# Can mode of delivery or antibiotics in childhood increase chronic illnesses?

## Repeated courses of antibiotics in early childhood reduce the biodiversity of the gut microbiota, influencing the maturation of the immune system. A Finnish study has now established that the delivery route is the first factor to have an impact on the development of the child's intestinal microbiome.

Research has shown that repeated courses of antibiotics in early childhood reduce the biodiversity of the gut microbiota. Antibiotics deplete both individual species of bacteria and the entire microbiome, which in turn impacts on the development of the immune system.

A University of Helsinki study, conducted by a group led by Professor **Mikael Knip,** has proven that the mode of delivery is the first factor influencing the development of a child's gut microbiota. The microbiome of the intestinal system is powerfully shaped by the first months of life, and reaches a more permanent composition by the age of three years.

The gut microbiota of children born through C-section is not as diverse as that of children born vaginally. In this study, all children born via C-section as well as 20% of children born vaginally still had fewer bacteria of the *Bacteroides* genus at the age of 5 to 12 months. The diversity of these children's gut microbiota remained lower than that of their peers in long-term monitoring. In addition, children who received multiple courses of antibiotics had more antibiotic-resistant bacterial strains.

"Based on our study, it seems that the intestinal system can recover from one course of antibiotics in a few weeks, but recurring antibiotic treatment leads to microbial perturbations and recovery takes longer. The situation can be compared to a forest fire in that the antibiotics destroy most of the bacteria. Some species die out while others survive in the folds of the mucous membrane, returning to multiply. The academic community is currently studying this phenomenon where each generation seems to lose important intestinal bacteria due to antibiotics," explains doctoral student **Tommi Vatanen** from the Department of Computer Science, Aalto University, and the Broad Institute in the United States.

The gut microbiota plays a significant role in the early immune education in children. A healthy, diverse and stable microbiota has been found to support health: it promotes the absorption of nutrients, guides metabolism and protects from infection.

The DIABIMMUNE study coordinated by the University of Helsinki followed 39 Finnish children from birth until the age of three. Half of these children were exposed to several courses of antibiotics, some as many as 15, while no antibiotics were administered to the other half. Monthly stool samples were collected from the children between the ages of 2 and 36 months, and microbe analyses were conducted in collaboration with the research group led by **Ramnik Xavier** at the Broad Institute.

Professor Knip points out that treatments which affect the gut microbiota in early childhood, such as antibiotics, can make the child susceptible to chronic illnesses that appear later in life, such as asthma, inflammatory bowel diseases, diabetes and obesity. "Antibiotic drugs should definitely be used only in infections that require such treatment," Knip emphasises.

In addition to researchers from the University of Helsinki and the Broad Institute, the study involved researchers from the Hospital District of Helsinki and Uusimaa as well as Aalto University. The primary

funders for the study were the EU (7th Framework Programme), the Academy of Finland and the Juvenile Diabetes Research Foundation. The research results have been published in the internationally esteemed *Science Translational Medicine* publication series.

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*Reference: Moran Yassour, Tommi Vatanen, Heli Siljander, Anu-Maaria Hämäläinen, Taina Härkönen, Samppa J Ryhänen, Eric A. Franzosa, Hera Vlamakis, Curtis Huttenhower, Dirk Gevers, Eric S. Lander, Mikael Knip on behalf of the DIABIMMUNE Study Group and Ramnik J Xavier. Natural history of the infant gut microbiome and impact of antibiotic treatments on bacterial strain diversity and stability. Science Translational Medicine 2016; Vol 8, Issue 343, 15 June, 2016. http://stm.sciencemag.org/content/8/343/343ra81*