What Is Ultraprocessed Food, and What Are Its Effects?

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In 2010, Brazilian epidemiologist Dr Carlos Monteiro, scientific coordinator of the Nutritional Epidemiology Research Center at the University of São Paulo in Brazil, gained global recognition for developing the NOVA classification. Although initially not based on robust mathematical reasons or randomized studies, NOVA stood out internationally for introducing the concept of ultraprocessed foods, bringing significant changes in nutrition and public health, as well as causing discomfort in the food industry.

During the International Congress on Obesity in São Paulo, Brazil, Monteiro presented the latest evidence supporting his classification. He shared the session with Canadian researcher Dr Kevin Hall, senior investigator at the National Institute of Diabetes and Digestive and Kidney Diseases in Bethesda, Maryland. Hall's research, until then, had been motivated by skepticism regarding Monteiro's ideas.

Monteiro began the session by outlining the basic premise of the NOVA classification, which categorizes foods according to the degree of processing. The categories include unprocessed or minimally processed foods like bagged beans and pasteurized milk; processed culinary ingredients like butter, olive oil, and sugar; processed foods like canned grains and vegetables, jams, and tomato paste; and ultraprocessed foods, which are products resulting from aggressive fractionation of unprocessed foods, such as sodas, cookies, and frozen pizzas.

"Ultraprocessed foods were created to replace fresh meals, not to provide the necessary [nutrient] proportion or improve sensory properties. For this, there are a series of industrial processes. [Foods] are hydrolyzed, hydrogenated, extruded, and prepared through industrial methods like frying. To make them palatable and durable, cosmetic additives such as flavors, emulsifiers, colorings, and flavorings are added. All these processes explain the name 'ultraprocessed' and have impacts on the final quality of the food and health," explained Monteiro.

He presented scientific evidence on the risks associated with excessive consumption of these products. A systematic review published in February 2024, conducted by experts from various institutions such as the Johns Hopkins Bloomberg School of Public Health in Baltimore and the University of Sydney in Sydney, Australia, analyzed data from more than nine million participants. The research found direct associations between exposure to ultraprocessed food and 32 health parameters, covering mortality, cancer, and issues related to mental, respiratory, cardiovascular, gastrointestinal, and metabolic health.

In addition, Monteiro presented a study of his own, which is under peer review. The results suggest that ultraprocessed food currently provides close to or more than half of the calories in the diets of developed countries such as Canada, the United States, and the United Kingdom. In middle-income countries, consumption is also significant but in smaller, though increasing, proportions (eg, nearly 20% in Brazil).

The study analyzed data from 93 countries on the consumption and sales of ultraprocessed food between 2007 and 2022. "The results show a steady increase in the consumption of these products, especially in low- and middle-income countries. In contrast, high-income countries show stabilization, the result of a reduction in the sales of sugary drinks, offset by the increase in other ultraprocessed foods," said Monteiro. In China, the proportion of ultraprocessed foods in the diet tripled. Similarly, countries like Brazil, Mexico, Korea, and Spain also showed twofold to threefold increases in the consumption of these products.

Monteiro also highlighted a study showing that people with diets rich in ultraprocessed food consume many more calories, often exceeding 5000 per day, thus resulting in weight gain. The post hoc analysis of this study suggests that the hyperpalatability and high caloric density of these foods are the main factors contributing to this excessive consumption. Another point raised was the deterioration of the nutritional quality of foods due to ultraprocessing, which reduces the content of beneficial phytochemicals, such as flavonoids. According to Monteiro, these characteristics are "a recipe for diseases." Processing also "creates chemical contaminants, such as acrylamide and bisphenol, which have proven harmful effects on health," he added. He also addressed the problem of dependence on ultraprocessed food. About 14% of adults and 12% of children in the United States show signs of addiction to these foods, he said. Addiction may be amplified by aggressive marketing.

Despite the wealth of data presented, Monteiro emphasized the need for more research. "We are far from a complete understanding. We do not have adequate data on low-income countries, especially those in Africa. We also know little about the total exposure to additives present in ultraprocessed foods, including the amounts in micrograms or milligrams of emulsifiers and other ingredients. Even so, the evidence is already sufficient to demand public health measures to mitigate the negative impacts of ultraprocessed food," he said.

Proof of Concept

Hall, on the other hand, started his presentation by emphasizing that his research on ultraprocessed foods was initially motivated by the criticisms of the concept. "There were quite strong criticisms, and initially, I agreed with them. However, I realized that the people criticizing were not trying to test the concept but just giving opinions. And as a scientist, one of the things we must do is design experiments to prove whether we are right or wrong, and that's what I did," he said.

Hall's study was designed to investigate whether diets rich in ultraprocessed food influence excessive consumption and weight gain. "We conducted a study at our clinical center, involving 20 people with stable weight. For a month, we monitored their food environment, randomizing them into two groups that were exposed to a diet consisting almost entirely of ultraprocessed food (83% of the total diet energy)," said Hall. He explained the experimental design in which participants had the freedom to consume the designated diets *ad libitum.* "Our approach allowed participants to consume amounts they found satisfying, without explicit weight gain or loss restrictions. We evaluated the diets for fat, sugar, fiber, sodium, energy density, and glycemic load composition, essential elements. For 2 weeks, they strictly consumed ultraprocessed foods and an alternative diet for the remaining 2 weeks," he explained.

As a result of the study, which was published in *Cell Metabolism* and considered one of the first randomized controlled trials on the subject, Hall saw that critics of the concept of ultraprocessed food were wrong. "I was mistaken, which wasn't bad. In fact, it's better to prove for yourself than for someone else to do it for you," he said. "We observed a difference of 500 calories per day in energy intake when people consumed ultraprocessed food compared with a minimally processed diet. Spontaneously, they gained weight during the ultraprocessed diet and lost weight in the minimally processed one."

The research raised the question of which potential mechanisms drive excessive consumption of ultraprocessed food. One of the theories, which Monteiro supports, suggests that these foods may be addictive and induce

dependence. This hypothesis, which is comparable to theories that addiction to ice cream and potato chips resembles addiction to heroin, motivated Hall to evaluate the addictive potential of ultraprocessed food. He and his team used standard methods from the US National Institutes of Health to measure the dopamine response in humans after consuming an ultraprocessed milkshake.

Although the research, which used PET to locate and observe the dopamine receptors in the brain, did not find evidence of a massive dopamine release comparable with that associated with drugs, Hall emphasized that this study represents an important step in understanding how certain foods can influence brain reward pathways. "It is possible that the detection method used in the research is not sensitive enough to capture a significant release of dopamine comparable to that observed with drugs of abuse. To expand these findings, we are planning a new comparative study that will include a wider range of diets, from minimally processed to those with high ultraprocessed food content," he explained.

Combating Ultraprocessed Food

According to Monteiro, combating ultraprocessed food requires a multifaceted and vigorous approach like the strategies used against tobacco. For example, he proposed the implementation of public health campaigns that alert consumers to the dangers of these foods. These campaigns would include visible warnings on packaging, highlighting the health risks associated with consumption. In addition, Monteiro advocates the prohibition or severe restriction of ultraprocessed food advertising and the adoption of policies to eliminate the sale of these products in schools and healthcare facilities.

Another measure suggested by the expert is the imposition of significant taxation on ultraprocessed food, using the generated revenues to subsidize fresh and minimally processed foods. He argued that this approach would not only deter excessive ultraprocessed food consumption but also make healthier foods financially accessible to all. By highlighting the similarities between the marketing and lobbying strategies of the ultraprocessed food industry and the tobacco industry, Monteiro emphasized the urgent need for strict regulations to protect public health from the harm caused by these products.

When asked about his expectations, Monteiro told *Medscape Medical News* that the industry is unlikely to abandon products that generate high consumption and profits. He also pointed out that the industry disapproves of the concept of ultraprocessed foods, as it implies criticisms of the practices they have developed to maximize their gains, despite the negative effects on public health such as the obesity and diabetes

pandemics. While expecting difficulties, the researcher believes there will be a turning point, not so much due to industry initiative but due to the pressure from regulatory authorities and the increasing costs to the healthcare system.

"At some point, this will become so evident, and expensive, that the industry will have to change. The challenge is to know how long it will take. It is a situation like global warming. Eventually, humanity will realize the need for change. The question is whether we will have enough time. If we only solve these problems in 20 or 30 years, the damage will be enormous. I have no doubt that this will be resolved. The issue is that we want it to be resolved as soon as possible," concluded Monteiro.

Pereira is cofounder of Pallium Canada and has received stipends from the organization. Seow and Gallagher had no relevant financial relationships.

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