Consumption of Dairy Fat May Improve Metabolic Health

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Current dietary guidelines in the United States explicitly recommend the consumption of nonfat or low-fat dairy products, based on beliefs that consumption of full-fat dairy products might contribute to overconsumption of calories and obesity, or an increased risk of cardiovascular disease due to the high saturated fat content in milk fat. Recent observational evidence, however, have challenged these assumptions. Rather than raising risk, full-fat dairy consumption instead appears to be associated with lower risk of obesity, cardiovascular disease, and type 2 diabetes. To further investigate these relationships, Dr. Mario Kratz and colleagues in the Division of Public Health Sciences evaluated the relationship between dairy fat intake, as measured by biomarkers in the blood, and various metabolic characteristics. Reporting recently in *The American Journal of Clinical Nutrition*, their study found that higher intake of dairy fat was associated with improved glucose tolerance and insulin sensitivity, as well as reduced liver fat.

The researchers were motivated to perform this research by the surprising results of a recent literature review, in which they found dairy fat to be inversely related with obesity and cardiometabolic risk in most studies (see Kratz *et al*. 2013). In addition, two recent studies in large US cohorts had demonstrated a strong inverse association between dairy fat intake and the risk of type 2 diabetes. Said Kratz, "these studies and experiments in mice suggested that some of the unique fatty acids in milk may improve metabolic health by reducing the fat content in the liver."

A large challenge in nutrition research is accurately characterizing nutrient intake from the complex dietary habits of study participants. To better assess dairy fat consumption, the researchers measured several biomarkers in participants' blood, such as the amount of various fatty acids in the plasma phospholipids. These biomarkers provide a more accurate assessment of nutrient intake. To evaluate the metabolic effects of dairy fat intake, the researchers then used several different clinical methods to measure glucose tolerance, liver fat content, both hepatic and systemic insulin sensitivity, and the amount of insulin produced by pancreatic beta-cells.

Overall, the researchers found consistent associations between biomarkers of dairy fat intake and measures of metabolic health. Higher levels of dairy fat intake were associated with lower fasting

glucose concentrations, greater oral glucose tolerance, reduced liver fat, and greater hepatic and systemic insulin sensitivity. Combined with previous findings, "we now hypothesize that some of the unique fatty acids in dairy fat may affect fat metabolism in the liver, leading to lower liver fat content," said Kratz. "Our study, while small, fully confirmed our hypotheses, leading to a new model for how dairy fat may affect metabolic health" (see figure).

Increased fat content in the liver has recently emerged as a major risk factor for metabolic diseases such as type 2 diabetes, because a higher fat content in the liver cells makes them less sensitive to insulin. The resulting insulin resistance is a major contributor to glucose intolerance, and can eventually lead to type 2 diabetes. Thus, the associations found by this study could help explain the inverse association between dairy fat consumption and type 2 diabetes risk seen in previous large cohort studies. Increased liver fat is also a risk factor for liver disease, including liver cancer. Said Kratz, "identifying modifiable lifestyle and dietary factors that can affect liver fat content could therefore have substantial public health impact."

While these results are encouraging, the authors caution that further studies are needed to confirm these findings before any dietary recommendations should be made. Randomized controlled trials of dairy fat intake could provide such additional evidence, and the researchers are currently applying for funding to do just that. In addition, said Kratz, "it is worth noting that dairy fat is the most complex fat humans eat, with about 400 different types of fatty acids. It is long overdue that we pay attention to this complexity, rather than gauging the health effects of dairy fat only by its high content of saturated fatty acids." It is unclear, however, whether differences in milk fat composition, for example due to differences in dairy cow feed, influence the health effects of full-fat dairy products. Said Kratz, "addressing this question would certainly be of interest to us in the future as well."

Other PHS investigators contributing to this project were Drs. Xiaoling Song and Chongzhi Di.

Citation:

Kratz M, Marcovina S, Nelson JE, Yeh MM, Kowdley KV, Callahan HS, Song X, Di C, Utzschneider KM. 2014. Dairy fat intake is associated with glucose tolerance, hepatic and systemic insulin sensitivity, and liver fat but not β-cell function in humans. *Am J Clin Nutr*. 99(6):1385-1396.

See also:

Kratz M, Baars T, Guyenet S. 2013. The relationship between high-fat dairy consumption and obesity, cardiovascular, and metabolic disease. *Eur J Nutr*. 52(1):1-24.

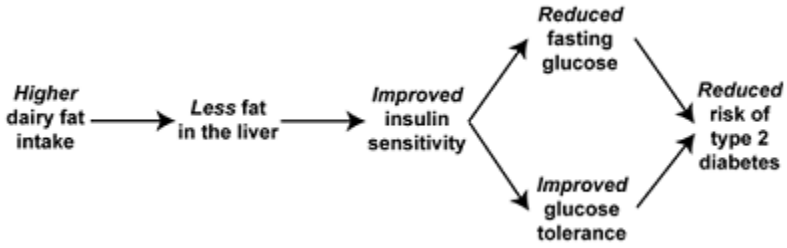

Image provided by Dr. Mario Kratz

In this study, higher dairy fat intake was associated with a lower fat content in the liver, better insulin sensitivity, lower fasting glucose concentrations, and improved glucose tolerance in an oral glucose tolerance test. Together, these findings suggest a new hypothesis, as shown in the figure, that dairy fat may primarily act on the liver to lower liver fat content, thereby making the liver more insulin sensitive. Greater sensitivity of the liver to insulin would reduce fasting glucose concentrations, and help the body to better maintain glucose homeostasis when challenged with a large oral glucose load, thereby reducing the risk of type 2 diabetes mellitus.