

Researchers reduce sugar content of yogurt without reducing sweetness

April 22 2016

A team from a Danish food ingredients company has manipulated the metabolic properties of yogurt-producing bacteria to sweeten the yogurt naturally, while reducing sugar in the final product. Similar manipulations have also all but eliminated lactose, so that those with lactose intolerance can enjoy the yogurt. They have accomplished all of this using microbiological methods that predate the era of genetic technologies. The research appears April 22nd in *Applied and Environmental Microbiology*, a journal of the American Society for Microbiology.

The goal was to engineer the yogurt bacteria not to consume glucose, a fermentation product that is a particularly sweet form of sugar, said corresponding author Eric Johansen, PhD. Johansen is Associate Vice President - Science, Chr. Hansen, A/S, Hørsholm, Denmark.

In certain countries, including Denmark, yogurt is defined as containing live cultures of *Streptococcus thermophilus* and *Lactobacillus delbrueckii subsp bulgaricus*.

Normally, when grown in milk, the two bacterial species break down lactose, a disaccharide, into its monosaccharide components, glucose, and galactose. They consume the glucose and secrete the galactose.

"We wanted to change them so that they would eat the galactose and spit out the glucose," said Johansen. "That required a number of changes in metabolism." In the first step, the investigators grew *S. thermophilus* on a

medium where galactose was the sole food source. Thus, individual bacteria had to consume galactose in order to grow. A few mutants were capable of doing so, and the investigators cultured these.

The next steps were to modify the bacteria so that they would no longer consume glucose, and would no longer even transport glucose into the cell. To this end, Johansen's team grew the bacteria in a medium containing a glucose analog called 2-deoxyglucose, which is toxic to cells. The few mutants that survived in this medium lacked the ability to metabolize glucose. A second round of selection, with higher levels of 2-deoxyglucose, resulted in survival of mutants lacking the glucose transport mechanism.

Johansen et al. also used 2-deoxyglucose to isolate mutants of *Lactobacillus bulgaricus*, to select for mutants that were unable to transport glucose into the cell. This prevented them from consuming the glucose produced by *S. thermophilus*.

Now they made yogurt with the modified bacteria. The yogurt had very little lactose, and not much galactose. But it was high in glucose—and sweet. They presented the yogurt to a taste panel, with varying amounts of sucrose added, but in all cases with less than is normally added to yogurt. The results: they were able to reduce added sucrose by 20 percent while maintaining the desired sweetness.

"The sugar content of food is of increasing concern to health-conscious consumers, and dairy products are often criticized due to the presence of added sugar—sucrose," said Johansen. "We reasoned that since glucose is considerably sweeter than lactose or galactose, bacteria that release [glucose](#) into the product could allow for a reduction in of added sugar while maintaining the desired sweetness in the yogurt." Additionally, said Johansen, the near absence of lactose enables those with [lactose intolerance](#) to enjoy yogurt.

Provided by American Society for Microbiology

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