Maternal diet could affect kids' brain reward circuitry

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Credit: public domain

Researchers in France found that rats who ate a junk food diet during pregnancy had heavier pups that strongly preferred the taste of fat straight after weaning. While a balanced diet in childhood seemed to reduce the pups' desire for fat, they nevertheless showed altered brain reward circuitry into adulthood.

The Western diet is full of energy-rich foods—from hamburgers to chocolates, we consume significant quantities of fat and sugar. The

health costs of this are well known, and conditions such as obesity and diabetes are related to overeating.

Factors underlying obesity include how we metabolize food, and our tendency to overeat and seek out energy-rich foods. The pleasure we derive from food stems from the brain reward circuitry, and changes in these reward circuits can contribute to overeating.

Surprisingly, pregnant or breastfeeding mothers who eat significant quantities of energy-rich foods can increase their child's risk for obesity in later life. However, scientists don't yet fully understand the mechanism behind this phenomenon.

In a study recently published in *Frontiers in Endocrinology*, scientists used rats to investigate the relationship between a mother's diet and their offspring's weight, relationship with food, and brain circuitry. The research team fed rats a high fat/high sugar diet (which they called the 'Western Diet'), or a balanced diet, during pregnancy and suckling. They monitored the mothers' pups straight after weaning, during adolescence and into early adulthood.

The pups primarily ate a balanced diet once they were weaned, but at specific times the researchers allowed some of the pups to choose between tasting a fatty or non-fatty liquid. The liquid wasn't fatty enough to affect the pups, but allowed the team to assess their preference for fat. Using brain tissue samples, the team also investigated gene expression and brain changes associated with the pups' reward circuitry.

While the pups from Western Diet mothers were a normal weight at birth, they gained more weight during suckling and were abnormally heavy at weaning. This may have been caused by the Western Diet mothers producing richer milk or more milk.

When the team allowed the just-weaned pups to choose between a fatty and non-fatty liquid, pups from Western Diet mothers strongly preferred the fatty liquid compared with pups from the balanced diet mothers.

However, when the team repeated this fat preference test with adolescent pups, they found that both groups showed a similar high preference for fat—and interestingly, the pups from Western Diet mothers gradually lost their interest in fat after a few days. This might have been a compensatory mechanism to protect the pups from further exposure to fat. By adulthood, both types of pups had similar strong preferences for fat.

The pups from Western Diet mothers also showed significant changes in their reward circuitry, including differences in a brain region call the hypothalamus and changes in gene expression associated with a neurotransmitter called GABA.

"Previous studies have shown that when pups from Western Diet mothers have unlimited access to junk food they maintain their preference for fatty food into adolescence," says Vincent Paillé, a researcher involved in the study. "While the pups from Western Diet mothers in our study showed extensive changes in their reward circuitry, a balanced diet in childhood seemed to protect them from an increased fat preference at adolescence."

These findings could have implications for nutrition and obesity in human children in Western countries.

The team plan to further investigate the changes in reward circuitry caused by a maternal Western diet. "How these altered reward circuits integrate information could be different, and these pups might behave differently under stress or when they have free access to fatty food," says Paillé.

More information: Julie Paradis et al, Perinatal Western Diet Consumption Leads to Profound Plasticity and GABAergic Phenotype Changes within Hypothalamus and Reward Pathway from Birth to Sexual Maturity in Rat, *Frontiers in Endocrinology* (2017). DOI: 10.3389/fendo.2017.00216

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