# The brain cannot be fooled by artificial sweeteners

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Eating low-calorie sweetened products—especially when hungry or exhausted—may lead to a higher likelihood of seeking high calorie alternatives later, due to a newly discovered signal in the brain, suggests new research published today in The *Journal of Physiology*.

The results of the new study imply that it is hard to fool the brain by providing it with 'energyless' sweet flavours. Our pleasure in consuming sweet solutions is driven to a great extent by the amount of energy it provides: greater reward in the brain is attributed to sugars compared to artificial sweeteners.

Professor Ivan de Araujo, who led the study at Yale University School of Medicine USA, says: "The consumption of high-calorie beverages is a major contributor to weight gain and obesity, even after the introduction of artificial sweeteners to the market. We believe that the discovery is important because it shows how physiological states may impact on our choices between sugars and sweeteners.

"Specifically, it implies that humans frequently ingesting low-calorie sweet products in a state of hunger or exhaustion may be more likely to 'relapse' and choose high calorie alternatives in the future.

"The results suggest that a 'happy medium' could be a solution; combining sweeteners with minimal amounts of sugar so that energy metabolism doesn't drop, while caloric intake is kept to a minimum."

The study identified a specific physiological brain signal that is critical for determining choice between sugars and sweeteners. This signal regulates dopamine levels – a chemical necessary for reward signalling in the brain – and only arises when sugar is broken down into a form where it is usable as fuel for cells of the body to function.

Research was performed in mice, using a combination of behavioural testing involving sweeteners and sugars, whilst measuring chemical responses in brain circuits for reward. The researchers believe the findings are likely to reflect in humans.

Professor de Araujo says: "According to the data, when we apply substances that interfere with a critical step of the 'sugar-to-energy pathway', the interest of the animals in consuming artificial sweetener decreases significantly, along with important reductions in brain dopamine levels.

"This is verified by the fact that when hungry mice – who thus have low sugar levels – are given a choice between artificial sweeteners and sugars, they are more likely to completely switch their preferences towards sugars even if the artificial sweetener is much sweeter than the sugar solution."

Now that the team know that dopamine cells are critical in sugar/sweetener choice, they hope to identify the associated receptors and pathways in the brain.

**More information:** Tellez L, Ren X, Han W, Medina A, Ferreira J, Yeckel C and de Araujo I (2013). Glucose utilization rates regulate intake levels of artificial sweeteners. The *Journal of Physiology*.

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