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Species of gut bacteria linked to enhanced cognition and language skills in infant boys

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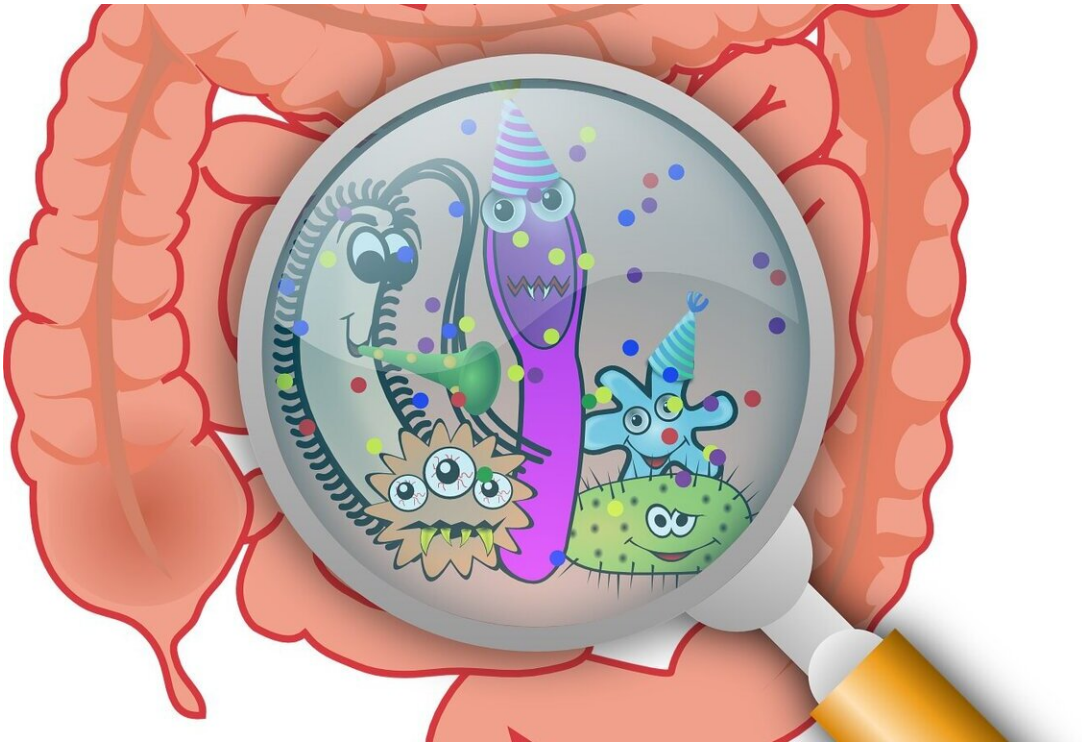

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A University of Alberta-led research study followed more than 400 infants from the CHILD Cohort Study (CHILD) at its Edmonton site. Boys at one year of age with a gut bacterial composition that was high in the bacteria Bacteroidetes were found to have more advanced cognition and language skills one year later. The finding was specific to male

children.

"It's well known that female children score higher (at early ages), especially in cognition and language," said Anita Kozyrskyj, a professor of pediatrics at the U of A and principal investigator of the SyMBIOTA (Synergy in Microbiota) laboratory. "But when it comes to gut microbial composition, it was the male infants where we saw this obvious connection between the Bacteroidetes and the improved scores."

"The differences between male and female gut microbiota are very subtle, but we do know from CHILD Cohort Study data that girls at early ages are more likely to have more of these Bacteroidetes. So perhaps most girls have a sufficient number of Bacteroidetes and that's why they have improved scores over boys," added Kozyrskyj.

The researchers, led by Kozyrskyj and associate professor of pediatrics Piush Mandhane, studied bacteria found in fecal samples from the infants and identified three different groups exhibiting similar dominant clusters of bacteria. They then evaluated the infants on a variety of neural developmental scales. Of those groups, only the male infants with Bacteroidetes-dominant bacteria showed signs of enhanced neurodevelopment.

The research replicates similar findings from a U.S. study that also showed an association between Bacteroidetes and neural development.

According to Kozyrskyj, Bacteroidetes are one of a very few bacteria that produce metabolites called sphingolipids, which are instrumental for the formation and structure of neurons in the brain.

"It makes sense that if you have more of these microbes and they produce more sphingolipids, then you should see some improvement in terms of the formation of neuron connections in our brain and improved

scores in cognition and language," she said.

According to Kozyrskyj, cesarean birth is one factor that can significantly deplete Bacteroidetes. Factors that positively influence gut microbiota composition in infants include breastfeeding, having a high-fiber diet, living with a dog and being exposed to nature and green spaces.

While the findings don't necessarily mean children with a lower proportion of Bacteroidetes will remain behind their peers in later childhood or adulthood, the researchers believe the study offers early promise as a way to potentially identify children at risk of neurodevelopmental disorders.

The team will continue to follow the infants participating in CHILD to determine whether the findings can be predictive of autism or attention deficit/hyperactivity disorder. Moving forward, the researchers are also examining several other factors that may have an impact on neurodevelopment in infants, including stress and gut colonization by the bacterium Clostridium difficile.

"Over the first one to two years of life, your brain is very malleable," said Kozyrskyj. "Now we're seeing a connection between its malleability and gut microbiota, and I think that is very important."

The study, "Bacteroides-dominant gut microbiome of late infancy is associated with enhanced neurodevelopment," was published in the journal *Gut Microbes*.

More information: Sukhpreet K. Tamana et al, Bacteroides-dominant gut microbiome of late infancy is associated with enhanced neurodevelopment, *Gut Microbes* (2021). DOI: 10.1080/19490976.2021.1930875

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