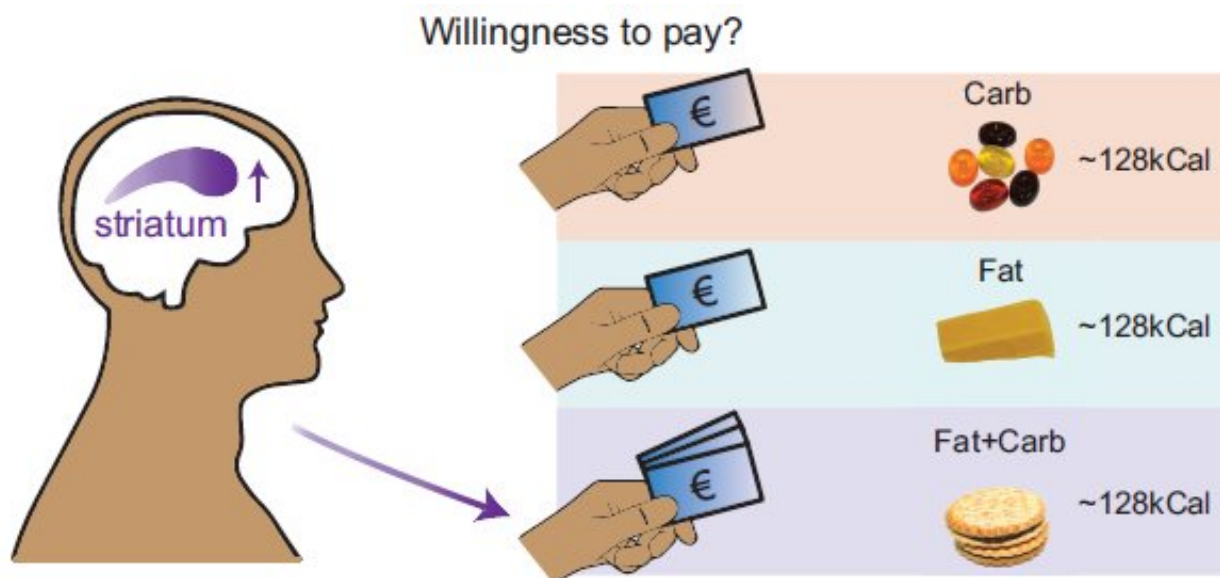


Foods combining fats and carbohydrates more rewarding than foods with just fats or carbs

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This visual abstract shows that foods containing fat and carbohydrate are more reinforcing than equicaloric foods containing primarily fat or carbohydrate. This effect is independent of liking and is reflected by supra-additive responses in the striatum during food valuation. This may be one mechanism driving overconsumption of high-fat/ carbohydrate processed foods. Credit: DiFeliceantonio and Coppin et al./*Cell Metabolism*

Researchers show that the reward center of the brain values foods high in both fat and carbohydrates—i.e., many processed foods—more than

foods containing only fat or only carbs. A study of 206 adults, to appear June 14 in the journal *Cell Metabolism*, supports the idea that these kinds of foods hijack our body's inborn signals governing food consumption.

"The biological process that regulates the association of foods with their nutritional value evolved to carefully define the value of a [food](#) so that organisms can make adaptive decisions," says senior author Dana Small, director of Yale University's Modern Diet and Physiology Research Center. "For example, a mouse should not risk running into the open and exposing itself to a predator if a food provides little energy."

"Surprisingly, foods containing fats and carbohydrates appear to signal their potential caloric loads to the [brain](#) via distinct mechanisms. Our participants were very accurate at estimating calories from fat and very poor at estimating calories from [carbohydrate](#). Our study shows that when both nutrients are combined, the brain seems to overestimate the energetic value of the food," she says.

In work that could help explain brain-body mechanisms underlying the genetic predisposition for obesity, eating in the absence of hunger, and difficulty losing or keeping off excess weight, Small and colleagues in Germany, Switzerland, and Canada looked at the neural response to food cues.

Test subjects underwent brain scans while being shown photographs of familiar snacks containing mostly fat, mostly sugar, and a combination of fat and carbs.

Allocated a limited amount of money to bid on their first-choice foods, subjects were willing to pay more for foods that combined fat and carbohydrates. What's more, the fat-carb combo lit up neural circuits in the [reward center](#) of the brain more than a favorite food, a potentially sweeter or more energy-dense food, or a larger portion size.

Our hunter-gatherer ancestors ate mostly woody plants and animal meat, the researchers noted. "In nature, foods high in fat and carbohydrate are very rare and tend to have fiber, which slows metabolism," Small says. "By contrast, it is very common for processed foods to have high fat and high carbohydrate loads."

After the domestication of plants and animals and the development of grain and dairy production around 12,000 years ago, opportunities to consume fat and carbohydrates together increased, but processed foods like donuts, which could contain 11 grams of fat and 17 grams of carbohydrate, have only been around for 150 years, not long enough for us to evolve a new brain response to them.

Scientists believe our past experience with the nutritive properties of carbohydrates releases dopamine in the brain through an as-yet-unknown metabolic signal. These kinds of signals seem to help regulate what and how much we eat.

The researchers theorize that the simultaneous activation of fat and carbohydrate signaling pathways launches an effect that human physiology has not evolved to handle. Consistent with this suggestion, rodents given access to fat alone or carbohydrate alone regulate their total daily caloric intake and body weight. But given unrestricted access to fat and carbohydrates, they quickly gain weight.

More information: *Cell Metabolism*, DiFeliceantonio and Coppin et al.: "Supra-Additive Effects of Combining Fat and Carbohydrate on Food Reward" [www.cell.com/cell-metabolism/fulltext/S1550-4131\(18\)30325-5](http://www.cell.com/cell-metabolism/fulltext/S1550-4131(18)30325-5) , DOI: [10.1016/j.cmet.2018.05.018](https://doi.org/10.1016/j.cmet.2018.05.018)

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