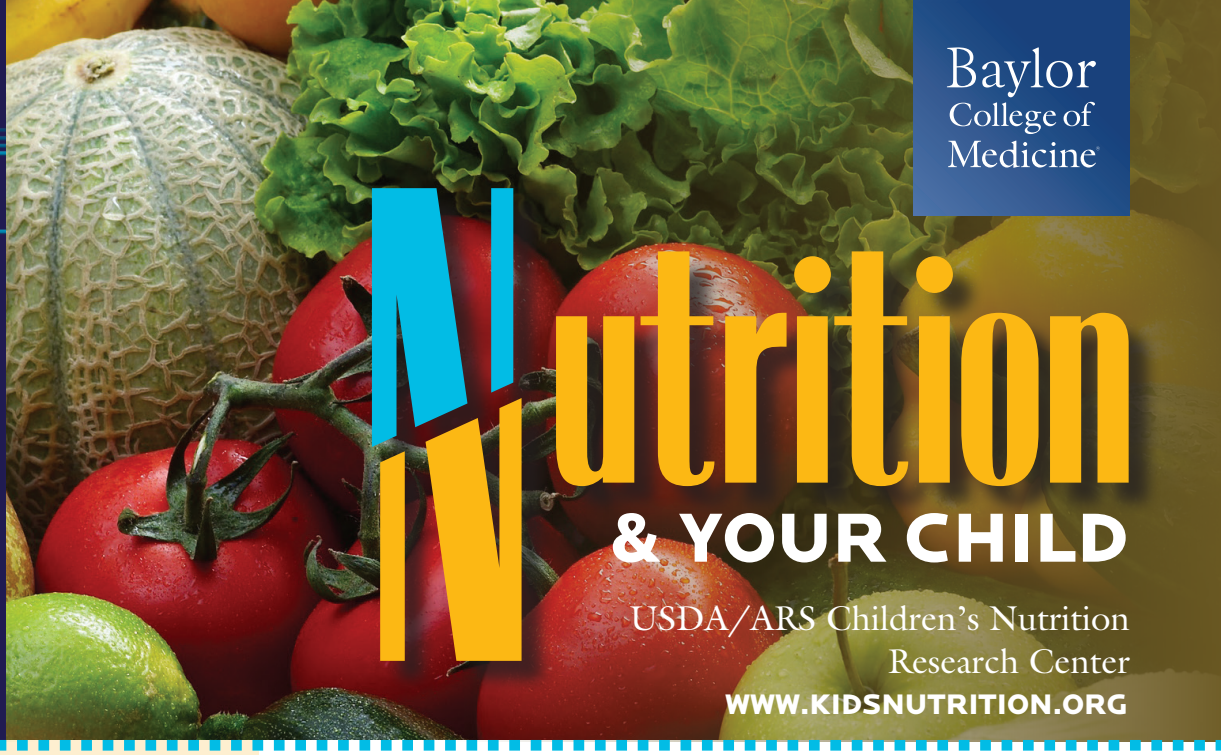
Studying Nutrition Today for the Health of Future Generations

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

Inside

NUMBER 4 • 2013



Baylor College of Medicine

Nutrition & YOUR CHILD

USDA/ARS Children's Nutrition Research Center

WWW.KIDSNUTRITION.ORG

Advancing the understanding and treatment of malnutrition in Africa

Dr. Mark Manary of Washington University in St. Louis, MD and adjunct professor at the USDA/ARS Children's Nutrition Research Center at Baylor College of Medicine has devoted much of his career to improving the diagnosis and treatment of malnutrition in African children. His two recent studies have helped advance the understanding of this health issue that proves deadly for nearly half a million children annually.

The studies on changes in the intestinal microbiome (the microorganisms that live in the gut) that are related to the development of kwashiorkor, a form of severe acute malnutrition, and on the use of antibiotics in addition to nutritional therapy to treat malnutrition were published in *Science* and the *New England Journal of Medicine*, respectively.

"The goal of the research on the intestinal microbiome as it relates to kwashiorkor is to work toward a thorough scientific understanding of what causes children to become malnourished in the first place. This is essential to a future where we can work to prevent malnutrition," said Manary.

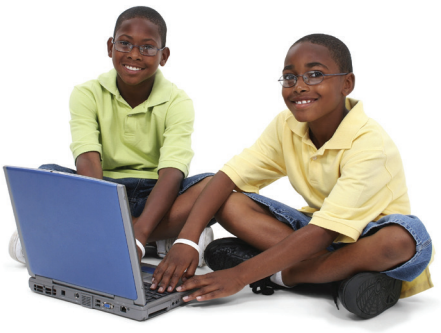
In the first study, twins were recruited shortly after birth from five rural villages in the country of Malawi. A total of 317 sets of twins and three sets of triplets were recruited. They were examined every month for the first three years of their lives for the development of acute malnutrition. Every two to three months, they also provided stool specimens. If any of the children became malnourished, they were treated using standard nutritional

Continued on page 3 > > >

Web-based intervention designed by and for teens is effective

How do you motivate teens to eat a healthy diet and become more active?

Researchers at the USDA/ARS Children's Nutrition Research Center at Baylor College of Medicine recently showed that when adolescents participated in an eight-week intervention using a website with helpful tools for healthy eating and physical activity designed by their peers, it resulted in higher vegetable consumption and increased physical activity than those who were given fewer tools. Their findings appeared in a recent issue of *Health Education Research*.



"Teen Choice: Food and Fitness" was designed by researchers after receiving input from teens between the ages of 12 and 17 on what materials they felt would help them be more active and eat healthy. These adolescents offered suggestions including information on what to eat, how much, types of physical activity and more.

"It was interesting to talk to these teens and realize that they wanted to have access to this information all at once and in one place," said Dr. Karen Cullen, professor of pediatrics at BCM and first author of the study.

After developing a website based on this input, researchers recruited 408 teens for the eight-week web-based intervention. Volunteers were asked questions about their physical activity and eating behavior at the beginning of the study and then asked to log onto the intervention website weekly during the eight-week period. They were asked to select one eating and/or physical activity goal for the week and then report on their progress the following week. They could then choose a new goal for the next week or stay on the same goal.

The website provided them with information on recipes and other nutritional information, and volunteers were able to watch short videos that showed examples of teens overcoming physical activity or healthy eating challenges.

"This put the teens in control of their own problem solving and goal setting," said Cullen.

After the intervention, volunteers were asked to complete a final questionnaire.

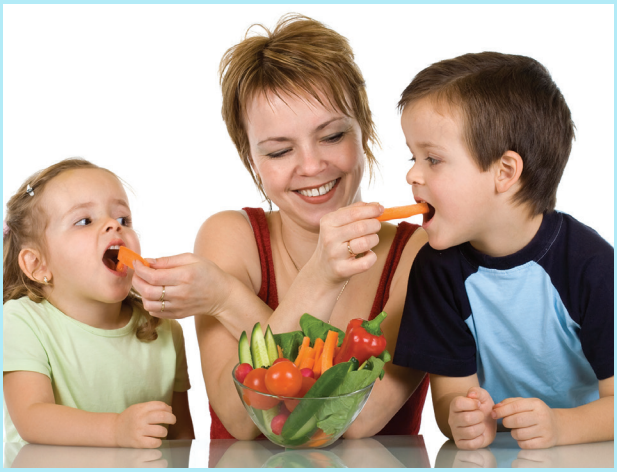
Volunteers in the control group had access to the same website, but without

Continued on page 4 > > >

Study shows that children tend to follow their mother's lead at dinner time

Parents are the first—and best—role models for their children in a variety of ways, including when it comes to nutrition. A recent study by Dr. Theresa Nicklas, professor at the USDA/ARS Children's Nutrition Research Center at Baylor College of Medicine, and colleagues reinforces the important role parents, particularly mothers, play in establishing healthy eating habits.

Although children's eating patterns are influenced by outside factors as well, the family meal is a more important influence, said Nicklas, lead author of the study that appeared in a recent issue of the *International Journal of Child Health and Nutrition*.



"We know that children who eat regular family meals have a better overall diet quality," said Nicklas. "This study points to the significant relationship between the diets of mothers and their children, specifically during dinner meals."

The study included mother and pre-school aged child pairs who were recruited from Head Start child care centers in Houston. Study participants were observed during dinner on two separate occasions to determine how intake of food by the child resembled intake by the mother. Digital photography was used to measure the amount of food served and consumed.

The goal of this study was to examine resemblance in intakes of foods, within the context of a dinner meal, among mother-child pairs from families of limited income. Although a total of 214 mother-child pairs were recruited for the study, only 52 percent of the mothers actually ate dinner with their child. The reasons why this was the case were not explored in this study. Future analyses will focus on whether diet quality differs among children who eat the dinner meal with their mother compared to children who eat alone.

However of those mother-and-child pairs that did eat together, one overall pattern was that sweetened beverages were the beverage of choice rather than milk.

"This has important implications," Nicklas said. "Milk consumption decreases as children get older so we don't want parents to do anything to discourage kids from drinking milk, such as replacing it with a sweetened beverage during meals."

Mothers who served themselves large portions of food also did the same for their child, and larger portion sizes for the parent and child resulted in both groups eating more food compared to others in the study.

Typically, the dinner meal consisted of a food from the meat, vegetable, grain, and dairy food groups. A small percentage of the mothers served fruit at the dinner meal.

"I think one important thing to come out of this study is the need to provide guidance to parents about modeling good nutrition behavior, such as serving and consuming food from all food groups at family meals," Nicklas said. "Educating mothers about portion size is also needed because we know from this study that if served more, children will eat more."

Others involved in this research included Carol O'Neil, of Louisiana State University Agricultural Center, and Sheryl Hughes and Yan Liu, of Baylor College of Medicine. It was supported by funding from the U.S. Department of Agriculture.

DNA methylation in embryonic stem cells turns genes on

It may be time to revise some textbooks. Practically any molecular genetics textbook will tell you that DNA methylation (the addition of a methyl group or CH3 molecule) is an epigenetic switch that turns off genes. Studies by researchers at the USDA/ARS Children's Nutrition Research Center at Baylor College of Medicine show, however, that during early human embryonic development, as stem cells start to develop into different cell types and tissues, the DNA in certain genome regions become methylated, turning on important genes involved in development. Stem cells have the flexibility to develop into any cell type in the body. DNA methylation is one of the molecular 'switches' that guides their development into specific cell types.

Methylation affects so-called CpG sites in our genomic DNA (a cytosine (C) is followed by guanine (G)). The methylation does not occur at the promoter region (the beginning of the gene), but rather at CpG-dense regions called 'CpG islands' at the end of the gene, called the 3' (3 prime) end, said Dr. Lanlan Shen, associate professor of pediatrics at BCM and senior author of the report in the journal *Molecular and Cellular Biology*.

"This study is the first to document a specific mechanism for how DNA methylation at 3' CpG islands activates gene expression," said Shen. Not only that, but by using a computer to analyze their large sets of DNA methylation data, she and her colleagues showed that as stem cells develop and become more specialized tissues and cells, these 3' CpG islands become more and more methylated.

This methylation regulates the activation of gene transcription (the first step in translating DNA into a blueprint that eventually becomes a protein) via a mechanism that depends on an important developmental transcription factor called CTCF.

"The bottom line of the report is that CTCF-mediated gene activation appears to be used by our cells as a general mechanism

Continued on page 4 > > >

Malnutrition advances Continued from page 1

therapy and additional stool specimens were collected during treatment.

The genetic material in the stool specimens was examined, allowing researchers to develop a complete genetic picture of all the bacteria in the intestinal tracts of the children in the study. These genetic pictures were compared and contrasted among children with kwashiorkor, children with marasmus (another form of severe malnutrition), children with moderate malnutrition, and children who had not become malnourished.

It was especially interesting and informative to compare the bacteria make-up of children who became malnourished to their healthy twin, Manary noted.

The stool specimens were then transplanted into healthy mice, and researchers observed what happened when the mice received the microbiome from healthy children compared to when they received the microbiome from children with kwashiorkor. The mice that were given the stool transplants from children who had kwashiorkor lost weight, but then gained weight and developed more normal intestinal bacteria when given therapeutic nutritional feedings.

"Taken together, these results strongly suggest that the intestinal microbiome plays an important—but not exclusive—role in the development of kwashiorkor," Manary said. "For children in Malawi and other places who are at high risk for kwashiorkor, this suggests that nutritional therapy alone may not be enough to keep them healthy. Extensive work is still needed, including identifying which bacteria specifically are important and by which immunological, metabolic, inflammatory and infectious pathways."

Manary noted that even in the best therapeutic feeding programs for children with severe malnutrition, some 15 percent will not recover and as many as 10 percent will die. The use of antibiotics in addition to nutritional therapy has been suggested as a possible form of treatment but there was little clinical evidence to support its use.

In a second study, Manary and his research colleagues sought to test the effectiveness of antibiotics in addition to nutritional therapy. The study was conducted at 18 different village malnutrition clinics in six districts in rural southern Malawi. Children in the study were randomly selected to receive one of two antibiotics (amoxicillin or cefdinir) or placebo in addition to standard nutritional therapy. They returned to the clinic every two weeks for follow-up to measure their recovery. A total of 2,767 children were enrolled in the study over 15 months.

"The results were indeed very significant and surprising," Manary said. "Most remarkably, the death rate was lowered by about 40 percent among children who received antibiotics."

New malnutrition guidelines are forthcoming from the World Health Organization that support the use of antibiotics for patients with severe malnutrition.

There are logistical and financial challenges to getting these medications to rural health centers, just as there are challenges in getting therapeutic foods to these sites, Manary noted.

"But by proving their effectiveness in a rigorous clinical trial and by having these results vetted and accepted by the WHO, this will hopefully become an accepted standard of care, which will motivate governments and aid agencies to include funds for this life-saving therapy as they do for other therapies for high-burden diseases," he said.

The study on intestinal microbiome was supported by funds from the Bill and Melinda Gates Foundation and the National Institutes of Health.

The study on antibiotic treatment was supported by a grant from the Hickey Family Foundation, a cooperative agreement with the Academy for Educational Development Food and Nutrition Technical Assistance 2 project (through the Office of Health, Infectious Diseases, and Nutrition, Bureau of Global Health, and Food for Peace, United States Agency for International Development), and the National Institutes of Health.

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. Financial compensation is provided for most studies, and transportation may be available.

For more information on any CNRC study call Marilyn Navarrete, 713.798.7002, or e-mail rilynn@bcm.edu.

DIGITAL DIET STUDY NEW!
Enrolling 3 to 5 year olds for validation of dietary intake method using a cell phone camera. All meals provided with private room.

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).

BUTTERFLY GIRLS
8- to 10-year old African American girls and a parent needed to participate in an eight week online program promoting healthy eating and physical activity. No meetings to attend. Participate from the comfort and convenience of home. Watch informative video: http://www.bcm.edu/cnrc/butterflygirl/butterflygirlintrovideo.html

CARDIOVASCULAR STUDY
13- to 18-year old adolescents and young adults (normal weight and overweight) with and without type 2 diabetes are needed for a research study investigating risk for heart disease in youth. Study involves body composition, heart scan and blood tests.

DIET AND STOMACH PAIN
Does your child have stomach pain that you believe is related to his/her diet? Children between the ages of 7 and 17 are needed for a research study. Researchers are interested in learning more about 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.

FATTY LIVER
11- to 21-year old overweight adolescents and young adults with and without liver disease are needed for a research study investigating risk for early heart disease in youth. Study involves body composition, liver scan and blood tests.

PREGNANCY & CHILD HEALTH
Did you have a pregnancy complicated by preeclampsia or a baby with low birth weight? Can a complicated pregnancy 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. 8- to 11-year old children of both eclamptic and non-preeclamptic pregnancies are needed as well as 8- to 17-year olds of pregnancies with high blood pressure. Study involves body composition and blood tests.

STOMACH PAIN & GENETICS
Do you have a child age 7 to 18 with recurrent abdominal pain (stomach aches)? Do they have a brother, sister, step-brother, step-sister and/or adoptive sibling age 7 to 18 living at home with them? You may be eligible for a research study about the environment and genetics of stomach aches. We will visit your home and provide all materials needed for the study.

TEEN IBS & GUT BACTERIA
Researchers at Texas Children's Hospital and Baylor College of Medicine are interested in learning about gut bacteria in healthy 13- to 17-year old adolescents and in those with chronic belly pain.

Baylor College of Medicine

USDA/ARS CHILDREN'S NUTRITION RESEARCH CENTER

Office of Communications & Marketing

Baylor College of Medicine
One Baylor Plaza, Suite 176B
Houston, Texas 77030-3411

Non-Profit
Organization
U.S. Postage
PAID
Houston, Texas
Permit 1492

Nutrition & Your Child is published quarterly by Baylor College of Medicine as a research and information update for the general public and Center volunteers and supporters.

Send comments or change of address information to

Children's Nutrition Research Center
1100 Bates Street
Houston, TX 77030-2600
cnrc@bcm.edu
www.kidsnutrition.org

Center Director
Dennis M. Bier, M.D.

Publication Advisors
Janice C. Baranowski, M.P.H., R.D.
Nancy F. Butte, Ph.D.
Karen W. Cullen, Dr.P.H., R.D.
Michael A. Grusak, Ph.D.
Teresia Margareta O'Connor, M.D., M.P.H.
Stephanie Sisley, M.D.
Janice E. Stuff, Ph.D., R.D.
Robert A. Waterland, Ph.D.

Editors
Dipali Pathak and Dana Benson
Office of Communications
Baylor College of Medicine

The Children's Nutrition Research Center is operated by Baylor College of Medicine, in cooperation with Texas Children's Hospital, for the Agricultural Research Service of the United States Department of Agriculture.

Web-based intervention CONTINUED FROM PAGE 1

the role model videos and the goal setting tools. They could print a goal sheet to use on their own.

Researchers found that those in the intervention group ate more vegetables than those in the control group. Both groups increased their amount of physical activity and recorded less television watching time.

Both the control and intervention group gave high ratings to the website, and researchers documented a 75 percent log-on rate for both groups over the eight-week period.

"This shows us that when you have a website designed by teens and for teens with everything they need, it does appeal to them and they use it," said Cullen.

Others who took part in the study include Debbe Thompson (USDA/ARS) and Tzu-An Chen (BCM) from the CNRC, Carol Boushey of the University of Hawaii Cancer Center, and Karen Konzelmann of West Lafayette, Indiana.

Funding for the study came from the U.S. Department of Agriculture, grant number #2007-55215-17998.

DNA methylation CONTINUED FROM PAGE 2

for regulation of gene expression during differentiation," said Dr. Robert Waterland, associate professor of pediatrics at BCM and a member of the faculty of the Children's Nutrition Research Center, as is Shen.

The finding is particularly important for shedding light on the complex roles of DNA methylation during mammalian development, and should lead to refinement of the 'textbook' view of this epigenetic modification.

Others who took part in this work include Da-Hai Yu, Miao-Hsueh Chen, Govindarajan Kunde-Ramamoorthy, Lagina M. Nosavanh and Manasi Gadkari, all of BCM, Carol Ware of the University of Washington in Seattle; and Jiexin Zhang of the University of Texas MD Anderson Cancer Center.

Funding for this work came from the Sidney Kimmel Foundation, the USDA/ARS (CRIS 6250-51000-055-50S), the National Institute of General Medical Services (P01GM081619-01), the National Institute of Diabetes and Digestive and Kidney Diseases (1R01DK081557) and private funding from the Institute for Stem Cell and Regenerative Medicine.