

# Fructose sets table for weight gain without warning

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Eating too much fructose can induce leptin resistance, a condition that can easily lead to becoming overweight when combined with a high-fat, high-calorie diet, according to a new study with rats.

Although previous studies have shown that being leptin resistant can lead to rapid weight gain on a high-fat, high-calorie diet, this is the first study to show that leptin resistance can develop as a result of high fructose consumption. The study also showed for the first time that leptin resistance can develop silently, that is, with little indication that it is happening.

The study, "Fructose-induced leptin resistance exacerbates weight gain in response to subsequent high-fat feeding," was carried out by Alexandra Shapiro, Wei Mu, Carlos Roncal, Kit-Yan Cheng, Richard J. Johnson and Philip J. Scarpance, all at the University of Florida College of Medicine in Gainesville. The study appears in the *American Journal of Physiology – Regulatory, Integrative and Comparative Physiology*, published by The American Physiological Society.

## Leptin as regulator

Leptin is a hormone that plays a role in helping the body to balance food intake with energy expenditure. When leptin isn't working -- that is, when the body no longer responds to the leptin it produces -- it's called leptin resistance. Leptin resistance is associated with weight gain and

obesity in the face of a high-fat, high-calorie diet.

Obesity has been a growing problem in the U.S. and in other parts of the world and fructose has been suspected of playing a role. Fructose is the sugar found in fruit, but it's not the normal consumption of fruit that is the problem. Table sugar and high-fructose corn syrup are about 50% fructose and these ingredients have become increasingly common in many foods and beverages. With sugar and high-fructose corn syrup being added to many foods, people now eat much more fructose than ever before.

The University of Florida researchers hypothesized that a high-fructose diet could lead to leptin resistance, which in turn could lead to exacerbated weight gain in the face of a high-fat, high-calorie diet, a typical diet in industrialized countries. To test their hypothesis, the research team performed a study with two groups of rats. They fed both groups the same diet, with one important exception: one group consumed a lot of fructose while the other received no fructose.

## **Two groups similar over six months**

The researchers next tested the animals to see if they were leptin resistant. They injected all the animals with leptin, to see if they would respond by eating less. Animals whose leptin response is functioning normally will lower their food intake. The researchers discovered that the rats on the high-fructose diet were leptin resistant, that is, they did not lower their food intake when given leptin. The no-fructose animals responded normally to leptin by eating less.

This first six months of the study showed that leptin resistance can develop silently. "Usually, leptin resistance is associated with obesity, but in this case, leptin resistance developed without obesity," Shapiro said. "This was very surprising."

## Role of diet

Having seen that leptin resistance could develop silently, the researchers next wanted to find out what would happen if they switched the rats to a high-fat, high-calorie diet -- the kind many Americans eat. They found that the animals exposed to the high-fructose diet, the leptin resistant rats, ate more and gained much more weight and fat than the leptin responsive animals on the fructose-free diet. All told, this study showed that leptin resistance can:

- develop by eating a lot of fructose
- develop silently, that is, with very little indication it is happening
- result in weight gain when paired with a high fat, calorie dense diet

Scarpace said the study suggests it is the interaction between consumption of large amounts of fructose-containing foods and eating a high-fat, high-calorie diet that produces the weight gain. "This study may explain how the global increase in fructose consumption is related to the current obesity epidemic," Shapiro said.

## How it happens

Other studies have shown that elevated triglycerides impair the transport of leptin across the blood brain barrier. The researchers hypothesize that the elevation in triglycerides produced by fructose prevented leptin from reaching the brain. If leptin does not reach the brain, the brain will not send out the signal to stop eating.

"The presence of high fructose alters the way leptin works, fooling the brain so that it ignores leptin," Scarpace said. Consumers should be cautious about what they eat, checking labels to see how much sugar the items contain, Shapiro said.

The researchers hope to perform future studies to find out if leptin resistance can be reversed by removing or reducing the fructose content of the diet.

Source: American Physiological Society

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