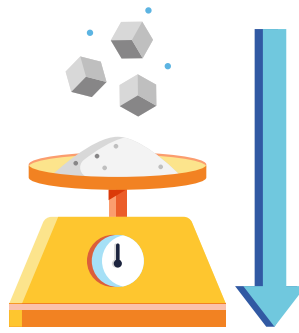


# Low-calorie Sweeteners:



Low-calorie sweeteners (LCS) are ingredients used in small amounts in food and beverages to provide a sweet taste with few or no calories.

The replacement of sugars with low-calorie sweeteners provides an approach to reduce sugar consumption and overall energy intake in the context of a balanced diet.<sup>1-6</sup>



LCS are key ingredients that PepsiCo uses as part of its sugar reduction goals. LCS share a lot in common, but they differ in terms of **taste profile, sweetness intensity, stability, metabolism and technical properties.** Common LCS include:

ASPARTAME ✓

ACESULFAME-K ✓

STEVIOLE GLYCOSIDES (STEVIA) ✓

SUCRALOSE ✓



## FOR MORE INFORMATION WATCH:

PepsiCo: Sweet Taste & Sweeteners  
<https://vimeo.com/816943163/2ce9543c6c>

## LCS ARE SAFE TO CONSUME!<sup>7</sup>

LCS have been confirmed as safe by the major international regulatory authorities including the European Food Safety Authority (EFSA), US Food and Drug Administration (FDA) and globally by the Joint FAO/WHO Expert Committee on Food Additives (JECFA).

**STUDIES SHOW:**  
There is no convincing evidence of adverse effects of aspartame on humans.<sup>8</sup>



SAFE FOR PREGNANCY



SAFE FOR CHILDREN

Only a very small number of people should not consume aspartame, including people with a genetic disorder called Phenylketonuria (PKU)<sup>9</sup> who are unable to break down the amino acid phenylalanine, which is found in aspartame and high-protein food.

## HOW MIGHT LCS INTERACT WITH GUT MICROBIOTA?

Some LCS (like aspartame, saccharin, acesulfame-K) are absorbed in the small intestine before reaching the colon, where the microbiota reside so it is unlikely that they influence the gut microbiota significantly.<sup>10-15</sup> Other LCS are unabsorbed in the small intestine, and may interact with the gut microbiota.<sup>16-20</sup> Most studies investigating effects have been conducted in animals<sup>21</sup>, and a definitive link between LCS and adverse effects on the gut microbiota has not been established.<sup>22,23</sup> More human clinical research is needed to understand the relationship between LCS and the gut microbiota.



## LCS - ASSUMPTION VS FACT



**Assumption:** Consuming LCS increases my appetite or causes weight gain

**Fact:** Diet beverage drinkers report feeling significantly less hungry than water-only drinkers.<sup>24</sup> Research has shown LCS can help to reduce calorie intake over time.<sup>1,4,25</sup>



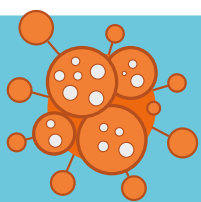
**Assumption:** Consuming sweet products or LCS makes me crave sweets

**Fact:** Research shows LCS do not increase sweet cravings.<sup>4</sup> A study where people were given diet beverages or water found the former reduced their overall calories from sugars more than the water-only drinkers.<sup>24</sup>



**Assumption:** LCS cause diabetes or glucose intolerance

**Fact:** LCS have no or little effect on blood glucose or insulin and do not cause diabetes. Many doctors advise their patients with diabetes to use LCS to reduce sugar intake.<sup>26-30</sup>



**Assumption:** LCS increase cancer risk

**Fact:** Experts agree there is no definitive evidence of a link between LCS and cancer. Research shows that all approved LCS are safe.<sup>7,17,31</sup>



**Assumption:** LCS are not safe for pregnant women and children

**Fact:** All approved LCS have undergone extensive safety assessments to ensure that they are safe to consume during pregnancy and childhood development.<sup>32</sup>

1. Harrold et al. (2023). Non-nutritive sweetened beverages versus water after a 52-week weight management programme: a randomised controlled trial. <https://www.nature.com/articles/s41366-023-01393-3>
2. Laviada-Molina et al. (2020). Effects of nonnutritive sweeteners on body weight and BMI in diverse clinical contexts: Systematic review and meta-analysis. <https://pubmed.ncbi.nlm.nih.gov/32216045/>
3. Ashwell et al. (2020). Expert consensus on low-calorie sweeteners: facts, research gaps and suggested actions. <https://pubmed.ncbi.nlm.nih.gov/31928558/>
4. Peters et al. (2016). The effects of water and non-nutritive sweetened beverages on weight loss and weight maintenance: A randomized clinical trial. <https://pubmed.ncbi.nlm.nih.gov/26708700/>
5. Miller & Perez. (2014). Low-calorie sweeteners and body weight and composition: a meta-analysis of randomized controlled trials and prospective cohort studies. <https://pubmed.ncbi.nlm.nih.gov/24944060/>
6. Rogers et al. (2016). Does low-energy sweetener consumption affect energy intake and body weight? A systematic review, including meta-analyses, of the evidence from human and animal studies. <https://pubmed.ncbi.nlm.nih.gov/26365102/>
7. European Parliament & Council. (2008). Regulation (EC) No 1333/2008 of the European Parliament and of the Council of 16 December 2008 on food additives (Text with EEA relevance). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32008R1333>
8. World Health Organization. (2023). Evaluations of the Joint FAO/WHO Expert Committee on Food Additives (JECFA): Aspartame. <https://apps.who.int/food-additives-contaminants-jecfa-database/Home/Chemical/62>
9. Wegberg et al. (2017). The complete European guidelines on phenylketonuria: diagnosis and treatment. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5639803/>
10. Lobach et al. (2018). Assessing the in vivo data on low/no-calorie sweeteners and the gut microbiota. <https://pubmed.ncbi.nlm.nih.gov/30557670/>
11. Byard et al. (1974). Excretion and metabolism of saccharin in man. II. Studies with 14-C-labelled and unlabelled saccharin. <https://pubmed.ncbi.nlm.nih.gov/4459232/>
12. Renwick. (1985). The disposition of saccharin in animals and man—A review. <https://www.sciencedirect.com/science/article/abs/pii/027869158590136X>
13. Erickson & Kim. (1990). Digestion and absorption of dietary protein. <https://pubmed.ncbi.nlm.nih.gov/2184718/>
14. Ruiz-Ojeda et al. (2019). Effects of Sweeteners on the Gut Microbiota: A Review of Experimental Studies and Clinical Trials. <https://pubmed.ncbi.nlm.nih.gov/30721958/>
15. Plaza-Diaz et al. (2020). Plausible Biological Interactions of Low- and Non-Calorie Sweeteners with the Intestinal Microbiota: An Update of Recent Studies. <https://pubmed.ncbi.nlm.nih.gov/32326137/>
16. Roberts et al. (2000). Sucralose metabolism and pharmacokinetics in man. <https://pubmed.ncbi.nlm.nih.gov/10882816/>
17. Magnuson et al. (2016). Biological fate of low-calorie sweeteners. <https://pubmed.ncbi.nlm.nih.gov/27753624/>
18. Koyama et al. (2003). In vitro metabolism of the glycosidic sweeteners, stevia mixture and enzymatically modified stevia in human intestinal microflora. <https://pubmed.ncbi.nlm.nih.gov/12504168/>
19. Wheeler et al. (2008). Pharmacokinetics of rebaudioside A and stevioside after single oral doses in healthy men. <https://pubmed.ncbi.nlm.nih.gov/18555578/>
20. Xu et al. (2015). Exploring in vitro, in vivo metabolism of mogrosin V and distribution of its metabolites in rats by HPLC-ESI-IT-TOF-MS(n). <https://pubmed.ncbi.nlm.nih.gov/26280925/>
21. Schiffman & Nagle. (2019). Revisited: Assessing the in vivo data on low/no-calorie sweeteners and the gut microbiota. <https://pubmed.ncbi.nlm.nih.gov/31351100/>
22. Food Insight. (2021). Everything You Need to Know About Sucralose. <https://foodinsight.org/everything-you-need-to-know-about-sucralose/>
23. Food Insight. (2021). Everything You Need to Know About Stevia Sweeteners. <https://foodinsight.org/everything-you-need-to-know-about-stevia-sweeteners/>
24. Piernas et al. (2013). Does diet-beverage intake affect dietary consumption patterns? Results from the Choose Healthy Options Consciously Everyday (CHOICE) randomized clinical trial. <https://pubmed.ncbi.nlm.nih.gov/23364015/>
25. Catenacci et al. (2014). Low/No calorie sweetened beverage consumption in the National Weight Control Registry. <https://onlinelibrary.wiley.com/doi/full/10.1002/oby.20834>
26. Greyling et al. (2020). Acute glycaemic and insulinemic effects of low-energy sweeteners: a systematic review and meta-analysis of randomized controlled trials. <https://pubmed.ncbi.nlm.nih.gov/32672338/>
27. Nichol et al. (2018). Glycaemic impact of non-nutritive sweeteners: a systematic review and meta-analysis of randomized controlled trials. <https://pubmed.ncbi.nlm.nih.gov/29760482/>
28. Tucker & Tan. (2017). Do non-nutritive sweeteners influence acute glucose homeostasis in humans? A systematic review. <https://pubmed.ncbi.nlm.nih.gov/28939430/>
29. Bryant et al. (2014). Non-nutritive sweeteners: no class effect on the glycaemic or appetite responses to ingested glucose. <https://pubmed.ncbi.nlm.nih.gov/24595225/>
30. Serra-Majem et al. (2018). Ibero American Consensus on Low- and No-Calorie Sweeteners: Safety, Nutritional Aspects and Benefits in Food and Beverages. <https://pubmed.ncbi.nlm.nih.gov/29941818/>
31. Food and Drug Administration. (2023). Aspartame and Other Sweeteners in Food. <https://www.fda.gov/food/food-additives-petitions/aspartame-and-other-sweeteners-food>
32. World Health Organization. (2008). Principles and methods for the risk assessment of chemicals in food. <https://www.who.int/publications/i/item/9789241572408>