



DO ARTIFICIAL SWEETENERS HELP YOU LOSE WEIGHT?

Research Examines Relationship Between Nonnutritive Sweeteners and Weight Loss

By Rita Carey Rubin, MS, RD, CDE

Sweet'N Low. Equal. NutraSweet. Splenda. Stevia.

Artificial sweeteners such as these grace grocery store shelves, and there's seemingly no end to the list of products available today that contain them. Nonnutritive sweeteners enable patients with diabetes who are overweight or obese, who must reduce their sugar intake and often want to shed unwanted pounds, continue to enjoy their favorite foods and beverages.

Clients with diabetes who struggle with overweight and obesity often ask about the weight-loss benefits of consuming artificially sweetened fare. Many assume the use of artificial sweeteners will automatically help them lose weight. Though it's clear that replacing sugar-sweetened foods with sugar-free options reduces patients' caloric intake, research shows it's unclear whether this substitution will ultimately help them slim down. In fact, even as the world's population consumes more nonnutritive sweeteners per

capita than ever before, no consensus exists regarding the specific effects these additives have on appetite, overall caloric intake, or BMI.

This article reviews the research that has examined the relationship between the use of artificial sweeteners and long-term weight loss and weight gain. The evidence is mixed, but the findings of these studies can help you counsel diabetes patients who must decrease sugar intake as they incorporate more healthful eating and lifestyle changes.

Sweeter Diets

The consumption of all types of sweeteners has skyrocketed in the United States over the last 50 years. An analysis of U.S. food consumption data from 1962 through 2000 indicates a 22% increase in per capita daily caloric intake from sugar and other nutritive sweeteners.¹ The data show that 80% of the additional sweeteners consumed during this period were from beverages.

Per capita intake of nonnutritive sweeteners also has increased over time, but data are limited concerning the actual amounts consumed. According to a study by Mattes and Popkin, food and beverage manufacturers

aren't required to provide data regarding the amounts of nonnutritive sweeteners used in product formulations.² Therefore, researchers can't determine the exact quantities of nonnutritive sweeteners contained in various foods and beverages. Instead, estimates are based on the volume of artificially sweetened foods consumed.

Using data from the Nationwide Food Consumption and the National Health and Nutrition Examination surveys, researchers estimated that the average daily intake of artificially sweetened beverages (the largest source of nonnutritive sweeteners in the diet) was 26.2 oz in 2003 to 2004, more than twice the average intake in 1965.

Appetite, Caloric Intake, and BMI

Although nonnutritive sweeteners are promoted and sold as weight-control aids, there's no consensus regarding their short- or long-term effects on appetite, caloric intake, and BMI. According to Mattes and Popkin, some concern about the connection between nonnutritive sweeteners and weight gain arose in 1986 based on findings from a study commissioned by the American Cancer Society (ACS).^{2,3}

In the study, the ACS surveyed more than 78,000 women aged 50 to 69 and found that those who used the artificial sweetener saccharin were more likely to gain weight over the

course of one year than nonusers. The mean difference in weight gain between the two groups was less than 2 lbs, and researchers couldn't establish causality regarding the long-term effects of nonnutritive sweeteners on weight gain.

A review published in 1991 reported that some aspects of a 1982 study by Stellman and Garfinkel made it difficult to determine whether nonnutritive sweeteners actually affected weight. The study was designed to examine cancer incidence related to obesity, not patterns of weight loss or gain. Reports of baseline weight were based only on participant recall with no subsequent confirmation of data validity, and participants who had changed their dietary habits over a previous 10-year period were excluded (likely leaving dieters who regularly used artificial sweeteners out of the survey). The review also indicated that the most overweight women in the survey actually lost more weight if they used artificial sweeteners during the study period than those who didn't.⁴

Questions regarding the effects of aspartame on appetite surfaced in 1986 following the publication of a study in *The Lancet* by Blundell and Hill.⁵ These researchers compared the one-hour postprandial effects of plain water with separate solutions of glucose and aspartame to determine participant-reported levels of appetite and fullness. Subjects who drank the aspartame solution reported decreased levels of fullness and a greater desire to eat (interpreted as increased appetite) than those who drank the glucose solution or plain water.

One shortcoming of this study, according to the 1991 review,⁴ is that researchers didn't offer food to participants, so they couldn't determine whether an increased motivation to eat resulted in a greater caloric intake during a meal. In addition, unflavored solutions of glucose and a nonnutritive sweetener don't replicate how people ingest either artificial or nutritive sweeteners. Therefore, the study results couldn't be applied to real-life situations in which people consume sweeteners contained in beverages or food.

According to the 1991 review, most studies examining the short-term impact of aspartame on hunger and food intake report slightly decreased to no effect on hunger levels in participants after eating aspartame-containing products and reduced to no effect on food intake at subsequent meals.⁴ The results of some long-term trials, however, suggest that non-nutritive sweeteners have a potentially significant effect on body weight.

In 1997, Blackburn and colleagues published results of an intervention trial that examined the effects of a diet containing aspartame-sweetened products on weight loss in adults.⁶ In this study, 163 obese women were randomly assigned to a group that either consumed aspartame-containing products or avoided them while participating in a supervised weight-reduction and weight-loss maintenance program. The amount of weight lost was similar between the two groups during the 16-week intensive intervention stage. (Participants met weekly with a dietitian, and researchers gave them detailed menu plans, exercise prescriptions, and coaching for behavior modification).

In the aspartame group, the amount of aspartame used was directly correlated to the amount of weight lost. Weight loss was also positively correlated to exercise and eating control in both groups, and there was no difference in the levels of hunger reported between aspartame users and non-users. Blackburn concluded in a 1999 study that "the use of aspartame-containing foods and beverages is as effective at promoting weight loss as the same diet, exercise, and behavior program devoid of aspartame-containing products."

However, the authors noted an interesting and positive effect of aspartame use on long-term weight-loss maintenance: Seventy-one weeks after the intensive weight-loss stage of this study, the aspartame users regained significantly less weight (2.6 kg) than the women who didn't use the artificial sweetener (5.4 kg). Theoretically, the replacement of nutritive sweeteners with aspartame may have helped these individuals reduce their overall caloric intake enough to initially lose and maintain a lower body weight.

Contrary to Blackburn's research, results from the San Antonio Heart Study indicate a strong, positive association between nonnutritive sweetener consumption and weight gain.⁷ In this eight-year study of more than 3,000 adults, users of artificially sweetened beverages increased their BMI significantly more than nonusers, with heavy users of artificially sweetened beverages (11 to more than 22 per week) gaining the most weight overall.

Several baseline characteristic differences between the artificially sweetened beverage users and nonusers were notable. At baseline, participants who drank artificially sweetened beverages were more likely to be overweight or obese, of a higher socioeconomic status, and female. They consumed more calories from protein, total fat, and



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saturated fat and fewer calories from carbohydrates than nonusers of artificially sweetened beverages.

In addition, dieting was strongly associated with nonnutritive sweetener consumption, with 72% of dieters vs. 41% of dieters reporting the use of artificially sweetened drinks. Overall, participants who were dieting at baseline gained more weight over the eight years of follow-up than nondieters. Because chronic dieting has been associated with long-term weight gain, chronic calorie restriction could be implicated as a factor in weight gain in this study.

Among dieters, the mean change in BMI at follow-up was significantly greater in those using artificial sweeteners than in those who didn't (2 kg/m² vs. 1.23 kg/m²). The authors concluded there may be no causal relationship between artificial sweetener consumption and weight gain. However, they emphasized the need to examine and explain the strong positive dose-response relationship between the use of artificial sweeteners and weight gain in this study.

The Jury Is Still Out

Research on the physiologic and behavioral effects of nonnutritive sweeteners offers some interesting insight on the impact they might have on appetite and weight. Human and animal research examining the effects of artificial sweeteners on the release of glucagon-like peptide-1 (GLP-1) suggests that a premeal dose of a nonnutritive sweetener may stimulate sweet-taste receptors in the gut, enhance the release of GLP-1 and, in animals, augment the uptake of glucose after a meal.⁸

In a study published in *Diabetes Care*, volunteers consumed the equivalent of two-thirds of a can of diet soda sweetened with sucralose and acesulfame-K or unflavored carbonated water 10 minutes before a 75-g glucose load.⁸ Plasma glucose, GLP-1, and insulin levels were measured for 180 minutes after the glucose load. Although blood glucose and insulin levels didn't vary dramatically, GLP-1 levels were markedly higher when volunteers drank diet soda vs. plain carbonated water.

The authors of this study noted that the metabolic effects of increased GLP-1 secretion after ingesting artificial sweeteners are uncertain following a carbohydrate-containing meal. They recommended further research to isolate the metabolic effects of individual sweeteners, especially in people with metabolic abnormalities, such as type 2 diabetes.

Behavioral research has demonstrated that some people may consume more calories after knowingly eating artificially sweetened foods. In a study published in 1990, participants who knew they had eaten an artificially sweetened and lower-calorie breakfast cereal were more likely to consume extra calories later in the day than participants who weren't informed of the type of cereal they had eaten. This effect, known as overcompensation, has been proposed as a potential

weight-gaining effect of nonnutritive sweeteners.⁹ The trend to overcompensate in this study was not significant, and Mattes and Popkin later reported that other studies have failed to support this hypothesis.²

Undoubtedly, questions still exist regarding the short- and long-term effects of nonnutritive sweeteners on appetite, energy intake, and BMI. No one has been able to clearly demonstrate the benefits of artificial sweeteners for weight loss nor the physiologic mechanisms behind potential weight gain, especially among heavy users. Some individuals clearly lose weight and maintain that weight loss while using artificial sweeteners. Still, others gain weight while using the same products. And, of course, different nonnutritive sweeteners may vary in their metabolic effects.

Until research demonstrates a clear and direct metabolic effect of nonnutritive sweeteners, one can conclude that the impact of artificial sweeteners on weight probably depends on other lifestyle and behavioral factors, such as exercise patterns, portion control, and overall dietary habits.

— Rita Carey Rubin, MS, RD, CDE, is a dietitian practicing in northern Arizona.

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