SCIENCE NEWS of the week

Fructose Risk for High-Fat Diners?

While it's hard to predict who will suffer artery-clogging heart disease, certain metabolic warning signs can signal individuals at increased risk. Among the classic risk factors for coronary artery disease are elevated blood levels of cholesterol (in low-density and very-low-density lipoproteins), triglycerides, certain apoproteins and uric acid. In a new nutrition study, researchers have simultaneously (and reversibly) brought about all of these changes in men by feeding them a diet that is ordinary in all respects except its sugar content. Whereas fructose – which chemically constitutes half of all table sugar – usually accounts for 10 to 12 percent of the calories in the average American diet, this study raised the fructose content to 20 percent of the calories.

Fructose, best known as the simple sugar found in fruits and honey, is increasingly being used as an additive to sweeten soft drinks and many processed foods, according to Agriculture Department data. This sugar is also frequently recommended for diabetics – individuals who, as a medical necessity, tend to eat a low-fat diet.

However, research has indicated that in people eating a *high*-fat diet, fructose can elevate blood levels of lipids (fats), especially triglycerides. So chemists at the Agriculture Department's Human Nutrition Research Center (HNRC) in Beltsville, Md., decided to investigate fructose's risk potential for those consuming the average American diet – one known to be high in fat.

Measured changes in triglycerides, cholesterol and other factors were small to moderate but signal a disturbing trend, according to Sheldon Reiser, who is research leader at the HNRC's Carbohydrate Nutrition Laboratory and who headed the study. All the observed changes, he says, were in the direction of increasing heart disease risk.

At special risk, these data indicate, are the 10 to 15 percent of adults who already have higher-than-normal levels of insulin or triglycerides circulating in their blood. Reiser says his data, when taken together with data from earlier studies, show that for these individuals "it appears that fructose at present levels of consumption represents a metabolic risk" for heart disease. Ten of the 21 men in the study fit into this category.

In the basic diet the researchers used – "typical," they say, of what the average American eats – fat contributed 37 percent of the calories and the daily cholesterol content was 580 milligrams. Both exceed the American Heart Association's recommended limits (see p. 203). Moreover, while the association recommends keeping the dietary level of saturated fats at or below that of polyunsaturated fats, most Americans actually consume about twice as much saturated as polyunsaturated fat, as did the men in this study.

Each participant spent five weeks on a high-fructose diet, another five weeks on a similar diet in which the fructose had been replaced with a high-amylose cornstarch. Compared with the starch, the fructose produced uric acid levels 13 percent higher among all participants – both those who are normal and those who have trouble regulating insulin responses to sugar (hyperinsulinemia). On most other measures, the hyperinsulinemic participants showed distinctly different results. For example, their total cholesterol levels jumped 11.4 percent after the fructose diet, compared with a 7.7 percent increase among the other men. Similarly, after the fructose diet, total blood-plasma triglyceride levels climbed 56.2 percent in the hyperinsulinemic group – to 228 mg per deciliter of blood. Triglyceride levels increased just 24 percent in the other group on fructose – to 93 mg/dl.

Perhaps more important, says Daniel Scholfield, another of the researchers, was the finding that most cholesterol and triglyceride increases occurred in the very-low-density lipoproteins and low-density lipoproteins – the so-called "bad" lipoproteins that increase the risk of heart disease.

"I think these are intriguing findings," says John A. Colwell, president of the American Diabetes Association and director of endocrinology metabolism at the Medical University of South Carolina in Charleston. Although he says "it sounds like a pretty good study," Colwell downplays its immediate clinical significance, citing the rather modest increase in risk factors measured over the five weeks when participants ate the high-fructose diet. However, Reiser counters, "These changes are really not small if they turn out to be cumulative, and therefore magnify further over time."

Walter H. Glinsmann, associate director for clinical nutrition with the Food and Drug Administration, says he is particularly struck by the way the participants' insulin and blood-sugar levels responded to the different diets. Usually, says Glinsmann, who recently co-authored a massive overview on sugar safety, one expects to see the carbohydrate that induces the biggest spike in blood insulin or sugar (called a glycemic response) to pose the more serious heart disease risk. But here, while the cornstarch elicited the biggest glycemic response, it was fructose that caused the greatest blood-lipid changes. That's counterintuitive, he says, and suggests fructose may be reacting quite differently from other sugars. – *J. Raloff*

Breast milk may stimulate immunity

Scientists have long recognized that breast milk contains maternal antibodies that help newborn mammals, including human babies, to fight infection. Now researchers are finding evidence that one or more proteins in breast milk may also stimulate babies' own immune systems. The as-yet-unidentified protein or proteins speed the maturation of cultured B lymphocytes (a type of white blood cell) and prime them for production of antibodies, says Michael H. Julius of McGill University in Montreal.

Maternally acquired antibodies are very useful to the newborn, whose immune system is not fully developed, Julius said in an interview. "But at some point in time we have to get the baby's immune system off the ground. These proteins may be important in helping the newborn to cope with antigens in the outside world."

As reported in the March 1 JOURNAL OF IMMUNOLOGY, Julius first noticed that sheep colostrum – the milk produced immediately after the birth of a lamb – enhances the growth and differentiation of cultured white blood cells. Since then, he says, he has seen similar activity in human milk.

Armond S. Goldman of the University of Texas Medical Branch in Galveston told SCIENCE NEWS that other studies, including some of his own, have suggested the presence of immunity enhancers in human breast milk. In research to be published in the May PEDIATRIC RESEARCH, Goldman finds that certain soluble proteins in breast milk can activate macrophages – white blood cells that complement B lymphocytes in the immune response. "We're busily trying to characterize that material," he says.

Julius says that his earlier experiments looked at the effects of human- and sheep-milk proteins on cultured mouse B lymphocytes, but that current work using human-milk proteins and human cells is showing similar results. – *R. Weiss*