



RESEARCH OFFERS INFORMATION ON ROLE VITAMIN D PLAYS IN TYPE 2 DIABETES

Type 2 diabetes is a significant health concern — it affects hundreds of millions of people worldwide and is one of the leading risk factors for cardiovascular disease. People with this disease have impaired glucose tolerance, or high blood levels of a type of sugar called glucose. Important research is being conducted to understand how type 2 diabetes develops. Some of this research is being conducted at the USDA/ARS Children's Nutrition Research Center at Baylor College of Medicine, where researchers are studying the role that vitamin D plays in type 2 diabetes.

"Diabetes is associated with vitamin D deficiency but we don't understand if this deficiency has a role in the onset or severity of diabetes," said Dr. Stephanie Sisley, assistant professor of pediatrics at the CNRC and a pediatric endocrinologist with Texas Children's Hospital. "Receptors for vitamin D previously had been discovered in an area of the brain called the hypothalamus that controls glucose levels. However, no one had studied why the hypothalamus had these receptors or what they did. We hypothesized that vitamin D might act in the brain, specifically in the hypothalamus, to help control blood glucose."

In a series of studies, Sisley and her research colleagues used rodents to test what happens when the hypothalamus is given vitamin D directly and also what happens when vitamin D cannot act in the brain. For the first set of studies, they delivered the active form of vitamin D directly into a specific location of the brain through a tiny tube called a cannula. For the second set of studies, they used mice that lacked vitamin D receptors in specific parts of the brain. These studies were the basis for a review paper that recently was published in the *Journal of Steroid Biochemistry and Molecular Biology*.

Through their studies, Sisley and her colleagues found that vitamin D can act directly in the brain to improve glucose tolerance. Also, if vitamin D cannot act in a very specific part of the brain's hypothalamus — the paraventricular nucleus — animals had worse glucose tolerance. They also found that vitamin D action in the brain is not important in lean animals but that it is important in obese animals.



Together, Sisley said that these results suggest that vitamin D has an important role in maintaining normal glucose levels, but that this action is in the brain. Additionally, it points to a protective effect of vitamin D action in the brain in obesity, which could be why we see the clinical associations between diabetes risk and vitamin D deficiency.

"Ideally, we would be able to use these findings to either create a new therapy for vitamin D supplementation in those type 2 diabetes patients who have low vitamin D levels," she said. "However, we still need to do a lot more work to understand how vitamin D works in the brain. We know from clinical studies that giving patients vitamin D orally does not drastically improve glucose levels. Vitamin D is complicated because the form we take as humans gets processed several times before it becomes the active form that actually acts in cells, the form used in my studies. Thus, determining exactly how vitamin D works in the brain will help us learn how to make better compounds or even combinations of existing therapies to utilize the vitamin D pathway in the brain."

This research was supported by the USDA, ARS under Cooperative Agreement Number 58-3092-5-001, and American Diabetes Association grant No. 1-17-JDF-037 (SS). Others who contributed to this work include Keisha Harrison, Danielle Harper, Yanlin He, and Yong Xu also of the CNRC, and collaborators at the University of Cincinnati, Darleen Sandoval, Randy Seeley and Deanna Arble

NONINVASIVE DEVICE TO ESTIMATE FRUIT AND VEGGIE INTAKE CAN BE IMPORTANT RESEARCH TOOL

Eating a diet rich in fruits and vegetables is important to our health. However, it can be hard to recall our fruit and vegetable intake. In a recent study published in *Public Health Nutrition*, researchers at the USDA/ARS Children's Nutrition Research Center at Baylor College of Medicine collaborated with other researchers from across the country to explore whether a new technological device can be used to accurately estimate someone's fruit and vegetable intake.

"People struggle with remembering exactly what they ate so that makes it hard for researchers and physicians or for community programs to assess someone's diet quality and help people to change their dietary habits," said Dr. Nancy E. Moran, assistant professor at the CNRC and researcher on the study. "However, it is important for us to know what people are eating so that we can evaluate and improve programs aimed at changing their diets."

"The goal of this study was to determine if a new device, which utilizes a technology called pressure mediated reflection spectroscopy, or RS, could precisely and rapidly measure skin carotenoids," Moran said. Additionally, researchers wanted to know if this skin measure could be used as a proxy for the standard methods of estimating fruit and vegetable intake, which include a blood test and/or filling out a food intake questionnaire.

Carotenoids are fat-soluble pigments in fruits and vegetables, and they color fruits and vegetables red, orange or yellow. Even dark, leafy green vegetables have carotenoids but their yellow coloring is covered up by green chlorophyll. "When we consume carotenoid-rich fruits and vegetables we absorb those carotenoids, some of which are deposited into our skin, and that is what is measured by RS," Moran said.

The device works by shining a white LED light on a finger as it rests on a lens. A meter then measures how much light is reflected off of your skin in a specific wavelength so that researchers are only looking at the yellowness from carotenoids. Melanin pigmentation and blood pigmentation from hemoglobin have no impact on the readings.

The project included two separate studies conducted in eastern North Carolina. The first was a cross-sectional study of 479 corner store customers who completed the National Cancer Institute Fruit and Vegetable Screener survey as well as RS measures. Researchers found that it was easy to transport and set up the RS device at the corner store and that people were comfortable having their skin carotenoid score measured on the device.

Researchers measured participants' skin carotenoid levels three times and found that it took approximately

a minute and a half each time and the measurement results were very similar. This suggests that using the device will provide a rapid and precise estimate of fruit and vegetable intake.

For study two, the validity of the RS device was assessed in a sample of 30 people by comparing the RS measurements against the results from food intake questionnaires filled out by participants and blood tests taken from the participants.

From this study, researchers found that the RS measurements agreed closely with the calculations from the food intake questionnaires and with the blood carotenoid concentrations.

"It was exciting to see that the blood carotenoid and the skin carotenoid measures were correlated in this diverse group of study participants. This suggests the possibility of using RS instead of blood tests or food intake questionnaires to monitor fruit and vegetable intake in a community setting. However, more research needs to be done in order to accurately calculate someone's fruit and vegetable intake from their RS reading," Moran said.

Since this project focused only on adults in North Carolina, the next step for Moran and collaborators at the CNRC is to explore using the RS device to measure the fruit and vegetable intake in infants, older children and parents.

From a children's nutritional standpoint it is particularly challenging for researchers to study what children eat because they can be even more unreliable than adults when reporting fruit and vegetable intake and very young children are nonverbal. Moran's future studies will focus on how infant carotenoid intake is associated with skin carotenoids to see if researchers can use this skin carotenoid measure to determine the amount of fruits and vegetables children are consuming in their first year of life.

The study was led by Stephanie Bell Jilcott Pitts of East Carolina University. Other researchers who participated in the study include Lisa Jahns, Qiang Wu, Ronny A. Bell, Kimberly P. Truesdale and Melissa N. Laska. The researchers are affiliated with one or more of the following institutions: East Carolina University, USDA/ARS Grand Forks Human Nutrition Research Center, and the University of North Carolina at Chapel Hill and/or University of Minnesota.

This study was supported by the USDA (Duke-UNC Behavioral Economics and Choice Research Center New Perspectives Fellowship, grant number 59-5000-4-0062); the Brody Brothers Endowment Fund; and the East Carolina University Departments of Public Health and Biostatistics. This work also was supported in part by the USDA/ARS (projects, 3062-51000-051-00D and 3092-51000-056-02S N.E.M.) and by the National Institutes of Health National Center for Complementary and Integrative Health and Office of Dietary Supplements (R00 AT008576, N.E.M.).



STUDY SHOWS THAT PARENTS USE MANY STRATEGIES TO ENCOURAGE AND DISCOURAGE THEIR CHILDRENS' PHYSICAL ACTIVITY

Researchers at the USDA/ARS Children's Nutrition Research Center at Baylor College of Medicine have been working on a project to better understand and measure strategies used by parents to discourage or encourage physical activity among their children. The study appears in *BMC Public Health*.

"The premise of this study was to try and come up with a more consistent and comprehensive way of measuring parenting practices across research studies," said Dr. Teresia O'Connor, associate professor of pediatrics at the CNRC and co-author on the study.

There are currently more than 70 different survey tools that researchers use to measure parenting practices that relate to their child's physical activity. With so many tools, it's almost impossible to determine what works best. This study aimed to understand what parents report actually doing to help create a more complete way of measuring parent practices for parents and children from many different backgrounds.

"These kinds of tools can be helpful to not only understand what parents do but also to be able to measure if parent-targeted interventions or programs that try to increase children's physical activity are resulting in any change in parenting behaviors," she said.

The research consisted of 134 parents with children between the ages of 5 to 12 years old who live in the United States or Canada. Parents were recruited through the web-based polling firm YouGovPolymatrix.

Parents were encouraged to answer open-ended questions about what they do to encourage or discourage physical activity in their child. Responses were then coded and summarized. Researchers were able to investigate whether there were differences in responses by country, parental sex, age of child or household income.

Researchers found that the most common parenting practice reported to encourage physical activity was co-participation. This refers to when parents try to be active with their child, for example by walking, riding bikes or exercising together, to encourage that child to be more active. They also found that parents try to encourage physical activity by creating structure in their child's environment by having rules and scheduling time that encouraged activity. For example, some parents reported only allowing their child to play inside after they have spent some time being outdoors or scheduling time to go to a park or playground.

The most common parenting practice that discouraged physical activity was having an unstructured environment. Parent-reported behaviors like allowing



screen media use without setting limits discourage children from physical activity.

"How parents interact with their kids can have a positive or negative impact on them. Even things that parents try to do to increase physical activity can sometimes be discouraging to the child, such as being too controlling or pushy about physical activity," O'Connor added.

Importantly, there was no difference in the responses from parents by country, parental sex, age of child or household income, suggesting these parenting practices are universal among parents in North America. Researchers will now use information gathered in their study to develop a new research tool to better measure what parents do to encourage or discourage their children's physical activity.

"I think a take-away message from this study is that parents reported using co-participation with their child to try and encourage physical activity. Others could try this as well. Doing things as a family is very important for children in this age range. The activity can even be made into a fun game. Co-participation in physical activity is a win-win situation because it benefits both the parents and the kids," O'Connor said.

This study was supported by the Canadian Institute of Health Research Institute of Nutrition, Metabolism and Diabetes (CIHR-INMD; MOP-119359); researchers involved in the study received support from the Child and Family Research Institute, the Michael Smith Foundation for Health Research and BC Children's Hospital Research Institute. The work also is a publication of the U.S. Department of Agriculture Children's Nutrition Research Center, Department of Pediatrics at Baylor College of Medicine, funded in part by the USDA/ARS (Cooperative Agreement 58-3092-5-001). Other researchers involved in this study include Louise C. Masse from the Child and Family Research Institute, School of Population and Public Health, and Andrew W. Tu, who was the senior author of the study, Mark R. Beauchamp from the School of Kinesiology, at the University of British Columbia, and Sheryl O. Hughes and Tom Baranowski, both from the CNRC.

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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
Sheryl O. Hughes, Ph.D.
Nancy E. Moran, Ph.D.
Marta L. Fiorotto, Ph.D.
Karen W. Cullen, Dr.P.H., R.D.
Teresia Margareta O'Connor, M.D., M.P.H.
Stephanie Sisley, M.D.
Jayna M. Dave, Ph.D.
Robert A. Waterland, Ph.D.

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

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VOLUNTEERS

Join a CNRC Nutrition Study!

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.

FOR MORE INFORMATION ON CNRC STUDIES, CONTACT

Noemi Islam at 713.798.7002 or nislam@bcm.edu



Adult Volunteers Needed H-34291

Volunteers aged 18 to 65 who are either healthy and overweight, or have been diagnosed with type 2 diabetes within the last three years are needed for a metabolic study. The study will investigate whether healthy volunteers, type 2 diabetics and ketosis-prone diabetics make an important compound called arginine in different amounts. Healthy, overweight volunteers should have no chronic medical conditions, and all who reply should consume a diet adequate in calories and protein. Women must not be pregnant.

Baylor Infant Orometer Study H-40416

Researchers are conducting a study to examine infants' (4 months old) feeding behaviors and their overall behavior. The study requires two visits to the CNRC. Financial compensation is provided. For more information, contact Mackenzie Senn at 713.798.0355 or mackenzie.senn@bcm.edu.

Survey for Fathers H-38237

Fathers with children ages 5 to 11 are needed to answer an online questionnaire about their interactions with their child to promote physical activity and eating behaviors. Compensation provided. If interested, call Alicia at 713.798.0503, email healthydads@bcm.edu (subject: Fathers' Study) or visit www.healthydads.net.

Teen Heart Health H-30665

Adolescents and young adults aged 12 to 21 (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, scan and blood tests. Compensation provided.

Peppermint Oil Study H-40351

Children aged 7 to 12 who have frequent abdominal pain are needed for a research study on peppermint oil (how it works as well as to determine the appropriate amount given to children to treat frequent belly pain). The study involves three visits to the CNRC with free parking provided. Financial compensation is provided at end of each study visit. If you are interested in participating, please click on the link [Parent Screening Survey Questionnaire](#) and complete the survey. For any additional questions, please email Peppermint@bcm.edu.