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Low Gut Microbiota Levels Affect the Development of Depression and Anxiety

Lactobacillus Levels Connect to Improvements in Mental Health

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Illustrated by Emma Larson



Depression affects about 7 percent of the population, and several hypotheses have been proposed to explain what may cause it. Depression has been directly connected to genetic polymorphisms, monoamine deficiency, stress response dysregulation, neuronal plasticity deficits, and inflammation, but none of those can account for all cases of depression. In order to further explore the possible link between gut microbiota and depression, one research team decided to see if people living in a “shared environment,” or having a shared microbiota composition, also had similar vulnerability to developing depression and other mental illnesses. The team discovered a new factor that might be involved in the development of health problems and how those issues could improve or worsen with certain types of medicines.

The gut microbiome is known to affect many aspects of health, but its connection to mental health has never been established empirically. In 2017, Marin and colleagues invented a system to model how gut bacteria in mice play a role in causing anxiety and depression-like behaviors. The team discovered that a lower presence of two different types of bacteria influences the development of certain behaviors. More specifically, *Lactobacillus* levels in mice influence the behavioral abnormalities and despair behavior that the mice demonstrate. However, when the level of *Lactobacillus* was restored, the mice’s metabolic alterations and behavioral abnormalities showed significant improvement.

Marin and others combined behavioral, molecular, and computational techniques to test the role of the microbiota in

The mice displaying despair behavior had an altered microbiota composition, specifically carrying less *Lactobacillus* in the gut.

mediating despair behavior. The mice displaying despair behavior had an altered microbiota composition, specifically carrying less *Lactobacillus* in the gut. Scientists also found an increase in circulating kynurenine, a metabolite that is often measured as higher in patients with depression, in the stressed mice relative to the control group. They then identified a *Lactobacillus*-derived, reactive oxygen species

that may suppress host kynurenine metabolism by inhibiting the IDO1-enzyme expression in the intestine. Results showed that the administration of *Lactobacillus* to stressed mice led to improved metabolic homeostasis and stopped the demonstrated despair behavior. The gut-microbiome environment is likely to play an important role in the development of depression and anxiety for some species, even though they have varied microbiota environments.

The research on the gut microbiome did not stop in 2017. A study published in 2019 highlighted an unusual increase in the stress hormone corticosterone in young mice with normal gut microbiomes that had previously been subjected to early-in-life stressors. The results of this study indicated that the bacteria in the environment are contributing to behaviors associated with anxiety and depression. However, both of the studies involved only mice; researchers did not perform any further tests to compare the microbiota levels in people who suffer from depression and anxiety versus those who do not. Therefore, much more work has to be done before we can draw the parallel conclusion between depression development in mice and in humans.

The 2017 research team’s data provides a mechanistic scenario of how a microbiota player (specifically *Lactobacillus* in their research) may contribute to regulating metabolism and resilience during stress. These results inspired a new and more effective pharmacology approach for people struggling with depression and anxiety. Instead of relying on drugs that may be too strong, may not work for everyone, or could have negative side effects on the patient, a new method focusing on patient’s gut microbiota composition could be more beneficial and less costly. Most Americans believe that prescription drug prices are unreasonable and can contribute to a lot of financial stress on families. It would be a relief for patients who struggle to afford their medicine to have another option which is likely much more affordable and could target one’s diet rather than manipulating the process of signal transduction in the central nervous system. Given that a lot of frequently prescribed drugs are still mysterious to medical professionals, it might be wise for patients suffering from depression to consider other treatment options, once they become available. The research done in 2017 and 2019 not only laid the foundation for scientists to further explore the connection between gut microbiota and depression but potentially opened up a whole new branch of medicine. ● ● ●