Obese moms give birth to heart healthier kids following bariatric surgery

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Kids born to moms who have lost a substantial amount of weight after undergoing bariatric surgery have fewer cardiovascular risk factors than their siblings who were born before the weight loss surgery.

This is because the metabolic changes and weight loss that occur after the surgery have a positive effect on inflammatory disease-related genes in the offspring, according to a new study presented at the Canadian Cardiovascular Congress, co-hosted by the Heart and Stroke Foundation and the Canadian Cardiovascular Society.

"Our research found that maternal obesity affects the genes of the offspring," says Dr. Frédéric Guénard, a post-doctoral fellow under the supervision of Dr. Marie-Claude Vohl of the Functional Food Institute at Laval University and a recipient of a Heart and Stroke Foundation Research Fellowship.

"The good news is that we can do something to change this outcome: Reducing obesity in the mother has a positive health impact on the health of future offspring."

The study comes from the cutting-edge field of epigenetics, which looks at how our genes can be switched on and off by environmental changes. What's novel here is that the scientists looked at how these changes can impact the DNA of our offspring (without necessarily altering the DNA sequence).

Think of identical twins with the same DNA – how can two individuals with the same DNA have different states of health? It was once thought that only DNA structure changes caused genetic variation. But we now know that genes can be turned on or off ("expressed"). A variety of processes is thought to "flick the switch."

One such process is that small molecules bind to DNA. These molecules are produced by one's own body and their binding to DNA is modulated by the environment (for example, from foods or from toxins in the environment).

Scientists now know that molecules called methyl groups can turn genes on and off – a process called DNA methylation that can change the gene expression, but doesn't change the gene sequence. Generally speaking, more methylation means a gene is turned off and less means a gene is turned on.

Parental obesity contributes substantially to pediatric obesity through genetic, environmental and epigenetic influences. Obesity during pregnancy predisposes the offspring to lifelong excess body weight and increased risk of heart disease.

Bariatric surgeons and researchers at Laval University observed that children born after their mothers had a type of bariatric surgery called bilio-pancreatic bypass surgery were less likely to be obese, had improved insulin resistance, lower blood pressure and an improved cardiovascular disease risk profile.

This observation prompted Dr. Guénard and his team to study the underlying reasons for this improvement in heart disease risk.

They took blood samples from 25 children of 20 mothers who were born before their mothers had bilio-pancreatic bypass surgery and blood

samples from 25 of their siblings who were born afterwards.

The children ranged in age from two to 24 years. The average body mass index (BMI) of the mothers was 45 before bariatric surgery and 27 after. Bariatric surgery is indicated for individuals with a BMI of 40 or greater, or those with a BMI of 35 or greater who have co-morbid conditions (for example, diabetes) and are of low surgical risk.

They then tested the DNA from blood samples, using a special tool – the Infinium HumanMethylation450 BeadChip – to find any changes in the genes caused by methylation.

They found that methylation levels were very different in the children born to mothers before bypass surgery from those who were born after.

Specifically, they found that more than 5,500 known genes with differential methylation in the children born before their mothers had bypass surgery compared to children born afterwards.

"Our findings show that maternal bariatric surgery results in significant metabolic effects to the methylation profiles of inflammatory disease-related genes," says Dr. Guénard. "The bariatric surgery and weight loss experienced by the mothers created an in utero environment that favorably changed the gene methylation levels of the fetus."

"Basically, this study tells us that maternal obesity affects the obesity and cardiovascular risk profile of offspring and that weight loss can improve the cardiovascular health of children."

"We know our genetic makeup influences our children's risks – but so can our environment," says Heart and Stroke Foundation spokesperson Dr. Beth Abramson. "For example, if a disease runs in a family, we know to watch out for it in the children as they age. This study shows

that external factors also influence our risk for heart disease – and that of our offspring by switching genes on or off in our DNA; providing a glimpse as to why this occurs. This is why lifestyle behaviours are so important."

Dr. Abramson says this study is another reminder about why we need to manage and control our weight at all stages of life. "What other things could we be doing to flip those switches and provide a better blueprint for our kids to start them off right in life?"

Dr. Guénard says we would need other genetics studies to find out if weight loss changes the methylation profile of the genes of offspring of women who have lost weight through other measures.

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