

# Infant gut microbiota influenced by caesarean section and breastfeeding practices

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Method of birth (vaginal birth s. cesarean delivery) and feeding practices (breastfeeding v. formula-feeding) influence the development of gut bacteria in newborns and thus may affect lifelong health, according to a new study in *CMAJ* (*Canadian Medical Association Journal*).

Bacteria in the gut play an important role in health, helping digest food, stimulating the development of the immune system, regulating bowels and protecting against infection. Disruption of the gut [microbiota](#) has been linked to a range of diseases, such as [inflammatory bowel disease](#), allergies, asthma, cancer and others.

"Our study addresses an important [knowledge gap](#), since the infant gut microbiota has rarely been characterized with sequencing methods that provide sufficient coverage of the entire bacterial community," writes Dr. Anita Kozyrskyj, University of Alberta, with coauthors. "Our findings are particularly timely given the recent affirmation of the gut microbiota as a "super organ" with diverse roles in health and disease, and the increasing concern over rising cesarean delivery and insufficient exclusive breastfeeding in Canada."

As little is known about the development of this gut microbiota, a team of Canadian researchers sought to understand how the gut microbiome is established during early life, and what factors might disrupt this process. They looked at data on 24 healthy infants as part of the larger Canadian Healthy Infant Longitudinal Development (CHILD) study. CHILD involves more than 10 000 people, including 3 500 infants in 4 provinces

(British Columbia, Alberta, Manitoba and Ontario) born after 2010 as well as their parents. The sample was representative of the Canadian newborn population, with 25% born by cesarean delivery, and 42% breastfed exclusively at 4 months of age.

New DNA sequencing technology was used by the research team to better understand the infant gut microbiome. Previous studies of this type have been conducted on laboratory cultures, although they were limited, as about 80% of intestinal microbes cannot be grown in culture. The DNA-based methods used in this study allow detection of virtually all bacteria since laboratory culture is not required.

The researchers found that infants born by cesarean delivery were lacking a specific group of bacteria found in infants delivered vaginally, even if they were breastfed. Infants strictly formula-fed, compared with babies that were exclusively or partially [breastfed](#), also had significant differences in their [gut bacteria](#).

"We want parents (and physicians) to realize that their decisions regarding c-section and breastfeeding can impact their infant's gut microbiome, and this can have potentially lifelong effects on the child's health," says postdoctoral student and first author Meghan Azad, University of Alberta.

"The potential long-term consequences of decisions regarding mode of delivery and infant diet are not to be underestimated," write the authors. "Infants born by cesarean delivery are at increased risk of asthma, obesity and type 1 diabetes, whereas breastfeeding is variably protective against these and other disorders."

Beginning before birth, CHILDB collects a range of information on environmental exposures such as pets, air pollution, household cleaning products, maternal and infant diet and more, and child health outcomes

(including biological samples and clinical assessments). The researchers will use this information to study the development of the gut microbiome and its relationship to conditions such as wheeze and allergies in future studies.

"Children born by cesarean delivery or fed with formula may be at increased risk of a variety of conditions later in life; both processes alter the [gut](#) microbiota in healthy infants, which could be the mechanism for the increased risk," writes Dr. Rob Knight, a Howard Hughes Medical Institute Early Career Scientist and an Associate Professor with the BioFrontiers Institute and Departments of Chemistry and Biochemistry and Computer Science, University of Colorado, Boulder, Colorado, United States, in a related commentary.

"These issues are of direct relevance to pregnant women and health practitioners and should be considered when choices such as elective cesarean delivery and other interventions are discussed," state the commentary authors.

**More information:** [www.cmaj.ca/lookup/doi/10.1503/cmaj.121189](http://www.cmaj.ca/lookup/doi/10.1503/cmaj.121189) , [www.cmaj.ca/lookup/doi/10.1503/cmaj.130147](http://www.cmaj.ca/lookup/doi/10.1503/cmaj.130147)

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