

Artificial Sweeteners Are Toxic to Gut Bacteria

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✓ Fact Checked

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STORY AT-A-GLANCE

- › Animal research shows all artificial sweeteners currently approved and deemed safe by the U.S. Food and Drug Administration cause DNA damage in, and interfere with the normal and healthy activity of gut bacteria
- › Artificial sweeteners reviewed in this study include aspartame, sucralose, saccharin, neotame, advantame and acesulfame potassium-k
- › Saccharin caused the greatest, most widespread damage, exhibiting both cytotoxic and genotoxic effects, meaning it is toxic to cells and damages genetic information in the cell (which can cause mutations)
- › Aspartame and acesulfame potassium-k were both found to cause DNA damage. Neotame was found to cause metabolic disruption, and raised concentrations of several fatty acids, lipids and cholesterol
- › Other recent research shows artificial sweeteners damage vascular function and cause cellular changes that may be important during the onset and progression of diabetes and obesity

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Recent research into the health effects of artificial sweeteners deliver yet another blow to safety claims. The animal study,^{1,2,3,4,5} published in the journal *Molecules*, found all artificial sweeteners currently approved and deemed safe by the U.S. Food and Drug

Administration cause DNA damage in, and interfere with the normal and healthy activity of gut bacteria. The artificial sweeteners included in this study included:

Artificial sweetener	Brand name(s)
Aspartame	NutraSweet, Spoonful, Canderel, Equal, NatraTaste Blue
Sucralose	Splenda, Zerocal, Sukrana, SucraPlus, Candys, Cukren and Nevella
Saccharin	Sweet 'N Low, Sweet Twin, Sugar Twin, Necta Sweet
Neotame	Newtame
Advantame	(No brand names)
Acesulfame potassium-k	Sunnette, Sweet One, ACE, ACE K, Sweet 'N Safe

All Artificial Sweeteners Are Toxic to Gut Bacteria

As reported by Business Insider,⁶ the research team concluded that all of these sweeteners "had a toxic, stressing effect, making it difficult for gut microbes to grow and reproduce." While the authors do not directly refer to them as having antibiotic effects, when something is killing bacteria, that's essentially what's happening.

According to the researchers, the effects on your gut health may in turn affect your body's ability to process regular sugar and other carbohydrates. According to this study, the toxic limit for these artificial sweeteners appears to be around 1 milligram per milliliter (mg/mL).

Ariel Kushmaro, Ph.D., professor of microbial biotechnology at Ben-Gurion University and lead author, told Business Insider, "We are not claiming that it's toxic to human beings. We're claiming that it might be toxic to the gut bacteria, and by that, will influence us."

Sweetener-Specific Effects

While, overall, all six artificial sweeteners were found to have toxic effects on gut bacteria, there were individual differences in the type and amount of damage they produced. For example:

- **Saccharin** caused the greatest, most widespread damage, exhibiting both cytotoxic and genotoxic effects, meaning it is toxic to cells and damages genetic information in the cell (which can cause mutations).
- **Neotame** was found to cause metabolic disruption in mice, and raised concentrations of several fatty acids, lipids and cholesterol. Several gut genes were also decreased by this sweetener.
- **Aspartame and acesulfame potassium-k** – The latter of which is commonly found in sports supplements – were both found to cause DNA damage.

Hazards of Sucralose

Previous studies have also revealed an extensive list of safety concerns for sucralose (a synthetic organochlorine sweetener), some of which are very similar to those found in the featured study, including:⁷

Genotoxicity (DNA damage) and potentially adverse epigenetic effects

The generation of toxic compounds (chloropropanols) when heated

Destruction of gut bacteria;⁸ one study⁹ found it can kill as much as 50% of your

microbiome, and appears to target beneficial microorganisms

Alterations in glucose, insulin and glucagon-like peptide-1 levels and responses,¹⁰ which raises the risk for diabetes

Decreased red blood cells, a sign of anemia, at levels above 1,500 mg per kilo per day

Increased male infertility by interfering with sperm production and vitality, as well as brain lesions at higher doses

Kidney enlargement and calcification

Significantly increased risk for miscarriage (in rabbits, spontaneous abortions affected nearly half the rabbit population given sucralose, compared to zero aborted pregnancies in the control group)

Significantly increased death rate (a 23% death rate in rabbits, compared to a 6% in the control group)

Bioaccumulation¹¹

Potential drug interactions¹²

Artificial Sweeteners Linked to Diabetes and CVD

Other recent research^{13,14} adds to the ever-growing evidence pile showing that artificial sweeteners raise your risk of obesity and Type 2 diabetes to the same or greater degree as sugar. The study in question explored how different sweeteners – including glucose, fructose, aspartame and acesulfame potassium-k – affect energy usage, energy storage and vascular functioning.

According to the authors, both high amounts of sugar and artificial sweeteners caused vascular impairment and other cardiovascular disease (CVD) effects "that may be important during the onset and progression of diabetes and obesity." The artificial sweeteners, however, accumulated in the blood, thereby harming the blood vessel lining to a greater degree.

Of the two artificial sweeteners included in this study, acesulfame potassium appeared to be the worst. As noted by lead author Brian Hoffmann, Ph.D., assistant professor in the department of biomedical engineering at the Marquette University and Medical College of Wisconsin:¹⁵

"Sweeteners kind of trick the body. And then when your body's not getting the energy it needs – because it does need some sugar to function properly – it potentially finds that source elsewhere," Hoffman says.¹⁶

One alternative sugar source is muscle and, indeed, evidence of protein break down was found in the animals' blood. Essentially, the rats were burning muscle as a source of energy when given artificial sweeteners. Hoffman also notes that this research is different from previous attempts to conclusively tie artificial sweeteners to health problems:

"Most of these sweeteners were approved well before we had the technology to perform studies like my lab is doing. So they weren't able to look as in-depth at some of the potential effects being caused.

By knowing what biochemical changes these are causing through these large-scale studies, we can take an unbiased approach and see what's changing to give us a better direction. What I like to tell people is that most things in moderation are going to be fine ...

It's when people start to chronically consume these [drinks] – say, a person drinks two, three, four ... every day – that we should start to be concerned. Because you're starting to introduce these biochemical changes and the body has no time to recover."

Artificial Sweeteners Associated With Many Health Problems

Research published over the last three decades has also convincingly shown that artificial sweeteners stimulate appetite, increase cravings for carbs, and produce a variety of metabolic dysfunctions that promote fat storage and weight gain.

As early as 1986, a study¹⁷ that examined nearly 78,700 women for one year found women who used artificial sweeteners were significantly more likely to gain weight compared to those who did not use them, regardless of their initial weight.

According to the researchers, the results "were not explicable by differences in food consumption patterns. The data do not support the hypothesis that long-term artificial sweetener use either helps weight loss or prevents weight gain."

Similarly, the 25-yearslong San Antonio Heart Study,¹⁸ published in 2005, found those who drank diet soda were significantly more likely to gain weight compared to those who drank regular soda. On average, for each diet soft drink the participants drank per day, they were 65% more likely to become overweight during the next seven to eight years, and 41% more likely to become obese.

In 2010, an important scientific review¹⁹ was published in the Yale Journal of Biology and Medicine. It summarized the epidemiological and experimental evidence available on artificial sweeteners' effects on weight, and explained those effects in light of the neurobiology of food reward.

More than 11,650 children aged 9 to 14 were included in this study. Each daily serving of diet beverage was associated with a BMI increase of 0.16 kg/m². It also showed the correlation between increased usage of artificial sweeteners in food and drinks, and the corresponding rise in obesity. According to the authors:

"[F]indings suggest that the calorie contained in natural sweeteners may trigger a response to keep the overall energy consumption constant ... Increasing evidence suggests that artificial sweeteners do not activate the food reward pathways in the same fashion as natural sweeteners ... [A]rtificial sweeteners,

precisely because they are sweet, encourage sugar craving and sugar dependence."

Three years later, a report²⁰ published in the journal Trends in Endocrinology & Metabolism highlighted the fact that diet soda drinkers suffer the same exact health problems as those who opt for regular soda, including excessive weight gain, Type 2 diabetes, cardiovascular disease and stroke. The researchers proposed that frequent consumption of artificial sweeteners may induce metabolic derangements.

Your Body Is Not Fooled by Zero-Calorie Sweetness

Right around 2013, research started emerging detailing some of the reasons for why zero calorie sweeteners can make you gain weight. A study in the Journal of Physiology^{21,22} showed that when you eat something sweet, your brain releases dopamine, which activates your brain's reward center.

The appetite-regulating hormone leptin is also released, which eventually informs your brain that you are "full" once a certain amount of calories has been ingested. When you consume something that tastes sweet but doesn't contain any calories, your brain's pleasure pathway still gets activated by the sweet taste, but there's nothing to deactivate it, since the calories never arrive.

Artificial sweeteners basically trick your body into thinking that it's going to receive calories, but when the calories fail to arrive, your body continues to signal that it needs more, which results in carb cravings.

The following year, 2014, another important study²³ was published in the journal Nature. It was, for the first time, able to clearly show causality, revealing there's a direct cause and effect relationship between consuming artificial sweeteners and developing elevated blood sugar levels.

People who consumed high amounts of artificial sweeteners were found to have higher levels of HbA1C — a long-term measure of blood sugar — compared to nonusers or occasional users of artificial sweeteners.

Seven volunteers who did not use artificial sweeteners were then recruited, and asked to consume the equivalent of 10 to 12 single-dose packets of artificial sweeteners daily for one week. Four of the seven people developed "significant disturbances in their blood glucose," according to the researchers.

Some became prediabetic within just a few days! The reason for this dramatic shift was traced back to alterations in gut bacteria. Some bacteria were killed off, while others started proliferating. Which brings us back full circle to the featured study in the journal *Molecules*, which showed that all artificial sweeteners currently on the U.S. market have the ability to impair and/or kill gut bacteria.

Considering what we now know about the gut microbiome and its influence on health and disease, it's becoming easier to see how and why artificial sweeteners are able to wreak havoc on your health.

To Improve Your Health, Ditch the Artificial Sweeteners

If you're overweight and/or have insulin resistance or Type 2 diabetes, it's really important to understand that artificial sweeteners are not going to help matters. They're probably only going to make it worse.

If you have to choose between two evils, regularly-sweetened beverages are likely less hazardous in the long run, since your body at least knows how to metabolize fructose, even if it is processed.

That said, I firmly believe ditching soda and other sweetened beverages is one of the most important steps you can take to improve your weight and health. Remember, pure water is a zero-calorie drink. You cannot find a beverage that contains fewer calories.

If you want some flavor, just squeeze a little bit of fresh lemon or lime into mineral water. In instances where your cooking, baking or beverage needs a little sweetener, be mindful of your choice. For more information, see "Sugar Substitutes – What's Safe and What's Not."

Sources and References

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