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Recent study shows maternal protein restriction in mice alters energy and behavior in male offspring

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A team of researchers at Baylor College of Medicine have found that the

adult offspring of mouse dams that consumed a low-protein diet during pregnancy and lactation had an increase in body fat, lower energy expenditure and increase in anxiety-like behavior even though they had all been fed normal diet from weaning.

Maternal diet has a significant impact on fetal growth, and the researchers aimed to learn how a maternal low-protein diet in dams influences metabolism, circadian rhythm and behavior in male mice offspring.

"Animal studies and human research indicate that the intra-uterine environment is influenced by many external factors and exposures, one of which is a mother's diet before and during the pregnancy," said Dr. Ignatia Van den Veyver, professor of obstetrics and gynecology at Baylor, specialist in maternal-fetal medicine at the Texas Children's Pavilion for Women, and corresponding author on this study. "Adverse exposures, such as suboptimal nutrition can have long-term consequences for the health and well-being of their offspring. Yet, details of which types of exposures, their timing and the mechanisms by which they affect the offspring's health are still not fully understood, although epigenetics plays a role."

Previous studies by others have shown that male offspring exposed to a maternal low-protein diet have reduced body weight. However, most of these results reflect a maternal low-protein diet that started from the beginning to the end of pregnancy.

In this study, which appears today in the online journal *PLOS ONE* , the researchers discovered that offspring of dams fed more chronically on low-protein diet from four weeks prior to pregnancy and throughout gestation and lactation, were significantly smaller, had higher body fat, were less active at night and had lower levels of energy. Although the male offspring were less active at night, they showed no circadian

rhythm alterations, but demonstrated mild anxiety-related behavioral differences.

"We wanted to model the effects of a more chronic nutritional deprivation on offspring, such as in populations with longstanding poor nutritional resources. The outcomes of this are not the same as when mice are only fed low-protein diet during pregnancy. Our findings begin to provide some clues about the long-term consequences of maternal protein-deprived diets for the offspring's neurobehavioral and overall well-being, but more research will certainly be needed. It will be important to explore if these effects are the same for female offspring and if the findings in mice translate to humans. We would also like to explore the mechanisms by which these permanent effects happen," she said.

More information: Randy F. Crossland et al. Chronic Maternal Low-Protein Diet in Mice Affects Anxiety, Night-Time Energy Expenditure and Sleep Patterns, but Not Circadian Rhythm in Male Offspring, *PLOS ONE* (2017). DOI: 10.1371/journal.pone.0170127

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