Lab research finds gluten causes brain inflammation in mice

August 8 2023

Credit: CC0 Public Domain

In what is believed to be a world first discovery, University of Otago researchers have found that wheat gluten causes brain inflammation in mice.

The research, led by Associate Professor Alex Tups, and published in the *Journal of Neuroendocrinology*, may be of importance for human physiology.

"Mice are an excellent model to study human physiology. They have a very similar circulatory, reproductive, digestive, hormonal and nervous system. "So, it is quite possible that the same inflammation we found in mice could happen in humans."

The study investigated whether a standard diet, referred to as low fat diet (LFD), enriched with 4.5% gluten (matching human average daily consumption), or a high fat diet (HFD), enriched with 4.5% gluten, alters body weight, metabolic markers or central inflammation in male mice.

"Gluten, which is found in cereals such as wheat, rye and barley, makes up a major dietary component in most western nations.

"While previous studies have shown gluten promotes body mass gain and inflammation in mice in the enteric nervous system and gastrointestinal tract, we investigated the impact of gluten on the brain."

While somewhat expectedly, the study confirmed a "moderate obesogenic effect of gluten when fed to mice exposed to a high fat diet, for the first time we can report gluten-induced hypothalamic (brain) inflammation," Associate Professor Tups says.

"The brain has two types of immune cells similar to macrophages in the blood. These are called astrocytes and microglia. We found that gluten as well as HFD increases the number of those immune cells. The effect of gluten added to normal diet increased the cell number to the same extent as if mice were fed an HFD. When gluten was added to the HFD, the cell number went up even further."

The hypothalamic region of the brain is vital for coordinating basic metabolic functions like body weight regulation and blood sugar regulation.

"If gluten led to hypothalamic inflammation in humans and therefore brain damage, it can be bad in the long run, such as increase in body weight and impaired blood sugar regulation. If these effects became persistent they might exacerbate the risk of e.g. impaired memory function which is linked to disturbed blood sugar regulation.

Why this is happening is not known, he says.

"This is entirely new and so we don't know yet why it is the case.

"It could be that digestion resistant components of wheat of gluten can lead to an immune response as seen in celiac patients that then manifests in the brain. These are early days and we need future studies to confirm whether this has implications for celiac or gluten sensitive people."

However, Associate Professor Tups says the finding does not mean people should suddenly stop eating gluten.

"We are not saying that gluten is bad for everyone. For gluten tolerant people to go entirely gluten free may have health implications that may outweigh potential benefits. Often people don't consume wholefoods and highly processed gluten free products are often low in fiber and high in sugar.

"We are saying that future studies need to reveal whether our findings in mice are translatable to humans and whether gluten-induced astro- and microgliosis may also develop in gluten sensitive individuals."

More information: Mohammed Z. Rizwan et al, Dietary wheat gluten

induces astro- and microgliosis in the hypothalamus of male mice, *Journal of Neuroendocrinology* (2023). DOI: 10.1111/jne.13326