Study of cadmium in pregnant women yields crucial insights into fetal development

July 28 2023

Credit: CC0 Public Domain

As with many toxins, exposure to the toxic metal cadmium during pregnancy can adversely impact fetal development. Now, researchers at the Rutgers School of Public Health think they're beginning to understand how the metal inflicts its damage: by disrupting placental hormones that regulate pregnancy physiology.

Unlike other toxins, relatively little cadmium crosses the placenta to directly impact the fetus. Instead, the placenta concentrates cadmium in its tissue at rates of up to six times that found in umbilical cord serum.

"We already know a lot about cadmium and its detrimental impacts on fetal health, such as low birthweight," said Zorimar Rivera-Núñez, an assistant professor in the Department of Biostatistics and Epidemiology and lead author of the study published in the journal *Toxics*. "What we don't really understand is how the placenta regulates exposure to cadmium and other toxicants. That's what this research was trying to ascertain."

Very few epidemiological studies have examined cadmium's endocrine-disrupting potential during pregnancy, the researchers said. To address this knowledge gap, Rivera-Núñez, together with Megan Hansel, a doctoral degree student at the Rutgers School of Public Health, and Camila Capurro, a clinical research assistant at the school and an MPH student, analyzed urine samples from 294 pregnant women who participated in the Understanding Pregnancy Signals and Infant Development (UPSIDE) study in Rochester, N.Y.

Study participants provided urine samples during each trimester and answered questions about demographics, lifestyle, health history and other measures.

By testing their urine for cadmium and sex steroid levels, including testosterone, which is important to fetal brain development, the researchers determined as cadmium levels increased, levels of free testosterone—testosterone that isn't attached to a protein—decreased.

At the same time, total testosterone—both free and bound testosterone—remained stable, suggesting cadmium may influence fetal exposure to sex steroids, which in turn can adversely influence fetal

growth.

"We think that what cadmium is doing is altering the bound/unbound process of testosterone during pregnancy," said Rivera-Núñez. "If cadmium is interfering with these binding proteins, it might explain why we're seeing lower levels of free, or unbound, testosterone."

Rivera-Núñez said one goal of this research is to help pregnant women avoid cadmium exposure. Doing so will be difficult: Although human exposure occurs through tobacco products, it's frequently found in foods, accumulating in the environment through industrial emissions, mining and the burning of coal. To address these sources, expectant mothers need to understand the risks and regulators must work to keep the toxin from the environment in the first place, she said.

"If we can understand the mechanisms by which cadmium impacts growth in utero, we might be able to understand how similar chemicals work on the placenta," Rivera-Núñez said. "Eventually, that could help lower exposure risks across the board."

More information: Zorimar Rivera-Núñez et al, Prenatal Cadmium Exposure and Maternal Sex Steroid Hormone Concentrations across Pregnancy, *Toxics* (2023). DOI: 10.3390/toxics11070589

Provided by Rutgers University