Increased dietary fructose linked to elevated uric acid levels and lower liver energy stores

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Obese patients with type 2 diabetes who consume higher amounts of fructose display reduced levels of liver adenosine triphosphate (ATP)—a compound involved in the energy transfer between cells. The findings, published in the September issue of *Hepatology*, a journal of the American Association for the Study of Liver Diseases, indicate that elevated uric acid levels (hyperuricemia) are associated with more severe hepatic ATP depletion in response to fructose intake.

This exploratory study, funded in part by grants from the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), also suggests that uric acid levels may serve as a marker for increased fructose consumption and hepatic ATP depletion. Uric acid is produced by the breakdown of purines, natural substances commonly found in foods. According to the authors, increased dietary fructose can alter the body's metabolism and energy balance. Energy depletion in the liver may be associated with liver injury in patients with non-alcoholic fatty liver disease (NAFLD) and in those at risk for developing this metabolic condition.

Fructose is a simple sugar that fuels the body, and is found in fruits and vegetables. High fructose corn syrup—a mixture of glucose and fructose—is used as a sweetener in consumer food products such as bread, cereal, and soda. Prior research reports that fructose consumption in the U.S. has more than doubled in the past 30 years. In fact, studies have shown that Americans' fructose intake climbed from 15 grams per day in the early 1900s to 55 grams per day in 1994, which experts

believe stems from an increase in soft drink consumption.

"There is an alarming trend of increased rates of obesity, type 2 diabetes and NAFLD in the U.S.," said lead author Dr. Manal Abdelmalek from Duke University Medical Center. "Given the concurrent rise in fructose consumption and metabolic diseases, we need to fully understand the impact of a high-fructose diet on liver function and liver disease."

For the present study, 244 obese and diabetic adults from the Look AHEAD Study were evaluated, with dietary fructose consumption estimated by the food frequency questionnaire. Liver ATP and uric acid levels were measured in 105 patients who participated in the Look AHEAD Fatty Liver Ancillary Study. Researchers assessed the change in liver ATP content using an IV fructose challenge in 25 subjects, comparing patients with low fructose consumption (less than 15 grams per day) to those with high fructose consumption (greater than 15 grams per day).

The team found that participants with a high intake of dietary fructose had lower liver ATP levels at baseline and a greater change in ATP content following the fructose challenge than those who consumed a lower amount of fructose. Patients with high uric acid levels (5.5 mg/dL or more) displayed lower ATP stores in response to fructose.

Dr. Abdelmalek concludes, "High fructose consumption and elevated levels of uric acid are associated with more severe depletion of liver ATP. Our findings suggest that increased dietary fructose intake may impair liver "energy balance." Further research to define the clinical implications of these findings on metabolism and NAFLD is necessary." The authors highlight the importance of public awareness of the risks associated with a diet high in fructose.

More information: "Higher Dietary Fructose Is Associated with

Impaired Hepatic ATP Homeostasis in Obese Individuals with Type 2 Diabetes." Manal F. Abdelmalek, Mariana Lazo, Alena Horska, Susanne Bonekamp, Edward W. Lipkin, Ashok Balasubramanyam, John P. Bantle, Richard J. Johnson, Anna Mae Diehl, Jeanne M. Clark, and the Fatty Liver Subgroup of the Look AHEAD Research Group. Hepatology; (DOI: 10.1002/hep.25741); Print Issue Date: September, 2012.