Gut Microbiome Tied to Chemo-Related Cognitive Problems

Chemotherapy can greatly alter the gut microbiome and affect levels of inflammatory molecules.

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In women with breast cancer, changes in the gut microbiome were linked to cognitive impairment during chemotherapy, independent of inflammation, according to study findings published in Brain, Behavior, and Immunity. This suggests that microbiome-focused strategies could help predict and prevent chemotherapy-related cognitive side effects.

“We found that patients treated with chemotherapy who showed decreases in cognitive performance also had reductions in the diversity of their gut microbiome,” Leah Pyter, PhD, a researcher at the Ohio State University Wexner Medical Center and College of Medicine, said in a press release. “The potential connection between the gut and the brain would allow us to create treatments for the gut to treat the brain.”

Chemotherapy is known to cause cognitive impairment, sometimes known as “brain fog,” among other behavioral side effects. Gut health has been found to influence cognitive function via the gut-brain axis, through which the microbiome communicates with the brain to affect cognition and behavior. Pyter’s team set out to determine whether disruption of the gut microbiome—the ecosystem of bacteria and other microorganisms that live in the intestines—influences cognition.

The Intelligut Study included 77 women treated at the Ohio State University Stefanie Spielman Comprehensive Breast Center. The average age was 50 years, and nearly 90% were white. All participants were receiving chemotherapy for breast cancer. They provided blood and stool samples before, during and after chemo and completed cognitive tests and dietary assessments.

In earlier work, Pyter’s team found that chemotherapy-driven changes to gut microbiota led to cognitive and behavioral changes in mice. In this observational study, they noted similar links in humans.

The researchers observed that chemotherapy affected the diversity and abundance of different microbes in the gut. What’s more, these changes were linked to higher levels of inflammatory cytokines in the blood, namely TNF-alpha and IL-6.

Participants reported subjective cognitive impairment during chemotherapy, but this was not

related to changes in the gut microbiome or inflammatory biomarkers. In contrast, a decline in objectively measured cognitive performance was linked to reduced microbial diversity, independent of inflammatory cytokine levels.

Based on four objective tests, 35% of participants exhibited measurable cognitive decline during chemotherapy. The gut microbiome changed dramatically over the course of treatment in women who experienced cognitive decline compared to those without cognitive impairment.

“These results suggest that microbiome-related strategies may be useful for predicting and preventing behavioral side effects of chemotherapy,” the study authors concluded.

“We believe that gut microbiome-focused interventions, such as fecal microbial transplantation, may improve behavioral side effects of chemotherapy,” Pyter said.

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