

Umbilical cells shed light on how obesity may pass from mother to child

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Elvira Isganaitis, M.D., M.P.H., is Assistant Investigator and Staff Pediatric Endocrinologist at Joslin Diabetes Center and Instructor in Pediatrics at Harvard Medical School. Credit: Joslin Diabetes Center

Scientists have long known that infants born to women who are obese show higher risks of obesity, but they don't fully understand what boosts those risks. Researchers at Joslin Diabetes Center now have demonstrated that umbilical cells from children of obese or overweight mothers show impaired expression of key genes regulating cell energy and metabolism, compared to similar cells from babies of non-obese mothers.

Such findings may help to pave the way toward improved healthcare, both before and after birth, for children at heightened risk of [obesity](#), says Elvira Isganaitis, M.D., M.P.H., Assistant Investigator and Staff Pediatric Endocrinologist at Joslin Diabetes Center and Instructor in Pediatrics at Harvard Medical School, and corresponding author on a paper about the work published in the *International Journal of Obesity*.

The Joslin study also suggests that the increased risks of obesity may be driven by boosted levels of certain lipids (fats and other substances that are not soluble in water) in the maternal blood that flows through the umbilical cord, says Isganaitis. A research associate and staff endocrinologist at Joslin, she is an instructor in pediatrics at Harvard Medical School.

Suzana Maria Ramos Costa, M.D., Ph.D., of Joslin and the Federal University of Pernambuco in Recife, Brazil, who is co-first author on the paper, began the research by gathering umbilical cords after birth from healthy Brazilian women without diabetes. Costa recruited 24 overweight or obese women (with a [body mass index](#) over 25 before pregnancy) and 13 women who were not overweight for the study.

The scientists collected umbilical cells from the vein that carries oxygen and other nutrients from the placenta to the embryo. "These samples give a window into the nutrients and metabolites that are coming from the mom into the infant," says Isganaitis.

The Joslin team discovered that in these cells, increased obesity in the mothers correlated with lower expression of genes regulating mitochondria (which act as the cell's powerhouses) and of other genes regulating the production and metabolism of lipids.

"This suggests that already at birth there are detectable metabolic perturbations resulting from maternal obesity," she says. Changes in

these cells were similar to some known to occur in obesity, insulin resistance and type 2 diabetes, she adds.

When the researchers followed up by analyzing fetal blood from the [umbilical cord](#) vein, "we found that the infants of [obese mothers](#) had significantly higher levels of many lipids that are known to be metabolically deleterious, like saturated fatty acids," Isganaitis says. Fat tissues in the obese mothers may shed fatty acids that make their way into the fetal blood and create a kind of "fuel overload" for the embryo, she remarks.

Isganaitis and her colleagues will carry out further research on umbilical cells and blood among Boston newborns to see if the study results are confirmed in this population. She also plans similar analyses for children born to mothers who have either gestational diabetes or type 1 diabetes.

Additionally, Isganaitis is examining how such prenatal exposures may encourage certain stem cells found in umbilical cords, which can differentiate into various types of tissues, to preferentially turn into fat cells.

She hopes that eventually it will be possible to use blood markers to identify embryos at risk for obesity or related conditions such as type 2 diabetes, and to follow up with suitable medical interventions.

"Pregnant women engage often with their healthcare providers, and you can really tap into their motivation," she says. "If we could come up with tailored interventions—if we could say, take this vitamin, exercise regularly and you can minimize obesity or diabetes risk in your child—I'm sure mothers would do it."

Isganaitis adds that mothers and healthcare providers also could carefully monitor the growth patterns and nutrition of children at risk of obesity,

both in the first two years of life and afterwards. "Your risk of chronic diseases isn't set in stone at birth; there are many different periods in which your lifelong disease risk can be modulated," she emphasizes.

Provided by Joslin Diabetes Center

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