Study shows way to test health claims of probiotics

October 26 2011, By Caroline Arbanas

IMAGE: ROBERT BOSTON

(Medical Xpress) -- Yogurt is popular among consumers, largely because the special live bacteria it contains are thought to benefit digestive health. But how much influence do these bacteria actually have on digestion and, by extension, on overall health?

It's a question that plagues food regulators charged with evaluating the health claims made by manufacturers of yogurt and other "functional foods" that contain probiotics or other added ingredients designed to promote health and wellness. Scientists have had a difficult time testing the credibility of these claims because people don't live in laboratories, where diet and environment can be carefully controlled.

In a new study published Oct. 26 in *Science Translational Medicine*,

scientists at Washington University School of Medicine in St. Louis demonstrate a rigorous way to test the effects of probiotic bacteria on digestive health: they zeroed in on the community of microbes that naturally live in the intestine and help to digest foods our bodies can't on their own.

The research establishes a way to understand more fully the complex relationship that exists between diet and the way the gut microbiome operates to digest particular foods.

"Now, we can directly test the influence of existing or candidate probiotics on the ability of our gut microbial community to digest various components of our diets," says senior author Jeffrey I. Gordon, MD, the Dr. Robert J. Glaser Distinguished University Professor and director of the Center for Genome Sciences & Systems Biology. "Our group's goal is to help develop new ways to improve the nutritional value of the foods we consume, in part by optimizing the features contained in the gut microbial communities of people at various stages of life and from different cultural traditions."

Gordon, a pioneer in elucidating the influence of diet on gut microbial communities, and his colleagues looked at the way a popular commercially available yogurt influenced intestinal microbes in people and in mice that were raised under sterile conditions and seeded with a model community of human gut microbes.

Yogurt typically contains at least two live bacterial strains, but the yogurt used in this study is manufactured with five strains of bacteria.

The scientists found that the results in mice, which can be studied in a highly controlled environment, mirrored those in the humans, whose diets and surroundings vary from person to person. Their discovery sets the stage for using mice harboring distinct communities of human

intestinal microbes as a preclinical discovery pipeline to identify the effects of existing and new probiotic bacterial strains on human digestive health.

“This is a proof of principle,” Gordon says. “We have developed an approach to test the health effects of probiotics that focuses on how those microbes influence the dynamic operations of our gut microbial communities.”

As part of the new research, the scientists first tested the effects of the yogurt on the gut microbial communities of seven pairs of healthy adult identical twins – all females – who ate two servings daily for seven weeks. The yogurt, with its five live bacterial strains, did not disturb the mix of microbes in the women’s digestive tracts, says first author Nathan McNulty, a graduate student in Gordon’s lab.

A repeated analysis of stool samples taken in the weeks before, during and after the yogurt was consumed showed that the various microbial species and their genes present in the women’s intestines remained remarkably stable. Within two weeks after the women stopped eating the yogurt, no live bacteria from the yogurt could be detected in their intestines.

The researchers then compared their results in humans with those in mice that had been transplanted with a model community of 15 prominent human intestinal microbes, in which each of the microbes’ genomes had been sequenced. When the mice were fed the same yogurt strains, the mix of human microbes and the content of their 58,000 human microbial genes did not change appreciably, either.

But then the researchers delved deeper. By analyzing the expression of genes in the human intestinal microbes of these mice, along with metabolites in their urine, the researchers found that the yogurt strains

elicited key changes in a number of metabolic pathways, particularly those related to the processing of carbohydrates in the diet. Many of the changes in metabolism first detected in the mice also were found to occur in the twins.

“Carbohydrates are an important part of our diet, and the way they are broken down by gut microbes is an important part of digestive health,” Gordon says. “A number of carbohydrates are quite complex and can only be digested by enzymes made by gut microbes. We found that when the mice were given the bacterial strains found in the yogurt, at doses comparable to those consumed by humans, they could more efficiently break down certain classes of carbohydrates.”

Gordon cautions that the study was not designed to evaluate the health claims of the particular yogurt used in the research. But he notes that other studies have linked some products of carbohydrate fermentation to the time it takes food to move through the intestines – a benefit claimed by some yogurt manufacturers. More work is needed, he says, to directly test how carbohydrate metabolism influences intestinal transit time.

More information: McNulty NP, Yatsunenko T, Hsiao A, Faith JJ, Muegge BD, Goodman AL, Henrissat B, Oozeer R, Cools-Portier S, Gobert G, Chervaux C, Knights D, Lozupone CA, Knight R, Duncan AE, Bain JR, Muehlbauer MJ, Newgard CB, Heath AC, Gordon JI. The impact of a consortium of fermented milk strains on the gut microbiome of gnotobiotic mice and monozygotic twins. Science Translational Medicine. Oct. 26, 2011. DOI: 10.1126/scitranslmed.3002701

Provided by Washington University in St. Louis