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New culprit identified in metabolic syndrome

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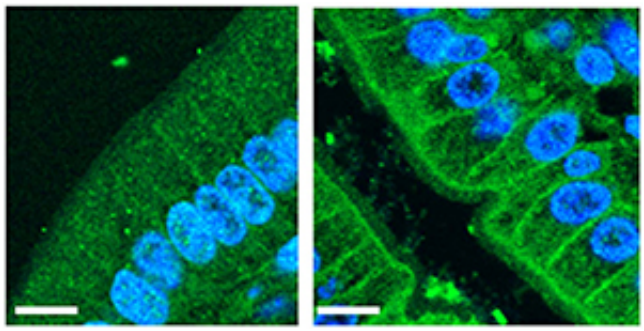

A new study suggests uric acid may play a role in causing metabolic syndrome, a cluster of risk factors that increases the risk of heart disease and type 2 diabetes. Normally, GLUT9 (green) is abundant in the membranes of cells lining the interior of the gut, where it transports uric acid out of the body. Mice lacking GLUT9 only in the gut show high levels of uric acid in the blood and quickly develop markers of metabolic syndrome. Cell nuclei are in blue. Credit: Moley Lab

A new study suggests uric acid may play a role in causing metabolic syndrome, a cluster of risk factors that increases the risk of heart disease and type 2 diabetes.

Uric acid is a normal waste product removed from the body by the kidneys and intestines and released in urine and stool. Elevated levels of uric acid are known to cause gout, an accumulation of the acid in the joints. High levels also are associated with the markers of metabolic syndrome, which is characterized by obesity, high blood pressure, elevated blood sugar and high cholesterol. But it has been unclear

whether uric acid itself is causing damage or is simply a byproduct of other processes that lead to dysfunctional metabolism.

Published Aug. 7 in *Nature Communications*, the new research at Washington University School of Medicine in St. Louis suggests excess uric acid in the blood is no innocent bystander. Rather, it appears to be a culprit in disrupting normal metabolism.

"Uric acid may play a direct, causative role in the development of metabolic syndrome," said first author Brian J. DeBosch, MD, PhD, an instructor in pediatrics. "Our work showed that the gut is an important clearance mechanism for uric acid, opening the door to new potential therapies for preventing or treating type 2 diabetes and metabolic syndrome."

Recent research by the paper's senior author, Kelle H. Moley, MD, the James P. Crane Professor of Obstetrics and Gynecology, and her collaborators has shown that a protein called GLUT9 is an important transporter of uric acid.

DeBosch, a pediatric gastroenterologist who treats patients at St. Louis Children's Hospital, studied mice to learn what happens when GLUT9 stops working in the gut, essentially blocking the body's ability to remove uric acid from the intestine. In this study, the kidney's ability to remove uric acid remained normal.

Eating regular chow, mice missing GLUT9 only in the gut quickly developed elevated uric acid in the blood and urine compared with control mice. And at only 6-8 weeks of age, they developed hallmarks of metabolic syndrome: high blood pressure, elevated cholesterol, high blood insulin and fatty liver deposits, among other symptoms.

The researchers also found that the drug allopurinol, which reduces uric

acid production in the body and has long been used to treat gout, improved some, but not all, of the measures of metabolic health. Treatment with the drug lowered blood pressure and total cholesterol levels.

Exposure to uric acid is impossible to avoid because it is a normal byproduct of cell turnover in the body. But there is evidence that diet may contribute to uric acid levels. Many foods contain compounds called purines that break down into uric acid. And adding to growing concerns about fructose in the diet, evidence suggests that fructose metabolism in the liver also drives uric acid production.

"Switching so heavily to fructose in foods over the past 30 years has been devastating," Moley said. "There's a growing feeling that uric acid is a cause, not a consequence, of metabolic syndrome. And now we know fructose directly makes uric acid in the liver. With that in mind, we are doing further research to study what happens to these mice on a high-fructose diet."

More information: DeBosch BJ, Kluth O, Fujiwara H, Schurmann A, Moley KH. Early-onset metabolic syndrome in mice lacking the intestinal uric acid transporter SLC2A9. *Nature Communications*. Aug. 7, 2014.

Provided by Washington University School of Medicine

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