Mother's diet influences weight-control neurocircuits in offspring

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Credit: Anna Langova/public domain

Maternal diet during pregnancy and lactation may prime offspring for weight gain and obesity later in life, according to Penn State College of Medicine researchers, who looked at rats whose mothers consumed a high-fat diet and found that the offsprings' feeding controls and feelings of fullness did not function normally.

Previous research shows that obesity compromises the neurocircuits that control how the stomach and intestine work to regulate how much we eat, and that the time around pregnancy and lactation is important in the development of these circuits. In both human and laboratory studies, the offspring of mothers who are obese or consume a high-fat diet during pregnancy have been shown to be much more likely to be overweight and have weight-related problems such as metabolic syndrome, diabetes and heart disease later in life.

In the new study, researchers fed one group of rats a high-fat diet during pregnancy and lactation. Their offspring were fed the same diet after weaning. When the rats reached adolescence, the researchers measured their neural activity involved in energy balance and appetite regulation.

"We looked at the circuits that relay information from the stomach and the small intestine to the brain and back to the stomach telling it how to work," said lead investigator Kirsteen Browning, associate professor of neural and behavioral sciences.

These normal reflex mechanisms, which help limit the amount of food we eat, can malfunction and become less sensitive in obesity.

"We found that parts of these reflexes were actually compromised even before we saw obesity," Browning said. "Rats on the high-fat diet looked exactly the same as the control group rats in terms of weight, but their feeding reflexes were already beginning to be compromised."

The findings, published in the *Journal of Physiology*, suggest that there are significant effects of maternal and perinatal diet on some of the regions that control feeding and satiety in the brain. Exactly how maternal diet influences these functions is still unknown.

"It's time that we start to take seriously the idea that obesity is, in part, a brain disease," Browning said.

However, Browning emphasized that obesity is a complex disease with many genetic and environmental factors playing important roles.

"Not all people who are obese had mothers who ate high-fat diets when they were pregnant, and not all mothers who eat high-fat diets will have obese children," she said. "It's just one more risk factor. An understanding of the biological mechanisms underpinning obesity could help stem the tide of obesity."

"The principle of 'calories in, calories out' for weight loss is incredibly oversimplified, and, clearly, telling

people to eat less and move more is not getting the job accomplished," she said. "But perhaps if we recognize that this critical window during development may have very long-term outcomes, we'll pay more attention to mothers' health, wellbeing and diet."

Browning plans to do more research to determine the precise perinatal timeframe within which feeding neurocircuits are vulnerable to unhealthy alterations, and—perhaps most importantly—whether these changes can be reversed once set into motion. She also wants to test whether the fat content or the caloric load of the rats' diet induced the changes.

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