Study finds that high fat diet changes gut microbe populations

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Have you ever wondered why eating one good-tasting French fry may lead you to eat the whole batch and leave you wanting more? According to a new study with rats, that high-fat indulgence literally changes the populations of bacteria residing inside the gut and also alters the signaling to the brain. The result? The brain no longer senses signals for fullness, which can cause overeating—a leading cause of obesity.

The findings from this study conducted by researchers at the University of Georgia, Washington State University and Binghamton University, are to be presented this week at the Annual Meeting of the Society for the Study of Ingestive Behavior, the society for research into all aspects of eating and drinking behavior.

"When we switch the rats to a high fat diet, it reorganizes brain circuits," explained Krzysztof Czaja, DVM, PhD, a principal investigator on the study who is an associate professor of neuroanatomy at the University of Georgia College of Veterinary Medicine. "The brain is changed by eating unbalanced foods. It induces inflammation in the brain regions responsible for feeding behavior. Those reorganized circuits and inflammation may alter satiety signaling."

So what happens to the microbiota in the intestines after a switch to a high fat diet? Dr. Czaja likens the phenomenon to how a sudden significant shift in temperature might impact the people who live in the affected area: Some people will be fine. Others will become ill.

"In the regular physiological state, many different strains of bacteria live in a balanced environment in the intestinal tract," said Dr. Czaja. "They don't overpopulate. There are little shifts, but in general this population is quite stable. When we start feeding the rats a different diet, there is an immediate effect. Suddenly, different nutrients are changing the microenvironment in the gut and some bacteria begin to overpopulate. Some sensitive bacteria begin to die and some populations may even vanish. So, introducing a significant change in the gut microenvironment triggers a cascade of events that leads to this population switch."

These changes can cause inflammation that damages the nerve cells that carry signals from the gut to the brain, resulting in gut-brain miscommunication. It is not yet known whether this change is permanent or reversible, but Dr. Czaja and his colleagues plan to address this question in the future.

When it comes to diet and how it impacts health, Dr. Czaja says we should "think systemically." "All of the components and receptors in our body are interconnected and should work in harmony. There is not a single receptor responsible for huge physiological outcomes."

Throughout most of history until just a few decades ago, our bodies were accustomed to whole foods derived from natural sources, rather than artificial and highly processed foods. The research provides new insight into how balance in the intestinal microbiota and gut-brain communication—which was well-adjusted over millennia - might be disturbed by the introduction of modified foods high in fat and sugar. Disrupting that balance leads to the confused brain and inappropriate satiety feedback that can result in obesity.

More information: Research: Diet-induced obesity is associated with a change in the intestinal microbiota, activation of microglia, and reorganization of the nucleus of the solitary tract

Provided by Society for the Study of Ingestive Behavior