Researchers connect lower antibiotic resistance with higher levels of bifidobacteria in infant gut

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A study published this week in *mSphere* suggests that infants, who are vulnerable to an array of infectious diseases, may have a microbial ally

in keeping antibiotic-resistant infections at bay. Researchers found that children with higher gut levels of *Bifidobacterium*, a common commensal, had reduced abundance and lower frequency of the genes associated with antimicrobial resistance (AMR).

The study is the first to analyze the relationship between *Bifidobacterium* and AMR. The findings suggest that colonization by the microbe can help guard the infant intestine by producing acids and preventing colonization by other, potentially AMR-related bacteria, says microbiologist and study leader Diana Taft at the University of California, Davis.

Every year, AMR contributes to the deaths of more than 23,000 people and the illnesses of 2 million in the United States. AMR looms as a public health crisis, and the genes responsible for AMR can appear early in life.

"It's the gatekeeper," says Taft, of *Bifidobacterium*.

Nursing promotes the growth of the microbes, which thrive on carbohydrates like the oligosaccharides in breast milk. While a child is breastfeeding, some species can dominate the infant intestine.

"*Bifidobacterium* can be very dominant as long as an infant is breastfed, and then bacterial levels drop off during weaning," says Taft.

Previous studies have found that children in middle- and lower-income countries, where children often nurse for two years or more, have higher levels of *Bifidobacterium* than children in developed countries like Finland or Sweden, where children often stop nursing by one year of age.

Taft and her collaborators use metagenomic sequencing to analyze 31

stool samples collected at a few weeks of age from infants in Bangladesh, as well as 15 samples from the same population collected when the infants were two years old. In the early-life group, the researchers found fewer genes associated with AMR in samples with higher levels of *Bifidobacterium* (more than 65 percent relative abundance) than they did in samples with lower levels (less than 20 percent relative abundance).

They also reported that by age two—when most children have weaned—levels of AMR were about the same, regardless of *Bifidobacterium* level.

"As soon as you drop the bifidobacteria away with weaning, other bugs sort of take up that space, but they're not necessarily the ones high in AMR," says microbiologist David Mills, also at the University of California, Davis, and senior author on the paper. Taft is a postdoctoral researcher in Mills' lab.

Mills notes that many children are treated with antibiotics like penicillin in the first year or two of life, but that those treatments may at the same time increase their AMR. The new findings suggest that maintaining high levels of bifidobacteria, either naturally or via probiotic supplementation, may help reduce levels of AMR-related genes.

"They're gaining protection in this early life window," says Taft.

The current study adds to a growing body of evidence suggesting that the early-life microbiome can play an important role a person's health for their entire life, Mills says. "We're in this situation right now where we know they're linked, but we don't fully understand what a healthy adult microbiome looks like," he says.