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# Cesarean Birth Linked to Differences in Gut Microbiome

Larry Hand | February 11, 2013

Cesarean delivery, combined with a lack of breast-feeding in infants, may negatively influence gut bacteria development in newborns, possibly exposing them to multiple health risks later in life, according to a study published online February 11 in the *Canadian Medical Association Journal*.

Meghan B. Azad, PhD, from the Department of Pediatrics, University of Alberta, Edmonton, Canada, and colleagues analyzed the records of 24 healthy infants born at term (37 - 41 weeks' gestation) whose mothers enrolled in the Canadian Healthy Infant Longitudinal Development (CHILD) study between November 2008 and August 2009. The investigators selected the first 24 infants for whom fecal samples were available.

Using high-throughput gene sequencing, the researchers analyzed bacterial DNA extracted from the stool samples collected at age 3 to 4 months. They conducted variance analyses to measure the Chao1 score, which estimates the number of species, and the Shannon diversity index, which measures the number of species and evenness of distribution. Further analysis measured the differences in abundance of bacterial taxa using Metastats, a program specific to microbial community comparisons.

Of the 24 infants (12 boys and 12 girls), 6 (25%) were cesarean born, 10 (42%) were exclusively breast-fed, 5 (21%) were partially breast-fed and partially formula fed, and 9 (38%) were formula fed.

The researchers found that cesarean-born infants had significantly lower abundances of *Escherichia-Shigella* ($P < .001$) and an absence of *Bacteroides* ($P = .02$) compared with infants delivered vaginally.

Moreover, infants who were not breast-fed had significantly higher abundances of the Peptostreptococcaceae bacterial family ($P = .002$) and the Verrucomicrobiaceae family ($P < .001$) compared with breast-fed infants. Prevalence of *Clostritium difficile* was significantly lower in exclusively breast-fed infants compared with formula-fed infants (20% vs 71%; $P = .01$).

The Chao1 overall mean score was 12.0 (11.2 vaginal delivery, 19.7 emergency cesarean, 9.3 elective cesarean), and the Shannon diversity index was 1.38 overall (1.33 vaginal, 2.02 emergency cesarean, 1.09 elective cesarean). Formula-fed infants scored higher for increased richness ($P = .06$), and elective-cesarean-born infants scored lowest for richness and diversity. The difference in elective vs emergency cesarean may be a result of "partial" microbial exposure during emergency delivery, the researchers write.

The researchers add that disruption of gut bacteria, which help the body develop an immune system, has been linked in recent studies to an increasing number of chronic conditions. Although cesarean delivery can disrupt normal microbial colonization "by preventing exposure to maternal microbes," breast-feeding can promote healthy gut development through exposure to selective beneficial bacteria, they write.

"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 rates of cesarean delivery and insufficient exclusive breastfeeding in Canada," they write.

In an accompanying commentary, Se Jin Song, BS, from the Department of Ecology and Evolutionary Biology, University of Colorado, Boulder, and colleagues write, "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."

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