Premature infants may get metabolic boost from mom's breast milk

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The breast milk of mothers with premature babies has different amounts of microRNA than that of mothers with babies born at term, which may help premature babies catch up in growth and development, according to

researchers.

In a study, researchers compared the breast milk of mothers with babies born prematurely—between 28 and 37 weeks gestation—and at term—after 38 weeks. They examined whether there were differences in the composition of the breast milks' microRNAs, snippets of RNA that affect gene expression and can be passed to the infant.

"We found that there are differences in these microRNA profiles, and that the majority of the altered microRNAs influence metabolism," said Molly Carney, medical student in the Penn State College of Medicine. "If those microRNAs are being transferred to the infant, that could potentially impact how the newborn processes energy and nutrients."

The researchers said the results—recently published in *Pediatric Research*—could help better match babies with donated breast milk and give insight into how to develop better infant formula.

Babies born prematurely are at risk for a host of problems, including failure to thrive and neurodevelopmental delays. They also tend to be born at a lower weight than term infants. Because of these issues, premature babies have different nutritional needs than babies born at term.

Previous research has established that the macronutrients—fats, sugars and proteins—in the breast milk of mothers with premature babies are customized to meet the unique needs of these infants. But although researchers have suspected that microRNAs in breast milk have a role in infant health and development, no study has specifically looked at whether microRNAs differed between premature and term breast milk.

The researchers collected 36 samples of breast milk from mothers with infants born at term and 31 samples from mothers with infants born

prematurely. Then they processed the samples in a lab, extracting the microRNAs and comparing them to the human genome to pinpoint the differences between premature and term breast milk.

After the analysis, the researchers identified nine microRNAs that were significantly different in the premature breast milk. They found that these microRNAs target metabolic processes and may help regulate gastrointestinal function and energy use in premature babies.

Steven Hicks, assistant professor of pediatrics in the Penn State College of Medicine, said the results may help explain why premature infants tend to do better when breast-fed by their mothers.

"We know that babies born prematurely have better health outcomes with breast milk than with formula, and our results may explain some of these health benefits associated with breast-feeding," Hicks said. "The unique microRNA profiles that we found in premature breast milk seem well suited to premature infants, because they target metabolic pathways that could spark catch-up growth."

For example, microRNAs found in premature breast milk block both ADRB3 and NR3C1 gene expression—both of which negatively affect adipogenesis, or fat storage. Blocking these pathways could help boost fat production in premature babies that are having problems gaining weight.

Hicks said the results could have several applications, including matching babies with donated breast milk.

"For a variety of reasons, babies who are born preterm often rely on donated breast milk," Hicks said. "Oftentimes, that milk comes from a mother who gave birth at term, and has been breast-feeding for months. That milk may not be optimal for a 32-week premature infant who was

born two days ago."

Hicks also said the findings could lead to opportunities to create better baby formula in the future.

"MicroRNAs are an epigenetic material that is made by our bodies and is not present in formula. So even though formula is made to mirror the nutritional components of breast milk—carbohydrates, lipids and proteins—it doesn't have any of these epigenetic factors," Hicks said. "It is possible to create microRNAs in a lab and put them in formula. This approach might help bridge the health gap we see between formula- and breast-fed infants."

The researchers said the study helps reinforce that breast milk has multiple nutritional benefits, and may be adapted to individual infant's needs.

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