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What Does Sugar Do to Your Brain?

Analysis by Dr. Joseph Mercola ✔ Fact Checked | June 18, 2022

STORY AT-A-GLANCE

- The overconsumption of sugar is increasingly being linked to brain-related health issues such as depression, learning disorders, memory problems and overeating
- Research suggests consumption of sugar and sweets can trigger reward and craving states in your brain similar to addictive drugs
- Not all sugars have identical effects. Fructose has been shown to activate brain pathways that increase your interest in food, whereas glucose triggers your brain's satiation signal

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While all cells in your body can use glucose for energy, when you burn fat as your primary fuel your liver produces ketones that burn far "cleaner" in that they generate fewer reactive oxygen species (ROS) and secondary free radicals than sugars. The conventional view is that you need sugar or glucose to satisfy your energy needs, but only a very small amount of sugar is actually required. Because sugar represents calories, excessive consumption will negatively affect your health.

If you haven't given much thought to how much sugar you consume and what it may be doing to your health, now is the time to get educated. Overconsumption of sugar is increasingly being linked to brain-related health issues such as depression, learning disorders, memory problems and overeating.[1]

Your Body Recognizes Sugar as a 'Drug'

Writing in The Atlantic, neuroendocrinologist Dr. Robert Lustig, professor of pediatrics in the division of endocrinology at University of California, San Francisco, states:[2]

> *"… [T]he [U.S.] war on drugs has taken a back seat, but not because it has been won. Rather, because a different war has cluttered the headlines — the war on obesity. And a substance even more insidious, I would argue, has supplanted cocaine and heroin.*
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> *The object of our current affliction is sugar. Who could have imagined something so innocent, so delicious, so irresistible … could propel America toward … medical collapse?"*

Previous research[3] involving humans and laboratory rats suggests consumption of sugar and sweets can trigger reward and craving states in your brain similar to addictive drugs. Not only can sugar and sweets substitute for drugs like cocaine, in terms of how your brain reacts to them, they can be even more rewarding.

The dramatic effects of sugar on your brain may explain why you may have difficultly controlling your consumption of sugary foods when continuously exposed to them. Another study[4] suggests a high degree of overlap exists between brain regions involved in processing natural rewards, such as sugar and sweets, and drugs of abuse.

> *"'Non-drug' or 'behavioral' addictions have become increasingly documented … and pathologies include compulsive activities such as shopping, eating, exercising, sexual behavior and gambling. Like drug addiction, non-drug addictions manifest in symptoms including craving, impaired control over the behavior, tolerance, withdrawal and high rates of relapse."*

How Bad Habits Like Sugar Addiction Take Root

An article published by CNN Health[5] reminds us that the connection between your nucleus accumbens and prefrontal cortex drives intentional actions, such as deciding

whether you will take another bite of chocolate cake, for example.

Your prefrontal cortex also activates hormones like dopamine, triggering thoughts such as, "Hey, this cake is really good. And I'm going to remember that for the future." Lustig explains the biological process that takes place when you consume sugar or any addictive substance:[6]

> *"The brain's pleasure center, called the nucleus accumbens, is essential for our survival as a species. … Turn off pleasure, and you turn off the will to live. But long-term stimulation of the pleasure center drives the process of addiction.*
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> *When you consume … sugar, your nucleus accumbens receives a dopamine signal, from which you experience pleasure. And so you consume more. The problem is with prolonged exposure, the signal … gets weaker. So you have to consume more to get the same effect — tolerance. And if you pull back on the substance, you go into withdrawal. Tolerance and withdrawal constitute addiction. And make no mistake, sugar is addictive."*

Brain-injury survivor and author Debbie Hampton explains how habits are formed around addictive behaviors:[7]

> *"Every time you follow the same path, a specific pattern is activated and becomes more defined … and it becomes easier to activate the circuit the next time. … Pretty soon, the bad habit neuronal pathway becomes the unconscious default, and your brain, wanting to be efficient, just takes the easiest, most familiar route. This is particularly true in the case of depression.*
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> *In a depressed brain, there's less dopamine activity happening in the nucleus accumbens, which means that things that used to be enjoyable are not as pleasurable, and the only things that motivate it have to have a big dopamine payoff, which are the baddest of the bad habits, such as junk food, drugs, alcohol [and] gambling."*

Brain Imaging Shows Food Addiction Is Real

Research published in the American Journal of Clinical Nutrition[8] examined the effects of high-glycemic index (GI) foods on brain activity, using functional magnetic resonance imaging (fMRI). Twelve overweight or obese men between the ages of 18 and 35 consumed one high-GI and one low-GI meal.

Imaging was completed four hours after each test meal to assess the cerebral blood flow as a measure of resting brain activity. The researchers expected brain activity to be greater after the high-GI meal in regions related to craving, eating behavior and reward. According to the researchers:

> *"Compared with a … low-GI meal, a high-GI meal decreased plasma glucose, increased hunger and selectively stimulated brain regions associated with reward and craving in the late postprandial period … [T]he high-GI meal elicited greater brain activity centered in the right nucleus accumbens."*

The study demonstrates what you may experience when eating a high-GI meal. After rapidly digesting net carbohydrates, your blood sugar initially spikes, followed by a sharp crash later. As noted by researchers, this crash in blood glucose stimulated greater brain activity in the nucleus accumbens, the brain's pleasure center Lustig mentioned above.

Can Too Much Sugar Contribute to Alzheimer's Disease?

While insulin is usually associated with its role in keeping your blood sugar levels in a healthy range, it also plays a role in brain signaling. In one animal study, when researchers disrupted the proper signaling of insulin in the brain, they were able to induce many of the characteristic brain changes seen with Alzheimer's disease, including confusion, disorientation and the inability to learn and remember.[9]

It's becoming increasingly clear that the same pathological process that leads to insulin and leptin resistance, as well as Type 2 diabetes, may also hold true for your brain. As you overindulge on sugar and grains, your brain becomes overwhelmed by the

consistently high levels of insulin. Eventually insulin, leptin and signaling become profoundly disrupted, leading to impairments in your memory and thinking abilities.

A study published in Diabetes Care found that Type 2 diabetes is associated with a 60% increased risk of dementia in men and women.[10] Research featured in the New England Journal of Medicine noted a mild elevation of blood sugar, such as a level of 105 or 110, is also associated with an elevated risk for dementia.[11]

Dr. David Perlmutter, neurologist and author of the books "Brain Maker" and "Grain Brain," believes Alzheimer's disease is primarily predicated on lifestyle choices, including sugar consumption. He suggests anything that promotes insulin resistance will ultimately also raise your risk of Alzheimer's.

Glucose and Fructose: How Do They Affect Your Brain?

Increases in processed fructose consumption, typically in the form of high fructose corn syrup (HFCS), seem to be running parallel to the spikes seen in obesity rates, so much so that diets high in it are thought to promote insulin resistance and weight gain.

The Journal of the American Medical Association featured a study[12] involving 20 adult volunteers who underwent magnetic resonance imaging sessions at Yale University to identify neurophysiological factors related to fructose versus glucose consumption.

The research suggests fructose — a type of sugar commonly extracted from corn and found in sweetened products like soda — may activate brain pathways that increase your interest in food, whereas glucose ingestion appears to trigger your brain's satiation signal, effectively telling you "you've had enough." When participants ingested glucose and were then shown food pictures, their brains registered increased measures of satiety and fullness. The researchers noted:

> *"Glucose … ingestion reduced the activation of the hypothalamus, insula and striatum — brain regions that regulate appetite, motivation and reward processing; glucose ingestion also increased functional connections between the hypothalamic-striatal network and increased satiety."*

In contrast, when the participants consumed fructose and were presented with images of food, more activity was noted in the orbitofrontal cortex, an area linked to increased motivation to seek out rewards, such as drugs or food.[13]

Subsequent research,[14] presented in the Proceedings of the National Academy of Sciences USA, went a step further to investigate the effects of sugar on food-approach behavior. After ingesting either fructose or glucose, 24 volunteers underwent two fMRI sessions while viewing pictures of high-calorie foods and nonfood items in a block format.

After each block, participants were asked to rate their hunger and desire for food, as well as perform a decision task. The decision task involved choosing between an immediate food reward or a delayed monetary bonus. Hormone levels were measured at baseline and 30 and 60 minutes after the sugars were consumed. The authors of the study noted:

> *"Parallel to the neuroimaging findings, fructose versus glucose led to greater hunger and desire for food and a greater willingness to give up long-term monetary rewards to obtain immediate high-calorie foods. These findings suggest ingestion of fructose relative to glucose results in greater activation of brain regions involved in attention and reward processing, and may promote feeding behavior."*

Both of these studies underscore the importance of paying attention to the type of sugars you consume. Clearly, fructose disrupts your brain's signaling mechanism that is designed to tell you when you've had enough. Because fructose fails to stimulate insulin, which in turn fails to suppress ghrelin, or "your hunger hormone," which then fails to stimulate leptin or "your satiety hormone," you are likely to eat more and develop insulin resistance when consuming fructose.

The second body of research seems to indicate fructose intake can influence you to act impulsively with respect to food, consuming more and more of it even when your body should have told you it's had enough. As you may imagine, continuing to consume large

amounts of fructose will become increasingly problematic if you've already developed a bad habit of overeating.

Fructose Packs on the Pounds Faster Than Any Other Nutrient

Because fructose is often consumed in liquid form, mostly as HFCS, its negative metabolic effects are even further magnified. Energy drinks, fruit juices, soda and sports drinks, as well as countless other sweetened beverages, contain HFCS. Like all fructose, HFCS is metabolized as body fat far more rapidly than any other sugar.

Similar to alcohol, the entire burden of metabolizing fructose falls to your liver. This severely taxes and overloads it, introducing the possibility of liver damage. Fructose also promotes a particularly dangerous kind of body fat called adipose fat. This type of fat collects in your abdominal region and is associated with a greater risk of heart disease.

Although HFCS has about the same amount of fructose as cane sugar, it is in a "free" form that is not attached to any other carbs. In contrast, fructose in fruits and cane sugar is bonded to other sugars, resulting in a decrease in metabolic toxicity. Consuming foods containing high amounts of fructose — even if it's a natural product — is the fastest way to trash your health. Among the health problems you invite when you consume high amounts of fructose are:

- Arthritis, cancer, gout and heart disease
- Insulin resistance, metabolic syndrome, obesity and Type 2 diabetes
- Elevated blood pressure, LDL (bad) cholesterol, triglycerides and uric acid levels
- Liver disease, especially nonalcoholic fatty liver disease

In addition, unbound fructose, found in large quantities in HFCS, can interfere with your heart's use of minerals like chromium, copper and magnesium. Furthermore, as you likely know, HFCS is most often made from genetically engineered corn, which is fraught

with its own well-documented health concerns and side effects, many of which are linked to glyphosate or Roundup residues.

How to Manage and/or Limit Your Sugar Consumption

Sugar, in its natural form, is not inherently bad when consumed in amounts that allow you to burn fat as your primary fuel. However, you should avoid all sources of processed fructose, particularly processed foods and beverages like soda. According to SugarScience.org, 74% of processed foods purchased from the grocery store contain added sugar.[15]

Other sources have suggested it may be as high as 80%. I recommend your diet be composed chiefly of naturally occurring whole foods, with 10% or less coming from processed foods.

I also recommend severely limiting your consumption of refined carbohydrates found in cereal, bread, pasta and other grain-based foods, as they break down to sugar in your body, which increases your insulin levels and causes insulin resistance. As a general recommendation, I suggest you keep your total fructose consumption below 25 grams per day, including whole fruit. Keep in mind while fruits are rich in nutrients and antioxidants, they naturally contain fructose.

If consumed in high amounts (especially if you are not burning fat as your primary fuel), fructose from fruit worsens your insulin sensitivity and raises your uric acid levels. Also, be sure to avoid artificial sweeteners like aspartame and sucralose due to the health problems associated with them, which are worse than those associated with corn syrup and sugar. Below are some additional tips to help you manage and/or limit your sugar consumption:

- **Increase your consumption of healthy fats, such as omega-3, saturated and monounsaturated fats —** Your body needs health-promoting fats from animal and plant sources for optimal functioning. In fact, emerging evidence suggests healthy fats should make up at least 60 to 85% of your daily calories.

Some of the best sources include avocado, coconut oil, free-range eggs, organic butter from raw milk, raw nuts like macadamia and pecans, (unheated) virgin olive oil and wild Alaskan salmon.

- **Drink pure, clean water —** Drinking pure water instead of sugary beverages like fruit juice and soda will go a long way toward improving your health. The best way to gauge your water needs is to observe the color of your urine — it should be light-pale yellow — and the frequency of your bathroom visits should be around seven to eight times per day.

- **Add fermented foods to your meals —** The beneficial bacteria in fermented foods will aid your digestion and provide detoxification support, lessening the fructose burden on your liver. Some of the best choices include fermented vegetables, kefir made from grass fed milk, kimchi, natto and organic yogurt made from raw grass fed milk.

- **Use the Emotional Freedom Techniques (EFT)**

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