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News: Researcher Focuses on Developing Foods with a Boost for Health

March 27, 2013

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Food scientist Yael Vodovotz focuses on developing functional foods to make it easy for people to make their diets healthier and to potentially prevent and treat chronic disease. (Photo by Kenneth Chamberlain)

COLUMBUS, Ohio -- Just about everyone agrees that food and health are inextricably linked.

But Yael Vodovotz goes well beyond that standard: the Ohio State University food scientist focuses on creating new functional foods that potentially could prevent and treat chronic disease without demanding that consumers make major changes to their diet.

Among the products under development: Soy-based bread that contains enough soy to approach what's typical in the soy-rich Asian diet. Soy-based soft pretzels with a low glycemic index to fight diabetes and weight gain. Black raspberry confections and nectar packed with polyphenols to battle prostate and oral cancer.

The idea is to formulate foods with specific health benefits that can be easily incorporated into the typical American diet, said Vodovotz, a professor of food science and technology and scientist with the Ohio Agricultural Research and Development Center, the research arm of Ohio State's College of Food, Agricultural, and Environmental Sciences.

"We want to offer alternatives that require no change in lifestyle, because for most people, changing your lifestyle is harder to do than anything else."

"Yes, people could eat more soy now. But how many people would really eat tofu for an extended period of time? That's what it would take to offer a preventive effect.

"What we try to formulate are things that you normally would eat anyway. It would be a no-brainer that instead of buying your standard everyday bread, you buy a soy-based bread. That way, with no change in your habits, you'll be getting the benefit. We want to offer alternatives that require no change in lifestyle, because for most people, changing your lifestyle is harder to do than anything else."

Vodovotz arrived at Ohio State's Department of Food Science and Technology in 2000 after working with NASA, developing novel foods for a manned mission to Mars. Her expertise lies in understanding the material properties of foods. By closely examining the physical and chemical properties, she helps unlock the mysteries of how certain components contribute health benefits, and how they act within the product itself -- affecting a product's flavor, quality, stability and safety.

"If you change the material, the properties of all these components can change," Vodovotz said. "Understanding that is critical. Everything depends on these properties."

With collaborators across the college and university as well as a half-dozen graduate students and post-doctoral researchers, Vodovotz works simultaneously on a multitude of projects. A few of them include:

Soy bread

Vodovotz first began working on a soy-based bread while with NASA. In her time at Ohio State, she and her team have done some fine-tuning to create a product that tastes good and has enough soy to carry the U.S. Food and Drug Administration's "heart-healthy"

Soy bread, developed in Vodovotz's lab, could

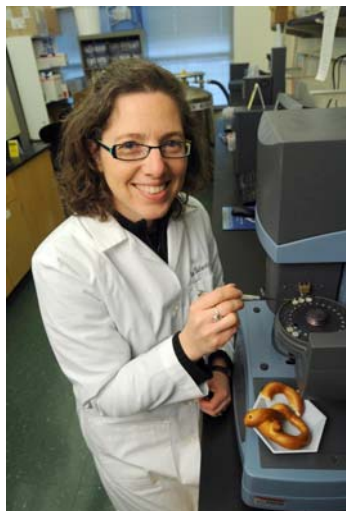
food claim.

The bread's commercialization is under development, Vodovotz said, but in the meantime, she has worked with Dr. Steve Clinton, a medical oncologist with The Ohio State University Comprehensive Cancer Center - Arthur G. James and Richard J. Solove Research Institute, and Steve Schwartz, Ohio State's Carl. E. Haas Endowed Chair in Food Industries, to conduct clinical trials to examine the product's benefits against prostate cancer.

They have even tested new formulations -- one with almond powder as an ingredient, and a sourdough version -- and have found that they make the beneficial isoflavones from soy more easily absorbed by the body and may offer benefits for men diagnosed with prostate cancer.

Next on tap: combining the soy bread with vitamin D and assessing its health benefits in a human clinical trial.

Soy-based soft pretzels



Vodovotz examines the properties of a soy-based pretzel. She hopes the pretzels' low glycemic index and the addition of safflower oil will help people control their blood sugar. (Photo by Kenneth Chamberlain)

In a project similar to the soy bread work, Vodovotz developed a soy-based soft pretzel, which doesn't cause blood sugar to spike.

Pretzels and snack foods available at movie theaters, ball parks and other venues often have a high glycemic index, which means they cause blood sugars to spike suddenly. Choosing foods with a low glycemic index is encouraged for people with diabetes or pre-diabetes to better control their blood sugar, which plays a role in controlling appetite and weight gain.

"There are really no healthy snack alternatives in these venues available now," Vodovotz said.

Now, in a new collaboration with Martha Belury, the Carol S. Kennedy Professor in the human nutrition program in the College of Education and Human Ecology, Vodovotz is developing a soy-based soft pretzel made with safflower oil, which Belury has previously shown can reduce fat in the midsection, reduce blood sugar and increase muscle tissue in women with controlled Type 2 diabetes.

"We'd like to get these pretzels to high school students as an alternative snack to what they're eating now," Vodovotz said. "It could help prevent childhood obesity."

Black raspberry confections and nectar

Vodovotz has been working with a large multidisciplinary team for several years to study the anti-cancer properties in confections and nectar made from freeze-dried black raspberries. The products have a high concentration of polyphenols, a type of antioxidant found naturally in black raspberries.

Currently, the team is analyzing results of a clinical trial of prostate cancer patients. During the three to four weeks while the participants awaited surgery, they consumed differing amounts of the confections or the nectar. Researchers are studying whether the compounds from the solid confection or the liquid nectar are better absorbed, and they're also studying other aspects of the participants' diets -- coffee, tea and chocolate consumption -- to determine if antioxidant compounds in those foods affected the black raspberry absorption.



Participants in one clinical trial consume either black raspberry confections (left) or nectar. Vodovotz's team is studying if absorption of polyphenols differs between the two products. (Photo by Kenneth Chamberlain)

"Out of all this, we hope to find which diet is best, which dosage is best, and which form of delivery (nectar or confection) is best," Vodovotz said. "What we're looking for, through blood work and post-surgery tissue samples, is a therapeutic effect" -- that is, which method of introducing the compounds into the body has a stronger benefit.

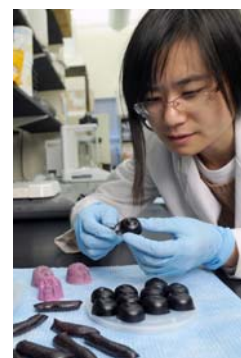
In a related project, this one funded by the [Pelotonia Research Award Program](http://pelotonia.org/about/money/) (<http://pelotonia.org/about/money/>), Vodovotz and colleagues are examining the best method to deliver black raspberry compounds to fight oral cancer.

"We had formulated three different types of confections for this -- a starch-based gummy, a pectin-based gummy and a hard candy. When tested in artificial saliva, the three matrices release the berry polyphenols very differently. It's sort of like what you might see with medications -- is it fast release or slow release and does it make a difference?"

For now, the three confections are being tested in healthy individuals. "We're looking very simply at the metabolites to see how they are being absorbed in the mouth."



soon be commercialized and available for consumer purchase. (Photo by Kenneth Chamberlain)



Junnan Gu, a doctoral student in Vodovotz's lab, prepares black raspberry confections for use in a clinical trial. The confections offer a high concentration of polyphenols which are thought to have anti-cancer properties. (Photo by Kenneth Chamberlain)

Results from this study and others like it could pave the way to a clinical trial for oral cancer patients in the future, Vodovotz said.

That's just a small taste of the projects on Vodovotz's plate. Others include:

- In collaboration with [Abbott \(http://www.abbott.com/index\)](http://www.abbott.com/index), Vodovotz has begun looking at alternatives to foods that could combat malnutrition in Haiti. "We looked at what the people are given now -- a peanut-butter-based product -- and I worked with Matt Kleinhenz (a researcher in Ohio State's Department of Horticulture and Crop Science) on what they could grow in Haiti that we could add to the product or could use to develop something new. What we're looking at is the product development side of fighting malnutrition. We just had one year on this project -- phase one -- but hope we're able to continue it in the future."
- Working with Ohio State anthropologist Scott McGraw, Vodovotz is examining one of the primary constituents of the diet of sooty mangabeys -- large monkeys that live in the Upper Guinea forests of West Africa. The nuts from the tree *Sacoglottis gabonensis* "are very, very hard to crack, like an unpopped popcorn seed or a cherry pit," Vodovotz said. "But these monkeys will go out of their way to find and eat them." McGraw first approached Vodovotz to see if she had a method to test the hardness of the nuts, but the project grew from there.

"Since these nuts are hard to find and hard to crack, I suggested that there must be a reason why these monkeys seek out these nuts," she said. And sure enough, by working with Esperanza Carcache de Blanco in medicinal chemistry in the College of Pharmacy, the team isolated a compound in the nuts that has an anti-diabetes effect.

Interestingly, Vodovotz said, the Centers for Disease Control and Prevention has a colony of these monkeys -- they are the monkeys that carry the AIDS virus but do not express it. They are fed a standard monkey chow -- not the hard-to-gather nuts they eat in the wild -- and they have a high incidence of diabetes. The diabetes connection is still a hypothesis, Vodovotz said, but an intriguing one. "In the end, we might be able to extract these compounds and put them in a food product to fight diabetes in humans," she said.

- In a project not related to food, Vodovotz is working Katrina Cornish, Endowed Chair in Bio-Based Emergent Materials, and Kurt Koelling, professor of chemical and biomolecular engineering, in studying the properties of bioplastics made from invasive grasses found around Lake Erie. "We're blending her material with a material from microorganisms to see if it can improve the properties for packaging," Vodovotz said. Vodovotz also is assisting on the "[Buckeye Gold \(http://www.youtube.com/watch?feature=player_embedded&v=QQDVxWQOkjQ\)](http://www.youtube.com/watch?feature=player_embedded&v=QQDVxWQOkjQ)" project, examining the properties of Russian dandelion, which shows promise as a source of natural rubber. Potentially, an acre of Russian dandelion could provide enough rubber to produce 500 tires. Vodovotz's lab is helping analyze the physical and chemical properties of the material. "It's a very strong collaboration," she said.

The project is a good example of taking a multidisciplinary approach to basic research on a cellular level, applying it to practical uses, and getting a product into the marketplace. It's what Vodovotz loves about her job.

"I have a great time with my collaborators," Vodovotz said. "It's fascinating. It's very neat seeing a project from their side, and they find it very interesting to see it from the way we approach it. Research-wise, we never fail to have enough ideas."

For information on more projects Vodovotz is working on, see her research website at <http://fst.osu.edu/vodovotz/research.html> (<http://fst.osu.edu/vodovotz/research.html>).

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