are associated with these exposures."

Provided by Brown University