Hundreds of antibiotic resistant genes found in the gastrointestinal tracts of Danish infants

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Danish one-year-olds carry several hundred antibiotic resistant genes in their bacterial gut flora according to a new study from the University of Copenhagen. The presence of these genes is partly attributable to antibiotic use among mothers during pregnancy.

An estimated 700,000 people die every year from antibiotic resistant bacterial infections and diseases. The WHO expects this figure to multiply greatly in coming decades. To study how antibiotic resistance occurs in humans' natural bacterial flora, researchers from the University of Copenhagen's Department of Biology analyzed stool samples from 662 Danish one-year-old children.

Within the samples, the researchers discovered 409 different genes, providing bacteria with resistance to 34 types of antibiotics. Furthermore, 167 of the 409 genes found are resistant to multiple types of antibiotics, including those classified as 'critically important' by the WHO for being able to treat serious diseases in the future.

"It's a wake-up call that one-year-old children are already carrying gut bacteria that are resistant to very important types of antibiotics. New resistant bacteria are becoming more widespread due to increased antibiotic consumption. The horror scenario is that we will one day lack the antibiotics needed to treat life-threatening bacterial infections such as pneumonia or foodborne illnesses," explains Department of Biology professor Søren Sørensen, who led the study.

Antibiotic use during pregnancy is an important factor

The important factor for whether an infant had more antibiotic-resistant genes in bacteria in the gut was if the child's mother had been administered antibiotics during late pregnancy or if the year-old infant

had received antibiotics in the months prior to the collection of their stool samples.

"We found a very strong correlation between a mother's antibiotic treatment during late pregnancy and of infants and gut bacteria with many resistant genes, although it appears that other influences come into play as well," says Xuan Ji Li of the Department of Biology, the study's lead author.

At the same time, the researchers found a link between how well-developed the gut flora of children were and the concentration of resistant bacteria. Well-developed gut flora equated with a lesser incidence of resistant bacteria. Previous studies from the same group of children demonstrated that the development of gut flora is linked to asthma risk later in life.

E. coli collect resistant genes

Escherichia coli (*E. coli*) is common in the intestine and can lead to intestinal infections. But in this study, the researchers also learned that *E. coli* appears to act as a main collector and a potential spreader of antibiotic-resistant genes to other gut bacteria.

The researchers also found *E. coli* in infants with high concentrations of resistance genes in their intestinal tracts.

"The new findings have expanded our understanding of antibiotic resistance by showing us which bacteria act as collectors and potential spreaders of resistance genes. While we know that resistance is transferred among bacteria, we also now know that *E. coli* is one of the ones we need to keep a particularly close eye on," says Xuan Ji Li of the Department of Biology. Søren Sørensen adds:

"The new knowledge brought about by this study may prove useful in the effort to better manage antibiotic treatments among pregnant women and serve as a basis for more targeted methods of eliminating the types of bacteria which collect resistance genes."

More information: Xuanji Li et al, The infant gut resistome associates with E. coli, environmental exposures, gut microbiome maturity, and asthma-associated bacterial composition, *Cell Host & Microbe* (2021). DOI: 10.1016/j.chom.2021.03.017

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