

Study finds high-fat diets impair immune, intestinal and brain health

January 3 2024, by Jules Bernstein



Credit: Pixabay/CC0 Public Domain

A UC Riverside study that could motivate your New Year's resolutions demonstrates that high-fat diets affect genes linked not only to obesity, colon cancer and irritable bowels, but also to the immune system, brain

function, and potentially COVID-19 risk.

While other studies have examined the effects of a high-fat diet, this one is unusual in its scope. UCR researchers fed mice three different diets over the course of 24 weeks where at least 40% of the calories came from fat. Then, they looked not only at the microbiome, but also at [genetic changes](#) in all four parts of the intestines.

One group of mice ate a diet based on saturated fat from coconut oil, another got a monounsaturated, modified [soybean oil](#), and a third got an unmodified [soybean](#) oil high in polyunsaturated fat. Compared to a low-fat control diet, all three groups experienced concerning changes in [gene expression](#), the process that turns genetic information into a functional product, such as a protein.

"Word on the street is that plant-based diets are better for you, and in many cases that's true. However, a diet high in fat, even from a plant, is one case where it's just not true," said Frances Sladek, a UCR cell biology professor and senior author of the new study.

A new *Scientific Reports* [paper](#) about the study documents the many impacts of high-fat diets. Some of the intestinal changes did not surprise the researchers, such as major changes in genes related to fat metabolism and the composition of gut bacteria. For example, they observed an increase in pathogenic E. coli and a suppression of Bacteroides, which helps protect the body against pathogens.

Other observations were more surprising, such as changes in genes regulating susceptibility to infectious diseases. "We saw pattern recognition genes, ones that recognize infectious bacteria, take a hit. We saw cytokine signaling genes take a hit, which help the body control inflammation," Sladek said.

"So, it's a double whammy. These diets impair [immune system](#) genes in the host, and they also create an environment in which harmful gut bacteria can thrive."

The team's [previous work](#) with soybean oil documents its link to obesity and diabetes, both major risk factors for COVID. This paper now shows that all three [high-fat diets](#) increase the expression of ACE2 and other host proteins that are used by COVID spike proteins to enter the body.

Additionally, the team observed that high-fat food increased signs of stem cells in the colon. "You'd think that would be a good thing, but actually they can be precursors to cancer," Sladek said.

In terms of effects on gene expression, [coconut oil](#) showed the greatest number of changes, followed by the unmodified soybean oil.

Differences between the two soybean oils suggest that polyunsaturated fatty acids in unmodified soybean oil, primarily linoleic acid, play a role in altering gene expression.

Negative changes to the microbiome in this study were more pronounced in mice fed the soybean oil diet. This was unsurprising, as the same research team previously documented other negative health effects of high soybean oil consumption.

In 2015, the team [found](#) that soybean oil induces obesity, diabetes, insulin resistance, and fatty liver in mice. In 2020, the researchers team demonstrated the oil could also affect genes in the brain related to conditions like autism, Alzheimer's disease, anxiety, and depression.

Interestingly, in their current work they also found the expression of several neurotransmitter [genes](#) were changed by the high fat diets, reinforcing the notion of a gut-brain axis that can be impacted by diet.

The researchers have noted that these findings only apply to soybean oil, and not to other soy products, tofu, or soybeans themselves. "There are some really good things about soybeans. But too much of that oil is just not good for you," said UCR microbiologist Poonamjot Deol, who was co-first author of the current study along with UCR postdoctoral researcher Jose Martinez-Lomeli.

Also, the studies were conducted using mice, and mouse studies do not always translate to the same results in humans. However, humans and mice share 97.5% of their working DNA. Therefore, the findings are concerning, as soybean oil is the most commonly consumed oil in the United States, and is increasingly being used in other countries, including Brazil, China, and India.

By some estimates, Americans tend to get nearly 40% of their calories from fat, which mirrors what the mice were fed in this study. "Some fat is necessary in the diet, perhaps 10 to 15%. Most people though, at least in this country, are getting at least three times the amount that they need," Deol said.

Readers should not panic about a single meal. It is the long-term high-fat habit that caused the observed changes. Recall that the mice were fed these diets for 24 weeks. "In human terms, that is like starting from childhood and continuing until middle age. One night of indulgence is not what these mice ate. It's more like a lifetime of the food," Deol said.

That said, the researchers hope the study will cause people to closely examine their eating habits.

"Some people think, 'Oh, I'll just exercise more and be okay.' But regularly eating this way could be impacting your immune system and how your brain functions," Deol said. "You may not be able to just exercise away these effects."

More information: Jose Martinez-Lomeli et al, Impact of various high fat diets on gene expression and the microbiome across the mouse intestines, *Scientific Reports* (2023). [DOI: 10.1038/s41598-023-49555-7](https://doi.org/10.1038/s41598-023-49555-7)

Provided by University of California - Riverside

Citation: Study finds high-fat diets impair immune, intestinal and brain health (2024, January 3) retrieved 18 June 2024 from <https://medicalxpress.com/news/2024-01-high-fat-diets-impair-immune.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.