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Nutrition & Your Child

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USDA/ARS
Children's Nutrition Research Center
at Baylor College of Medicine

What You Eat Before Conception May Affect Your Infant

What a female mouse eats before and during pregnancy and lactation can affect the size of her offspring and the way their livers function, said researchers at the USDA/ARS Children's Nutrition Research Center at Baylor College of Medicine in a report in a recent issue of the *Journal of Nutrition*.

"We found that mice born to mothers who were fed a low-protein diet four weeks before conception and during pregnancy and lactation were smaller from birth. Although they grew normally, they still remained smaller than mice born to mothers who consumed a normal diet. In particular, what remained small were the animals' muscles," said Dr. Ignatia B. Van den Veyver, vice chair of research in the department of obstetrics and gynecology at BCM and corresponding author of the study. "While prior studies of mothers fed this kind of diet showed that animals were predisposed to diabetes, we did not see this."

"We think this difference occurs because we fed them the low-protein diet from before they conceived, and not just during their pregnancy," said Dr. Alfred Balasa, a postdoctoral associate in Van den Veyver's laboratory at the CNRC.

In order to find the explanation for small birth size, researchers analyzed the animals' gene expression in the liver at 1 year of age (adulthood in a mouse). They found changes in genes that regulate proper positioning of the chromosomes during cell division. While the livers looked normal, these genes were expressed at higher levels, and some liver enzyme tests were different.

"Even though the livers looked normal, they were functioning quite differently," said Balasa. "We started to wonder if this is a new

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Study Finds No Downward Trend in Nutritional Value of Broccoli

Over the years, there has been speculation that changes in the way vegetables are grown have decreased their overall nutritional value. According to experts at the USDA/ARS Children's Nutrition Research Center at Baylor College of Medicine, this is not the case with broccoli.

In a study that analyzed 14 varieties of broccoli grown in the same field and environment since 1975, researchers at the CNRC found that there was no decline in the nutritional value of broccoli varieties developed over the past 35 years. The report appeared in a recent issue of *Crop Science*.

Although previous reports suggested that the quality of our plant-based food supply is declining, these earlier reports used data that did not specify the varieties grown or the environments used for each crop's production, according to Dr. Michael Grusak, USDA/ARS plant physiologist and professor of pediatrics at BCM, who served as co-author of the paper.

"We know that the environment has a big impact on the nutritional quality of foods," said Grusak. "We decided to go as far back as we could with available varieties of broccoli and grow them in the same environment, in the same fields and test their nutritional value for minerals to see if there was a longitudinal decline in nutritional quality."

All 14 varieties of broccoli were grown together two times, using the same field environment in South Carolina.

Researchers analyzed a variety of essential minerals including calcium, magnesium, potassium, phosphorous, iron, and zinc.

These minerals are the building blocks for our body's tissues and aid in regulating metabolic activity at the cellular level.

Grusak and colleagues found no downward trend in nutritional value of commercially available broccoli.

"We know that even though plant breeders and growers have changed and improved upon the way in which broccoli is grown, over the years there has been no change in the mineral quality of broccoli," said Grusak. "In the future, this information can be a useful guide for future plant breeders so they can maintain this level of mineral quality in new varieties."

Others who took part in the study include Mark W. Farnham with the USDA/ARS U.S. Vegetable Laboratory, Charleston, South Carolina and Anthony P. Keinath at Clemson University.

Funding for this study came from the U.S. Department of Agriculture – Agricultural Research Service.

The full report can be found at **https://www.crops.org/publications/cs/abstracts/51/6/2721.**

Study Offers Understanding of Belly Pain in Children

For a significant percentage of children, stomach pain is not just "belly-aching." It is a serious health issue that can keep them from going to school or enjoying pleasurable activities.

In a first step toward identifying and treating this problem that can affect as many as 20 percent of school-age children, researchers at the USDA/ARS Children's Nutrition Research Center at Baylor College of Medicine have identified several specific bacteria in children with recurrent abdominal pain and irritable bowel syndrome. A report on their findings appeared in the journal ***Gastroenterology***.

It is the first major report by the Texas Children's Microbiome Center and Baylor's Alkek Center for Metagenomics and Microbiome Research, which have been federally funded to understand the links between children's gastrointestinal diseases and their microbiomes. The microbiome refers to the billions of bacteria, viruses and fungi that normally inhabit the skin, intestines, genitourinary tract and other parts of the human body.

"When we characterized the bacteria that make up the microbiome in the intestines of children with irritable bowel syndrome, we found it was different from what we found in healthy children," said Dr. Robert Shulman, CNRC researcher and professor of pediatrics – gastroenterology at BCM. "We also found that the severity of their pain and how frequently it occurred was associated with certain types of bacteria. That does not mean necessarily that the bacteria cause the pain, but these children had certain species of bacteria that were less likely to be found in the intestines of healthy children."

Shulman and his colleagues have long attempted to understand the source of chronic belly pain in children.

"It is a mystery as to what triggers the chronic belly pain of some children," said Dr. James Versalovic, professor of pathology & immunology at BCM, director of the Texas Children's Microbiome Center and a corresponding author of the study. "Why do some kids have frequent bouts of pain and why do some have constipation or diarrhea with their belly pain?"

To understand the mysteries of abdominal pain better, Versalovic and his colleagues assembled a profile of the bacteria in the intestines of children with irritable bowel syndrome and compared it to a profile of the bacteria of children who did not suffer from the disorder. Youngsters with irritable bowel syndrome have stomach pain that is associated with changes in their bowel movements—either constipation or diarrhea.

A total of 44 children completed the study. Half of the children had irritable bowel syndrome and half did not. Children kept diaries of their abdominal pain and bowel function for two weeks. They also gave a stool sample for microbiome analyses.

Researchers extracted DNA from the samples and determined what types of bacteria were present in the samples. While the total amount of bacteria did not differ between the two groups, the researchers did find differences in the kinds of bacteria. Children with irritable bowel syndrome had more Gammaproteobacteria than the healthy ones. Gammaproteobacteria encompass a wide range of bacteria—some benign and others associated with disease. In particular, the study found a greater proportion of Haemophilus parainfluenzae, Veillonella and Alistipes bacteria in the children with irritable bowel syndrome than those who were healthy. They also found a new organism related to a genus of bacteria called Ruminococcus that was more common in the intestines of children with irritable bowel syndrome.

"The next step is to see if these bacteria can be causing the children's belly pain and whether we can use this information to devise new treatments that change the gut bacterial composition, including specific nutritional diets, probiotics, or antibiotics," Versalovic said.

Shulman said the findings have many important contributions. With more studies, the scientists will be able to figure out how these bacteria might influence the severity of pain or changes in bowel habits.

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Volunteers

Houston-area residents are invited to participate in the following nutrition research projects designed to help CNRC scientists learn more about the nutritional needs of children. Free parking is provided. For most studies, financial compensation is provided and transportation may be available.

For more information on any CNRC study, contact Marilyn Navarrete at 713-798-7002 or rilynn@bcm.edu.

Visit CNRC study opportunities online by scanning the QR code to the right using your smart phone.

PREGNANCY & CHILD HEALTH

Did you have a pregnancy complicated by preeclampsia or a baby with low birth weight? Can these and other complications in mom put the child at risk for future health problems? To answer this question, we are conducting a research study that looks at pregnancy history and its effect on the child's health. Study involves body composition and blood test.

TEXTMe

14- to 17-year-olds are needed for a study to test whether text messages can help teens be physically active.

SUGAR METABOLISM

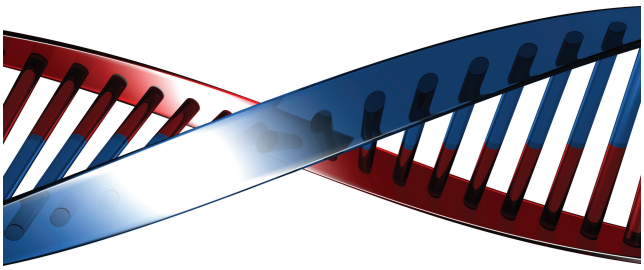
Are you 10 to 17 years old, overweight and not on any prescription medications? You may qualify to participate in a research study about sugar metabolism in the body.

DIET AND STOMACH PAIN

Does your child have stomach pain that you believe is related to his or her diet? Children between the ages of 7 and 17 are needed for a research study on the role of diet in childhood stomach pain. Participants will be asked to start a specific diet on two separate weekends to determine whether this will help the pain. Food will be provided.

GENETICS: The Link Between Rare and Chronic Diseases

The understanding of the human genome and its impact on health is constantly evolving. Researchers at the USDA/ARS Children's Nutrition Research Center at Baylor College of Medicine now suggest that studying genetics is not only important in identifying and treating rare genetic conditions, but also in understanding a person's general health and risk for disease. These researchers propose a unified genetic model for human disease in a recent issue of the journal ***Cell***.



Dr. John Belmont, professor of molecular and human genetics at BCM, and his colleagues noted, as an example, that several genes known to contribute to common diseases such as diabetes, obesity, atherosclerosis and cancer also cause severe genetic diseases in some individuals.

"There are common molecular mechanisms involved in the rare genetic diseases that are also now known to be involved in the common diseases," Belmont explained.

This finding reinforces what researchers already knew—by studying rare diseases we learn a lot about basic disease mechanisms important to all types of human diseases. However Belmont also notes that the opposite is also true—studying the common diseases also tells us important things about how rare diseases work.

This conclusion allows researchers to set a research agenda in the future of how they will use genetic information to help improve health care.

"These studies tell us we should continue our focus on finding the causes of rare genetic diseases because it is extremely helpful and informative to find those rare and unusual cases. It also gives us an idea of how we should use the genetic information that is coming from studies of common diseases and tells us that we need to go more deeply into the study of those diseases," Belmont said. "We need to use new methods like complete genome sequencing to study common human diseases because we are going to find not just common genetic variants, but we'll find rarer variants that are specific to a particular family or even unique to a certain individual that are contributing to that common disease."

Belmont's work at the CNRC involves supporting researchers at the Center through genomic research. He applies genetic methods to help researchers understand underlying problems in nutrition. For example, Belmont is collaborating with CNRC researchers in using genetic methods to study severe malnutrition in children and determine why some children have severe and life threatening complications, but others recover quickly.

"This problem has defied explanation for the last 100 years, so we're hoping that new genetic methods may give us some insight that we haven't been able to get before," said Belmont.

He is also working with researchers to determine why some children develop obesity after treatment for acute leukemia.

"We know that gene interactions with environmental factors are extremely important in all kinds of diseases. Nutrition is the most important environmental factor in human disease, and that's part of the reason I moved my lab here to the CNRC—to have the opportunity to develop this line of investigation of gene/environment interactions," he said.

Other authors of the paper include Dr. James Lupski and Dr. Richard Gibbs of BCM and Dr. Eric Boerwinkle of The University of Texas School of Public Health at Houston.

Funding for this work came from the National Human Genome Research Institute and the National Institute of Neurological Disorder and Stroke.

What You Eat Before Conception *(continued from page 1)*

and different epigenetic mechanism that may play a role in how the body handles exposures to poor nutrition or an otherwise suboptimal environment in early development," said Van den Veyver.

Epigenetic mechanisms are established during development to stably regulate how genes are expressed in different tissues. This new finding may point to another layer of epigenetic regulation.

"If you look at the mice, they are healthy," said Balasa. "They are smaller and leaner. Some of the liver enzymes were significantly lower in the low-protein offspring when compared to controls."

He and Van den Veyver plan to study the effect of this diet and determine whether other early exposures induce similar changes in other organs of the mice.

Others who took part in this research include Dr. Amarilis Sanchez-Valle (another first author of the report), Dr. Bekim Sadikovic, Dr. Haleh Sangi-Haghpeykar, Jaclyn Bravo, Liang Chen, Dr. Wei Liu, Shu Wen and CNRC researcher, Dr. Marta L. Fiorotto, all of BCM.

Funding for this work came from the U.S. Department of Agriculture, Agriculture Research Service, the National Institute of Arthritis, Musculoskeletal and Skin Diseases and the National Institute of General Medical Sciences.

BREAKFAST STUDY
Children who are 8 to 10 years old are needed for a study on breakfast consumption and mental abilities. The study includes three overnight visits to the CNRC. There will be blood draws at each visit (numbing creams and sprays are available).

LACTATION STUDY: PRODUCTION OF MILK SUGARS AND TRIGLYCERIDES
Are you 18 to 35 years old, healthy and exclusively breastfeeding? Is your baby less than 10 weeks old? If so, you are needed for a study investigating factors that affect breast milk production. The study includes a 24-hour stay at Texas Children's Hospital with your baby.

LACTATION STUDY: GENE EXPRESSION
Pregnant mothers who are healthy, between 13 and 35 years of age, who will exclusively breastfeed for the first two months and who will be delivering at St. Luke's or Ben Taub Hospital are needed for a research study that will investigate factors (the regulation of gene expression) that affect breast milk production during the first six weeks.

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Belly Pain in Children *(continued from page 2)*

"It allows us to look at children more objectively. Instead of just relying on children's or parent's reports of their symptoms, we can characterize them by the bacteria in their guts," he said.

Shulman and Versalovic hope to expand the study, encompassing a wider group of children with chronic belly pain. In the future, being able to determine what kind of belly pain a child has by the character of the bacteria in the gut may make treatments easier.

"Two children who appear to have the same type of chronic belly pain may actually need two different treatments," said Shulman.

Those who wish to enroll in the expanded study should call 713-798-0381.

Others who took part in this research include Delphine M. Saulnier, Kevin Riehle, Toni-Ann Mistretta, Maria-Alejandra Diaz, Sabeen Raza, Erica M. Weidler, Xiang Qin, Cristian Coarfa, Aleksandar Milosavljevic, Joseph F. Petrosino, Sarah Highlander, Richard Gibbs, all of BCM, and Debasmita Mandal and Susan V. Lynch of the University of California San Francisco. Saulnier is now with NIZO, Ede, The Netherlands. Many of the BCM researchers are also affiliated with Texas Children's Hospital. Petrosino is director of the Alkek Center for Metagenomics and Microbiome Research at BCM.

Funding for this work came from the National Institute of Diabetes, Digestive and Kidney Disease, the National Human Genome Research Institute, the National Institute of Nursing Research, the Daffy's Foundation, and the Rainin Foundation.

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