

# Growth failure in preterm infants tied to altered gut bacteria

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Extremely premature infants who fail to grow as expected have delayed development of their microbiome, or communities of bacteria and other micro-organisms living in the gut, according to a new study published in

*Scientific Reports*. Analysis of these infants' metabolism revealed that their bodies are responding as if they were fasting, despite caloric intake similar to extremely premature infants with appropriate growth. The study findings also suggest that the unique makeup of the microbiome in infants with growth failure might contribute to their inability to properly metabolize nutrients.

"Our identification of the distinct features within the microbiome and [metabolism](#) associated with growth failure might point to new ways to predict, prevent and treat this pervasive problem among preterm infants," says one of the senior authors Patrick Seed, MD, Ph.D., Associate Chief Research Officer of Basic Sciences at Stanley Manne Children's Research Institute at Ann & Robert H. Lurie Children's Hospital of Chicago, and Research Professor of Pediatrics, Microbiology and Immunology at Northwestern University Feinberg School of Medicine. "Currently we lack the means to identify infants at highest risk of growth failure. The microbiome might give us the insights we need to guide individualized interventions and measure response to therapy."

The human microbiome is estimated to consist of over a trillion bacteria in a single person, with 10 times the number of microbial cells to every human cell. Research has established that specific microbiome characteristics play causal roles in obesity, allergy, asthma, diabetes, autoimmune disease, depression and a variety of cancers. Studies have shown stark differences in the microbiome composition of preterm infants compared to full term infants. Recent studies also found that childhood malnutrition is associated with persistent immaturity of the gut microbiome.

"In our study, we investigated the relationships between intestinal microbiome, metabolism and growth in preterm infants," says Dr. Seed, who also is Division Head of Infectious Diseases at Lurie Children's.

"The significant associations we found will need to be reproduced by more studies in the future. We are looking to determine if the specific signatures of microbiome and metabolism maturation we discovered apply broadly to infants with and without growth failure."

Growth failure in [preterm infants](#) is a risk factor for cognitive and motor impairment and may predispose these children to obesity, type 2 diabetes and heart disease later in life.

The study included 58 infants who were born at or before 27 weeks of pregnancy, weighing less than two pounds on average. Growth failure in these infants was defined as weight less than the third percentile on sex-specific growth charts at 40 weeks of postmenstrual age (birth gestational age plus chronological age). In the study, 36 infants had growth failure, while the rest had appropriate growth. These groups had consistent differences in the microbiome and metabolism regardless of complications of prematurity, such as sepsis (blood infection), necrotizing enterocolitis (intestinal inflammation), or intestinal perforation.

Infants with growth failure had disrupted maturation of the intestinal microbiome, characterized by low bacterial diversity, dominance of certain disease-causing bacteria (*Staphylococcus* and *Enterobacteriaceae*) and low proportions of harmless bacteria (such as *Veillonella*). They also displayed delayed metabolic development with features that suggest deficiencies in metabolism of glucose and other non-lipid fuels, leading to greater reliance on fatty acids. The infants with growth failure were in a persistent physiologic state that resembled fasting.

"Our analyses of the relationship between the microbiome of infants with growth failure and the byproducts of their metabolism suggest that the unique composition of bacterial communities living in their gut

might play a role in this metabolic state with similarities to fasting," says Dr. Seed. "This might explain why simply increasing caloric supply for [infants](#) with growth failure often does not work. In order to develop effective treatments, we need to better understand how their inability to utilize nutrients for energy is influenced by delayed maturation of the [microbiome](#) and metabolism."

**More information:** Noelle E. Younge et al, Disrupted Maturation of the Microbiota and Metabolome among Extremely Preterm Infants with Postnatal Growth Failure, *Scientific Reports* (2019). [DOI: 10.1038/s41598-019-44547-y](#)

Provided by Ann & Robert H. Lurie Children's Hospital of Chicago

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