Medical Xpress

Breast milk reveals clues for health

July 28 2014, by Diane Nelson

Credit: Karin Higgins/UC Davis

Evidence shows that breast-feeding is good for babies, boosting immunity and protecting them from a wide range of health issues such as obesity, diabetes, liver problems and cardiovascular disease.

How does it provide those benefits? What makes mother's milk so good?

"Mother's milk is the Rosetta Stone for all food," said Professor Bruce German, director of the UC Davis Foods for Health Institute. "It's a complete diet, shaped over 200 million years of evolution, to keep healthy babies healthy."

German and his team have spent 10 years decoding the mechanisms of

human breast milk. Their discoveries are surprising and significant, and could lead to supplements that boost immunity for cancer patients, the elderly and children in the developing world—and enhance health for us all.

Solving a milk mystery

The two most abundant biomolecules (molecules produced by a living organism) in breast milk are proteins and lipids, which babies digest and convert to energy. The third most abundant biomolecule is something the human baby lacks the enzymes necessary to digest. In other words, it goes in their mouths and out into their diapers with no digestion along the way.

That's curious. Of the 500 calories a lactating woman burns each day to make milk, 10 percent is spent synthesizing something the baby treats as waste. If it didn't have value to the developing baby, wouldn't natural selection have discarded it long ago?

"We were gob-smacked when we discovered how much of what lactating mothers produce is indigestible matter," German said. "What is it? What does it do?"

Turns out, the indigestible matter is a slew of complex sugars called oligosaccharides that are extremely difficult to detect and analyze. Enter Professor Carlito Lebrilla with the UC Davis Department of Chemistry, who developed new analytical methods to separate, identify and quantify the oligosaccharides in human breast milk.

What do the oligosaccharides do? Researchers theorized that they fed bacteria in the baby's gut since they didn't nourish the baby, but what strain of bugs do they feed and why?

That puzzle was solved by professor David Mills, the UC Davis Peter J. Shields Endowed Chair in Dairy Food Science. Mills pinpointed one particular gut bacterium called Bifidobacterium infantis, which is uniquely able to break down and feed on the specific oligosaccharides in mother's milk.

Lactating mothers produce oligosaccharides to help B. infantis proliferate and dominate in the baby's gut, keeping their babies healthy by crowding out less savory bugs before they can become established. Perhaps more importantly, the oligosaccharides help B. infantis nurture the integrity of the lining of the babies' intestines, playing a vital role in protecting them from infection and inflammation.

"What a genius strategy," German said. "Mothers are recruiting another life form to babysit their babies."

Sharing the wealth with all ages

Capitalizing on what they're learning about breast milk, researchers are working to promote wellness for humans beyond healthy babies.

Premature infants, for example, are often not healthy babies. They are particularly susceptible to a gastrointestinal disease called necrotizing enterocolitis, which destroys the bowel. Up to 10 percent of extremely premature infants get the disease and up to 40 percent of those with the severest form of the disease die. Researchers are conducting clinical trials at UC Davis Children's Hospital, giving premature babies oligosaccharides and their corresponding bacteria to see if this can improve their intestinal and overall health.

Researchers believe providing oligosaccharides and specific bacteria could also be used to treat gastrointestinal disease in adults, restoring microbial balance in their digestive tracts. Similar treatments could soon

be used to boost the immune defenses of people with compromised immune systems, such as people with the human immunodeficiency virus, patients undergoing chemotherapy, the elderly and others.

It's too early to know whether healthy adults should add oligosaccharides (or other bacteria feeders) to their diets for preventative health. Scientists can't even say for sure what a healthy bacterial community in our guts should look like. But one thing is certain: "Our good bacteria play a much more important role in our health than we realized," German said.

Turning trash into treasure

For treating premature infants and others in need of microbial balance, where are we going to find the oligosaccharides that help the good bugs thrive?

Cows make the necessary oligosaccharides, although the amounts produced decrease after the cow's first few days of lactation. Professor Juan Medrano with the UC Davis Department of Animal Science is searching for approaches to selective cow breeding to promote cow oligosaccharide production and to slow the reduction of oligosaccharides as lactation progresses.

There may be another option: turning a dairy-industry byproduct into bacterial treasure. Whey is the waste product of cheese making, and it's produced in enormous amounts. For every pound of cheese produced, 10 pounds of whey are left over. The whey is hard to dispose of—it's not environmentally friendly—but it still contains oligosaccharides. Professor Daniela Barile with the UC Davis Department of Food Science and Technology is looking to alter the industrial processing of millions of pounds of whey and other dairy waste, identifying, extracting and delivering health-promoting oligosaccharides from these underused

waste streams.

Addressing infant mortality around the world

Oligosaccharides in cow's milk might also improve infant mortality rates in developing countries. Children in areas such as West or Central Africa are 30 times more likely to die before their sixth birthday than children in the industrialized world, in large part due to malnutrition and intestinal diseases caused by contaminated food and water.

Children are less affected by intestinal disease while breast-feeding, but that protection drops off once they're weaned and no longer consuming oligosaccharides. Funded by a $9 million Gates Foundation grant, UC Davis researchers are studying how gut microbes consume oligosaccharides, which could help them develop substances that improve immunity in non-breast-feeding children. Researchers are also developing selective prebiotics based on their work isolating and concentrating oligosaccharides in cow's milk. Clinical trials begin soon.

There's still a lot to learn. But breast milk is already providing researchers intriguing clues to lasting health and ways to deliver better health and nutrition around the world.

Provided by UC Davis

Citation: Breast milk reveals clues for health (2014, July 28) retrieved 15 May 2024 from https://medicalxpress.com/news/2014-07-breast-reveals-clues-health.html