

# Research Reveals Disturbing Sucralose (Splenda) Side Effects

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✓ Fact Checked

## STORY AT-A-GLANCE

- › The artificial sweetener industry has defended the safety of sucralose (Splenda), stating that it rapidly passes through your body without being broken down and therefore has no biological effects
- › Research reveals your body does indeed metabolize sucralose and that it accumulates in your fat cells. Two new metabolites were also identified. As these findings were not part of the original regulatory decision process for sucralose, researchers are calling for a review of its safety and regulatory status
- › Sucralose causes definite changes in the liver of treated rats, suggesting toxic effects. According to the researchers, sucralose should be used with caution to avoid liver damage
- › Previous research found sucralose reduces gut bacteria by 50%, increases the intestinal pH level and causes biochemical distortions. This was again confirmed in 2018, when all currently approved artificial sweeteners were found to cause DNA damage in, and interfere with, the normal and healthy activity of gut bacteria
- › Consuming artificial sweeteners such as sucralose, aspartame, saccharin, neotame, advantame and/or acesulfame potassium-k can impair your appetite regulation and cause weight gain

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Sucralose (sold under the brand names Splenda, Splenda Zero, Zero-Cal, Sukrana, Apriva, SucraPlus, Candys, Cukren and Nevella, to name a few) was approved by the U.S. Food and Drug Administration (FDA) in 1998<sup>1</sup> as a tabletop sweetener and for use in products such as baked goods, nonalcoholic beverages, chewing gum, frozen dairy desserts, fruit juices and gelatins. It is also permitted as a general-purpose sweetener for all processed foods.

In the European Union, sucralose is known under the additive code E955.<sup>2</sup> However, this artificial sweetener, like aspartame before it, was approved based on extremely limited evidence of safety, and studies published in the years since it was brought to market confirm early suspicions, showing it is not an inert substance after all, and that it accumulates in body fat, disrupts your gut microbiome, and causes metabolic dysregulation and associated health problems.

## **Splenda Was Approved With Near-Nonexistent Evidence of Safety**

The FDA claims it approved sucralose after reviewing more than 110 animal and human safety studies. What they don't tell you is that of these 110 studies,<sup>3</sup> only two human trials were actually published before the FDA approved sucralose for human consumption.

These two human trials had a grand total of 36 subjects, only 23 of whom were actually given sucralose, and the longest lasted just four days and looked at sucralose in relation to tooth decay, not human tolerance.<sup>4</sup>

What's more, the absorption of sucralose into the human body was studied on a grand total of eight men.<sup>5</sup> Based on that study, the FDA allowed the findings to be generalized as being representative of the entire human population, including women, children, the elderly and those with any chronic illness — none of whom was ever examined.

These studies are hardly indicative of what might happen to someone consuming sucralose in multiple products every single day for years or a lifetime. In my book, "Sweet Deception," I explain how some of the animal studies also raised questions about the product's safety, showing:<sup>6</sup>

- Decreased red blood cells (a sign of anemia) at levels above 1,500 mg/kg/day
- Increased male infertility by interfering with sperm production and vitality, as well as brain lesions at higher doses
- Spontaneous abortions in nearly half the rabbit population given sucralose, compared to zero aborted pregnancies in the control group
- A 23 percent death rate in rabbits, compared to a 6 percent death rate in the control group

I knew the approval of sucralose was a serious mistake, which is why I wrote "Sweet Deception" in 2006, despite the fact Johnson & Johnson threatened to sue me if the book went to publication. Since then, many new studies have confirmed my warnings, showing artificial sweeteners confuse your metabolism and cause biochemical distortions that can result in weight gain, metabolic dysfunction and other health problems.

## **Sucralose 'Should Carry a Big Red Warning Label'**

Sucralose has been found to be particularly damaging to your gut. Research<sup>7</sup> published in 2008 found it reduces gut bacteria by 50 percent, preferentially targeting bacteria known to have important human health benefits. Consuming as few as seven little Splenda packets may be enough to have a detrimental effect on your gut microbiome.

The study also found it increases the pH level in your intestines, and is absorbed into and accumulates in fat tissue. In response to this study, James Turner, chairman of the national consumer education group Citizens for Health, issued the following statement:<sup>8</sup>

*"The report makes it clear that the artificial sweetener Splenda and its key component sucralose pose a threat to the people who consume the product. Hundreds of consumers have complained to us about side effects from using Splenda, and this study ... confirms that the chemicals in the little yellow package should carry a big red warning label."*

## **All Artificial Sweeteners Are Toxic to Your Gut Bacteria**

More recent research confirmed these findings, and expanded them to all currently approved artificial sweeteners. The animal study,<sup>9</sup> published in the journal *Molecules* in October 2018, found aspartame, sucralose, saccharin, neotame, advantame and acesulfame potassium-k all cause DNA damage in, and interfere with, the normal and healthy activity of gut bacteria.

As reported by Business Insider,<sup>10</sup> the research team concluded that all of these sweeteners "had a toxic, stressing effect, making it difficult for gut microbes to grow and reproduce," and that by being toxic to gut bacteria can have an adverse effect on human health.

Aside from the countless side effects associated with an impaired gut microbiome, the researchers warn it may also affect your body's ability to process regular sugar and other carbohydrates.

## **Sucralose Is Not an Inert Compound**

Research has also demonstrated that sucralose is not a biologically inert compound, as claimed. In the 2013 paper,<sup>11</sup> "Sucralose, a Synthetic Organochloride Sweetener: Overview of Biological Issues," the authors state, in part:

*"Sucralose and one of its hydrolysis products were found to be mutagenic at elevated concentrations in several testing methods ... Both human and rodent studies demonstrated that sucralose may alter glucose, insulin and glucagon-*

*like peptide 1 levels. Taken together, these findings indicate that sucralose is not a biologically inert compound."*

According to this paper, the acceptable daily intake set for sucralose may in fact be hundreds of times too high to ensure safety. Importantly, the study also notes that "Cooking with sucralose at high temperatures ... generates chloropropanols, a potentially toxic class of compounds."

Yet, Splenda's makers recommend it for cooking and baking.<sup>12</sup> Plus, sucralose is often used in processed foods in which high heat was involved. Chloropropanols, which are still poorly understood, are thought to have adverse effects on your kidneys and may have carcinogenic effects.<sup>13</sup>

## **Researchers Called for New Safety Review in 2018**

Another industry claim that has been demolished by science is that sucralose passes unmetabolized through your body and therefore has no biological effects. Alas, research<sup>14,15</sup> published in the online version of the Journal of Toxicology and Environmental Health August 21, 2018, shows it is in fact metabolized and that it accumulates in fat cells.

Here, 10 rats were given an average dose of 80.4 mg of sucralose per kilo per day (k/day) for 40 days. According to the researchers, this dosage is "within the range utilized in historical toxicology studies submitted for regulatory approval in North America, Europe and Asia."

Urine and feces were collected daily from each rat, and were analyzed using ultrahigh performance liquid chromatography tandem mass spectrometry (UHPLC–MS/MS), which "revealed two new biotransformation products that have not previously been reported."

The two metabolites are acetylated forms of sucralose that are lipophilic, meaning they dissolve in and combine with fats. Sucralose itself is far less lipophilic, which has been part of the safety argument. According to the authors:

*"These metabolites were present in urine and feces throughout the sucralose dosing period and still detected at low levels in the urine 11 days after discontinuation of sucralose administration and six days after sucralose was no longer detected in the urine or feces.*

*The finding of acetylated sucralose metabolites in urine and feces do not support early metabolism studies, on which regulatory approval was based, that claimed ingested sucralose is excreted unchanged (i.e., not metabolized).*

*The historical metabolic studies apparently failed to detect these metabolites in part because investigators used a methanol fraction from feces for analysis along with thin layer chromatography and a low-resolution linear radioactivity analyzer.*

*Further, sucralose was found in adipose tissue in rats two weeks after cessation of the 40-day feeding period even though this compound had disappeared from the urine and feces."*

So, not only is sucralose metabolized, but it turns out these metabolites accumulate in your fat tissues, where they remain for "an extended period of time" after you stop consuming sucralose. In all, these findings led the authors to conclude:

*"These new findings of metabolism of sucralose in the gastrointestinal tract and its accumulation in adipose tissue were not part of the original regulatory decision process for this agent and indicate that it now may be time to revisit the safety and regulatory status of this organochlorine artificial sweetener."*

## **Sucralose Linked to Liver, Kidney and Thymus Damage**

Another study<sup>16</sup> published online August 2, 2018, in the journal Morphologie, found sucralose caused "definite changes" in the liver of treated rats, "indicating toxic effects on regular ingestion." The researchers warn these findings suggest sucralose should be "taken with caution to avoid hepatic damage."

In other words, regularly using Splenda could damage your liver. Here, adult rats were given a much higher (yet nonlethal) oral dose of sucralose – 3 grams (3,000 mg) per kilo body mass per day for 30 days, after which the animals' livers were dissected and compared to the livers of unexposed controls. According to the authors:

*"Experimental rats showed features of patchy degeneration of hepatocytes along with Kupffer cells hyperplasia, lymphocytic infiltration, sinusoidal dilatation and fibrosis indicating a definite hepatic damage on regular ingestion of sucralose. Sinusoidal width was also found to be increased in experimental animals as compared to controls."*

Earlier research has also linked sucralose consumption to liver and kidney enlargement<sup>17,18</sup> and kidney calcification.<sup>19,20</sup> Another organ affected by sucralose is your thymus, with studies linking sucralose consumption to shrinkage of the thymus (up to 40 percent<sup>21,22</sup>) and an increase in leukocyte populations (immune system cells) in the thymus and lymph nodes.<sup>23</sup>

## **Sucralose Raises Risk of Type 2 Diabetes**

Like all other artificial sweeteners, sucralose is commonly used by diabetics who need to limit their sugar consumption. However, research again shows you simply cannot trick your body with calorie-free sweetness. Research<sup>24</sup> published in 2013 revealed sucralose alters glucose, insulin and glucagon-like peptide-1 levels and responses, which raises your risk for Type 2 diabetes.

It confirmed that, compared to controls, obese patients using sucralose experienced a greater incremental increase in peak plasma concentrations of glucose, a greater incremental increase in insulin and peak insulin secretion rate, along with a decrease in insulin clearance.

According to the authors, "These data demonstrate that sucralose affects the glycemic and insulin responses to an oral glucose load in obese people who do not normally consume non-nutritive sweeteners."

## Lots of Studies Question Safety of Sucralose

As of January 2022, there are 22,500 references to sucralose in the scientific search engine Google Scholar, so there's no shortage of studies to review for those who are curious. Here's a small sampling with a focus on more recent papers showing sucralose may be harmful to your health:

**Potential Metabolic Effect of Sucralose Following an Oral Glucose Load in Subjects With Obesity and Normal-Weight Subjects, 2018<sup>25</sup>** – This food science and human nutrition master's degree thesis notes sucralose "may have adverse effects on glucose metabolism in people with obesity, which is the group that most frequently consumes non-nutritive sweeteners to facilitate weight management."

The findings also highlight the role of sweetness perception in glucose homeostasis, "which supports the notion that sweetness, regardless of an associated caloric contribution, should be consumed in moderation."

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**The Artificial Sweetener Splenda Promotes Gut Proteobacteria, Dysbiosis, and Myeloperoxidase Reactivity in Crohn's Disease-Like Ileitis, 2018<sup>26,27</sup>** – This study found Splenda consumption may exacerbate gut inflammation and intensify symptoms in people with Crohn's disease by promoting harmful gut bacteria.

A letter<sup>28</sup> to the editor argued against the findings, but at least one of the protesting writers, V. Lee Grotz, works for the company that owns Splenda.<sup>29,30</sup>

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**Pharmacokinetics of Sucralose and Acesulfame-Potassium in Breast Milk Following Ingestion of Diet Soda, 2018<sup>31</sup>** – This study found sucralose shows up in breast milk after consumption. Considering the effects of sucralose on beneficial gut bacteria, organ health and metabolism, this is a rather crucial piece of information for pregnant women as it may have significant ramifications for their baby's health.

Other research<sup>32</sup> shows sucralose is so ubiquitous it's even found in groundwater and sanitary wastewater. It persists through sewage treatment, and may therefore be



present in your drinking water as well.

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**Artificial Sweetener such as Sucralose May Promote Inflammation in Human Subcutaneous Fat-Derived Mesenchymal Stromal Cells, 2017<sup>33</sup>** — Research presented at GW Annual Research Days in 2017 shows sucralose consumption caused an increase in superoxide accumulation and cellular inflammation.

The sweetener also increased expression of a specific sweet taste receptor. According to the researchers, "upregulation of adipogenic genes ... cultured in near physiological concentrations of sucralose, indicate possible causality between increased fat deposition and sweetener use."

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**The Effect of Sucralose on Flavor Sweetness in Electronic Cigarettes Varies Between Delivery Devices, 2017<sup>34</sup>** — Sucralose is found in a wide variety of products, and not just food. It's also commonly added to drugs, often without being listed on the label, and even e-cigarette liquids.

This study found sucralose contributes sweet taste only when used in a cartridge system, and chemical analysis showed the use of a cartridge system also raised the concentration of sucralose in the aerosol.

According to the authors, "Together these findings indicate that future regulation of sweet flavor additives should focus first on the volatile constituents of e-liquids with the recognition that artificial sweeteners may also contribute to flavor sweetness depending upon e-cigarette design."

While this study did not look at health effects, previous research<sup>35</sup> has shown sucralose, when heated, releases potentially carcinogenic chloropropanols,<sup>36</sup> which are part of a class of toxins known as dioxins.

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**Chronic Sucralose or L-Glucose Ingestion Does Not Suppress Food Intake, 2017<sup>37</sup>** — This study demonstrated that when sucralose is consumed along with a low-carbohydrate diet, it "causes a pronounced increase in calories consumed." In other words, it increases hunger and promotes overeating.

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**Gut Microbiome Response to Sucralose and Its Potential Role in Inducing Liver Inflammation in Mice, 2017<sup>38</sup>** – Echoing the research discussed earlier in this article, this study also found that sucralose alters "the developmental dynamics of the gut microbiome," and that the sweetener may thus play a role in chronic inflammation.

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**The Non-Caloric Sweeteners Aspartame, Sucralose and Stevia sp. Induce Specific but Differential Responses to Compartmentalized Adipose Tissue Accumulation, 2017<sup>39</sup>** – In this study, consumption of sucralose resulted in weight gain, elevated blood glucose and body fat accumulation.

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**Sucralose Activates an ERK1/2–Ribosomal Protein S6 Signaling Axis, 2016<sup>40</sup>** – Sucralose was found to stimulate insulin secretion much like glucose, but through completely different and poorly understood pathways. According to the authors, these findings "will have implications for diabetes."

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**Sucralose Promotes Food Intake through NPY and a Neuronal Fasting Response, 2016<sup>41</sup>** – Here, sucralose consumption was again linked to increased hunger and food intake. According to the authors, "dietary sucralose creates a sweet/energy imbalance," which in turn "activates a conserved neuronal starvation response."

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**Changes in the Expression of Cell Surface Markers in Spleen Leukocytes in a Murine Model of Frequent Sucralose Intake, 2016<sup>42</sup>** – This study found frequent sucralose intake may affect your immune function. According to the authors:

*"Our results show a decrease in the frequency of B lymphocyte population and T lymphocytes in comparison to the control group. In B and T lymphocytes the analysis of co-stimulatory molecules show a lower frequency compared to the control group. The immune response depends on the differentiation and activation of cellular populations.*

*We hypothesized that chronic ingestion of commercial sucralose might be affecting the immune response by modifying the frequencies of cellular populations, as well as the expression of co-stimulatory and inhibitory*

*molecules ... by decreasing the ability of co-stimulation between B and T lymphocytes, with a probable effect on the immune response.*

*It is necessary to further determine if sucralose intake affects the efficiency of the immune response."*

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**Sucralose Administered in Feed, Beginning Prenatally Through Lifespan, Induces Hematopoietic Neoplasias in Mice, 2016<sup>43</sup>** — This study is significant as it specifically refutes industry claims that sucralose is not carcinogenic. As noted by the authors:

*"Long-term carcinogenicity bioassays on rats and mice conducted on behalf of the manufacturer have failed to show the evidence of carcinogenic effects. The aim of this study was to evaluate the carcinogenic effect of sucralose in mice, using a sensitive experimental design.*

*We found a significant dose-related increased incidence of males bearing malignant tumors and a significant dose-related increased incidence of hematopoietic neoplasias in males, in particular at the dose levels of 2,000 ppm and 16,000 ppm.*

*These findings do not support previous data that sucralose is biologically inert. More studies are necessary to show the safety of sucralose, including new and more adequate carcinogenic bioassay on rats. Considering that millions of people are likely exposed, follow-up studies are urgent."*

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**Effects of Splenda in Experimental Crohn's Disease, 2014<sup>44</sup>** — As in later studies, this one found Splenda may exacerbate symptoms of Crohn's disease by augmenting "inflammatory activity at the biochemical level" and altering microbial-host interactions within the intestinal mucosa.

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**Sucralose Affects Glycemic and Hormonal Responses to an Oral Glucose Load, 2013<sup>45</sup>** — Here, sucralose was found to affect the glycemic and insulin responses in

obese individuals who normally did not consume non-nutritive sweeteners. Compared to controls, sucralose ingestion caused a greater incremental increase in peak plasma glucose concentrations, greater increase in insulin, greater peak insulin secretion and a decrease in the insulin clearance rate.

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**Sucralose, A Synthetic Organochlorine Sweetener: Overview of Biological Issues, 2013<sup>46</sup>** — This review highlights a number of health effects associated with sucralose, including alterations in P-glycoprotein levels, which could result in medications used in chemotherapy, AIDS treatment and treatments for heart conditions being shunted back into the intestines, rather than being absorbed by your body; alterations in the microbial composition in your gastrointestinal tract; mutagenic effects and more.

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**Popular Sweetener Sucralose as a Migraine Trigger, 2006<sup>47</sup>** — As noted by the authors, "This observation of a potential causal relationship between sucralose and migraines may be important for physicians to remember this can be a possible trigger during dietary history taking.

Identifying further triggers for migraine headaches, in this case sucralose, may help alleviate some of the cost burden (through expensive medical therapy or missed work opportunity) as well as provide relief to migraineurs."

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## **Sucralose Safety Studies Nearly Always Produced by Industry**

So, what about studies that support Splenda's safety? A hallmark of such studies is that they're overwhelmingly done or funded by industry. Following is a sampling of oft-cited studies ostensibly showing that sucralose is safe. As you will see, many of these have conflicts of interest that likely taint their findings, as one or more of the authors have close ties to the industry.

**Regulatory Toxicology and Pharmacology, 2017<sup>48</sup>** — This study came to the conclusion that "The collective evidence supports that sucralose has no effect on

A1c or glycemic control."

**Conflict of Interest** — The lead author, V. Lee Grotz, is the director of global medical and safety science for Heartland Products Group, which owns Splenda. She also previously worked as director of product safety at McNeil Nutritionals (now Johnson & Johnson), which markets and sells Splenda.

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**Food and Chemical Toxicology, 2017**<sup>49</sup> — This review, based on an "extensive database of research" concluded that "sucralose is safe for its intended use as a non-caloric sugar alternative."

**Conflict of Interest** — As reported by Marion Nestle,<sup>50</sup> this so-called safety study "was commissioned by the Calorie Control Council,<sup>51</sup> a trade association representing 'manufacturers and suppliers of low- and reduced-calorie foods and beverages, including manufacturers and suppliers of more than two dozen different alternative sweeteners, fibers and other low-calorie, dietary ingredients.'"

The authors are also affiliated with Health Science Consultants and Intertek. (One of the authors on this study is also an author on the Regulatory Toxicology and Pharmacology study above).

According to Nestle, the Calorie Control Council has a vested interest in demonstrating that Splenda is safe, and the consultant groups have a vested interest in pleasing the Calorie Control Council.

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**Nutrition and Cancer, 2016**<sup>52</sup> — This scientific review concluded that "sucralose does not demonstrate carcinogenic activity even when exposure levels are several orders of magnitude greater than the range of anticipated daily ingestion levels."

**Conflict of Interest** — This is another industry-biased review by Grotz, director of global medical and safety science for Heartland Products Group, which owns Splenda, and former director of product safety at McNeil Nutritionals (now Johnson & Johnson) that markets and sells Splenda.

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**International Journal of Scientific Research, 2018<sup>53</sup>** – This is a rather confusing study showing weight gain in sucralose-treated rats, even though they didn't eat any more than the control group.

What's confusing is that the study authors still concluded that sucralose is "safe at least for a period of one month in sublethal doses" even though they believe "the body weight gain after sucralose ingestion needs to be relooked and investigated further."

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**American Journal of Physiology, 2009<sup>54</sup>** – This Australian study concluded sucralose "does not stimulate insulin, GLP-1 or glucose-dependent insulinotropic polypeptide release or slow gastric emptying in healthy humans."

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## **Artificial Sweeteners Trick Your Body Into Storing Fat**

Those who switch to artificial sweeteners are typically carrying extra pounds and/or are diabetic, or prone to these conditions. Unfortunately, this may be the absolute worst diet change you could implement if you're overweight or diabetic.

Research has repeatedly shown that artificially sweetened no- or low-calorie drinks and other "diet" foods tend to stimulate your appetite, increase cravings for carbs, stimulate fat storage and weight gain, and promote insulin resistance and diabetes.

There are a number of different reasons for this. First of all, artificial sweeteners basically trick your body into thinking that it's going to receive sugar (calories), but when the sugar doesn't arrive, your body signals that it needs more, which results in carb cravings.

This connection between sweet taste and increased hunger can be found in the medical literature going back at least three decades. Following is another sampling of studies looking specifically at the connection between artificial sweeteners – sucralose and others – and weight gain. Repeatedly, studies have shown artificial sweeteners increase

your risk of unwanted weight gain, oftentimes to the same or greater degree than regular sugar.

So, if weight control is the reason you're using these products, you'd be wise to reconsider. Based on the evidence, you'd be better off consuming regular sugar when you want sweet taste. Alternatively, opt for one of the sweeteners discussed at the very end of this article.

**Journal of the American Geriatrics Society 2015<sup>55</sup>** — Seniors aged 65 and over were followed for an average of nine years, and there was a "striking dose-response relationship" between diet soda consumption and waist circumference. This held true even when other factors such as exercise, diabetes and smoking were taken into account.

People who never drank diet soda increased their waist circumference by an average of 0.8 inches during the nine-year observation period. Occasional diet soda drinkers added an average of 1.83 inches to their waist line in that time period. Daily diet soda drinkers gained an average of nearly 3.2 inches —quadruple that of those who abstained from diet soda altogether.

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**PLOS One 2014<sup>56</sup>** — This study, which was done on rats, using aspartame, also found an increased risk of glucose intolerance. Animals that consumed artificial sweeteners ended up with raised levels of propionate — short-chain fatty acids involved in sugar production. Consumption of artificial sweeteners shifted gut microbiota to produce propionate, which generated higher blood sugar levels.

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**Nature 2014<sup>57</sup>** — This important study was 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.

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**The Journal of Physiology 2013<sup>58,59</sup>** — This study demonstrated that your body is not fooled by sweet taste without accompanying calories, which is yet another reason why artificial sweeteners promote obesity.

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 have 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.

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**Trends in Endocrinology & Metabolism 2013<sup>60</sup>** — This report highlights the fact that diet soda drinkers suffer the same exact health problems as those who opt for regular soda, such as excessive weight gain, Type 2 diabetes, cardiovascular disease and stroke.<sup>61</sup> The researchers speculate that frequent consumption of artificial sweeteners may induce metabolic derangements.

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**Appetite 2012<sup>62</sup>** — Here, researchers showed that saccharin and aspartame cause greater weight gain than sugar, even when the total caloric intake remains similar.

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In 2011, the UT Health Science Center in San Antonio publicized the results of two studies, saying:<sup>63</sup>

*"In the constant battle to lose inches or at least stay the same, we reach for the diet soda. Two studies presented [June 25, 2011] at the American Diabetes Association's Scientific Sessions suggest this might be self-defeating behavior.*

*Epidemiologists from the School of Medicine at The University of Texas Health Science Center San Antonio reported data showing that diet soft drink consumption is associated with increased waist circumference in humans, and a second study that found aspartame raised fasting glucose (blood sugar) in diabetes-prone mice ...*

*Diet soft drink users, as a group, experienced 70 percent greater increases in waist circumference compared with nonusers [Editor's note: the study was 10 years long]. Frequent users, who said they consumed two or more diet sodas a day, experienced waist circumference increases that were 500 percent greater than those of nonusers.*

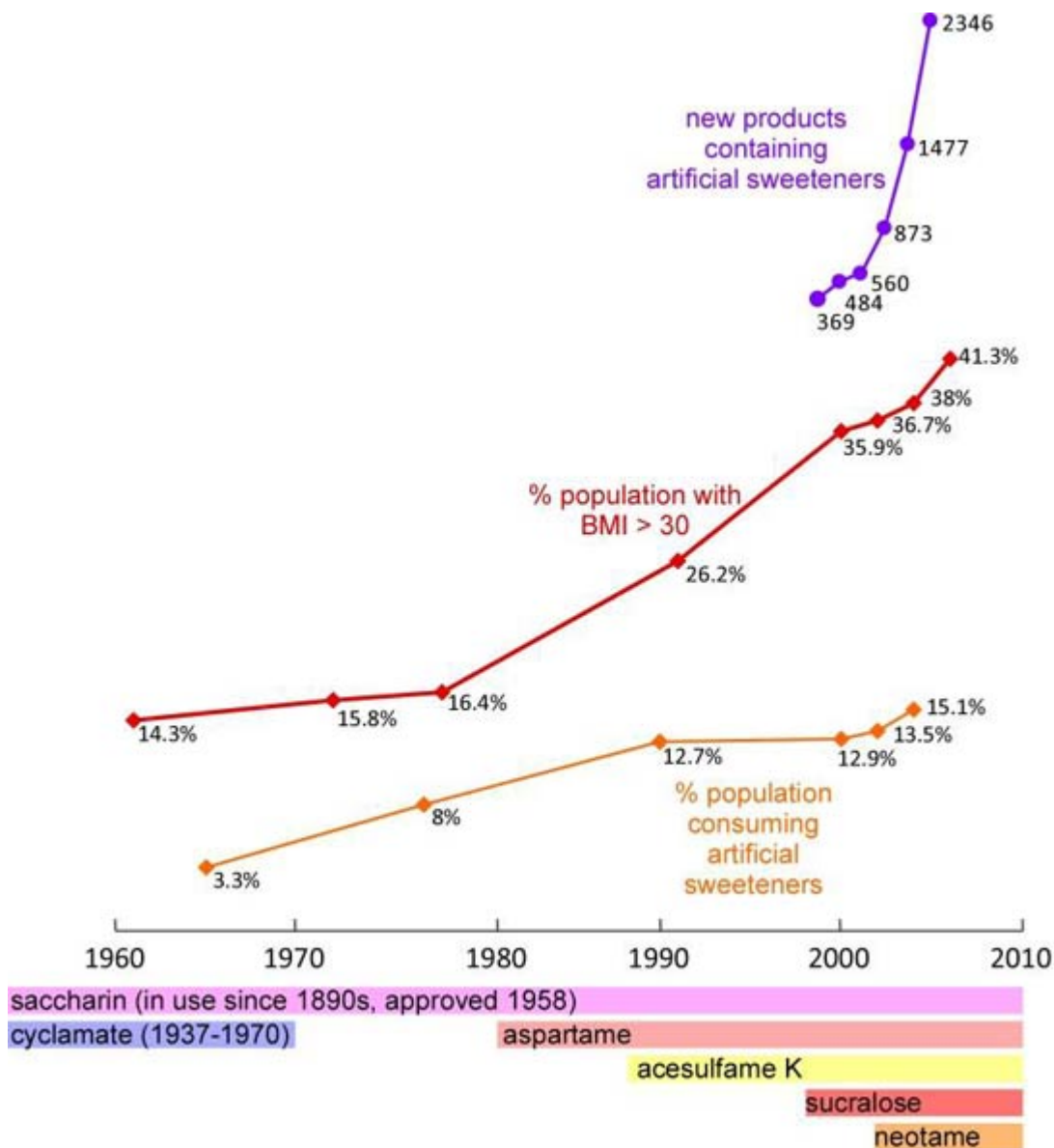
*'Data from this and other prospective studies suggest that the promotion of diet sodas and artificial sweeteners as healthy alternatives may be ill-advised,' said Helen P. Hazuda, Ph.D., professor and chief of the Division of Clinical Epidemiology in the School of Medicine. 'They may be free of calories but not of consequences.'"*

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**Yale Journal of Biology and Medicine 2010<sup>64</sup>** — This review offers a summary of epidemiological and experimental evidence concerning the effects of artificial sweeteners on weight, and explains 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/m<sup>2</sup>. It also shows the correlation between increased usage of artificial

sweeteners in food and drinks, and the corresponding rise in obesity.



Source: Yale Journal of Biology and Medicine June 8, 2010,: v83(2)

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."*

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**The Journal of Pediatrics 2006<sup>65</sup>** – The National Heart, Lung, and Blood Institute Growth and Health Study followed 2,371 girls aged 9 to 19 for 10 years. Soda consumption in general, both regular and diet, was associated with increase in total daily energy intake.

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**Journal of the American College of Nutrition 2005<sup>66</sup>** – In this two-year-long study, which involved 166 school children, increased diet soda consumption was associated with higher BMI at the end of the trial.

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**San Antonio Heart Study 2005<sup>67</sup>** – Data gathered from the San Antonio Heart Study, which went on for 25 years, showed drinking diet soft drinks increased the likelihood of serious weight gain far more so than regular soda.<sup>68</sup> On average, for each diet soft drink the participants drank per day, they were 65 percent more likely to become overweight during the next seven to eight years, and 41 percent more likely to become obese.

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**International Journal of Obesity and Metabolic Disorders 2004<sup>69</sup>** – This Purdue University study found that rats fed artificially sweetened liquids ate more high-calorie food than rats fed high-caloric sweetened liquids. The researchers believe the experience of drinking artificially sweetened liquids disrupted the animals' natural ability to compensate for the calories in the food.

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**International Journal of Food Sciences and Nutrition 2003<sup>70</sup>** – This study, which looked at 3,111 children, found that diet soda, specifically, was associated with higher body mass index (BMI).

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**Journal of the American Dietetic Association 1991<sup>71</sup>** – In a study of artificial sweeteners performed on college students, there was no evidence that artificial sweetener use was associated with a decrease in their overall sugar intake either.

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**Physiology and Behavior 1990<sup>72</sup>** – Here, they found that aspartame had a time-dependent effect on appetite, "producing a transient decrease followed by a

sustained increase in hunger ratings."

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**Physiology and Behavior, 1988<sup>73</sup>** – In this study, they determined that no- or low-calorie sweeteners can produce significant changes in appetite. Of the three sweeteners tested, aspartame produced the most pronounced effects.

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**Preventive Medicine 1986<sup>74</sup>** – This study examined nearly 78,700 women aged 50 to 69 for one year. Artificial sweetener usage increased with relative weight, and users were significantly more likely to gain weight compared to those who did not use artificial sweeteners, 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."

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## Commonly Reported Splenda Side Effects

Scores of people have reported side effects from using Splenda, ranging from mild to severe. The following are common symptoms, usually noticed within a 24-hour period following consumption of a Splenda product:

**Skin** – Redness, itching, swelling, blistering, weeping, crusting, rash, eruptions or hives (itchy bumps or welts)

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**Lungs** – Wheezing, tightness, cough or shortness of breath

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**Head** – Swelling of the face, eyelids, lips, tongue or throat; headaches and migraines (severe headaches)

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**Nose** – Stuffy nose, runny nose (clear, thin discharge), sneezing

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**Eyes** – Red (bloodshot), itchy, swollen or watery

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**Stomach** – Bloating, gas, pain, nausea, vomiting, diarrhea or bloody diarrhea

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**Heart** – Palpitations or fluttering

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**Joints** – Joint pains or aches

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**Neurological** – Anxiety, dizziness, spaced-out sensation, depression

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## Report Reactions to Splenda and Other Artificial Sweeteners

To determine if you're having a reaction to artificial sweeteners – be it Splenda, aspartame or any of the others – take the following steps:

1. Eliminate all artificial sweeteners from your diet for two weeks
2. After two weeks, reintroduce your artificial sweetener of choice in a significant quantity (about three servings daily)
3. Avoid other artificial sweeteners during this period
4. Do this for one to three days and take notice of how you feel, especially as compared to when you were abstaining from artificial sweeteners
5. If you don't notice a difference in how you feel after reintroducing your primary artificial sweetener for a few days, it's a safe bet you're able to tolerate it acutely, meaning your body doesn't have an immediate, adverse response. Just know that this doesn't mean your health won't be damaged in the long run
6. If you've been consuming more than one type of artificial sweetener, repeat steps 2 through 4 with the next sweetener on your list

If you do experience side effects from an artificial sweetener (or any other food additive for that matter), please report it to the FDA (if you live in the U.S.). It's easy to make a report – just go to the [FDA Consumer Complaint Coordinator page](#), find the phone number for your state, and make a call to report your reaction.

Keep in mind that some medications may contain sucralose as well, even if it's not listed on the label. If you continue to experience any of the symptoms above even though you're avoiding Splenda and other artificial sweeteners, then it may be worth investigating whether any of the medications you're taking contain artificial sweeteners.

## Healthier Sugar Substitutes

Two of the best sugar substitutes are from the plant kingdom: Stevia and Lo Han Kuo (also spelled Luo Han Guo). Stevia, a highly sweet herb derived from the leaf of the South American stevia plant, is sold as a supplement. It's completely safe in its natural form and can be used to sweeten most dishes and drinks.

Lo Han Kuo is similar to Stevia, but is my personal favorite. I use the Lakanto brand vanilla flavor which is a real treat for me. The Lo Han fruit has been used as a sweetener for centuries, and it's about 200 times sweeter than sugar.

A third alternative is to use pure glucose, also known as dextrose. Dextrose is only 70 percent as sweet as sucrose, so you'll end up using a bit more of it for the same amount of sweetness, making it slightly more expensive than regular sugar. Still, it's well worth it for your health as it does not contain any fructose whatsoever. Contrary to fructose, glucose can be used directly by every cell in your body and as such is a far safer sugar alternative.

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