Multiple births lead to weight gain and other problems for mouse moms and male offspring

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Women have long bemoaned the fact that as they have more children, their weight gain from pregnancy becomes more difficult to lose. A new study using a mouse model that mimics the human effects of multiparity (giving birth more than once) has found that mouse moms who gave birth four times accrued significantly more fat compared to primiparous females (those giving birth once) of similar age.

The study also found significantly more inflammation in the livers of multiparous animals. Multiparity's effect also extended to the male offspring, who showed significant weight gain during adulthood. Their primiparous counterparts did not, despite similar levels of food consumption. The findings are contained in a study entitled "Multiparity Leads to Obesity and Inflammation in Mothers and Obesity in Male Offspring," and appear in the American Journal of Physiology – *Endocrinology and Metabolism*, published by the American Physiological Society.

Methodology

Researchers at the University of Cincinnati designed the study in two parts. In the first part, they established the mouse model that mimics multiparity-induced obesity in humans. In the second part, they examined male offspring of the multiparous females.

The researchers compared one group of mice that gave birth four times with a second group of mice that gave birth only once, some of these at the same age that the first group had its fourth litter and some at a younger age.

The researchers weighed these animals and assessed the size of their fat deposits. They also performed glucose tolerance tests in all the mice and measured biochemical markers of inflammation. Additionally, the researchers performed similar tests in the male offspring of primiparous and multiparous mice, and measured weight, fat deposits, and glucose tolerance. They also measured the expression levels of various genes involved in storing versus using fat.

Results

The first part of the study showed that giving birth multiple times was a significant contributor to obesity regardless of age, with mice who gave birth multiple times being up to 45 percent heavier than those who had a single litter at the same age that the first animals had their fourth. The multiparous animals had fat deposits several times larger than those in typically-mated primiparous mice, as well as significantly larger glucose spikes after meals, a warning sign for diabetes. Multiparous moms also showed elevated markers for inflammation in numerous body tissues, a condition linked to heart disease, diabetes, cancer, and a variety of other diseases, as compared to the primiparous mice as well as age-matched females fed a high fat diet.

The second part of the study revealed that male offspring of multiparous mice weighed as much as 40 percent more than the male offspring of primiparous mice, despite eating no more food. Interestingly, the differences became apparent when the offspring were older, suggesting that excess energy was stored as fat only after growth rate slowed down. When the researchers examined genes responsible for storing versus

using fat, the offspring of multiparous animals appeared to use less fat compared to those of the primiparous animals.

Importance, Implications of the Findings

These findings confirm that in mice, as in humans, giving birth multiple times, regardless of age, can lead to significant weight gain, and inflammation. The results also support the theory that multiple pregnancies induce metabolic stresses on females that have heritable consequences and may be part of an obesity cycle between mothers and offspring.

The authors suggest that finding effective ways to help women lose weight between pregnancies will assist in maintaining their health and that of their children, though additional interventions will likely be required as multiple pregnancies appear to have an adverse effect on women that is independent of her fat mass. "The current studies are important in supporting a healthier, less obese population in that we have defined specific metabolic pathways that are likely involved in the programming of obesity and can be targeted in either the mother or her offspring," the authors say.

More information: The article is available online at bit.ly/zcIkKf

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