Antioxidants in pregnancy prevent obesity in animal offspring

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New biological research may be relevant to the effects of a mother's high-fat diet during pregnancy on the development of obesity in her children.

An animal study at The Children's Hospital of Philadelphia suggests that a high-fat, high-carbohydrate diet causes oxidative stress -- an excess of deleterious free radicals -- during pregnancy, predisposing the offspring to obesity and diabetes. Feeding rats antioxidants before and during pregnancy completely prevented obesity and glucose intolerance in their offspring.

If the results in animals prove to be similar in humans, the research may have implications for reducing obesity rates in children. "We already know that there are critical periods during human development that influence the later development of obesity," said senior author Rebecca A. Simmons, M.D., a neonatologist at The Children's Hospital of Philadelphia. "This research suggests that if we can prevent inflammation and oxidative stress during pregnancy, we may lower the risk that a child will develop obesity."

The study by Simmons and co-author Sarbattama Sen, M.D., was published in the December 2010 print edition of *Diabetes*.

Oxidative stress is a condition in which quantities of highly reactive oxygen-containing molecules (free radicals and other chemicals) exceed the body's ability to control their biological damage to cells. It is already

known that obesity in people contributes to oxidative stress, in part by causing inflammation. Furthermore, obesity during pregnancy creates an abnormal metabolic environment during human gestation.

The current study tested the hypothesis that a high-fat diet during pregnancy increases oxidative stress and leads to obesity in the offspring of animals. Simmons and Sen also investigated whether supplementing the animals' diet with antioxidants would prevent obesity in the offspring.

The researchers simulated a Western-style diet by feeding high-fat, high-carbohydrate chow to one group of rats, compared to a control group fed a more balanced diet. In two other groups (one fed a Western diet, the other fed a control diet), the researchers added antioxidant vitamins.

Among the rats that ate only the Western diet, the offspring had significantly higher measures of inflammation and oxidative stress, and as early as two weeks of age, were significantly fatter, with impaired glucose tolerance compared to control rats. However, rats eating the Western diet plus antioxidants had offspring with significantly lower oxidative stress, as well as no obesity and significantly better glucose tolerance. The effects persisted at two months of age.

"These results suggest that if we prevent obesity, inflammation and oxidative stress in pregnant animals, we can prevent obesity in the offspring," said Simmons. Simmons added that a next step in this research is to determine the mechanisms by which inflammation and oxidative stress cause more fat tissue to develop.

She cautioned that until these effects are carefully studied in people, one shouldn't conclude that the biological effects seen in animals are the same in humans. In the meantime, she added that, whether pregnant or not, women should certainly not conclude from this study that they

should consume large doses of antioxidant vitamins.

More information: Sarbattama Sen, Rebecca A. Simmons, "Maternal Antioxidant Supplementation Prevents Adiposity in the Offspring of Western Diet-Fed Rats," *Diabetes*, Dec. 2010. doi: 10.2337/db10-0301

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