Reducing diet early in pregnancy stunts fetal brain development

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Eating less during early pregnancy impaired fetal brain development in a nonhuman primate model, researchers from The University of Texas Health Science Center San Antonio reported today.

The researchers found decreased formation of cell-to-cell connections, cell division and amounts of growth factors in the fetuses of mothers fed a reduced diet during the first half of pregnancy. "This is a critical time window when many of the neurons as well as the supporting cells in the brain are born," said Peter Nathanielsz, M.D., Ph.D., director of the Center for Pregnancy and Newborn Research in the Health Science Center School of Medicine.

The study included collaborators at the Southwest Foundation for Biomedical Research (SFBR) in San Antonio and Friedrich Schiller University in Jena, Germany. The team compared two groups of baboon mothers located at SFBR's Southwest National Primate Research Center. One group ate as much as they wanted during the first half of pregnancy while the other group was fed 30 percent less, a level of nutrition similar to what many prospective mothers in the U.S. experience.

Hundreds of genes involved

"Our collaboration allowed us to determine that the nutritional environment impacts the fetal brain at both the cellular and molecular levels," said SFBR's Laura Cox, Ph.D. "That is, we found dysregulation

of hundreds of genes, many of which are known to be key regulators in cell growth and development, indicating that nutrition plays a major role during fetal development by regulating the basic cellular machinery."

Moderate versus severe reduction

It is known that marked nutrient restriction, such as in famine conditions, adversely affects development of the fetal brain. Senior author Thomas McDonald, Ph.D., also of the Health Science Center, said the study "is the first demonstration of major effects caused by the levels of food insecurity that occur in sections of U.S. society and demonstrates the vulnerability of the fetus to moderate reduction in nutrients."

Dr. Nathanielsz noted:

- In teenage pregnancy, the developing fetus is deprived of nutrients by the needs of the growing mother;
- In pregnancies late in reproductive life, a woman's arteries are stiffer and the blood supply to the uterus decreases, inevitably affecting nutrient delivery to the fetus;
- Diseases such as preeclampsia or high blood pressure in pregnancy can lead to decreased function of the placenta with decreased delivery of nutrients to the fetus.

'Lifetime effects'

"This study is a further demonstration of the importance of good maternal health and diet," Dr. McDonald said. "It supports the view that poor diets in pregnancy can alter development of fetal organs, in this

case the brain, in ways that will have lifetime effects on offspring, potentially lowering IQ and predisposing to behavioral problems."

Developmental programming of lifetime health has been shown to play a role in later development of obesity, diabetes and heart disease. In light of this new finding, research should focus on effects of developmental programming in the context of autism, depression, schizophrenia and other brain disorders.

Mother's protection

The study, published this week in Proceedings of the National Academy of Sciences, also forces researchers to review the commonly held notion that during pregnancy the mother is able to protect the fetus from dietary challenges such as poor nutrition, Dr. McDonald said.

The nonhuman primate model's brain developmental stages are very close to those of human fetuses, the researchers noted. Most previous research in this area was conducted in rats.

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