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Does Your Brain Structure Influence Your Food Choices?

Neuroanatomy may help explain why some people are better than others at resisting food temptations.

Let's say you're at a restaurant, and you hear the person at the table next to you order the most indulgent dessert on the menu. Then, suppose you glance over and see that that person is overweight. Would you come to a negative conclusion about the diner?

Across cultures, it's very common for food choices to be freighted with social judgments. People who yield to cravings at the expense of long-term health interests are seen as lacking willpower. Their dietary lapses are even conflated with character flaws.

Thinking this way presumes that everyone has the same capacity to tame their impulses and make more healthful choices. But what if our ability to exercise self-control is related, in part, to our neurobiology? That is precisely what my co-authors and I discovered in our recent research on healthy food choices, results from which were published in ***The Journal of Neuroscience***. My co-authors were Liane Schmidt of the Brain and Spine Institute (ICM) at Sorbonne University, Anita Tusche of California Institute of Technology, Nicolas Manoharan of Sorbonne-Universités-INSEAD Behavioural Lab, Cendri Hutcherson of University of Toronto, and Todd Hare of University of Zurich.

Brain scans and dietary plans

Our research encompassed four experiments involving 123 people in all – 78 women and 45 men. In the first three, participants were placed inside an fMRI scanner, shown photos of food items and asked whether they wanted to consume them, with response options ranging from "strong yes" to "strong no". They were further instructed to base their decisions either on health, tastiness or their own natural inclinations. The items depicted ranged from Brussels sprouts to chocolate chip cookies.

In the fourth experiment, we did not supply specific decision-making criteria, instead instructing participants to "indulge" in the food, "distance" themselves from taste-based cravings, or choose as they normally would. In lieu of the yes/no response, the fourth group was told to select the price they would pay to eat the food, on a scale from $0 to $2.50.

To make the experiments concrete, participants fasted for four hours before they began. We informed them that after the study, they would have the chance to eat one of the food products they had rated, which would be chosen at random. If the random item was one for which they had declared no desire, they would not receive it. We fulfilled our

promises to the letter. Participants in the fourth study even paid their self-selected prices to obtain the food.

Analysing the test subjects' brain anatomy alongside their food choices, we found that the level of self-control they exhibited – i.e. their ability to focus on health and de-emphasise taste when instructed to do so – was predicted by the grey matter volume (GMV) in two brain regions. Those with higher GMV in the dorsolateral prefrontal cortex (dlPFC) and ventromedial prefrontal cortex (vmPFC) displayed more self-control.

Relevant brain regions

There is a debate among neuroscientists as to which of the two regions is primarily responsible for self-control. Some believe that the dlPFC, which has been widely linked to cognition, working memory, and self-regulation of emotions comes into play only in instances where impulses are successfully resisted. The vmPFC is generally thought to be involved in valuation and decision-making.

Pinning down how the two regions interact to influence self-control was outside the scope of our study. It is a matter for future researchers to investigate. However, my personal theory, based on past research findings using functional rather than structural brain imaging techniques, is that the vmPFC is involved in the integration of various attributes such as healthiness and tastiness into a holistic value signal, and the dlPFC implements the self-control.

Neuroplasticity

Our findings do not imply that there are biologically predetermined limits on people's self-control. The structure of brain regions can change based on use as well as a host of other circumstances, an adaptive capacity known as "neuroplasticity." GMV is "like a muscle that can be developed with exercise".

For example, neurofeedback is a technique that has been found to **alter GMV** in some cases. Our findings suggest neurofeedback modalities targeting the vmPFC and dlPFC – if and when they are perfected – could potentially help people with self-control issues improve their eating habits.

Further, the role GMV plays in shaping self-control could produce helpful advancements in the treatment of food disorders linked to dysfunctional self-control behaviour such as anorexia and binge eating. Given how difficult it is to definitively diagnose these disorders, psychiatrists are always looking for objective biomarkers to aid in their assessments. Neuroanatomical differences could be useful –not as a replacement for standard diagnostic methods, but as one of many possible indicators of an illness requiring clinical intervention.

Along those lines, our findings also imply that neuroanatomy could one day help identify overweight people whose underdeveloped resources of self-control put them at enhanced risk of becoming obese later in life.

Public policy

In recent years, policymakers have been exploring how to nudge populations toward healthier food choices, in response to the **astronomical public health costs** associated with excess weight and obesity. Our results show that there are biologically encoded differences in the amount of food-related self-control individuals can muster.

Crafting one set of similar messages for an entire population, therefore, may be an ineffective communications strategy. For those capable of self-restraint, messages geared toward triggering health concerns may work. But for people without the neurological resources to make the best decisions for their health, policymakers should try campaigns emphasising how healthy foods can taste great and satisfy cravings.

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