Scientists develop visual tool to help people group foods based on their levels of processing

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Fralin Biomedical Research Institute at VTC scientists studying ultra-processed foods have created a new tool for assessing the rewarding and reinforcing properties of foods that make up 58% of calories consumed in the United States. The foods have been linked to a wide range of negative health outcomes.

The research, which was published in April in the journal *Appetite*, provides a collection of carefully curated images of minimally processed and ultra-processed foods matched on 26 characteristics, including macronutrients, sodium, dietary fiber, calories, price, and visual characteristics such as color and portion size.

The work was based on the NOVA classification system—"nova" means new in Portuguese—which groups foods into four categories based on their level of processing. Nutrition researchers at the University of São Paulo in Brazil developed the scale while studying the country's sharp increase in obesity rates.

The scale has its detractors.

"A major criticism of the NOVA scale is that it's difficult to use or that foods are classified differently by different people," said Alexandra DiFeliceantonio, corresponding author and assistant professor at the Fralin Biomedical Research Institute. "We found that people with
education in nutrition generally agreed on the food classifications, providing some data that it might not be a valid criticism."

**What they did**

The NOVA system assigns food to four categories: unprocessed or minimally processed, such as fresh fruit, legumes, or plain yogurt; processed culinary ingredients, such as cooking oils, butter, and salt; processed foods, which combine the two above through simple methods such as cheese, canned vegetables, or freshly baked bread; and ultra-processed foods, such as soft drinks, flavored yogurt, processed meat, and most packaged breads, made through industrial processing and additives rarely found in a home pantry.

To develop the picture set, a team of psychologists, neuroscientists, and registered dietitians selected foods to represent either minimally processed or ultra-processed foods.

The foods were prepared in a lab, visually represented through professional photography, and controlled for consistency. Researchers also gathered price, food weights, and nutritional information—calories, macronutrients, sodium, and dietary fiber—for the food in each image.

Study participants rated images across a range of qualities to generate a final set of 28 pictures matched across 26 characteristics. To objectively measure NOVA classification, researchers recruited 67 nutrition professionals and asked them to classify the foods as minimally or ultra-processed.

"With this food picture set we can start to infer that any differences between food pictures are due to the degree of food processing, and not all these other factors that we know are potentially impactful," said Zach Hutelin, the study's lead author and a Fralin Biomedical Research
Institute-based graduate student in the translational biology, medicine and health Ph.D. program.

**Why this matters**

Ultra-processed foods are linked with an increased risk of developing obesity, Type 2 diabetes, heart disease, and cancer. They represent more than half of calories consumed in the United States, Canada, and the United Kingdom and have been identified as a global threat to public health.

"There is very little experimental research on ultra-processed foods, and part of what's been holding us back is better tools for measuring and assessing their effects," said DiFeliceantonio, who is also associate director of the Fralin Biomedical Research Institute's Center for Health Behaviors Research. "The more tools we can provide, the more we can learn."

The Virginia Tech team is making the pictures and associated data accessible through the [Virginia Tech Data Repository](https://data.vt.edu) of the Virginia Tech University Libraries. This will allow scientists to test hypotheses in behavioral, economic and neuroimaging studies.

In the DiFeliceantonio lab, the photos are being used with functional MRI to reveal associated brain activity, with the images isolating the effects of food processing from other characteristics.
