Intestinal bacteria produce neurotransmitter, could play role in inflammation

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Researchers at Baylor College of Medicine and Texas Children's Hospital have identified commensal bacteria in the human intestine that produce a neurotransmitter that may play a role in preventing or treating inflammatory bowel diseases such as Crohn's disease.

"We identified, to our knowledge, the first bifidobacterial strain, Bifidobacterium dentium, that is capable of secreting large amounts of gamma-aminobutyric acid (GABA). This molecule is a major inhibitory neurotransmitter in the central and enteric nervous systems," says Karina Pokusaeva, a researcher on the study and a member of the laboratory of James Versalovic.

GABA is one of the chief inhibitory neurotransmitters in the human central nervous system. It plays a role in regulating pain and some pain relieving drugs currently on the market act by targeting GABA receptors on neural cells.

Pokusaeva and her colleagues were interested in understanding the role the human microbiome might play in pain and scanned the genomes of potentially beneficial intestinal microorganisms, identified by the Human Microbiome Project, for evidence of a gene that would allow them to create GABA.

"Lab analysis of metagenomic DNA sequencing data allowed us to demonstrate that microbial glutamate decarboxylase encoding gene is very abundant in intestinal microbiota as compared to other body sites," says Pokusaeva. One of the most prolific producers of GABA was B. dentium, which appears to secrete the compound to help it survive the acid environment.

In addition to its pain modulating properties, GABA may also be capable of inhibiting inflammation. Recent studies have shown that immune cells called macrophages also possess GABA receptors. When these receptors were activated on the macrophages there was a decrease in the production of compounds responsible for inflammation.

"Our lab was curious to explore if GABA produced by intestinal human isolate B. dentium could have an effect on GABA receptors present in immune cells," says Pokusaeva. Together with their collaborators Dr. Yamada and Dr. Lacorazza they found that when the cells were exposed to secretions from the bacteria, they exhibited increased expression of the GABAA receptor in the immune cells.

While the findings are preliminary, they suggest the possibility that B. dentium and the compounds it secretes could play a role in reducing inflammation associated with inflammatory bowel diseases.

The next step, says Pokusaeva is to conduct in vitro experiments to determine if the increased GABAA expression correlates with a decrease in production of cytokines associated with inflammation. GABAA receptor signaling may also contribute to pain signaling in the gut and may somehow be involved in abdominal pain disorders.

"Our preliminary findings suggest that Bifidobacterium dentium could potentially have an inhibitory role in inflammation; however more research has to be performed to further prove our hypothesis," says Pokusaeva.

More information: This research was presented as part of the 2012 General Meeting of the American Society for Microbiology held June 16-19, 2012 in San Francisco, California.

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