Study: Right gut bacteria may protect against malnutrition

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This photo provided by Washington University School of Medicine shows researchers measuring children's growth in Malawi. Researchers transferred gut bacteria from children into mice for tests that showed the right kind of bugs may protect against malnutrition by helping to get the most out of a poor diet. (Washington University School of Medicine/Kim Hedge via AP)

Manipulating what kinds of bacteria live in the gut might lead to a new way to treat millions of children suffering chronic malnutrition, says new

research that suggests the right microbes can help get the most out of a poor diet.

Researchers culled intestinal bacteria from babies and toddlers in Malawi, where malnutrition is a serious problem, and transferred them into mice for study. Tweaking those gut microbes improved growth—even though the animals didn't eat more, or more nutritiously.

We share our bodies with trillions of bacteria, a customized set called a microbiome that starts building at birth, and Thursday's work is the latest to illustrate how crucial it is to develop a healthy one. Among the findings: Certain nutrients in breast milk may help that happen.

"If we could hammer home a key point, microbiota count," said Dr. Jeffrey Gordon of Washington University in St. Louis, who led the series of experiments published in the journals *Science* and *Cell*. "Building healthy gut microbiota we think is important for health in the course of one's life."

Gut bacteria do more than simply break down food for digestion. They synthesize particular vitamins and micronutrients, and influence immune responses, for example.

"A healthy microbiome will allow us to access calories we might not have been able to use before," explained Dr. Ilseung Cho, a gastroenterologist and gut bacteria specialist at New York University School of Medicine, who wasn't involved in the new work.

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More research is needed before testing the approach in children, but Cho said the findings suggest there may be "very precise bacteria or very precise nutrient interventions that can unlock the microbiome and help it combat malnutrition."

While providing special "therapeutic foods" and vitamin supplements helps reduce deaths from malnutrition, Gordon said children still experience stunted growth and neurodevelopmental problems. His team turned to Malawi, where according to UNICEF almost half of children

under 5 have growth stunted by malnutrition. The researchers already suspected gut bacteria played a role, based on previous research with pairs of Malawian twins, only some of whom were affected.

This time, working with more than 250 healthy or undernourished children, Gordon's team defined how a healthy gut microbiome normally develops—and found that the chronically malnourished tots harbored an immature one, too young for their age.

Are those abnormal gut bacteria a result of the kids' malnutrition, or could they actually be contributing to it? To tell, the researchers transferred gut bacteria from either healthy or malnourished tots into different sets of germ-free baby mice, rodents born in sterile conditions so they lacked their own intestinal microbes. They received a mouse version of the typical Malawian diet, primarily corn flour with beans, peanuts and certain vegetables.

Despite eating the same calories, mice with the healthy gut bacteria gained more lean body mass, and showed healthier bone development and better metabolism in the liver, brain and muscles, the team reported in Science.

"The growth of these animals is markedly different," Gordon said.

Can the unhealthy gut bacteria be repaired? The researchers switched up the cages so some healthy mice could live with some unhealthy ones and, through that yucky rodent trait of eating feces, trade their gut bacteria. Sure enough, some microbes the team had identified as particularly healthy invaded the intestines of the undernourished mice—and prevented their growth impairment. Two bugs with tongue-twisting names—Ruminococcus gnavus and Clostridium symbiosum—seemed key.

In the U.S., doctors sometimes perform fecal transplants to alter the gut bacteria of patients suffering certain intestinal diseases. When it comes to malnutrition, the goal would be to build healthy gut bacteria from the start.

So the researchers next looked at babies' first food—breast milk—and found certain nutrients may play a role in how their microbiome develops.

Breast milk from the mothers of the healthy Malawian babies harbors higher levels of sugars containing sialic acid, a nutrient linked to brain development, the team reported in *Cell*.

Using a version of those sugars made from cow's milk, the researchers once again put gut bacteria from malnourished children into mice and supplemented some of the rodents' diets with the sugars. Sure enough, the supplemented mice grew better. Repeating the experiment with piglets showed the same benefit.

It's not extra calories, Gordon stressed. Different strains of bacteria were interacting at different stages of the sugars' digestion, pointing to what he calls a complex food web in the gut.

What We Know: Gut bacteria's role in malnutrition

New research suggests that manipulating the kinds of bacteria that live in the gut might lead to a new way to treat millions of children suffering from chronic malnutrition. Key takeaways from the studies published in *Science* and *Cell*.

—What they did: Researchers culled intestinal bacteria from babies and toddlers in Malawi, where malnutrition is a serious problem, and transferred them into mice for study.

—The findings: Healthy microbes can help get the most out of a poor diet. Animals with the better kind grew better, even though they didn't eat more, or more nutritiously.

—Why gut bacteria: Gut bacteria do more than simply break down food for digestion. They synthesize particular vitamins and micronutrients, and influence immune responses, for example.

—How do you alter gut bacteria: In the U.S., doctors sometimes perform fecal transplants to alter the gut bacteria of patients suffering certain intestinal diseases. When it comes to malnutrition, the goal would be to build healthy gut bacteria from the start. Researchers are exploring nutrients in breast milk.

—What's next: More research is needed before the approach can be tested in children.

More information: *Science*, dx.doi.org/10.1126/science.aad3311