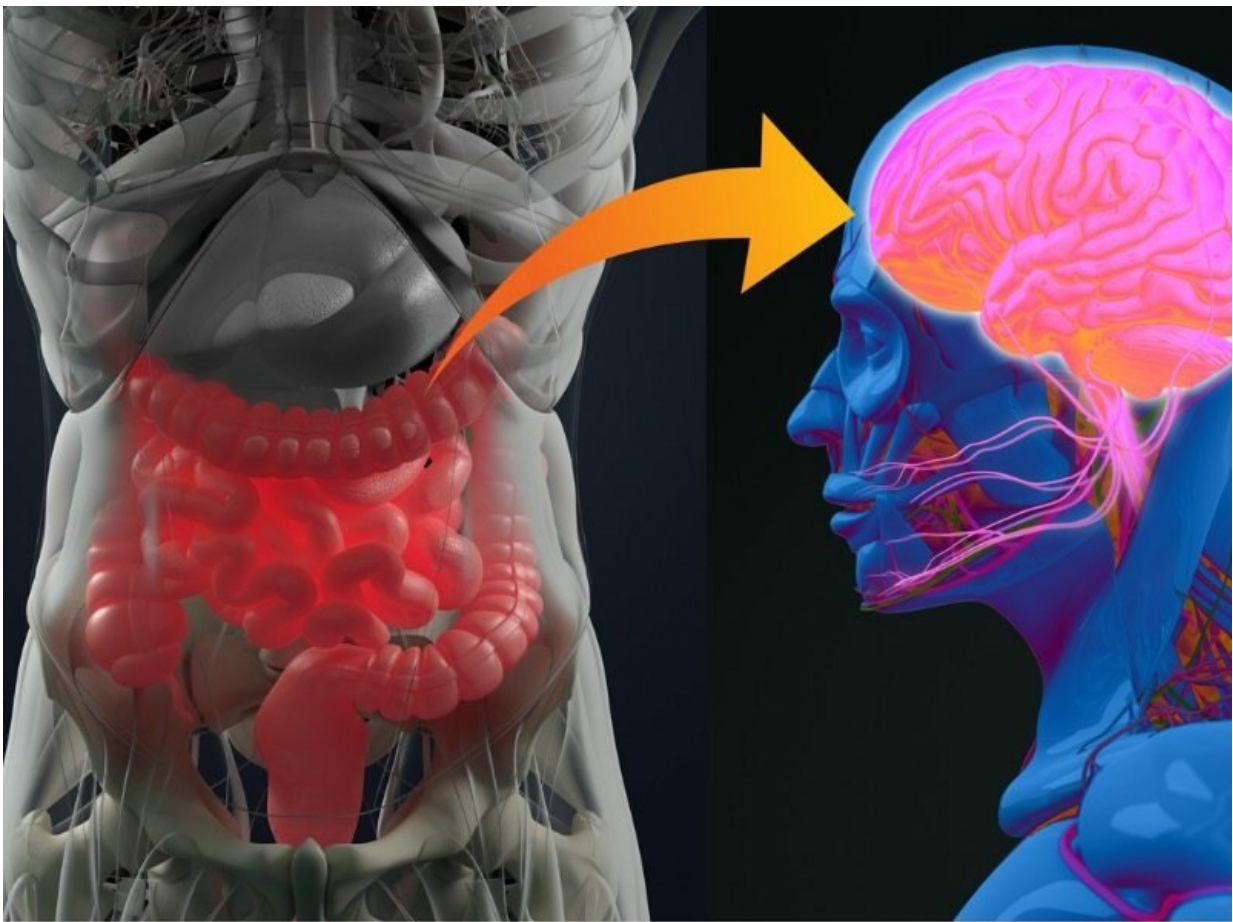


# Common food additives may promote anxiety-related behavior and reduce social behavior in mice, research shows

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Credit: Georgia State University

Food additives known as dietary emulsifiers, commonly found in processed foods to improve texture and extend shelf life, may adversely affect anxiety-related and social behaviors in mice, Georgia State researchers have found.

The scientists also observed sex differences in the mice's behavioral patterns, suggesting that emulsifiers affect the [brain](#) via distinct mechanisms in males and females.

The study, published in *Scientific Reports*, was led by Geert de Vries, professor of neuroscience and associate vice president for research at Georgia State, and Benoit Chassaing, assistant professor of neuroscience. Andrew T. Gewirtz, professor in the Institute for Biomedical Sciences, also contributed.

Previous research by Chassaing and Gewirtz has shown that emulsifiers can cause low-grade intestinal inflammation by altering the composition of gut microbiota, a diverse population of trillions of microorganisms that are vital to health. Their research has linked emulsifier consumption to obesity, metabolic syndrome and inflammatory bowel diseases such as colitis, conditions whose incidence has significantly increased since the mid-20th century.

In the same period there has also been an increased incidence of behavioral disorders such as autism, leading scientists to theorize that brain function may be affected by environmental exposure to modern chemical substances as well.

"We asked the question: Can emulsifiers' effects on general systemic inflammation also be extended to the brain and to [behavior](#)?" de Vries said. "The answer was yes."

The researchers added one of two commonly used emulsifiers,

polysorbate 80 and carboxymethylcellulose, to the drinking water of male and female mice. After 12 weeks, they observed that treatment with emulsifiers altered the gut microbiota of males and females in different ways. They then conducted tests to assess the effects of the emulsifiers on behavior. The researchers found that emulsifiers altered anxiety-like behavior in male mice and reduced [social behavior](#) in female mice.

Though de Vries says he cannot pinpoint the exact mechanism by which emulsifiers contribute to [behavioral changes](#), "we know that inflammation triggers local immune cells to produce signaling molecules that can affect tissues in other places, including the brain," he said. "The gut also contains branches of the vagus nerve, which forms a direct information pathway to the brain."

"We are currently investigating the mechanisms by which dietary emulsifiers are impacting the intestinal microbiota as well as the human relevance of those findings," Chassaing said.

As to what's driving the differences between male and female behavior, de Vries said there may be several factors. For example, there are known sex differences in the immune system, which help govern the composition of bacteria in the gut, and in the way the digestive system processes food.

As a result, "adding [emulsifiers](#) to the diet will have different consequences for the microbiota of males and females," he said. "Our data suggest that these sex-specific changes to the [microbiota](#) could contribute to the [sex differences](#) in behavior."

The researchers say the study adds to evidence that food additives should be evaluated for their effect on the [microbiome](#), which is tied up in many aspects of human health. De Vries said the results also confirm

that gut health and brain health are intertwined, and that there may be common mechanisms driving the parallel epidemics of obesity, inflammatory gut conditions and behavioral disorders.

**More information:** Mary K. Holder et al. Dietary emulsifiers consumption alters anxiety-like and social-related behaviors in mice in a sex-dependent manner, *Scientific Reports* (2019). [DOI: 10.1038/s41598-018-36890-3](https://doi.org/10.1038/s41598-018-36890-3)

Provided by Georgia State University

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