Researchers transform popcorn into microbiome-boosting superfood

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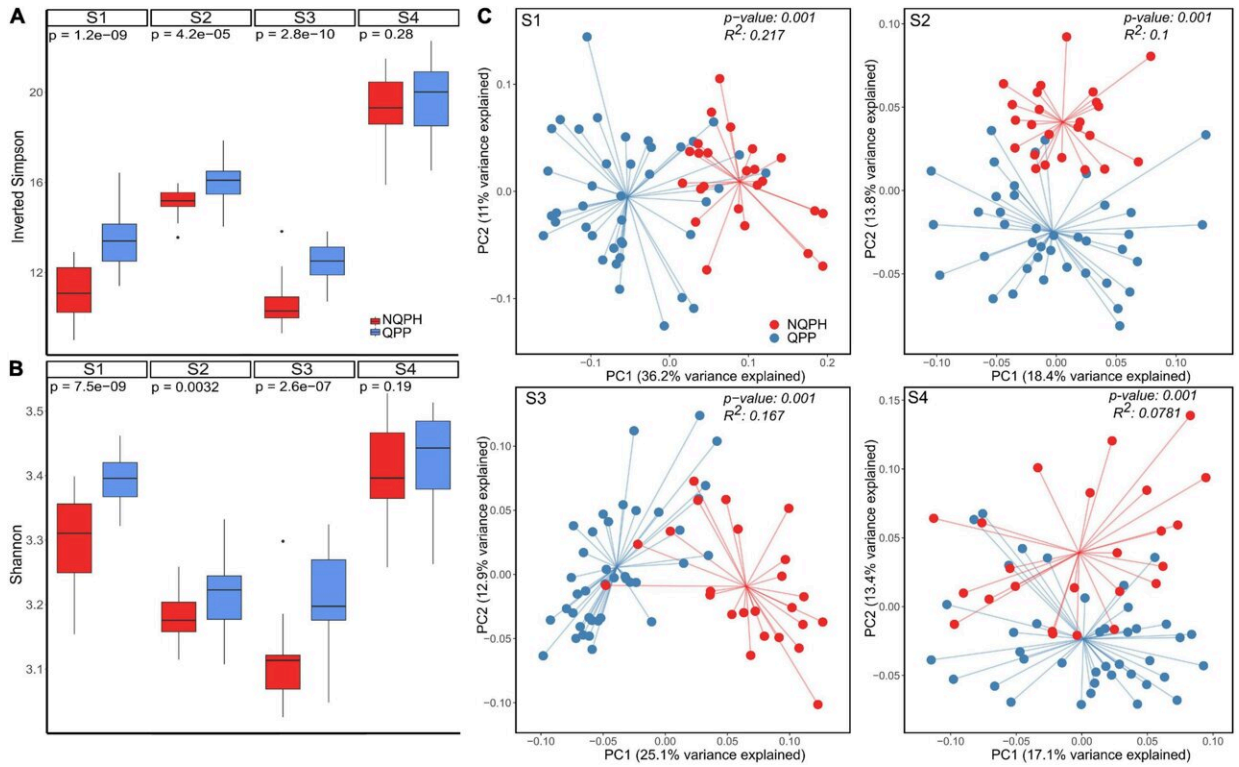

(A) Diversity reported as Inverted Simpson and (B) Shannon metrics of α-diversity for global differences between the microbial response to quality-protein popcorn (QPP) and non-quality-protein parental hybrid (NQPH); p-values were calculated by Wilcoxon test. (C) Jaccard index of β-diversity coupled with PCoA ordination shows total differences between microbiome response to QPP and NQPH. Credit: *Frontiers in Microbiology* (2022). DOI: 10.3389/fmicb.2022.921456

A Nebraska-led coming attraction may soon pop into a global blockbuster.

Through a decade-long project supported by Conagra Foods, a University of Nebraska–Lincoln research team led by David Holding has naturally bred new varieties of popcorn that outperform today's most popular kernels in their intrinsic nutritional value and taste.

"When we took on this challenge, I was 50% confident that we could deliver on improvements in terms of nutrition," Holding said. "But at no time did I think this would lead us to a level of success that also delivered improved taste, texture and prebiotics over conventional popcorn."

The Nebraska-made varieties—which are currently being tested by Conagra—offer nearly twice the level of lysine, an amino acid essential in the diets of humans and livestock, compared to popular popcorn varieties and other cereal grains.

Higher lysine can enhance nutritional value, thus adding economic value and broadening the appeal of the popular snack, Holding said.

Dent corn, a worldwide crop and the signature variety of the Midwest, is deficient in lysine. But in the 1990s, researchers successfully bred a gene variant known as opaque-2 into dent corn. In lowering the production of normally dominant prolamin proteins, opaque-2 allowed for a rise in non-prolamins: those containing lysine and another essential amino acid, tryptophan. The resulting variety—Quality-Protein Maize, or QPM—has since helped combat malnutrition in many developing countries.

With the backing of Conagra Foods, Holding decided to try the same in popcorn. "It turns out that that's really difficult to do," said Holding, professor and associate department head in the Department of

Agronomy and Horticulture.

The problem was at once simple and complex: Popcorn containing opaque-2 wouldn't pop. And that problem stemmed from what's in its name: Opaque-2 tends to turn popcorn's normally hard, glassy kernels into softer, chalkier forms resistant to popping.

Agronomists had previously managed to breed the undesirable softness trait out of the QPM dent corn, which was otherwise more susceptible to pests and harvesting damage. But they did so mostly without knowing which genes helped restore the kernels' glassy consistency.

Holding had devoted considerable time to identifying swaths of the corn genome responsible for restoring that glassiness. So he set out to cross-breed multiple generations of the QPM dent corn with popcorn varieties selected to contain the restorative genes.

The outcome? High-lysine Quality Protein Popcorn (QPP) that pops as well as the original variety.

"When this project started, I wasn't sure we could achieve that, given that people hadn't been very successful in transferring beneficial traits from dent corn to popcorn in the past," Holding said. "We're the first to take the dent QPM variety and successfully convert that into popcorn, achieving high lysine and maintaining popping.

"This is a product that lends itself to organic production and can be marketed as a novel popcorn variety, as consumers are paying more attention to their foods' nutritional value. For popcorn breeding in general, this also shows the potential for mining other traits from dent corn into popcorn to improve the crop's agronomic performance."

Other advancements include blind taste testing—many of the Nebraska

QPP hybrids outperformed the non-QPP lines in terms of taste and texture—and working with the Nebraska Food for Health Center to show positive prebiotic impacts of the popcorn.

"What we've developed here is a complete protein snack that can be marketed as a superfood due to its positive prebiotic qualities," Holding said. "And it isn't just a snack food. It is also quite nutritious and could be beneficial as a dietary supplement in developing countries where protein is needed.

"This work has truly been much more successful than we expected."

Related research has been published in *Frontiers in Microbiology* and the *Journal of Sensory Studies*.

More information: Nate Korth et al, The Unique Seed Protein Composition of Quality Protein Popcorn Promotes Growth of Beneficial Bacteria From the Human Gut Microbiome, *Frontiers in Microbiology* (2022). DOI: 10.3389/fmicb.2022.921456

Leandra Parsons et al, Improved taste and texture in novel popcorn varieties compared to conventional lines, *Journal of Sensory Studies* (2021). DOI: 10.1111/joss.12687

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