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ADVANCING HUMAN NUTRITION RESEARCH

The ARS human nutrition research program enhances the quality of the American diet and improves health through research. Obesity is estimated to cost \$190 billion annually, and as its prevalence has increased over recent decades, ARS scientists have researched innovative ways of reversing that trend. Since agriculture primarily produces food for human consumption, integrating human nutrition research into ARS is critical for solving the biggest problems facing producers and consumers. The following accomplishments highlight ARS advances human nutrition research in FY 2019.



A healthy microbiome in infants predicts better vaccine response. ARS scientists in Davis, California, found that infants with microbiomes colonized with more beneficial bacteria (*Bifidobacterium infantis*) had better responses to four vaccines (tuberculosis, polio, hepatitis B, and tetanus) given in early infancy. This study is the first to demonstrate that bifidobacteria, which are abundant in the infant gut as a result of breastfeeding, may lead to long-term enhancement of the immune system.

Evening snacking generally involves less healthy choices. Almost two-thirds of Americans eat or drink something after 8:00 p.m., which concerns researchers and policymakers because most people generally have consumed enough daily calories by the end of their evening meals. ARS researchers in Beltsville, Maryland, found that one in five adults obtained 30 percent or more of their total daily calories from late-evening consumption of foods and beverages. Those who ate late at night took in about 15 percent more calories than nonsnackers. Behavioral interventions for weight control or healthier diets could focus on this vulnerable time during which fewer calories and healthier choices could be selected.

Improving USDA food composition databases and launching FoodData Central. ARS scientists in Beltsville, Maryland, and the National Agricultural Library created and publicly released FoodData Central, which provides access to all USDA food composition information in a single location. These online, publicly available sites provide information on more than 560,000 different foods with more than 8.6 million food nutrient entries. Combined, these data products generated more than 30 million page views via 4 million user sessions.

Brain activation in children with obesity differs from that in normal-weight children. Research by ARS-supported scientists in Little Rock, Arkansas, suggests that normal-weight and obese children process high-calorie food stimuli differently, exhibiting different levels of brain activation when presented with images of high-calorie food. Understanding how normal-weight and obese young children process high-calorie food stimuli may provide ways to alter unhealthy eating behaviors.

Diet, gut bacteria, and chronic diarrhea. ARS researchers in Davis, California, in collaboration with University of California-Davis scientists, discovered that gut microbes in animals with inflammatory bowel disease consume more of the protective mucin layer produced by intestinal cells compared with microbes in nondiseased animals. These discoveries will enable new strategies to prevent chronic gastrointestinal diseases such as ulcerative colitis in humans.

Newly created atlas of epigenetic variation in humans. Most diseases still cannot be predicted on DNA sequences alone, leading researchers to explore the role of epigenetics in disease. ARS-supported scientists in Houston, Texas, performed deep sequencing of genomic DNA and identified regions that vary in DNA methylation (a type of epigenetic marking). These data will inform a basic understanding of disease processes from an epigenetic perspective.