

Factors in breast milk may play a role in transmission of obesity

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Image: Wikipedia.

A new study suggests the road to obesity may be paved with non-nutritious carbohydrates in breast milk, shifting popular notions about how and why children grow to become overweight adults.

Previous research has shown that maternal [obesity](#) strongly affects a baby's risk for becoming overweight, but scientists are unsure about how fatness is transmitted, said Michael Goran, the study's corresponding author and director of the Childhood Obesity Research Center at the Keck School of Medicine of USC.

Now Goran and his collaborators have found that variations in complex carbohydrates found in [breast milk](#) called human milk oligosaccharides (HMOs) are associated with variations in infant growth and obesity. HMOs, a natural component of breast milk, are known to play a role in helping to develop the infant immune system.

The study, published online in *The American Journal of Clinical Nutrition* on Oct. 28, is the first to identify variations in HMOs as a possible protective or risk factor for obesity, said Tanya Alderete, lead author and a postdoctoral research scholar at USC.

"At 6 months of age, higher breast milk levels of LNFPII and DSLNT were each associated with approximately 1 pound of greater fat mass," Alderete said. "Other HMOs were protective at 6 months. Increased amounts of a HMO called LNFPI in breast milk was associated with about a 1-pound lower infant weight and fat mass."

Excess weight

Previous studies on the overall effects of breastfeeding on obesity have produced conflicting results. Many suggested that breastfeeding decreases an infant's risk of developing obesity in childhood and adolescence. When these researchers examined 71 previous reports on this topic, they found that breastfeeding reduced the prevalence of excess weight and obesity by an average of 10 percent relative to formula.

However, the specific mix of HMOs in breast milk can make a big difference. The composition of individual breast milk is more important in predicting obesity than even the mother's obesity and her weight gain during pregnancy, the study found.

"Early life experiences related to the environment and different feeding

modalities contribute to obesity," said Goran, professor of preventative medicine, physiology and biophysics, and pediatrics at the Keck School of Medicine. "But typically we think of obesity risk kicking in after weaning—the timing of introduction to solid foods, early exposures to sugary beverages. Clearly there is something going on before weaning even in babies who are exclusively breastfed."

Obesity protection

The study examined 25 mother-infant pairs and looked at breast milk and infant measures at ages 1 and 6 months. Researchers defined breastfeeding as not using infant formula.

Some babies may have been introduced to solid food, which would have contributed to growth and body composition.

Although the study is small, its results are promising, Goran said. Larger, longer studies are needed.

"Ultimately what we would like to be able to do is identify which of the HMOs are most important for obesity protection and then use that as a supplement that can be given to the breastfeeding infant and added to infant formulae," Goran said, noting that current infant formula does not contain any HMOs.

Shaping a baby's ecosystem

Childhood obesity has more than doubled in children and has quadrupled in adolescents in the past 30 years, according to the Centers for Disease Control and Prevention.

"The infant's first exposure to nutrition sets the stage either for increased

or decreased risk of obesity," Alderete said. HMOs accumulate in the colon because they can't be digested. As a result, they act as prebiotics and play a role in shaping a baby's gut microbiome—the population of microorganisms in the intestine.

"How the gut microbiome develops will have a long-term influence on obesity and health risk," Goran said. "These compounds that are not being digested go straight into the infant's gut and act as prebiotics. They act as fuel for microbes in the gut and help them grow and become diverse."

The study could not determine cause and effect between HMO composition and obesity, partially because it did not have any measures beyond 6 months of age.

It may be all about the HMOs

While genetics play a role in HMO composition, scientists do not yet know what contributes to variation in the composition of breast milk, Goran said. What mothers eat likely has a role, but this aspect has not been studied, he added.

Overweight mothers may have a less favorable mix of breast milk HMO, but the study did not address this aspect, Alderete said.

"To our knowledge, there are no studies examining how HMOs are affected by the mothers' diet," she said. "It would be very interesting if dietary sugar or fat consumption were found to be related to HMOs. That is something we hope to explore in future studies."

The University Hospital at the University of Oklahoma Health Sciences Center collected data about the 25 mothers and [infants](#).

Expert opinions

"The study was conceptualized, initiated and conducted by my research group," said David Fields, senior author, associate professor at the University of Oklahoma College of Medicine and holder of its CMRI Chickasaw Nation Endowed Chair in pediatric diabetes. "After speaking with Drs. Goran and Bode, we decided to analyze for specific human milk oligosaccharides and determine if they are associated with early body composition, that is to say fat and muscle."

The Bode Lab at the University of California, San Diego School of Medicine, analyzed HMO composition in the breast milk samples.

"HMOs are the third most abundant component in [human breast milk](#)," said Lars Bode, corresponding author, an associate professor of pediatrics at UC San Diego and president-elect of the International Society for Research in Human Milk and Lactation. "The concentrations of these complex sugars are higher than the concentrations of all human breast milk proteins combined."

Researchers at USC inspected the data, creating models to understand relationships between HMOs and infant growth and body composition.

Provided by University of Southern California

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