

What Does Sugar Do to the Brain?

Glucose is the primary fuel for the human brain, but what happens when the brain is exposed to the excessive added sugars of the standard American diet?

Elevated blood glucose damages blood vessels, and this blood vessel damage is the major cause of vascular diabetes complications, such as retinopathy. The vessels in the brain can also become damaged by hyperglycemia, and there is evidence that this damage contributes to a progressive decline in brain function.^{1, 2} Studies on those who have lived with diabetes for many years have found deficits in learning, memory, motor speed, and other cognitive functions. Frequent exposure to high glucose levels likely diminishes mental capacity, as higher HbA1C levels have been associated with a greater degree of brain shrinkage. Even in those without diabetes, higher sugar consumption is associated with lower scores on tests of cognitive function.³ These effects are thought to be due to a combination of hyperglycemia, hypertension, insulin resistance, and elevated cholesterol associated with diabetes.^{1, 2} It is not surprising that type 2 diabetes increases the risk of Alzheimer's Disease, and that Alzheimer's has even been called "type 3 diabetes."^{4, 5}

Sugar's harmful effects on the brain don't only occur in the long term; during a single instance of hyperglycemia, slowed cognitive function and deficits in attention and memory have been reported.¹ Hyperglycemia also affects mood states; type 2 diabetic patients experienced increased feelings of sadness and anxiety during acute hyperglycemia.⁶ In healthy young people as well, a brain imaging study has suggested that in a hyperglycemic state, the brain's ability to process emotion is compromised.⁷



In addition to the damaging effects on cognition and mood, sugar also has drug-like effects in the reward system of the brain.⁸ Sugar is a palatable stimulus with reinforcing effects — having a little stimulates the desire for more. These reward systems drove early humans toward calorie-rich foods that would help them survive when food was scarce, but now contribute to the obesity and diabetes epidemics. Our physical and hormonal satiety signals seem to be overwhelmed by the sugar-induced reward.

The ability of sugar to produce a powerful reward response was demonstrated by a study in which rats were allowed to choose between pressing two levers: one lever gave them access to sugar-sweetened water, and the other a dose of intravenous cocaine. The rats preferred sugar over cocaine.⁹ In humans, high-glycemic foods have been found to activate regions of the brain associated with the reward response and provoked more intense feelings of hunger compared to a low-glycemic version, suggesting that foods that a higher elevation in blood glucose produces a greater addictive drive in the brain.¹⁰

In the brain, excess sugar impairs both our cognitive skills and self-control; throughout the body, excess sugar causes dangerous elevations in blood glucose and blood vessel damage. Added sugar is a dangerous food, and we can avoid these dangers by enjoying sweet, fresh fruits in place of refined sugars.