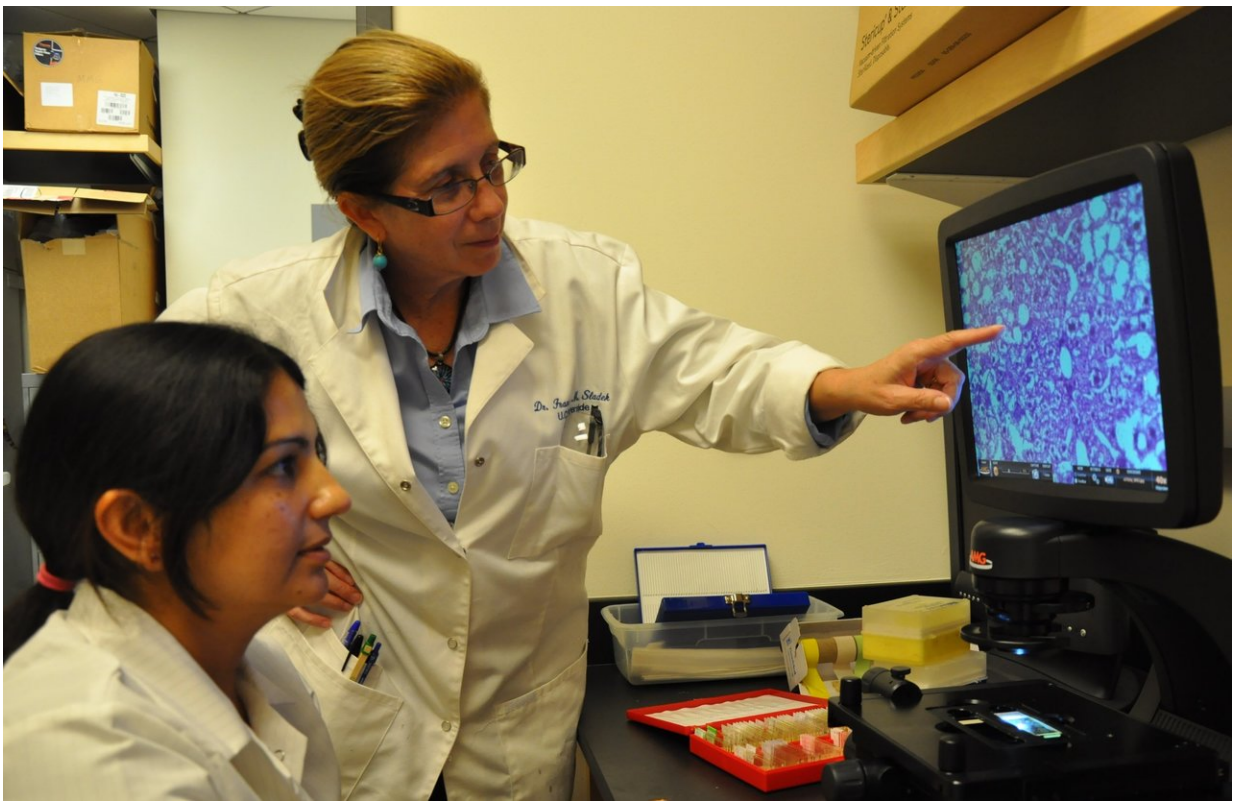
Medical Xpress

GM soybean oil causes less obesity and insulin resistance but is harmful to liver function

October 2 2017



Poonamjot Deol (seated) and Frances Sladek. Credit: I. Pittalwala, UC Riverside.

Researchers at the University of California, Riverside have tested a

genetically-modified (GM) soybean oil used in restaurants and found that while it induces less obesity and insulin resistance than conventional soybean oil, its effects on diabetes and fatty liver are similar to those of conventional soybean oil.

Soybean oil is the major vegetable cooking oil used in the United States, and its popularity is on the increase worldwide. Rich in unsaturated fats, especially linoleic acid, soybean oil induces obesity, diabetes, insulin resistance, and fatty liver in mice.

UC Riverside researchers tested Plenish, a genetically-modified (GM) soybean oil released by DuPont in 2014. Plenish is engineered to have low linoleic acid, resulting in an oil similar in composition to olive oil, the basis of the Mediterranean diet and considered to be healthful.

The study, published today in *Nature Scientific Reports*, is the first to compare the long-term metabolic effects of conventional soybean oil to those of Plenish.

The study also compares both conventional soybean oil and Plenish to coconut oil, which is rich in saturated fatty acids and causes the least amount of weight gain among all the high-fat diets tested.

"We found all three oils raised the cholesterol levels in the liver and blood, dispelling the popular myth that soybean oil reduces cholesterol levels," said Frances Sladek, a professor of cell biology, who led the research project.

Next, the researchers compared Plenish to olive oil. Both oils have high oleic acid, a fatty acid believed to reduce blood pressure and help with weight loss.

"In our mouse experiments, olive oil produced essentially identical

effects as Plenish - more obesity than coconut oil, although less than conventional soybean oil - and very fatty livers, which was surprising as olive oil is typically considered to be the healthiest of all the vegetable oils," said Poonamjot Deol, an assistant project scientist working in Sladek's lab and the co-first author of the research paper. "Plenish, which has a fatty acid composition similar to olive oil, induced hepatomegaly, or enlarged livers, and liver dysfunction, just like olive oil."

Sladek explained that some of the negative metabolic effects of animal fat that researchers often see in rodents could actually be due to high levels of linoleic acid, given that most U.S. farm animals are fed soybean meal.

"This could be why our experiments are showing that a high-fat diet enriched in conventional soybean oil has nearly identical effects to a diet based on lard," she said.

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The researchers further speculate that the increased consumption of soybean oil in the U.S. since the 1970s could be a contributing factor to the obesity epidemic. According to the Centers for Disease Control and Prevention, 35 percent of adults are obese. In some ethnic groups, however, such as Hispanics and African-Americans, between 42 percent and 48 percent of the population is obese. Obesity, officially designated by the American Medical Association in 2013 as a disease, is linked to diabetes, heart disease, and cancer.

"Our findings do not necessarily relate to other soybean products like soy sauce, tofu, or soy milk - products that are largely from the water-soluble

compartment of the soybean; oil, on the other hand, is from the fat-soluble compartment," Sladek said. "More research into the amounts of linoleic acid in these products and others is needed."

Linoleic acid is an essential fatty acid. All humans and animals must obtain it from their diet.

"But just because it is essential does not necessarily mean it is good to have more of it in your diet," Deol said. "Our bodies need just 1-to-2 percent linoleic acid from our diet, but Americans, on average, have 8-to-10 percent linoleic acid in their diets."

Deol and Sladek recommend avoiding conventional soybean oil as much as possible.

"This might be difficult as conventional soybean oil is used in most restaurant cooking and found in most processed foods," Deol said. "One advantage of Plenish is that it generates fewer transfats than conventional soybean oil."

"But with its effects on the liver, Plenish would still not be my first choice of an oil," Sladek said. "Indeed, I used to use exclusively olive oil in my home, but now I substitute some of it for coconut oil. Of all the oils we have tested thus far, coconut oil produces the fewest negative metabolic effects, even though it consists nearly entirely of saturated fats. Coconut oil does increase cholesterol levels, but no more than conventional soybean oil or Plenish."

The researchers have not examined the cardiovascular effects of coconut oil.

"As a result, we do not know if the elevated cholesterol coconut oil induces is detrimental," Sladek said. "The take-home message is that it is

best not to depend on just one oil source. Different dietary oils have far reaching and complex effects on metabolism that require additional investigation."

The study builds on an earlier study by the researchers that compared soybean oil to a high fructose diet and found soybean oil causes more obesity and diabetes than coconut oil.

Next, the researchers, who found a positive correlation between oxylipins (oxidized fatty acids) in linoleic acid and obesity, plan to determine whether the oxylipins cause obesity, and, if so, by what mechanism. They will also study the effects of conventional and GM soybean oil on intestinal health.

More information: Poonamjot Deol et al, Omega-6 and omega-3 oxylipins are implicated in soybean oil-induced obesity in mice, *Scientific Reports* (2017). DOI: 10.1038/s41598-017-12624-9

Provided by University of California - Riverside