Moderate exercise before conception resulted in lower body weight, increased insulin sensitivity of offspring

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Matt Hurt shows his five-year-old son how to swing a baseball bat. A new study suggests that fathers can give their children a genetic head start on a healthy metabolism by exercising prior to conception. Credit: The Ohio State University Wexner Medical Center.

Men who want to have children in the near future should consider hitting the gym.

In a new study led by Kristin Stanford, a physiology and cell biology researcher with The Ohio State University College of Medicine at the Wexner Medical Center, paternal exercise had a significant impact on the metabolic health of offspring well into their adulthood.

Laurie Goodyear of the Joslin Diabetes Center and Harvard Medical School co-led the study, published today in the journal *Diabetes*.

"This work is an important step in learning about metabolic disease and prevention at the cellular level," said Dr. K. Craig Kent, dean of the Ohio State College of Medicine.

Recent studies have linked development of type 2 diabetes and impaired metabolic health to the parents' poor diet, and there is increasing evidence that fathers play an important role in obesity and metabolic programming of their offspring.

Stanford is a member of Ohio State's Diabetes and Metabolism Research Center. Her team investigated how a father's exercise regimen would affect his offspring's metabolic health. Using a mouse model, they fed male mice either a normal diet or a high-fat diet for three weeks. Some mice from each diet group were sedentary and some exercised freely. After three weeks, the mice bred and their offspring ate a normal diet under sedentary conditions for a year.

The researchers report that adult offspring from sires who exercised had improved glucose metabolism, decreased body weight and a decreased fat mass.

"Here's what's really interesting; offspring from the dads fed a high-fat diet fared worse, so they were more glucose intolerant. But exercise negated that effect," Stanford said. "When the dad exercised, even on a high-fat diet, we saw improved metabolic health in their adult offspring."

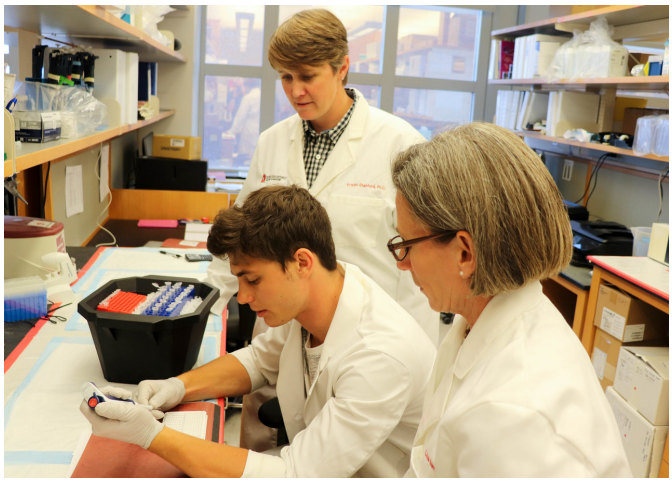
Stanford's team also found that exercise caused changes in the genetic expression of the father's sperm that suppress poor dietary effects and transfer to the offspring.

"We saw a strong change in their small-RNA profile. Now we want to see exactly which small-RNAs are responsible for these metabolic improvements, where it's happening in the offspring and why," Stanford said.

Previous studies from this group have shown that

when mouse mothers exercise, their offspring also have beneficial effects of metabolism.

Provided by Ohio State University Medical Center



Researchers examine the small-RNA of mice in a lab at The Ohio State University Wexner Medical Center. A new study finds that, while a father's high-fat diet results in poor metabolic traits in their offspring, exercise can completely reverse those negative effects. Credit: The Ohio State University Wexner Medical Center

"Based on both studies, we're now determining if both parents exercising has even greater effects to improve metabolism and overall health of offspring. If translated to humans, this would be hugely important for the health of the next generation," Goodyear said.

The researchers believe the results support the hypothesis that small RNAs could help transmit parental environmental information to the next generation.

"There's potential for this to translate to humans. We know that in adult men obesity impairs testosterone levels, sperm number and motility, and it decreases the number of live births," Stanford said. "If we ask someone who's getting ready to have a child to exercise moderately, even for a month before conception, that could have a strong effect on the health of their sperm and the long-term metabolic health of their children."