

# SDSU food scientist increases protein, fiber in steamed bread

BY CHRISTIE DELFANIAN AUGUST 17, 2020

A corn-based product can help increase the amount of protein and fiber people consume, according to South Dakota State University professor Padu Krishnan. The food scientist is fortifying breads and other baked goods with dried distillers grain, a coproduct of the corn ethanol industry.

His latest project in the Department of Dairy and Food Science is incorporating DDG into steamed bread. The product accounts for 60% of the wheat flour consumed in northern China and 20 to 30% in southern China, according to semanticscholar.org. Steamed bread is also popular in Asian countries, such as the Philippines, Singapore and Malaysia."

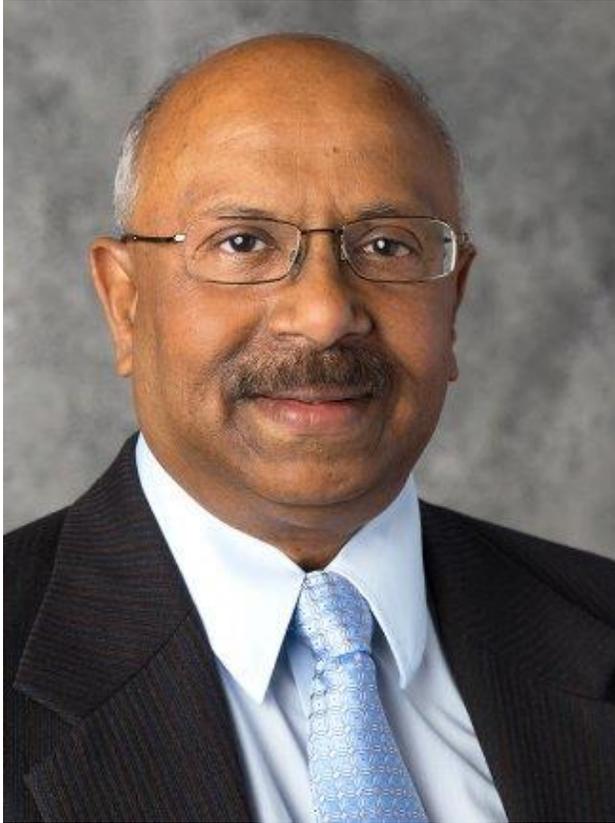


Steamed bread, which has little or no sugar and fat, has the texture of American white bread with a glossy outer skin. Incorporating up to 15% food-grade dried distillers grain into the flour can increase the bread's protein and fiber content while maintaining its taste and texture. (Photo courtesy of Wheat Marketing Center).

"We need to consume 35 to 50 grams of fiber a day to support cardiovascular and gastrointestinal health and help prevent diabetes and obesity, but we consume only 10 to 20 grams," he explained. Americans tend to get their protein from meat, but that's not possible in many countries.

"We are exploring products enriched with plant proteins to provide the nutrients people need and to do so in a more sustainable way," Krishnan said. He worked with visiting scientist Xiaona "Ivy" Li from the College of Food Science at Shenyang Agricultural University and her mentor C.Y. Wang, former associate dean of research for the College of Education and Human Sciences, to determine how much DDG can be integrated into steamed bread while maintaining the sensory characteristics consumers want.

Study results are published in the June 2020 issue of *Food Science and Nutrition*, an open-access, peer-



Professor Padu Krishnan is increasing the protein and fiber content of breads and other baked goods using dried distillers grain, a coproduct of the corn ethanol industry. His latest project is incorporating DDG into steam bread.

reviewed journal. The research was supported by the Minnesota Corn Research and Promotion Council, the China Scholarship Council and U.S. Department of Agriculture Hatch Act funding through the South Dakota Agricultural Experiment Station.

Dried distillers grain is sold as livestock feed for slightly more than \$140 a ton or 7 cents per pound. “If it can be used in food and specialty applications, we can increase its value comparable to other food ingredients,” Krishnan said. Furthermore, these nutritionally fortified products have the potential to open up new export markets for Midwestern DDG, which would benefit both the ethanol industry and corn producers.

### **Making food-grade DDG**

“Adding DDG to wheat flour improves nutritional value of the finished products,” Krishnan said. The food-grade DDG, developed at SDSU, contains 30 to 40% each of protein and fiber.

Krishnan obtains distillers grain from the centrifuge of an ethanol processing plant. “I need to know my source, to know the baseline information on the raw material to understand what effects the treatments have on distillers grain,” he explained.

“When it comes out of the plant, it is cooked, sterilized and piping hot,” Krishnan said. However, the mixture is 60 to 70% moisture and is not shelf-stable. The food scientist then freezes the raw material until he can “process and refine it so it is wholesome and fit for human consumption.”

### **Adjusting the formulation**

Steamed bread is made of flour, water and yeast with little or no sugar nor fat, Krishnan said. The internal texture is similar to that of American white bread, but steaming results in a smooth, shiny outer skin, rather than a brown crust. “It is a sensitive and challenging product as it has a lean formula,” he added.

The researchers used flour that had 10, 15, 20 and 25% DDG and made six loaves with each formulation. Steaming uses a lower temperature, thereby reducing nutrient loss as opposed to conventional baked bread, Krishnan said.

The researchers found that up to 15% DDG can be incorporated into the flour without damaging the dough functionality nor the texture and taste of the bread. However, higher DDG levels increase the hardness and adhesiveness of the bread.

“The DDG affected the dough’s gluten network, decreasing its endurance to mixing,” Krishnan explained. “At 15%, the bread was chewy, which is desirable and the dough maintained its elasticity.”

Although DDG tends to darken the bread’s color, this is not a concern among Asian consumers. Li told Krishnan that Asians add colors, like purple, green, brown and yellow because they prefer dark colors in their bread.

“It’s important to work with a food scientist, such as Ivy, who is familiar with the Asian cultural standards,” Krishnan said. The fortified steamed bread “has to meet consumers’ eating quality standards.”