

Food Additive Combinations Raise Your Risk for Type 2 Diabetes

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STORY AT-A-GLANCE

- › Studies show that mixtures of food additives in ultraprocessed foods are associated with a modestly higher risk of Type 2 diabetes, and the association held for people following otherwise healthy diets
- › Two additive mixtures pose higher diabetes risk — one found in sweetened beverages and another in processed foods like dairy desserts and canned broths
- › Food additives damage gut microbiome, disrupt cellular function, and cause DNA damage when combined in laboratory cell studies; DNA damage appeared at the highest concentrations tested rather than at everyday dietary levels
- › Current safety assessments by health agencies are incomplete as they test individual additives rather than the combinations consumed in everyday diets
- › Healthy recommendations include eliminating ultraprocessed foods, choosing whole or biodynamic foods, educating family about real food, and learning to identify harmful additives

Additives in modern foods are ubiquitous and ingested all the time. While a single additive in your food might seem harmless, keep in mind that all of your consumption will eventually add up. Furthermore, published studies have linked the usage of food additives to an increased risk of Type 2 diabetes.



Globally, around one in nine adults aged 20 to 79 are living with diabetes, and more than 40% are unaware that they already have this condition.¹ While common medical knowledge dictates that managing Type 2 diabetes is reducing sugar intake, it paints an incomplete picture. Research shows that food additives also come into play.

Additives in Ultraprocessed Food Are Quietly Raising Diabetes Risk

A large-scale observational study published in PLOS Medicine² investigated whether common combinations of food additives found in everyday ultraprocessed foods are increasing the risk of Type 2 diabetes in the general population.

Led by researchers from France, the team analyzed data from 108,643 adults over an average follow-up of nearly eight years. The unique approach in this study is that instead of isolating individual additives, it focuses on mixtures of additives, mimicking food habits practiced in daily life. Two things about the cohort are worth knowing: It is a volunteer cohort recruited online, 79% women, who may or may not be more health-conscious than the general population — which the authors note limits how far the results generalize. And additive intake was estimated from dietary records rather than measured in blood or urine, so exposure is an estimate.

Based on collated data, here are the common additives used together:^{3,4}

Mixture 1: Additives — Sodium carbonates; diphosphates; glycerol; ammonium carbonates; potassium carbonates; sorbitol

Mixture 2: Additives — Modified starches; pectins; guar gum; carrageenan; polyphosphates; potassium sorbate; curcumin; xanthan gum

Mixture 3: Additives — Magnesium carbonates; riboflavin; alpha-tocopherol; ammonium carbonates

Mixture 4: Additives — Ammonium carbonates; sodium carbonates; diphosphates; alpha-tocopherol; DATEM; magnesium carbonates; lecithins

Mixture 5: Additives — Citric acid; sodium citrates; phosphoric acid; sulphite ammonia caramel; acesulfame K; aspartame; sucralose; arabic gum; malic acid; carnauba wax; paprika extract, capsanthin, and capsorubin; anthocyanins; guar gum; pectins

- **Sweetened beverages increase your risk of diabetes** — Based on the results of the study, the researchers noted that two additive mixtures contributed more to diabetes risk compared to the others. Specifically, they pointed out mixture 5, which contains chemicals mainly found in sweetened beverages like sodas. The size of that association was a 13% higher risk of Type 2 diabetes for each one standard deviation increase in intake of this mixture. While a small effect at the individual level, it can matter across a large population.
- **Processed foods are also to blame** — The second group that greatly contributes to diabetes risk is mixture 2. According to the researchers, examples of these foods are processed dairy desserts, sauces, and canned broths. The association here was an 8% higher risk per standard deviation increase. The other three mixtures were not significantly associated with diabetes risk.
- **Additive mixtures act in complex ways** — The study detected signs of both synergistic and antagonistic interactions between additives. In other words, some additives enhanced each other's harmful effects, while others blunted them.

For example, within the second mixture, researchers found six additive pairings that acted synergistically and four that seemed to cancel each other out. The takeaway here is that these interactions are unpredictable for your health.

The Mechanisms Behind the Additives You Eat

Several of the additives in the mixtures, especially artificial sweeteners like aspartame and sucralose, have been shown in previous articles to damage the gut microbiome. The result — your blood sugar stays elevated, and your risk of insulin resistance and full-blown Type 2 diabetes increases.

- **Emulsifiers are implicated in microbiome disruption and gut barrier damage** — These substances affect the mucus layer that protects the intestinal lining. When that layer breaks down, your body becomes more permeable to toxins and inflammatory triggers.

In the review of published literature, the researchers noted that carrageenan has been shown to impair glucose tolerance and promote inflammatory pathways that mirror early-stage diabetes.

- **Metabolic effects of food dyes** — Food dyes are worth a brief note, though the featured paper did not analyze food dyes in connection to diabetes specifically. In their discussion, the study authors mention that an earlier paper found Brilliant Blue (E133) and monosodium glutamate (E621) to be more toxic in combination than separately — an illustration of the synergy point rather than a finding about diabetes. Brilliant Blue itself was not in any of the five mixtures analyzed. Separately, a review of blue dyes notes that Blue No. 1 “has been found to inhibit mitochondrial respiration in vitro.”⁵ Inhibiting mitochondrial respiration, in turn, has in some studies been linked to insulin resistance,⁶ though the evidence is neither conclusive nor uncontested.
- **It's not just one additive that's causing poor health** — The researchers investigated whether individual additives within the mixtures were solely responsible for the risk. They weren't.

When the team adjusted for each additive one by one, the diabetes risk didn't go away. This confirmed that it wasn't just a matter of one or two chemicals — it was the combined, cumulative effect of the mixture that mattered most.

While the authors state that “causality cannot be established based on this single observational study,” the association held after adjustment for the usual explanations, and the practical response is the same either way: If you're trying to manage your blood

sugar, cutting back on ultraprocessed food as a category is a good idea, as these foods contain not just excess sugar but also other chemical combos that may have undesirable effects.

Toxic Reactions from Additive Mixtures Show Up in Human Cells

Earlier research published in *Food and Chemical Toxicology*⁷ took a different approach to investigate the issue of food additive in human health. Instead of looking at long-term human outcomes, researchers tested how these common additives, and their mixtures, affect human cells directly.

The study examined 32 widely consumed food additives and mixtures of additives commonly found in six food clusters, such as cookies and sweet cakes, or sweetened sodas. Here, the researchers exposed human liver, colon, kidney, and neuron cells to the additives, both alone and in combinations, and recorded signs of toxicity or damage.

- **Most individual additives caused no measurable harm, but there were exceptions**
 - Of the 32 additives tested on their own, 19 showed no cytotoxicity or genotoxicity. The remaining 13 did: eight were cytotoxic, four promoted cell proliferation, and two
 - E120 (carmines) and E503 (ammonium carbonates) – were genotoxic, meaning they damaged the cells' DNA. The authors note that this could not be explained by the concentrations of the individual additives within them. DNA damage of this kind is a recognized early step toward mutation and faulty cell replication, which is why it is measured.
- **The researchers modeled realistic exposure; DNA damage appeared at the top of the range** – The researchers calculated expected human exposure by converting dietary intake into bloodstream concentration equivalents. Then, they tested mixtures at a range of levels around those estimates. The genotoxic effects, specifically, appeared at the highest concentrations tested.

At ten times the modeled average real-world intake, the chemical mixture found most often in the broths, meal substitutes, butter and bread consumer cluster produced a significant increase in γ H2AX, a marker of DNA damage, in liver and colon cells, and reduced cell survival in colon, kidney and neuron cells.

Notably, the four additives present at the highest levels in that mixture – modified starches (E1442), citric acid (E330), sodium carbonates (E500) and monosodium glutamate (E621) – produced no DNA damage when tested individually, which the authors describe as a synergistic effect.

The mixture representing soda consumers reduced cell survival in liver and kidney cells from three times average intake, but produced no DNA damage; the authors attributed this to the higher levels of citric acid and sodium citrate, both cytotoxic on their own. No mixture produced any effect at the concentration modeling current average consumption.

- **More sensitive testing found DNA damage that standard assays missed** – For instance, E503 (ammonium carbonates) and E120 (carmine) had previously come up negative in standard regulatory genotoxicity assays, but the more sensitive method used here found both to be genotoxic on their own. E503 caused DNA damage in liver, colon and neuron cells at 3 mg/mL – roughly seven times the level the highest-consuming group's diet would deliver to the bloodstream, a margin narrow enough to warrant follow-up. E120 caused damage from 1 mg/mL, thousands of times above dietary exposure.
- **Cellular processes are affected** – The researchers followed another biomarker, phosphorylated histone H3 (pH3), a marker of cell division, not a measure of acidity, to detect whether additives interfered with mitosis, the process of cell division. Disrupted mitosis can lead to uncontrolled cell growth or cell death, which is why researchers watch for it.

Several mixtures increased pH3 levels dramatically, signaling that these chemical combinations can interfere with the cells' ability to reproduce and maintain normal function.

Ultimately, the research shows that safety assessments released by health agencies based on single tests are incomplete and inadequate. In the real world, you're not consuming one isolated chemical — you're ingesting cocktails of them, often multiple times a day.

Note: The cell-culture findings described in this article have not been confirmed as clinical outcomes in people.

Take Control of Your Food Choices

If you're dealing with blood sugar issues, struggling with your weight, or just trying to stay healthy, it's important to address the root cause of the problem and not just to focus on managing the symptoms only.

As discussed by the research, it's the hidden combinations of industrial food additives in ultraprocessed products that also stealthily disrupt your metabolism, gut health, and cellular function. Once you start reading labels and connecting the dots, you'll notice the patterns. To protect your health, here are practical recommendations:

- **Stop eating ultraprocessed food** — Cutting out ultraprocessed food removes most of these additive combinations from your diet, along with the refined ingredients and industrial fats that come with them. That means cutting out any product with an ingredient list that reads like a chemistry experiment — preservatives, stabilizers, emulsifiers, artificial sweeteners, and anything ending in “gum” or “sorbate.”
- **Choose whole, biodynamic, or regenerative foods as your base** — If you want to heal your metabolism and gut, start with foods that never needed additives in the first place. Go for fresh fruits and vegetables, root vegetables, meats from properly

raised animals (especially ruminants like beef and lamb), raw dairy from trusted farms, and eggs from pasture-raised chickens.

If you're not able to find biodynamic foods near you, prioritize clean labels and connect with local producers. Your gut microbiome needs real food — not synthetic chemical blends.

- **Educate your family about where real food comes from** — If you're a parent, your kids need to understand this early. If you're caring for older parents, help them see how food has changed. Teach them to recognize the difference between an apple and an apple-flavored snack. Remind them that food doesn't need to have a paragraph of ingredients.

Explain how pesticides, additives, and flavorings weren't part of human diets for thousands of years, and show them the difference in how they feel when they eat clean. Change starts in your home.

- **Check the label when going grocery shopping** — Avoid products that contain emulsifiers, artificial sweeteners, and preservatives. That includes carrageenan, guar gum, aspartame, sucralose, acesulfame-K, citric acid, and potassium sorbate. Look up every ingredient you don't recognize — In essence, be a discerning consumer.

Frequently Asked Questions About the Link Between Food Additives and Type 2 Diabetes

Q: How do food additives contribute to Type 2 diabetes?

A: Food additives, especially in ultraprocessed foods, have been linked to an increased risk of Type 2 diabetes, even among people with otherwise healthy diets. Sugar isn't the only thing worth watching in processed food. Mixtures of common

additives have also been associated with higher diabetes risk in large population studies, and laboratory work points to plausible mechanisms involving gut bacteria and glucose metabolism, although definitive proof of causation is still missing.

Q: Which types of foods are most associated with diabetes risk?

A: Research has shown two product groups that contain additives greatly contributing to your risk of diabetes:

- **Sweetened beverages** — Sodas and processed fruit juices contain artificial sweeteners like aspartame and sucralose, as well as food dyes.
- **Processed foods** — Dairy desserts, sauces, and canned broths include substances like modified starches, carrageenan, and potassium sorbate.

Q: What are the biological effects of additive mixtures on human health?

A: In laboratory studies on cultured human cells, additive mixtures caused DNA damage, cellular stress, reduced cell survival, and altered cell division in colon, liver, kidney, and neuron cell lines. These effects appeared at the highest concentrations tested, and the researchers say it is not yet known whether those concentrations predict what happens in the body.

Q: Why aren't current food safety regulations enough?

A: Most food safety assessments evaluate additives in isolation, not the combinations people consume daily. However, research reveals that when combined, even harmless additives interact synergistically or antagonistically, masking damage until it's too late. This makes current safety evaluations incomplete and misleading.

Q: What steps can individuals take to reduce their risk?

A: Here are four strategies to help turn your health back on the right track:

- **Eliminate ultraprocessed foods** — Avoid products containing additive cocktails (preservatives, sweeteners and emulsifiers).
- **Opt for whole, organic, or regenerative foods** — Choose fresh fruits and vegetables, pasture-raised meats, and raw dairy.
- **Learn to read labels** — Avoid unfamiliar or synthetic ingredients.
- **Educate family members** — Share information about the benefits of eating real food at home instead of relying on chemically processed alternatives.

This article is for informational purposes only and does not constitute medical advice. Consult a qualified healthcare provider before making changes to your health regimen.

Sources and References

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