

Diabetes: Nutrition Research Tackles Widespread Disease

In one way or another, type 2 diabetes affects nearly every household in America. Though you may not have the disease, you probably know someone who does.

Agricultural Research Service nutrition researchers are leading an array of studies to discover more about this complex disorder and—especially—to determine how better nutrition and regular physical activity might help prevent it.

Better Biomarkers Needed

Some of these studies are yielding new indicators, called “biomarkers,” of the disease. In time, physicians and other health care professionals might be able to use these biomarkers to identify—sooner—kids and adults who are at risk for developing this type of diabetes. Nutrition scientists would be able to use the markers to monitor the progress of experimental nutrition- and exercise-based strategies designed to prevent diabetes.

A study led by ARS physiologist Sean H. Adams and collaborators underscores the potential of natural compounds in the body, known as “fatty acylcarnitines,” to serve as biomarkers of type 2 diabetes. The team determined this after finding telltale molecules in blood samples from diabetic and nondiabetic African-American women who volunteered for the research.

In some instances, levels of certain fatty acylcarnitines were almost 300 percent higher in the diabetic volunteers than in those without the disease. The higher levels “apparently result from incomplete or inefficient fat oxidation in the diabetic volunteers,” says Adams.

Incomplete oxidation of fats has already been associated with insulin resistance, a hallmark of type 2 diabetes. This new study adds important detail to what Adams describes as “the emerging picture of abnormal fatty acylcarnitine levels in blood as potential biomarkers of type 2 diabetes.” Adams is research leader of the Obesity and Metabolism Research Unit, part of the ARS Western Human Nutrition Research Center at the University of California-Davis.

Adams collaborated in the research with Daniel H. Hwang and John W. Newman at the center, and with co-investigators at the University of Alabama-Birmingham and Case Western Reserve University in Cleveland, Ohio. The scientists documented the study in a 2009 issue of the *Journal of Nutrition*.

Chromosomes Hold Clues to Type 2 Diabetes Risk

Other researchers are scrutinizing DNA samples from Houston-area youngsters to identify genetic variations—in their chromosomes—that are associated with predisposition to type 2 diabetes. Once generally regarded as a disease of adulthood, type 2 diabetes is now often seen in America’s young, too.

Nancy F. Butte, professor of pediatrics with the ARS Children’s Nutrition Research Center at Baylor College of Medicine, Houston, Texas, and co-investigators have found an apparent relation between high blood glucose levels and variations in genetic material in a region on chromosome 13.

They found the association by running a genome scan and a fasting blood glucose test of 1,030 Hispanic children, ages 4 to 19. All were volunteers in the “Viva La Familia” study. That multiyear investigation “addresses childhood obesity and obesity-related disorders—such as type 2 diabetes—among young Hispanics,” according to Butte.

Fasting blood glucose levels were measured in this research because they may



ARS researchers are looking at how increasing fitness may improve blood sugar control and help prevent diabetes. Here, physiologists Sean Adams and Mary Gustafson examine results of University of California-Davis clinical specialist Caitlin Campbell's calorie consumption and fat oxidation while she test-rides a cycle ergometer.

be indicative of diabetes risk. “There may be a gene or genes in this chromosomal region that influence blood glucose levels and increased susceptibility to type 2 diabetes,” says Butte. She and colleagues from SAS Institute, Cary, North Carolina, and the Southwest Foundation for Biomedical Research in San Antonio, Texas, describe the research in the *Journal of Clinical Endocrinology and Metabolism* in 2007.

Building on that study, the scientists are learning more about the region of interest on chromosome 13 through fine-scale

The research may reveal genes that accurately signal susceptibility to type 2 diabetes



mapping. ARS and the National Institutes of Health are funding the investigations.

The work may reveal genes that accurately signal susceptibility to type 2 diabetes in Hispanic youngsters and perhaps in kids of other racial or ethnic groups as well. In earlier work, done elsewhere, this region was associated with risk of obesity in adults. But the region had not, until Butte's investigation, been aligned with type 2 diabetes risk in either kids or adults.

Extracts Hold Potential

In Maryland, ARS researchers have published findings that suggest certain spices may be beneficial to some people with diabetes. Chemist Richard Anderson, at the Beltsville Human Nutrition Research Center (BHNRC), and colleagues

PEGGY GREB (D1818-1)



Components of cinnamon are being purified, characterized, and evaluated for their beneficial effects on insulin levels and related functions. Here, chemists Richard Anderson and Marilyn Polansky extract compounds from cinnamon.

are studying water-soluble extract of cinnamon.

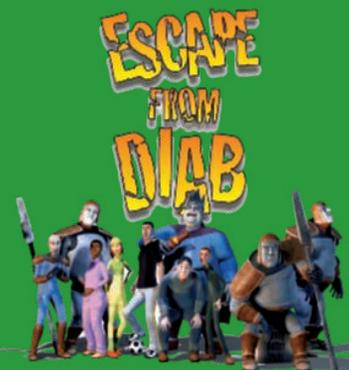
Among several diabetes-focused studies conducted and published in the last 5 years by BHNRC researchers, one involved looking at a potential interplay between the extract and insulin or blood glucose levels. Insulin is a key hormone that "opens a door" within cells and then escorts glucose into those cells, thus providing fuel to them. Without a sufficient insulin supply, or ability to use available insulin, glucose builds up in the blood instead of going into cells where it can be metabolized and used for fuel. Over time, damage occurs to the eyes, kidneys, heart, and nerves.

The study, conducted in Ohio with collaborators, involved 22 volunteers with "metabolic syndrome," which increases the chances of developing diabetes. Volunteers were randomly assigned to supplement their diets with either water-soluble cinnamon extracts or a placebo for 12 weeks.

Volunteers in the extract group had significant decreases in fasting blood glucose and small increases in lean muscle mass when compared with the placebo group. Improvement in lean muscle mass is considered a marker of improved body composition. A before-and-after analysis of the extract group also uncovered small but statistically significant decreases in body fat and blood pressure. But other characteristics of metabolic syndrome, such as abnormal blood LDL or HDL cholesterol levels or triglycerides, did not improve.

This study—among a series of published studies looking at potential nutritional benefits of water-soluble

Adventure Video May Help Kids Dodge Diabetes



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In the action-packed video game "Escape From Diab," kids break free from the evil, diabetes-inducing Kingdom of Diab by making wise food choices. The fast-paced, educational-yet-entertaining game is the work of Tom Baranowski, professor of pediatrics and specialist in behavioral nutrition, and colleagues at the ARS Children's Nutrition Research Center at Baylor College of Medicine in Houston, Texas. His results from testing the video with 153 young volunteers should be ready to report later this year.

See "Diab" characters and a short interview with Baranowski at tinyurl.com/diabgame.

—By Marcia Wood, ARS.

cinnamon extracts—was published in December 2006 in the *Journal of the International Society of Sports Nutrition*.—By Marcia Wood and Rosalie Marion Bliss, ARS.

This research is part of Human Nutrition, an ARS national program (#107) described at www.nps.ars.usda.gov.

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