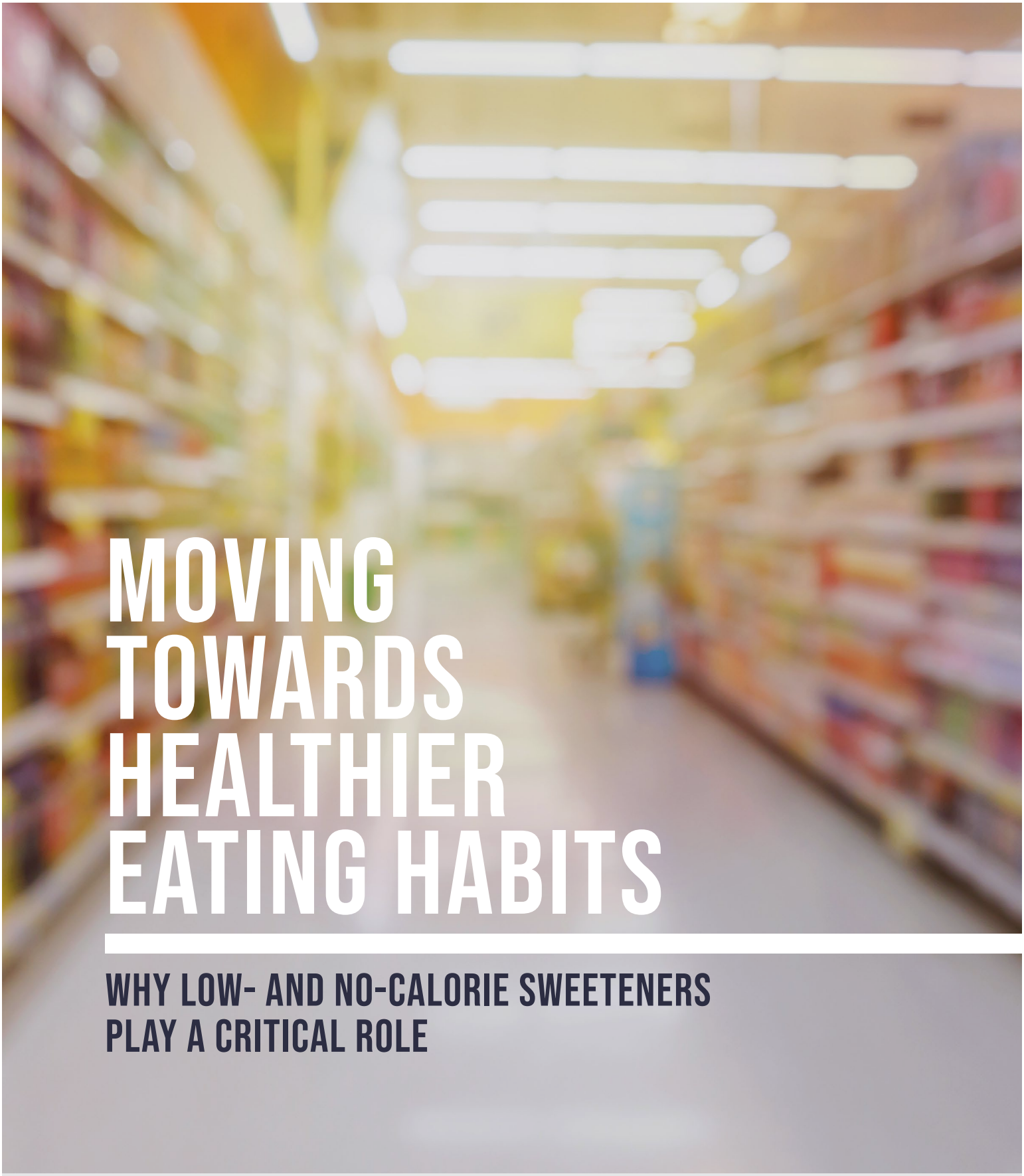

MOVING TOWARDS HEALTHIER EATING HABITS

WHY LOW- AND NO-CALORIE SWEETENERS PLAY A CRITICAL ROLE

Business for Impact

GEORGETOWN UNIVERSITY McDonough School of Business

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His research focused on the relationship of diet and prevention of chronic diseases. Among his scientific discoveries are the first demonstration that red wine consumption resulted in fewer cardiovascular lesions, that the cholesterol-filled cells in human arterial lesions are white blood cells, that reducing calories was more important than reducing fat in the diet for decreasing cancer growth, and a mediator of this last effect was likely IGF-1. Dr. Klurfeld has published more than 200 peer-reviewed articles and book chapters. He was Associate Editor of the American Journal for Clinical Nutrition from 2007 to 2019. He was elected a Fellow of the American Society for Nutrition (ASN) in 2018, received the Ralph Holman Lifetime Achievement Award from the American Oil Chemists Society in 2019, and the David Kritchevsky Career Achievement Award from ASN in 2020.

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CONTENTS

EXECUTIVE SUMMARY

Low- and no-calorie sweeteners (LNCS) are commonly used in the food supply to help reduce calorie and sugar intake. This paper examines the current state of LNCS usage, the benefits and safety of LNCS, consumer perspectives regarding the utilization and labeling of sugar and LNCS, and projections for how much sugar and calories can be removed from the food supply by increasing the incorporation of LNCS into foods and beverages. Among the key findings and implications of this paper are that three-quarters of consumers want to limit or avoid their sugar intake; sugar is the #1 nutrition item searched for on packaging; LNCS have consistently been shown to be safe, though consumers and the public are confused about this; and the number of food products containing LNCS is currently low, but increasing their adoption within permitted regulatory limits can contribute, according to our analyses, to the potential reduction of seventy billion grams of added sugar and two hundred twenty-five billion calories in the diet. Government and public health officials should prioritize educating consumers and the media about the benefits of LNCS in mitigating the obesity crisis.

INTRODUCTION

Concerns about the health of Americans are driving the public health community and regulators to look for ways to lessen the impact of food constituents, such as sugar. Declarations by the World Health Organization (WHO) and in the US Dietary Guidelines for Americans have highlighted the need to limit consumption of sugar to 10% or less of daily calories. The 2018 Political Declaration of the UN High Level Meeting on the Prevention and Control of Non-Communicable Diseases called upon the private sector to “strengthen its commitment” to make further efforts to reformulate foods and beverages to reduce the excessive use of salts, sugars and fats.[1]

Americans’ preference for sweet foods is likely to continue as indicated by increased sales of soft drinks and sweet baked goods in 2022 vs 2021. While the COVID-19 pandemic made consumers more conscious of their health, the desire for “permissible indulgence” is on the rise.[2]

LNCS offer a safe and effective means to provide sweetness while reducing sugar and caloric intake. Because LNCS are several times more sweet than table sugar, smaller amounts can be used to achieve the same level of sweetness as sugar. Thus, using LNCS in place of sugar permits users to consume fewer calories and sugar and better manage their blood glucose levels. These benefits are not only relevant for the healthy population but also those with diabetes .

This paper will increase understanding about the use, purpose, safety and benefits of LNCS in the food supply. It will demonstrate that LNCS are a beneficial tool to help individuals achieve public health recommendations to reduce added sugar consumption and manage caloric intake. The intent is to help guide more effective policy decisions, better dietary guidance and enlightened industry actions to enhance consumer health.

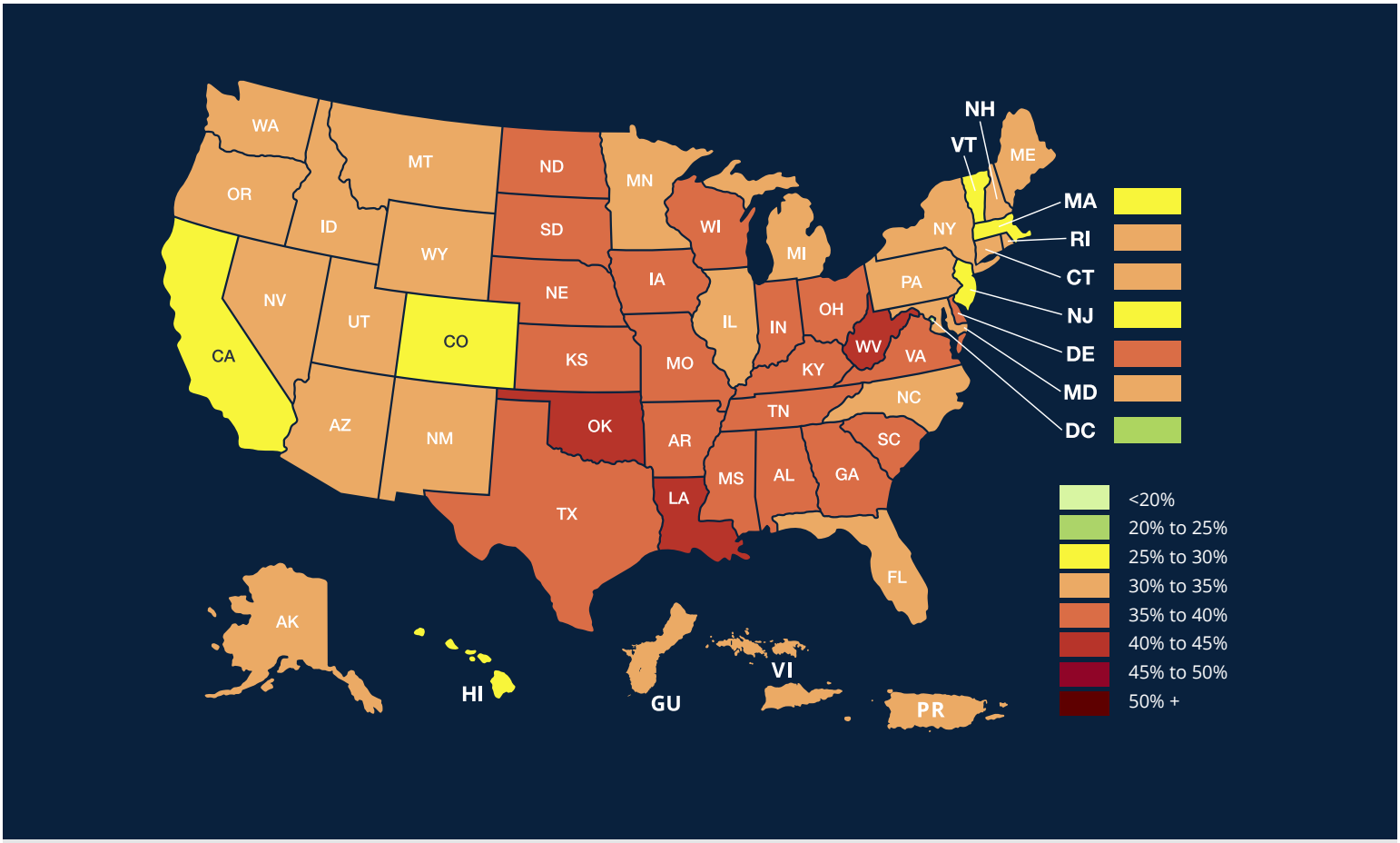

Figure 1. Twenty-two states now exhibit obesity rates of 35% or greater.

THE UNHEALTHY STATES OF AMERICA

The United States of America has one of the unhealthiest populations of all developed countries. Half of all American adults—117 million people—have one or more preventable chronic diseases. Three out of four Americans are overweight or obese. And one in ten have diabetes.[3] Many illnesses are preventable and result from habitual unhealthy eating patterns and low physical activity levels. America has the resources to become one of the healthiest populations in the world if healthy eating and physical activity recommendations were broadly adopted. Yet decades of public health initiatives aimed at reducing the socioeconomic, educational, and food access drivers of overweight and obesity have been ineffective. Revised or new approaches are needed to effect change.

Americans' Expanding Waistlines

The health of Americans is deteriorating with obesity rates climbing and longevity declining. As shown in Figure 1, the latest data from the Centers for Disease Control and Prevention (CDC) illustrates that obesity rates in the United States have jumped to 42.4% compared to 30.5% in 2000. Currently, obesity rates of 35% or higher are observed in 22 states whereas only four states demonstrated such high rates as recently as 2015.[4]

Compounding the effects of this long-term trend, consumers report having eaten more calories and "comfort" foods since the start of the COVID-19 pandemic, including over one in three (36%) consumers snacking more.[5] One year into the epidemic, the American Psychological Association conducted a national survey with The Harris Poll to understand the impact of the pandemic on long-term physical and mental health. They found "a majority of adults (61%) reported experiencing undesired weight changes."[6] A 2022 assessment by the USDA's Economic Research Service verified that weight gain during COVID-19 translated to an increase of three percent in the adult prevalence of Obesity. (see Figure 2)

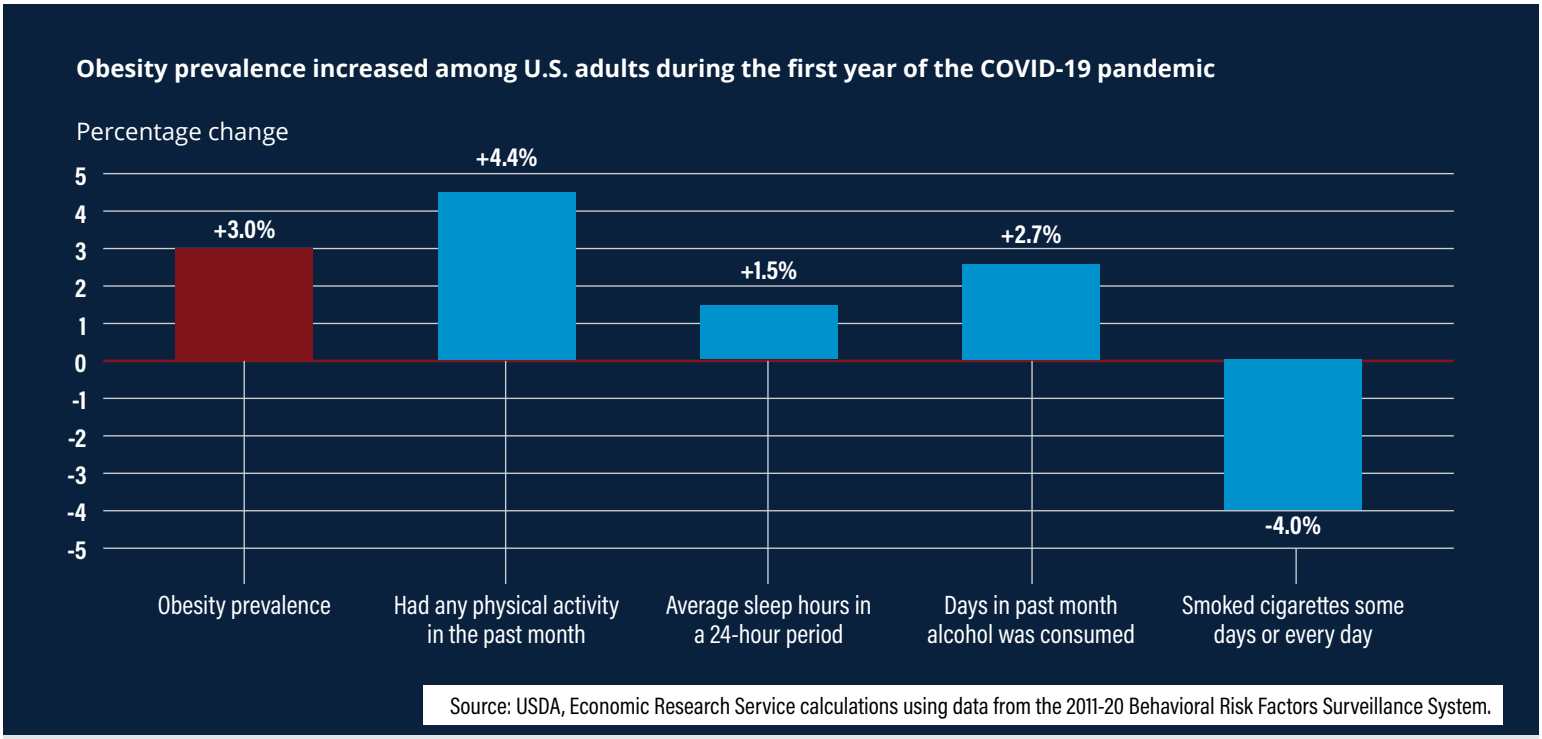

Figure 2. Adult obesity rates increased by 3% during the first year of the COVID-19 pandemic.

Just as notable is that child obesity rates continued their rise during the pandemic. A study released in September 2021 by the CDC found that the percentage of children and teens with obesity increased to 22.4%, compared to 19.3% before the pandemic and 16.9% in 2009-2010.[7] Such weight gains further exacerbate America's obesity crisis and support projections that almost half (48.9%) of the US population will experience obesity by 2030.[8] Also important, the COVID-19 quarantine time led others to focus on more healthy lifestyles, i.e., improved diet and activity and they tended to lose weight.[9] Nevertheless, consumer desire for "permissible indulgence" is the new long term trend signifying that people understand their need to be healthy, but not at the expense of enjoying the foods they love.[10]

Diabetes – Not to Be Overlooked

In the last 20 years, the number of adults diagnosed with diabetes has more than doubled as the American population has aged and become more overweight or obese.[11] Diabetes is the eighth leading cause of death in the United States and may be underreported.[12] More than 37 million people in the United States have diabetes, and 1 in 5 of them are unaware of their condition. Ninety-six million US adults have prediabetes, and more than 8 in 10 of them do not know they are at elevated risk. The CDC reports that 24 states now have diabetes rates of 10% or higher.[13]

The development of type 2 diabetes is generally caused by a combination of lifestyle and genetic factors, including being overweight or obese; eating a diet high in carbohydrates, sugars and fats; physical inactivity; and if a first-degree relative has experienced the condition.[14] The CDC emphasizes that obesity is the most important risk factor for developing type 2 diabetes. Research studies suggest that those with obesity are up to four times more likely to develop type 2 diabetes than those with a Body Mass Index (BMI) in the healthy range.

The Diabetes Standards of Care 2023 published by the American Diabetes Association clearly state that there is a role for LNCS for those confronting diabetes. The Standards cite that "There is evidence that low-and no-calorie sweetened beverages are a viable alternative to water… Healthcare professionals should continue to recommend water, but people with overweight or obesity and diabetes may also have a variety of no-calorie or low-calorie sweetened products so that they do not feel deprived."[15]

Added sugar: Nutrient of Concern

In March 2015, the World Health Organization recommended that adults and children reduce their intake of free sugars to help lower the risk of overweight, obesity and tooth decay.[16] The CDC added that, "Americans are eating and drinking too many added sugar, which can contribute to health problems such as weight gain and obesity, type 2 diabetes, and heart disease. To live healthier, longer lives, most Americans need to move more and eat better, including consuming fewer added sugar."[17]

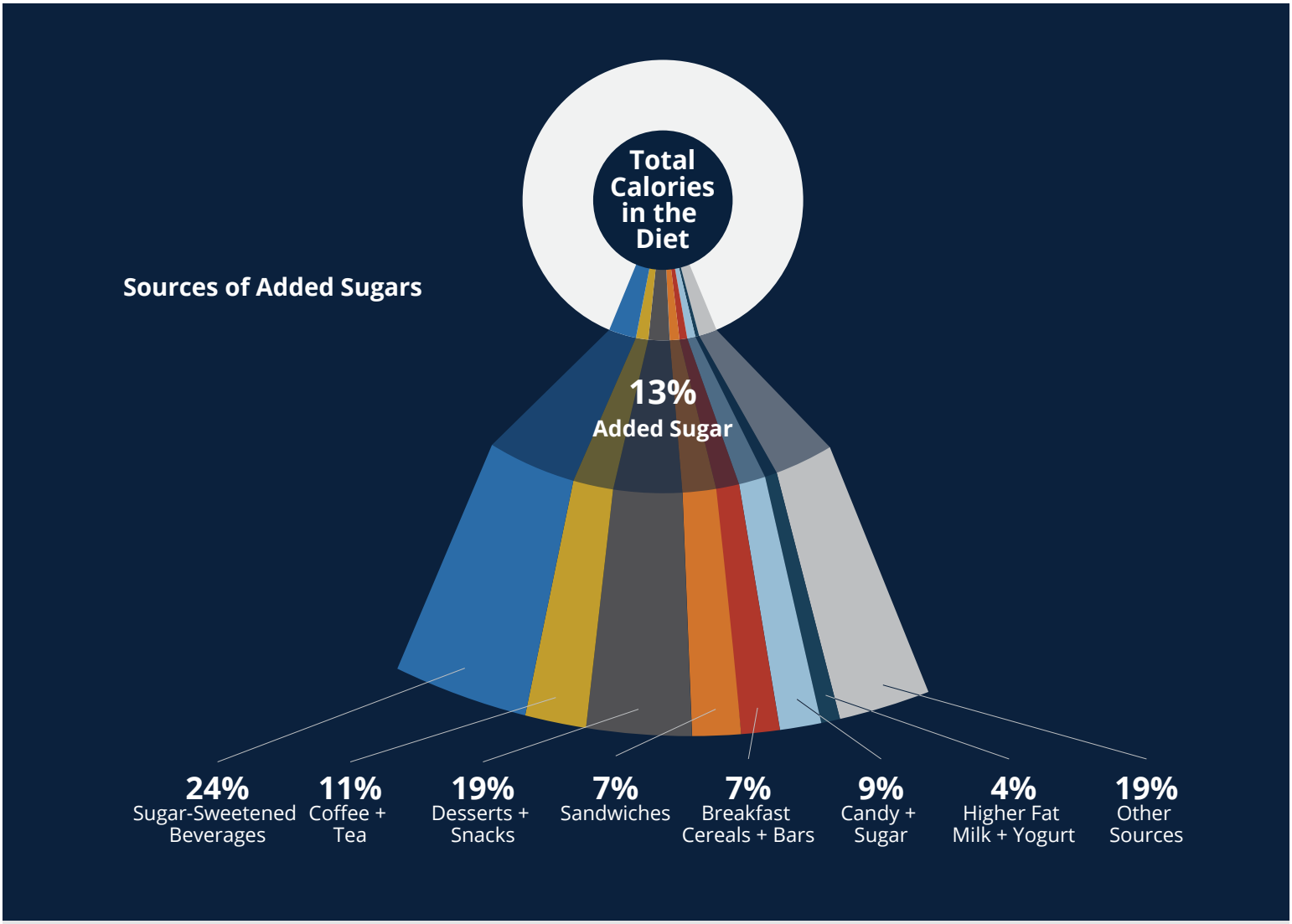

Figure 3. Added sugars contribute 13% of calories to the daily American diet[23]

Based on these assessments, lower targets for added sugar intake in the population have been recommended by several organizations and committees, including:

- The World Health Organization (WHO) in 2020 reaffirmed its healthy diet guidelines recommending that adults and children reduce their daily intake of free sugars to less than 10% of their total energy intake.[18] The global health body went further and cited that, "Capping your sugar intake at just 5% of your daily calories would provide additional health benefits."
- The US Dietary Guidelines for 2015-2020 also recommended a 10% intake limit for added sugar. This limit was upheld for the 2020-2025 Dietary Guidelines despite the position of the Dietary Guidelines Advisory Committee (DGAC) to reduce that level to 6%.[19] Because sugars contribute 13% of energy to the diet of Americans over one year of age (see Figure 3), the USDA put a proposal out for comment until May 10, 2023 to limit added sugar in school lunch and breakfast programs.[20]
- The American Heart Association (AHA) recommends limiting added sugar to no more than 6% of calories each day.[21] For most American women, that represents no more than 100 calories per day, or about 6 teaspoons of sugar. For men, it denotes 150 calories per day, or about 9 teaspoons. The AHA recommendations focus on all added sugar, without singling out any particular types such as high-fructose corn syrup. Despite these recommendations, the average American eats 17 teaspoons of sugar every day according to US government figures.[22]

INDUSTRY INITIATIVES

In 1980, the U.S. Department of Agriculture (USDA) issued its first dietary guidelines, and one of the primary directives was to avoid cholesterol and fat of all sorts. The food industry responded to this guidance and as consumption of many high fat products declined, calories from carbohydrates increased. But research has subsequently shown that the overconsumption of refined carbohydrates is tied to poor health outcomes.

Building on that history, several consumer packaged foods companies stepped up to make public commitments to sell fewer calories and added sugar, along with reducing portion sizes. In the past dozen years, three major industry sector initiatives (see Figure 4) stand out for their goals and accomplishments:

- ***Healthy Weight Commitment Foundation Calorie Reduction Commitment***. The Healthy Weight Commitment Foundation (HWCF), whose members include 16 of the nation's leading consumer packaged goods (CPG) food and beverage manufacturers, voluntarily pledged to collectively sell 1 trillion fewer calories in the US marketplace by 2012 (against a 2007 baseline) and 1.5 trillion fewer calories by 2015. In advance of the 2015 target date, it was determined that the committing companies had removed 6.4 trillion calories from the food supply, exceeding the original pledge by more than 400%. These caloric reductions by the HWCF companies translated to the consumption of 78 fewer calories per person per day.[24] Most of the calorie removal came from the reduction or elimination of sugars in soft drinks, cereals and snacks.
- ***Balance Calories Initiative***. In 2014, The Alliance for a Healthier Generation, the American Beverage Association (ABA), The Coca-Cola Company, Dr Pepper Snapple Group (now Keurig Dr Pepper) and PepsiCo announced an initiative to reduce the number of calories that Americans consume from beverages by 20% by 2025. From 2014 to 2021, calories per person declined by 7.4%. Meeting the 20% reduction goal by 2025 will require an acceleration of the annual calorie reduction pace to roughly 3.6%.[25] As with the Healthy Weight Commitment Foundation pledge, calorie reduction will come primarily from sugar reduction. The program has been supported by a major television educational campaign highlighting the industry's actions to offer "More Choices. Smaller Portions. Less Sugar."
- ***Always a Treat Initiative***. In 2017, the National Confectioners Association (NCA) brought together leading chocolate and sugar candy companies, including Mars Chocolate North America, Ferrara Candy Company, Ferrero, Lindt, Ghirardelli Chocolate, and Russell Stover Chocolates, to commit to the Partnership for a Healthier America (PHA) that calorie information would be printed on 90% of package fronts and that at least half of their single-serving products would be 200 calories or less after five years. At the completion of the 5-year pledge period ending December 31, 2021, both commitments were achieved: over 90% (94.8%) of SKUs were identified with calories labeled on front-of-pack (FOP) and half (49.8%) of Instant Consumable SKUs were at 200 calories or less.[26]

Figure 4. Examples of food industry commitments.[27]

Besides the aggregate company initiatives highlighted above, several individual food manufacturers have acted to increase better-for-you versions of the food and beverage brands they sell, including but not limited to:

- **Dannon.** In collaboration with the PHA, by 2017 Dannon reduced the sugar in all of its children's products and increased the nutrient density of all its products by over 10%. Further, it exceeded its pledge that 75% of its products would be low- or no-fat options.
- **General Mills.** The maker of Cheerios and Betty Crocker products established its Health Metric nutritional criteria to improve the nutritional content of its products. By 2019, the company achieved and exceeded its goal of 80% of its products meeting the nutritional criteria compared to 40% in fiscal 2008.
- **Mondelez.** The company has made a commitment that by 2025, 20% of the company's revenues will derive from portion-controlled items.
- **Nestlé**. To provide transparency on the nutritional value of its portfolio, Nestlé announced in November 2022 that it will benchmark its foods and beverages against the Health Star Rating (HSR) system, a nutrient profiling system used by the Access to Nutrition Index and on front-of-pack nutrition labels in some countries.

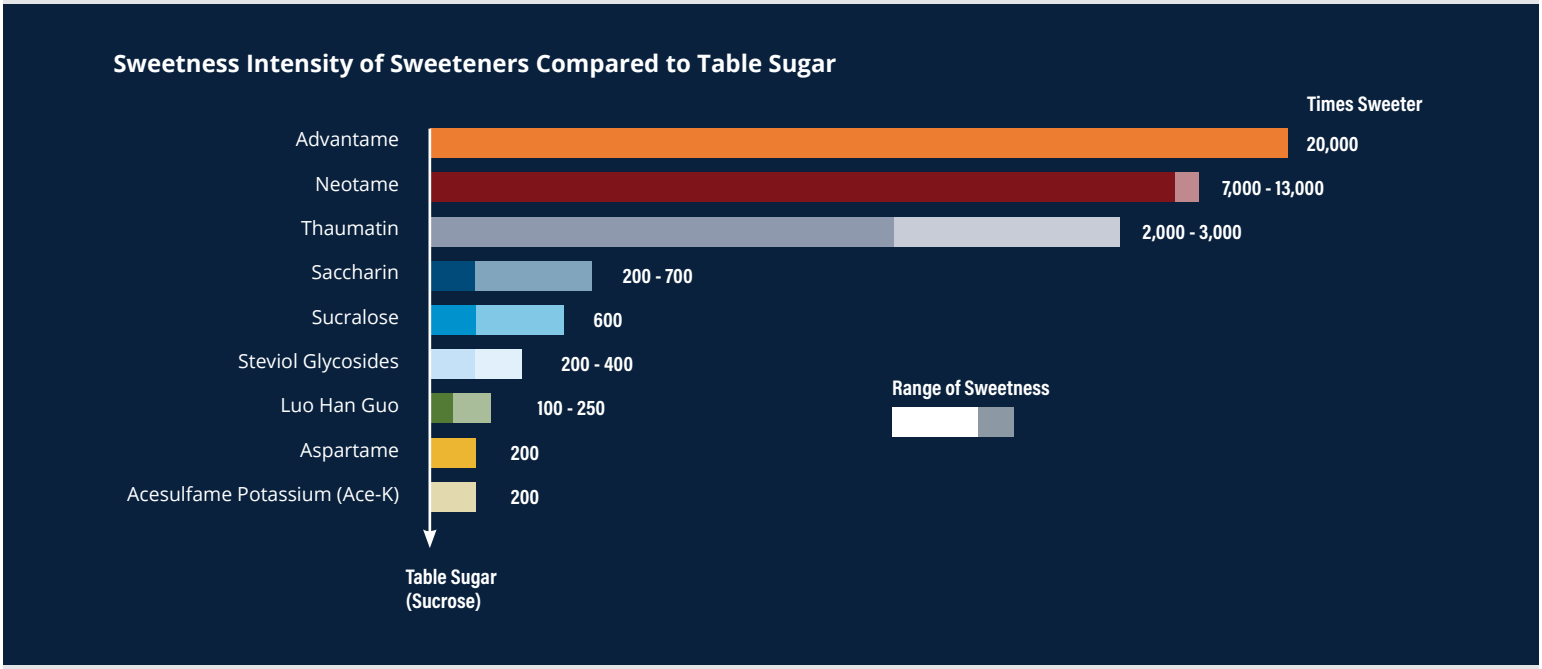

Figure 5. FDA-approved LNCS compared to sugar.[30]

SWEETENER OPTIONS TODAY

What are LNCS?

LNCS are ingredients used to sweeten and enhance the flavor of foods and beverages. Because LNCS are many times sweeter than table sugar (sucrose), smaller amounts are needed to achieve the same level of sweetness as sugar in food and beverage products. For example, only 31 mg of acesulfame-K and 58 mg of aspartame are used in typical diet sodas found on the market (compared to 39 grams of sugar typically found in a 12-ounce serving of regular soda). In addition to diet sodas, sweeteners are used widely in cereals, yogurt, baked goods and desserts, candy, sugar-free gum, juices and flavored waters.

Substitution of LNCS has been instrumental in delivering more foods and beverages containing less sugar. Six LNCS are FDA-approved as food additives in the United States: acesulfame potassium (Ace-K), advantame, aspartame, neotame, saccharin and sucralose. Additionally, the FDA has received GRAS Notices and has not questioned the notifiers' GRAS determination for three additional sweeteners made from plants or fruits: certain steviol glycosides obtained from the leaves of the stevia plant; extracts from monk fruit (also known as Swingle fruit or Luo Han Guo); and thaumatin, proteins isolated from the West African Katemfe fruit.[28]

Though the ratio of sweetness of a LNCS to sucrose will vary with concentration, as a generalization the relative sweetness of these LNCS compared to sugar is illustrated in Figure 5.[29]

What other sweeteners are on the market?

In addition to LNCS, other varieties of sweeteners are also available. Sugar alcohols (also known as polyols) such as erythritol, hydrogenated starch hydrolysate, isomalt, lactitol, maltitol, mannitol, sorbitol and xylitol provide the taste and texture of sugar. Most have about half the calories of sugar; erythritol, however, is calorie-free. They do not promote tooth decay or increase blood glucose.

Sugar alcohols are frequently combined with LNCS, such as acesulfame potassium, aspartame, saccharin and sucralose, in sugar-free chewing gums, candies, frozen desserts and baked goods. Polyols contribute mild sweetness as well as the bulk and texture of sugar while the LNCS bring the sweetness up to the level consumers expect.

Newer to the market are "rare sugars." Rare sugars are monosaccharides and disaccharides that are found in small quantities in plant foods, such as figs and raisins, and can be commercially produced from other agricultural sources like corn. Rare sugars include allulose, tagatose and isomaltulose. They offer sweetness levels approaching sugar and may contain fewer calories. In addition, rare sugars have different characteristics compared to traditional sugars and may offer distinct metabolic physiological benefits. For example, allulose is 70% as sweet as sugar and has the same onset, peak and decay of sweetness as sugar. In April 2019, the FDA allowed allulose to be excluded from total and added sugar counts on Nutrition and Supplement Facts labels when used as an ingredient because it provides less than one-tenth the calories of sucrose.[31]

Why different sweeteners are used for different applications.

Among the major LNCS there are differences in attributes and functionality that determine their appropriateness for varying food and beverage applications. Considerations include the intensity of the LNCS, whether the sweetener is heat stable, or if it delivers a lingering aftertaste. Selective specific nuances are noted below:

- Aspartame is typically used in lower pH environments. Applications include carbonated soft drinks, chewing gum, confections, frozen desserts and yogurt.
- Sucralose has been shown to be stable across a wide range of product applications and delivers three times the sweetness levels of aspartame and Ace-K.
- Stevia offers broad applications potential. Some stevia ingredients may have a bitter licorice-like aftertaste; however newer stevia ingredients on the market do not have similar taste challenges.
- Saccharin is approved for cooking or table use and in processed foods. Masking its bitter, metallic aftertaste is often required.
- Ace-K retains its sweetness under many food-processing conditions. This allows it to be used as an ingredient in a variety of food products, including baked goods, beverages, candies, chocolates, dairy products and desserts. Ace-K can also have a bitter note so it is often blended with other LNCSs to mask this characteristic.
- Sugar alcohols have diverse sensory and functional properties. For example, erythritol delivers good acid stability and high digestive tolerance, while improving baking stability and shelf life. However, it does not dissolve, brown or caramelize quite as well as sugar. Products made with isomalt have the same texture and appearance as those made with sugar and it is often used in hard candies, chocolates and baked goods while offering a good digestive tolerance as well.
- Allulose and isomaltulose deliver good stability in baked goods applications and in low pH systems, such as acidic beverages. In addition, isomaltulose has a low degree of hygroscopicity and absorbs virtually no moisture which has a positive effect on the shelf-life of many products.
- Further, certain LNCS are used in combination with other LNCS and/or sugar. For example, Ace-K in combination with other LNCS is frequently found in sugar-free sodas. Monk fruit is also often blended with other LNCS. And rare sugars, such as allulose, are often combined with LNCS like stevia and dietary fiber to reduce calories and deliver similar functionality of sugar in food and beverage products.

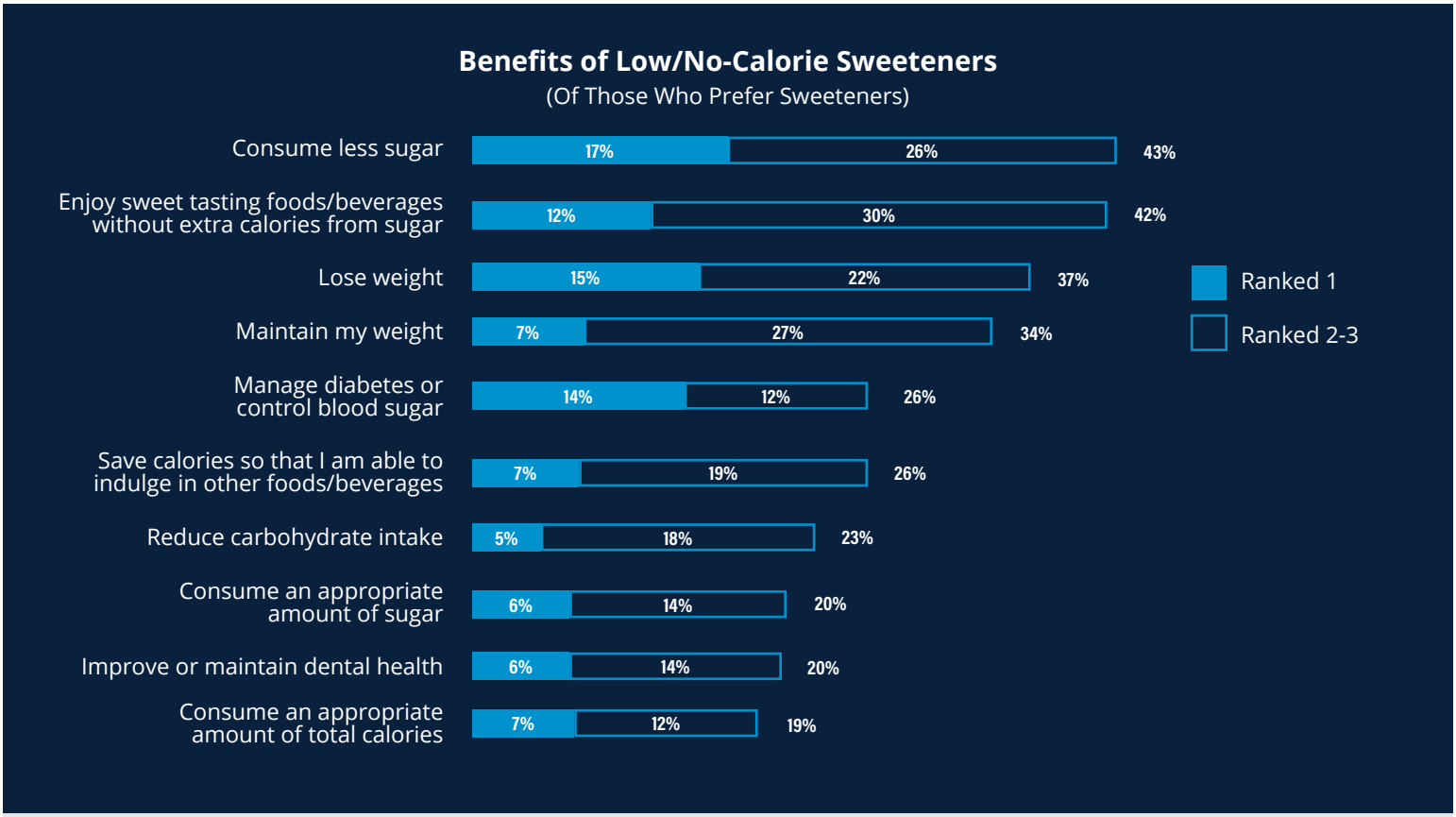

Figure 6. Benefits of low/no-calorie sweeteners.[35]

BENEFITS OF LOW- AND NO-CALORIE SWEETENERS

Scientific evidence long ago established a correlation between high-caloric intake and obesity, resulting in an abundance of policies focused on limiting calories and strengthening the importance of nutrition education. However, a major disparity exists between food-related policies and the mindsets and motivations of the people these policies are designed to impact, i.e., overweight consumers and those with obesity.[32] Many policymakers are ignoring the complex interdependencies associated with obesity.

In one analysis, researchers identified 37 determinants of low-calorie food choice that broke down into three major motivational driving categories: perceived health benefits, palatability, and accessibility of low-calorie sweeteners.[33]

The top reasons for selecting foods with low-calorie sweeteners were:

- "I want something that tastes sweet,"
- "I am trying to maintain/control my weight,"
- "They contain fewer calories,"
- "They are available," and
- "I want to save calories because I am eating a high-calorie meal."

According to a Natural Marketing Institute (NMI) survey, 58% of consumers state they have a sweet tooth and love sweet foods & beverages.[34] Americans' preference for sweet foods is likely to continue as manifested by the uptick in sales of soft drinks and sweet baked goods in 2022 vs 2021 along with the previously mentioned trend to "permissible indulgence."

How LNCS Can Help

LNCS can play a critical role in helping Americans limit added sugar in their diets while enjoying the taste profiles they desire. According to the 2023 International Food Information Council (IFIC) Food and Health Survey, the #1 benefit of LNCS is to help consumers reduce their sugar intake. (See Figure 6)

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In addition to helping reduce sugar intake, LNCS provide other important health benefits:

Dental Health

Dental caries is a major public health problem globally and is the most widespread noncommunicable disease (NCD). According to the WHO, dental caries can be prevented by avoiding dietary free sugars. Specifically, that organization cites that, "Limiting free sugars intake to less than 10% of total energy intake – and ideally even further, to less than 5% – minimizes the risk of dental caries throughout the life-course."[36]

Traditional sugars increase the risk of tooth decay and cavities since the bacteria in the mouth break sugar down into acids. Those acids combine with bacteria, saliva and food to create plaque, a substance that sticks to teeth and wears away at tooth enamel, eventually creating cavities. The bacteria most responsible for dental cavities is *Streptococcus mutans.*[37]

A study in the *International Dental Journal* concluded that LNCS can help prevent dental caries and that these sweeteners can be recommended by professionals to reduce the risk of dental caries in individuals.[38]

The FDA has also authorized the use of the "does not promote tooth decay" health claim for food products containing sugar alcohols like erythritol, hydrogenated starch hydrolysates, isomalt, lactitol, maltitol, mannitol, sorbitol, xylitol or a combination of these; the non-traditional sugars D-tagatose and isomaltulose; and sucralose.[39] The American Dental Association's Seal of Acceptance, the most trusted mark in oral hygiene since 1931, allows non-sugar sweetened gum to be eligible to receive the Seal.[40]

Blood Glucose and Insulin Levels

Studies support that LNCS do not impact blood glucose and insulin levels. A February 2023 network meta-analysis published in *Nutrients* concluded that, "Beverages sweetened with single or blends of NNS [non-nutritive sweeteners] have no acute metabolic and endocrine effects; i.e., their effects were not different from the water they were dissolved in. These findings provide support for beverages sweetened with LNCS as a replacement strategy for SSBs (sugar sweetened beverages)."[41]

The Mayo Clinic added that, "Sugar substitutes don't affect your blood sugar level. In fact, most artificial sweeteners are considered 'free foods.' Free foods contain less than 20 calories and 5 grams or less of carbohydrates, and they don't count as calories or carbohydrates on a diabetes exchange."[42]

There are reports challenging these claims based on observational data; however, a large meta-analysis of randomized controlled studies (a methodologically strong research design that allows conclusions of causality to be drawn) documents the lack of effect of LNCS on either blood sugar or insulin concentrations.[43]

The Efficacy of LNCS in Weight Management

Much is debated about the efficacy of LNCS in helping consumers manage their weight. Our assessment relies heavily on results from randomized controlled trials (RCTs) versus observational studies as only the former can provide evidence of causation. RCTs generally know how much a participant was exposed to while observational studies are usually only an approximation at baseline. These observational studies, also known as epidemiological studies, have numerous confounding factors, and all adjust for different facets, so are not truly comparable.[44] A review of well-designed RCTs up to two years in duration, considered to be the gold standard for assessing causal effects, support that substituting LNCS for regular-calorie versions leads to benefits in weight loss, lower body mass index (BMI) and reduced energy intake. Highlights from some of the most important studies follow.

A meta-analysis published by Miller and Perez in *The American Journal of Clinical Nutrition* demonstrated that in RCTs, LNCS modestly but significantly reduced all outcomes examined, including body weight, BMI, fat mass and waist circumference.[45] They concluded that substituting LNCS for their regular calorie versions would be a useful tool to improve compliance with weight loss or weight maintenance efforts.

A meta-analysis of 60 articles by Rogers et al. published in the *International Journal of Obesity* reported significant benefits of LNCS when substituted for sugar on energy intake, body weight and BMI. They concluded that, "The preponderance of evidence from all human RCTs indicates that low-energy sweeteners (LES) do not increase energy intake or body weight." The authors recommended such sweeteners to be used in place of sugar.[46]

Another meta-analysis of RCTs conducted by Laviada-Molina et al. revealed that replacing sugar with LNCS leads to beneficial effects on body weight and BMI among individuals specifically following unrestricted diets[47] and a recent meta-analysis extended the findings, documenting lower weight gain among adolescents substituting LNCS for sugar.[48]

Some studies actually report that LNCS use leads to greater weight loss than substitution of water for sugars. For example, in a 2016 RCT conducted by Peters et al., over 300 participants were assigned to consume either water or low-calorie-sweetened beverages for one year as part of a program that included 12 weeks of weight loss followed by 40 weeks of weight maintenance interventions.[49] Those who were assigned to the low-calorie-sweetened beverage group lost 6.21 kg on average; those in the water group lost 2.45 kg. However, the greater literature indicates substitution of LNCS and water are comparable in their beneficial effects on body weight.[50]

"...substituting LNCS for their regular calorie versions would be a useful tool to improve compliance with weight loss or weight maintenance efforts."

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Systematic reviews and meta-analyses by Lee et al. and McGlynn et al. of both prospective cohort studies[51] and randomized controlled trials demonstrated that LNCS beverages can be used as a replacement strategy similar to that for water for reducing cardiometabolic harm from sugar-sweetened beverages.[52]

The Scientific Report of the 2020 Dietary Guidelines Advisory Committee (DGAC) included a systematic review of 37 studies — six of which were randomized controlled trials, published between January 2000 and June 2019, on the relationship between low-calorie-sweetened beverages and adiposity. The DGAC report concluded that, "Replacing added sugar with LNCS may reduce calorie intake in the short-term and aid in weight management, yet questions remain about their effectiveness as a long-term weight management strategy."[53]

The above finding on LNCS was re-confirmed by

a 2022 systematic review by the WHO. The report cited that in RCTs up to two years in length, those consuming LNCS had lower body weight and BMI at the end of the trials than those not consuming LNCS, particularly when compared with sugars (including when LNCS were explicitly used as replacements for sugars). Those consuming LNCS also exhibited a significant reduction in energy intake, primarily when LNCS were compared to sugars. The analysis concluded that LNCS may be effective at assisting with short-term weight loss when their use leads to a reduction in total energy intake.[54]

In May 2023, the WHO published a meta-analysis of 29 trials that showed an overall lower sugar intake, lower energy intake and lower body weight with LNCS use, though they noted that, in trials 3 months or longer in duration, there was no benefit for body weight. However, the WHO noted that this conditional recommendation was based on evidence of low certainty overall. Specifically, there were only six trials where two showed a significant benefit for LNCS and one reported a benefit to non-use of LNCS. However, the latter was a trial comparing LNCS with water where both groups lost weight, but the conclusion was based on the fact that the decline was greater for water.[55]

A just released overview of previously published systematic reviews on the association of LNCS intake with multiple indicators of body weight in both randomized controlled trials and observational studies was performed by Higgins, Klurfeld et al. and identified 20 meta-analyses that met the inclusion criteria, with 8 reporting a beneficial effect, 4 an adverse effect, and 8 with insufficient evidence to draw a conclusion. The main reason for the diversity in findings was that the studies were heterogeneous and did not meet basic requirements for comparison in meta-analyses because of differences in approach, methods, and criteria. The study was presented at the Nutrition 2023 meeting in July 2023.[56]

In summary, there are multiple meta-analyses on the impact of LNCS, and, considering the hierarchy and weight of scientific evidence, the strongest ones conclude that LNCS use is associated with lower body weight and/or BMI in RCTs up to two years in duration. This conclusion was reaffirmed by the WHO in 2022 while a 2023 guideline suggested that use of LNCS did not confer any long-term benefit in reducing body fat.

LNCS Safety

Despite being deemed safe for decades by world-renowned, trusted and independent food safety and regulatory agencies, LNCS are among the most scrutinized ingredients in the food supply. The U.S. Food and Drug Administration (FDA) thoroughly reviews the safety of all new food additives, including LNCS, before they become available to the public. Regulatory bodies such as the European Food Safety Authority (EFSA) and the FAO/WHO Joint Expert Committee on Food Additives (JECFA) have also published opinions on the safety of these ingredients.

Unsplash | Louis Reed

Published scientific research has repeatedly documented that the LNCS permitted for use are safe for human consumption within the Acceptable Daily Intake (ADI) established for each type of LNCS. The ADI is the average daily amount of an ingredient that is expected to be safe for a person to consume every day over a lifetime. ADIs are established to ensure that LNCS are safe for all ages, life stages, and people with health conditions, such as diabetes. There is one exception—people with phenylketonuria, a rare hereditary health condition, should avoid or limit their consumption of aspartame and other foods that contain the amino acid phenylalanine. [57]

Questions have been raised that with the drive for sugar and energy reduction, and the use of LNCS in more foods and beverages, consumers may be at risk of excessive consumption. However, support for such concerns is lacking. In a 2018 review of studies

assessing dietary intake of seven LNCS, Martyn et al. concluded in *Nutrients* that intake studies conducted since 2008 do not indicate exposure exceeds the ADIs for individual sweeteners, and findings do not suggest a shift in exposure over time despite some data suggesting that there may have been an increase in the number of consumers of LNCS sweetened products.[58] In 2022, Lenighan et al. studied exposure to four LNCS (aspartame, acesulfame-k, steviol glycosides and sucralose) in Brazil, Canada, Mexico, and the USA, and noted in *Food Additives & Contaminants* that even among the highest consuming population (95th percentile of intake), exposure was well below the ADI.[59] In 2022, Martyn et al. modeled the substitution of added sugar with six LNCS (acesulfame-k, aspartame, cyclamate, saccharin, steviol glycosides, and sucralose) in the Brazilian population and predicted intakes would be below the JECFA ADI for five of the six sweeteners in all population groups for average and heavy consumers.[60] For the outlier, cyclamate, exceedance of the ADI was assessed only among heavy users. Published in *Food Additives & Contaminants* in 2021, L. Barraj and colleagues studied exposure to six LNCS (acesulfame-K, aspartame, cyclamate, saccharin, steviol glycosides and sucralose) in the Brazilian population and similarly showed that intakes up to the 95% percentile did not exceed the ADI.[61] A further study by L. Barraj in 2021 examining intakes of the same six LNCS in Argentina, Brazil and Peru confirmed intakes below the ADI in the total population, including children.[62]

Most recently, Food Standards Australia New Zealand (2023) published a risk assessment for steviol glycosides, including an updated dietary exposure assessment, that concluded estimated dietary exposures to steviol glycosides were well below the ADI for all population groups assessed (in Australia individuals aged 2 years and above; in New Zealand children aged 5 to 14 years, and individuals aged 15 years and above)[63] Similarly, a tiered and refined dietary exposure assessment of steviol glycosides in the Belgian population (aged 3 to 64 years) showed intake was below the ADI in all age groups in the general Belgian population.[64]

A scientific symposium at the 13th European Nutrition Conference (FENS 2019) reinforced the safety of LNCS by noting, "The ADI is typically calculated following the application of large safety factors (often a factor of 100 times lower than the 'no observed adverse effect level' (NOAEL)) to give a large margin of safety for even the most susceptible and sensitive individuals in the population, including children and pregnant women."[65]

It is also pertinent to note that while LNCS share a common technological function - sweetness - they are distinct compounds, and so are metabolized differently in the human body (Magnuson et al. 2016). There is no evidence to demonstrate any safety risk in consuming more than one sweetener in the diet, or in one foodstuff. Indeed, access to a range of sweeteners enables manufacturers to use different individual or combinations of LNCS in foods and beverages, reducing the probability that all reduced sugar and reduced energy products use the same sweeteners, thus lessening the risk of high consumption of any individual sweetener.[66]

A February 2023 meta-analysis published in the journal *Nutrients* also concluded that there are no adverse effects on glycemic response from LNCS, similar to water.[67] The findings provide support

for LNCS beverages as an alternative replacement strategy for sugar-sweetened beverages.

Conversely, a study published in September 2022 involving 120 healthy, non-overweight, normoglycemic individuals suggested that commonly consumed LNCS may not be physiologically inert in humans as previously contemplated. Among four LNCS evaluated, each administered LNCS altered stool and oral microbiome and plasma metabolome. The authors did stress, however, that the findings should not be interpreted as calling for consumption of sugar, which they note is strongly linked to cardiometabolic diseases and other adverse health effects.[68,69]

Recent Safety Reviews

On July 14, 2023 the International Agency for Research on Cancer (IARC), an agency of the WHO charged with identifying carcinogenic hazards to humans, declared that aspartame is a possible carcinogen.[70] That same day, the Joint Expert Committee on Food Additives (JECFA), a different WHO agency which performs risk assessments on food additives, contaminants and naturally occurring toxicants, reaffirmed aspartame's safety and denied that it is a carcinogen as did the FDA, which noted that aspartame was one of the most studied additives. The JECFA decision is in line with health agency evaluations performed in the U.S., Canada, the U.K. and other countries. IARC decisions are often controversial, particularly for common exposures such as red meat, coffee and aloe vera gel. Since the IARC's purpose is to identify hazard and not risk, potentially inconsequential exposures could be classed with important threats to public health. JECFA estimated the safe level of aspartame intake for a person weighing 154 pounds (70 kg) was about 9-14 cans of diet soft drink per day; it should be noted that a safety factor of 100 is typically built into that estimate. Finally, in the last several years, IARC eliminated its category of "not carcinogenic" indicating that everything it reviews is either a carcinogen or there is not enough evidence to prove it. In fact, the journal *Lancet Oncology*, where IARC decisions are published, printed an editorial in 2016 criticizing the process and called for significant reform so the decisions would have more credibility.[71]

Earlier in 2023, the polyol erythritol was cited by a Cleveland Clinic study as being associated with an increased risk of heart attack and stroke.[72] The authors stated that studies assessing the long-term safety of erythritol are warranted. It should be noted that both the academic researchers and the LNCS industry and many academic scientists challenged the study's methodology, highlighting that the research did not consider subjects' inherent increased cardiovascular risk factors, diet or exercise, and that the blood samples were collected years ago before erythritol was in common use in the U.S., making their conclusion about sweetened drinks questionable relevant to cardiovascular disease. Furthermore, the research did not consider that erythritol is a metabolite produced without consumption of that compound; that is, it is not metabolized by the human body and is excreted unmodified into the urine without changing blood glucose and insulin levels. Because of these characteristics, all polyols including erythritol have been given the most favorable Acceptable Daily Intake (ADI) assignation by JECFA of "not specified," which means that polyols do not represent a hazard to health based on the available data if used at Good Manufacturing Practice (GMP) levels.

This report remains to be verified through replication of appropriately designed trials of the main effects and purported mechanisms, including an assessment of specificity of the effects (i.e., erythritol versus all sugar alcohols) which likely has little bearing on the safety of LNCS.

In May 2023, FDA updated its sweeteners website, reassuring the public that "The FDA-established acceptable daily intake (ADI), or the amount of a sweetener that is considered safe to consume each day over the course of a person's lifetime, continues to be protective of public health."[73]

Clarifying Safety for the Consumer

A key challenge related to safety is that 1 in 5 consumers are unsure who is responsible for reviewing the safety of LNCS in the United States.[74] Of those expressing a point of view, 29% believe it is the US government while 34% believe it is companies who manufacture sweeteners or sell the products that contain them.

Additionally, research has shown that increased consumption of LNCS is associated with perceived benefits, whereas perceived risk is associated with non-consumption of LNCS. The authors concluded that if LNCS over sugar consumption is to be encouraged, perceived risk and benefits should be explained in public health messaging. [75]

CONSUMER DEMAND FOR REDUCED SUGAR PRODUCTS

Growing Concern Around Sugar Consumption

Taste continues to be the top driver of food and beverage purchases, ranking more important than price, healthfulness, convenience, and environmental sustainability.

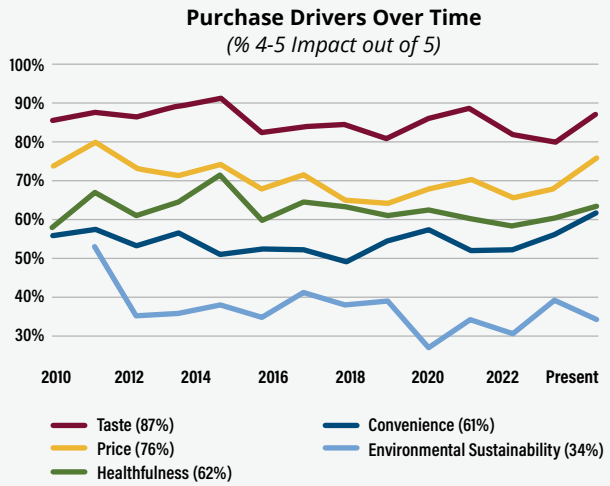
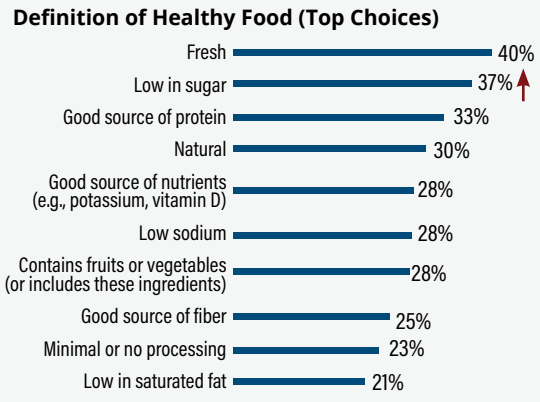


Figure 7. Taste remains the primary purchase driver for foods and beverages.[76]

Concurrently, there is a widespread concern in the US about the use of added sugar in food and beverages. According to the 2023 International Food Information Council Food and Health Survey, sugars are the top ingredient that consumers identify as most likely to cause weight gain.[77] As consumers strive to eat healthier, their top descriptors of a healthy food are "fresh" and "low in sugar." (See Figure 8) [78]

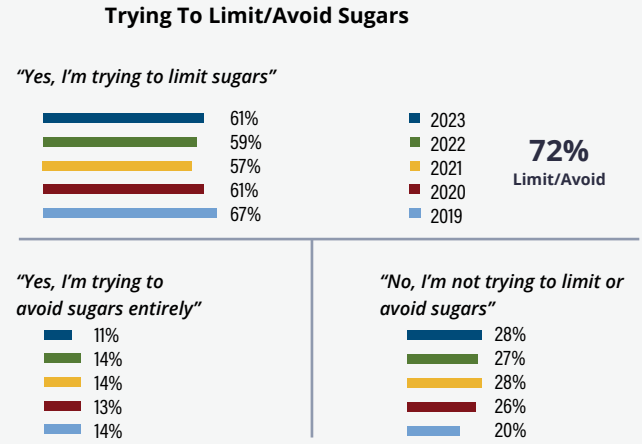
These characteristics rank higher than attributes such as "natural," "low sodium," and "low in saturated fat."



[TREND] Q12 Which of the following best define a healthy food to you? Please select up to 5 choices. (n=1,022) Note: "Other" and "none of the above" are not shown

Figure 8. "Low in sugar" is a top attribute for a healthy food.[79]

Almost 3 of 4 Americans are trying to limit or avoid sugars, primarily added sugar (see Figure 9).[80] And, according to NielsenIQ data, an estimated 5.1 million online searches for "no sugar products" were made in 2021.



[TREND] Q40 Are you trying to limit or avoid sugars in your diet? (n=1,022)/Q40A What type of sugars are you trying to limit or avoid? Filter: Tries to limit or avoid sugars: (n=725)

Figure 9. Almost 3 out of 4 consumers are trying to limit or avoid sugar.[81]

However, not all consumers are demanding fewer added sugar equally. Segmentation data from research firm Natural Marketing Institute (NMI) highlights the conundrum for public health and government officials in that those advocating for limitations on, or the complete avoidance of, added sugar are consumers already following healthier eating and lifestyle patterns. Well Beings, who comprise 30% of the population, are especially committed to consuming less added sugar and are the most vocal regarding the subject. Conversely, those consumers who are least engaged in eating healthier and exhibit higher rates of overweight and obesity are less likely to prefer foods with no sugars added. (See Figure 10)

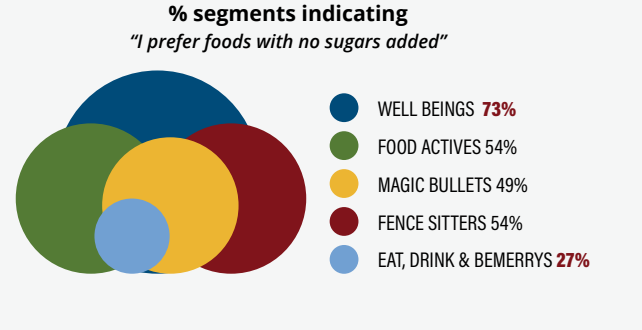


Figure 10. Well Beings, the healthiest consumer segment, are most committed to foods with no sugar added.[82]

The Market for Lower Sugar Products Is Growing

Several food and beverage categories are exhibiting strong growth in products containing LNCS. US retail sales of sugar-free chocolate products rose 27% over the 52-week period ended July 10, 2022, while volume sales were up 14%. Those percentages compared to overall chocolate dollar sales increasing 9% and overall chocolate volume sales increasing only 1.6%.[83]

Compared to full-calorie beverages, consumer share of volume sales of low- and no-calorie versions grew to 58.7% in 2020 versus just half (50.1%) in 2014.[84] The result has been the elimination of 1.5 trillion calories in the US diet since 2014. NielsenIQ scanner data covering the 5-year period ending September 10, 2022 showed that this trend continued, with unit sales of low-/no-calorie carbonated soft drinks increasing by 8.6% over that interval.

"No sugar" ingredients are outpacing their conventional higher-sugar counterparts in other categories as well as depicted in Figure 11.

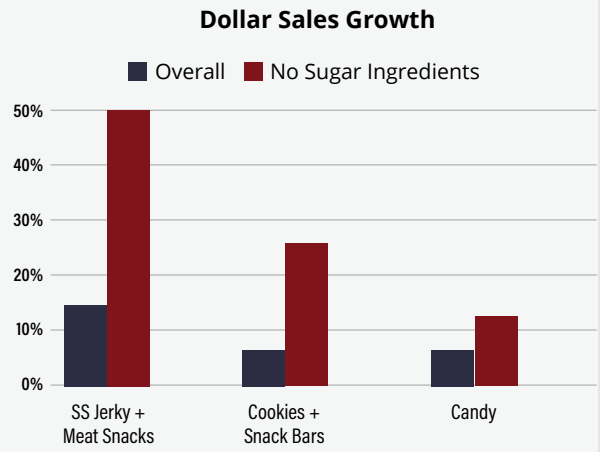


Figure 11. Source: SPINS 52-week period ending January 31, 2022.[85]

CONSUMERS + PACKAGE LABELS

Many Consumers Are Confused

The inability to interpret nutritional labels can cause Americans to ignore food labels when shopping. About half of Americans say they pay attention to food labels in-store or online. However, during the past year, fewer consumers are observing labels when shopping online, a six percentage-point decline. (See Figure 12)[86]

Figure 12. About half of shoppers are paying attention to labels.[87]

A survey of 2,000 consumers in the US conducted by Spoon Guru, a research and AI nutrition technology company partnering with large food retailers, has shown that 72% of consumers do not understand the recommended levels of salt, fat, and sugar consumption.[88] Only 28% of surveyed shoppers responded that they think they can confidently decipher the value of nutrients in food.

Another consumer research firm, Attest, surveyed 2,000 US consumers and found 60% are actively seeking food and beverage products to support their overall health. However, the survey noted widespread confusion when it comes to determining what is and isn't healthy. For example, participants were shown six varieties of cereal bars and asked to identify which was the healthiest choice. Comparing the responses to the Nutri-Score system, which converts the nutritional value of products into a simple ranking system, just 9% of respondents correctly identified the healthiest choice.[89]

What Do Consumers Want to See on Package Labels?

In September 2022, the White House published its National Strategy on Hunger, Nutrition & Health which highlighted the need to develop food and beverage labeling systems that quickly and easily communicate nutrition information.[90] When it comes to labels, sugar ranks at the top of what consumers check for the most. Data compiled by NMI depicted in Figure 13 shows that 'sugar content' is the #1 item checked for on food labels; almost half (48%) of consumers look for this ingredient most often. 'Added sugar' was the #4 item (35%) checked for most often, while 'type of sweetener' ranked much lower at #16 (22%).[91] These findings were affirmed by a FMI study titled *The Power of Health and Well-Being in the Food Industry 2022* which cited that 59% of shoppers were seeking product claims to avoid negatives (such as low sugar, sodium, fat, carbs and calories; and no added sugar or added hormones).[92]

% general population indicating what specific items they check for most often on the label of a food/beverage package

1	Sugar content	48%
2	Calories	46%
3	Sodium	40%
4	Added sugar	35%
5	Carbohydrates	33%
6	Ingredient list	33%
7	Fat content	31%
8	Cholesterol	28%
9	High fructose corn syrup	28%
10	Protein level	27%
11	Saturated fat	27%
12	Vitamins/Minerals	26%
13	Nutritional facts panel	24%
14	Fiber	23%
15	Natural ingredients	23%
16	Type of sweetener	22%
17	Artificial colors/flavors	20%

Figure 13. Sugar content is the #1 ingredient searched for most often on labels. [93]

From the data it is clear that consumers are not prioritizing examining package labels for the type of LNCS used. Only 22% of consumers mentioned type of sweetener, which is less than half of those mentioning sugar and calories.

Perhaps most critically, consumer segments exhibiting the highest incidences of overweight and obesity read the nutrition facts panel on packages the least. (See Figure 14) This is problematic as package information could help inform those who need advice the most on how to eat healthier.[94]

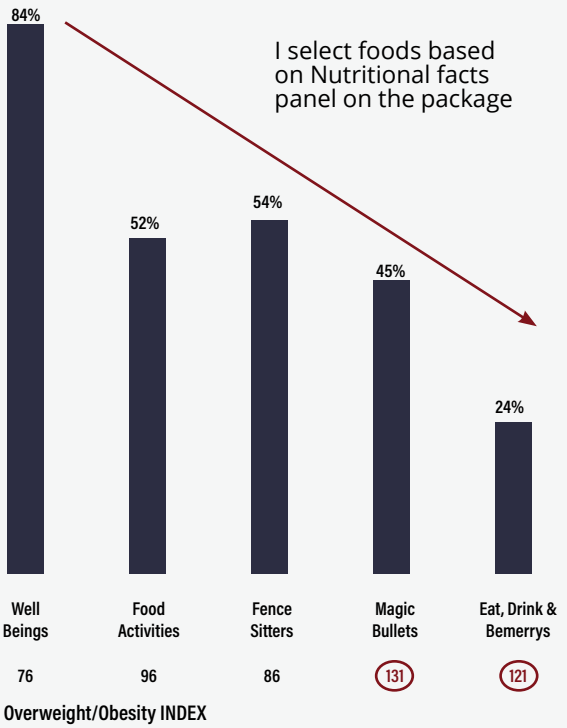


Figure 14. Those with the highest levels of overweight and obesity read nutrition labels the least.[95]

A study by the University of Minnesota's (UMN) School of Public Health gave an even more concerning view of how far package communications can effectively inform consumers.[96] They found that many people check the Nutrition Facts infrequently, with only one-third of young adults aged 25 to 36 reporting frequent use. Consistent with the results cited above, the UMN research showed that adults who did read Nutrition Facts labels more frequently were most interested in sugars, calories and serving size.

Consumers focus on the four nutrients of highest concern – sugar content, calories, sodium and added sugar. This suggests that nutritional labeling and information on packaging can go just so far in communicating all facets of a product's nutrition profile.

SWEETENERS IN THE FOOD SUPPLY

Current Use and Prevalence of Sweeteners in the Food Supply

To more accurately gauge the use and prevalence of sweeteners in the food supply, a detailed analysis was performed to quantify the percentage of products containing LNCS. The assessment examined products currently containing sweeteners and compared that to a University of North Carolina at Chapel Hill analysis for the period 2005-2009 to determine changes in the percentage of sweeteners in food products.

Methodology [97]

Data as of November 2022 was acquired from Label Insight, a NielsenIQ Company. The Label Insight database is the most robust repository of consumer packaged food & beverage product ingredient and label information available.

Seventeen "Super Categories," including 194 sub-categories of foods and beverages, were evaluated (see Figure 15). The categories were selected based on their high usage of caloric and/or low-/no-calorie sweeteners. In total, 169,781 stock keeping units (SKUs) were examined.

Super Categories	# Sub-Categories
Baking Mixes	24
Beverages	24
Candy, Gum, Mints	7
Cereal, Granola	4
Condiments	14
Cookies, Crackers	6
Creams, Non-Dairy Creamers	4
Desserts	18
Dough, Batter Products	2
Milk Products	7
Nut Butters, Jams, Jellies	15
Sauce, Seasoning Mix	16
Sauce, Gravy, Marinate	19
Sweeteners	3
Sweet Goods	14
Sweet Snacks	10
Yogurt	7
Total Sub-Categories	**194**

Figure 15. Food and beverage categories evaluated.

Products containing sweeteners were classified into three groups:

- Those containing added sugar only
- Those containing only LNCS
- Those containing both types of sweeteners

A separate analysis determining changes in product sales over the 5-year period ending September 2022 utilized NielsenIQ in-store data based on scanning barcodes of individual items (SKUs) sold at food retailers.

Sweetener SKU Analysis

Our evaluation found that added sugar items dominate the sweetener category. The vast majority (87%) of SKUs contain added sugar only. The remaining contain either LNCS by themselves (8%) or in combination with added sugar (5%).
(See Figure 16)

Sweetener Types	Total SKUs	Share of SKUs
Added Sugar Only	147,756	**87%**
LNCS Only	13,965	8%
Both Added Sugar & LNCS	8,060	5%
Total	169,781	100%

Figure 16. SKUs with added sugar dominate the sweetener category.

Comparing data from the 2005-2009 period to 2022, LNCS increased their share of SKUs by 6.7 percentage points while SKUs with added sugar declined by 3.7 percentage points and products with both LNCS and added sugar decreased by 3.0 percentage points. Nevertheless, the share of products with LNCS or a combination of LNCS and added sugar remains low.

It should be noted that certain categories in the 2005-2009 data were not included in the 2022 analysis as they were determined not to contribute significant amounts of sugar to the adult population.

These included baby food and formula; fresh, frozen, canned, or dry fruit; salad dressings and dips; and savory snacks. A separate analysis removing those categories revealed that changes in the SKU share profile were virtually identical to the current analysis.[98]

Using the in-store sales data from NielsenIQ comparing the 52-week period ending September 2022 to the 52-weeks ending September 2018, a separate analysis determined that between 2018 and 2022, the number of food and beverage items containing all types of added sweeteners increased by 2.1%. Items containing added sugar increased by 0.7% while those with LNCS increased at a faster rate (+6.5%). (See Figure 17) [99]

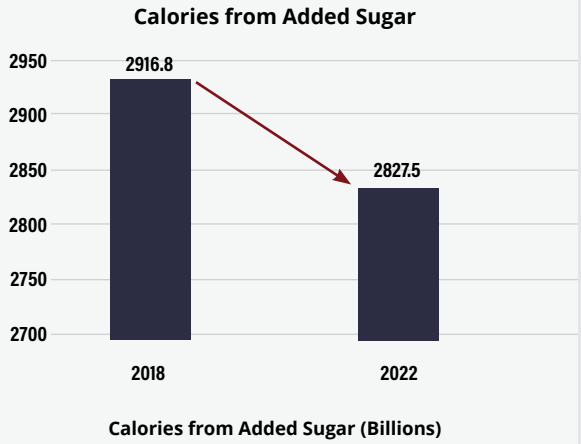
Annual Number of Items by Sweetener Type

Sweetener Type	2022	2018	% Change
Total Sweeteners	104.5 billion	102.4 billion	+2.1%
Added Sugar	78.4 billion	77.8 billion	+0.7%
LNCS	26.1 billion	24.5 billion	+6.5%

Figure 17. The number of food and beverage items containing sweeteners increased by 2.1% since 2018.

Calorie & Added Sugar Trend Analysis

In 2022, added sugar contributed over 2.8 trillion calories to the US food supply. Over the 5-year evaluation period, calories from added sugar declined by 90 million (-3.1%). (See Figure 18)



Source: Label Insight and NielsenIQ. Data for 52 weeks ending Sept. 2022 and Sept. 2018.

Figure 18. Calories from added sugar declined 3.1% over 5 years.

Concurrently, total grams of sugar per package declined by 1.4% from 2018 to 2022. However, had it not been for significant declines in the beverage and yogurt categories, -11.5% and -11.9%, respectively, the amount of sugar per package would have risen by 10.5%. (Figure 19)

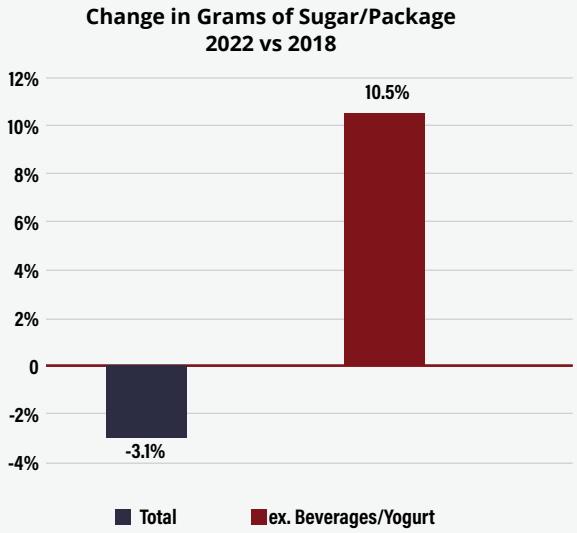


Figure 19. Without sugar decreases in beverages and yogurt, grams of sugar/package would have increased by 10.5%.

Key takeaways from this analysis include the following:

- Products with added sugar dominate the sweetener landscape.
- While LNCS are growing at a healthy clip, our findings dispel the premise that the use of LNCS in the food supply has skyrocketed.
- The share of SKUs containing LNCS would have to grow sharply to remove significant calories and sugar from the food supply.
- Two categories – beverages and yogurt – have driven the decline in added sugar grams per package. Outside of these, added sugar grams per package increased by 10.5% over the 5-year period evaluated.

The Future of Sweeteners in the Food Supply [100]

A key hypothesis of this paper is that added sugars are being replaced with LNCS at increasing rates due to consumers' need to reduce their caloric intake to maintain weight and for the betterment of their health. LNCS help achieve this goal by reducing calories and mimicking desired sweetener profiles.

To provide a benchmark for the impact LNCS can make in reducing sugar and calories, several scenarios were evaluated to assess the potential for sugar and calorie reduction by replacing added sugar with LNCS over the next five years. Specific scenarios examined included:

- Continuation of the current trend: a 3.1% reduction in added sugar and corresponding calories
- A 5% reduction in total added sugar and corresponding calories
- A 7.5% reduction in total added sugar and corresponding calories
- A 10.0% reduction in total added sugar and corresponding calories

Using the same Label Insight and NielsenIQ data, the following assumptions were made in performing the analysis:

- Calorie savings are reported at 3.18 calories saved per gram of added sugar replaced instead of 4 calories to account for the fact that sugar alcohols and rare sugars like allulose are not calorie free.
- The replacement of sugar by LNCS sometimes involves the use of bulking agents which can add back calories. This analysis does not have the capability of determining the impact of those additions.
- Average grams of added sugar per category are based on the weighted total of the values as Illustrated in Figure 20.

Added Sugar Gram Value Determination

Grams of Added Sugar Ranges	Values Used In The Analysis
0 grams	0
1 to < 2.5 grams	1.75
2.5 to <5 grams	3.75
5 to <7.5 grams	6.25
7.5 to <10 grams	8.75
10 to <15 grams	12.5
15 to <25 grams	20
25+ grams	25

Source: Label Insight. A NielsenIQ Company - Data as of September 2022 (52 weeks ending Sept. 2022 and Sept. 2018)

Figure 20. Categorization of added sugar grams.

The analysis showed that the upsides are significant. At the current rate of reduction/replacement, LNCS have the potential to reduce added sugar in our food supply across the 17 super categories by 21.9 billion grams, corresponding to 69.7 billion calories.

If the rate of reduction/replacement jumps to 10%, consumers could see a reduction of nearly 225 billion calories by the end of 2026. (See Figure 21) For context, actions taken by the 16-company Healthy Weight Commitment Foundation across a much broader array of foods and beverages resulted in a 6.4 trillion calorie reduction.

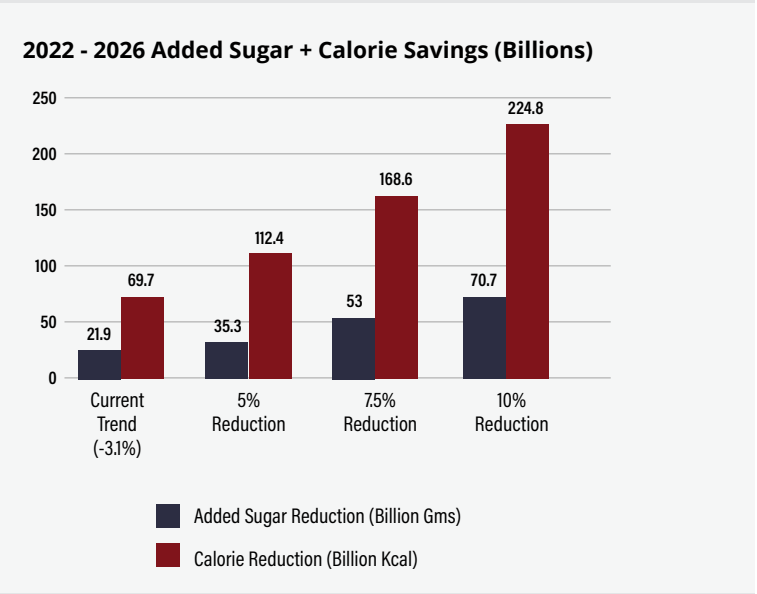


Figure 21. Replacing sugar with LNCS could potentially reduce sugar and calories substantially.

Significant savings in added sugar and calories from LNCS can be achieved in the next five years. A 10% reduction in added sugar would yield an elimination approaching ¼ trillion calories. The low share of category and ability to remove significant amounts of calories and sugar provide strong incentive for increasing the adoption of LNCS.

THE REGULATORY & PUBLIC HEALTH ENVIRONMENT

The U.S. Food and Drug Administration (FDA) recently has considered or taken action on several issues pertaining to food labeling, added sugar, LNCS and the definition of "healthy."

Nutrition Facts Label Update

In 2016, the FDA updated the Nutrition Facts Label on food packaging in an effort to recognize the link between diet and chronic diseases such as obesity and heart disease. Compliance was required for manufacturers by July 1, 2021. (See Figure 22)

Side-by-Side Comparison

Original Label

Nutrition Facts
Serving Size 2/3 cup (55g)
Servings Per Container 8

Amount Per Serving

Calories 230	Calories from Fat 70
	%Daily Value*
Total Fat 8g	**12%**
Saturated Fat 1g	**5%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 160mg	**7%**
Total Carbohydrate 37g	**12%**
Dietary Fiber 4g	**16%**
Sugars 12g	
Protien 3g	
Vitamin A	10%
Vitamin C	8%
Calcium	20%
Iron	45%

* Percent Daily Values are based on a 2,000 calorie diet. You Daily Value may be higher or lower depending on your calorie needs.

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

New Label

Nutrition Facts
8 servings per container
Serving Size 2/3 cup (55g)

Amount per serving
Calories 230

	%Daily Value*
Total Fat 8g	**10%**
Saturated Fat 1g	**5%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 160mg	**7%**
Total Carbohydrate 37g	**13%**
Dietary Fiber 4g	**14%**
Total Sugars 12g	
Includes 10g Added Sugars	**20%**
Protien 3g	
Vitamin D 2mcg	10%
Calcium 260mg	20%
Iron 8mg	45%
Potassium 240mg	6%

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Figure 22. Original Nutrition Facts Label compared to updated Label.

Among the key changes made were highlighting calories in a larger and bolder font and including the number of grams of added sugar because consuming too much added sugar, unlike LNCS, can make it hard to meet nutrient needs while staying within calorie limits. In other words, consumers who are conscientious about their diets would have to eat more calories throughout the day to get their nutrients to account for the "empty" calories taken up by added sugar.

Petition to the FDA by The Sugar Association

In 2020, a petition titled "Prohibition of Misleading Labeling of Sweeteners and Request for Enforcement Action" was submitted to the FDA by The Sugar Association. The petition argues that terms such as "No Added sugar," "Zero Sugar," or "Reduced Sugars" are used to mislead the public by implying their products are healthy alternatives, some with higher calorie content than the original products. It was also charged that sweeteners have adverse health effects that have not been well researched or communicated, posing risks to families in particular who are doing their best to make healthier choices for their children.[101]

Among the specific "asks" of the petition are: [102]

- Add the term "Sweetener" in parentheses to sugar substitutes on ingredient lists;
- Clearly label the amount of sugar substitutes on the front of children's food and beverage products;
- Require the disclosure language "Sweetened With" alongside no/low/reduced sugar claims if the product contains sugar substitutes.

On March 8, 2022, The Sugar Association submitted a supplemental petition to the FDA to further support its call to change regulations governing the labeling of LNCS used in packaged foods. The petition noted that the number of new food product launches each year containing LNCS has increased by 832% since 2000.[103] This ignores the findings shown in Figure 16 that products with added sugar dominate the sweetener category with an 87% share of SKUs. The petition also cited a study funded by The Sugar Association stating that 66% of consumers agree that sugar substitutes should be clearly identified as sweeteners on food labels. This contrasts with independent research cited in Figure 13 that sugar content is the #1 ingredient searched for most often on labels (48%) and that consumers are not prioritizing examining package labels for the type of LNCS used. Only 22% of consumers mentioned type of sweetener, which is less than half of those mentioning sugar and calories.

White House Conference on Hunger, Nutrition, and Health and the Biden-Harris Administration National Strategy on Hunger, Nutrition, and Health (September 2022) [104]

On September 28, 2022, the White House convened a broad group of government, non-profit and industry leaders for a Conference on Hunger, Nutrition, and Health, with a stated goal to "end hunger and increase healthy eating and physical activity by 2030 so fewer Americans experience diet-related diseases like diabetes, obesity, and hypertension." The strategy's third pillar--empower all consumers to make and have access to healthy choices—is expected to have a major impact on the food and beverage industry.

The strategy tasks the FDA to research new front-of-package labeling systems – such as star ratings or traffic light schemes – that will help consumers identify healthier choices and prompt industry to reformulate foods to be healthier. The National Strategy highlighted that, since the intake of added sugar is still too high for most Americans, the FDA will begin assessing approaches to reduce added sugar

consumption with the goal of developing targets for categories of foods, similar to the voluntary targets FDA developed for reducing sodium.

FDA Regulation of Use of the Term "Healthy" on Food Labeling [105]

On September 28, 2022, the FDA issued a proposed rule to update the definition of the nutrient content claim "healthy" to bring the standards in line with current dietary recommendations. The definition of healthy in food labeling has not been updated in nearly 20 years, in which time the lifestyles and consumption patterns of Americans have changed markedly. To meet the newly proposed definition, "A food product would need to contain a certain amount of food from at least one of the food groups or subgroups (e.g., fruit, vegetables, grains, dairy and protein foods) recommended by the 2020-2025 Dietary Guidelines for Americans." FDA research on US dietary intakes and recommendations show that 63% of Americans exceed the recommended limit for added sugar; thus, specific limits for added sugar would be established based on a percentage of the Daily Value for this nutrient. There is no proposed limit for LNCS.

Regulatory Implications

New food label systems and terminology are actively being evaluated by the FDA with a primary goal of reducing the consumption of added sugar to slow climbing rates of diabetes, obesity and other diet-related chronic diseases. Should voluntary goals to reduce added sugar in our diets be recommended, companies may feel compelled to accelerate the rate at which they replace added sugar with LNCS.

Empirical evidence confirms that consumers look most often on food labels for sugar content, calories, sodium and added sugar. LNCS fall far down the list of items checked. Of note, LNCS are not mentioned in the White House National Strategy or in the FDA's discussions of the definition and symbol for "healthy" foods.

CONCLUSIONS

- Excess intake of sugars has been cited by leading public health organizations as contributing little nutritional benefit and should be limited to ≤10% of calories per day.
- Almost three-quarters of consumers have stated that they want to limit their sugar intake or avoid sugar. LNCS are a viable option to help them achieve this goal.
- The preponderance of evidence shows that LNCS are safe and the most rigorous studies (randomized control trials) have demonstrated repeatedly that they aid in weight management.
- Sugar content is the item searched for most frequently on food nutrition labels, with added sugar at #4. Consumers do not prioritize searching for LNCS (#16).
- For products containing added sugar and/or LNCS, the overwhelming majority (87%) contain added sugar only. LNCS by themselves are contained in only 8% of products.
- Given its low share of sweeteners, our findings dispel the premise that the use of LNCS in the food supply has skyrocketed.
- Substantial savings in added sugar and calories from LNCS can be achieved in the next five years. A 10% reduction in added sugar would yield the elimination of 70 billion grams of sugar and almost ¼ trillion calories.
- Regulators and the White House are advancing initiatives to reduce added sugar and make it simpler for consumers to read and interpret food

IMPLICATIONS FOR INDUSTRY + POLICYMAKERS

- LNCS can serve as an important tool to help consumers manage their weight and to help fight rising rates of overweight and obesity. The number of products containing LNCS must be increased substantially from their current low percentage of food and beverage items to be an effective aid.
- As consumers have expressed concerns about who approves LNCS and the implications for safety, it is necessary for government agencies such as the FDA and public health organizations to proactively communicate and clarify the benefits and safety of LNCS to consumers.
- Randomized control trials (RCTs) rather than observational studies should be used by policymakers, the WHO and other non-profit organizations so that more accurate decisions can be made regarding the efficacy of LNCS.
- Consumers want simplicity on food labels. They most often look at four categories – sugar content, calories, sodium and added sugar. Consideration should be given to elevating the visibility of these nutrients to the level of prominence given to "calories" on food nutrition labels.
- Food manufacturers should align with government and public health officials around ways to help augment the acceptance of LNCS to meet consumer concerns regarding their intake of added sugar.

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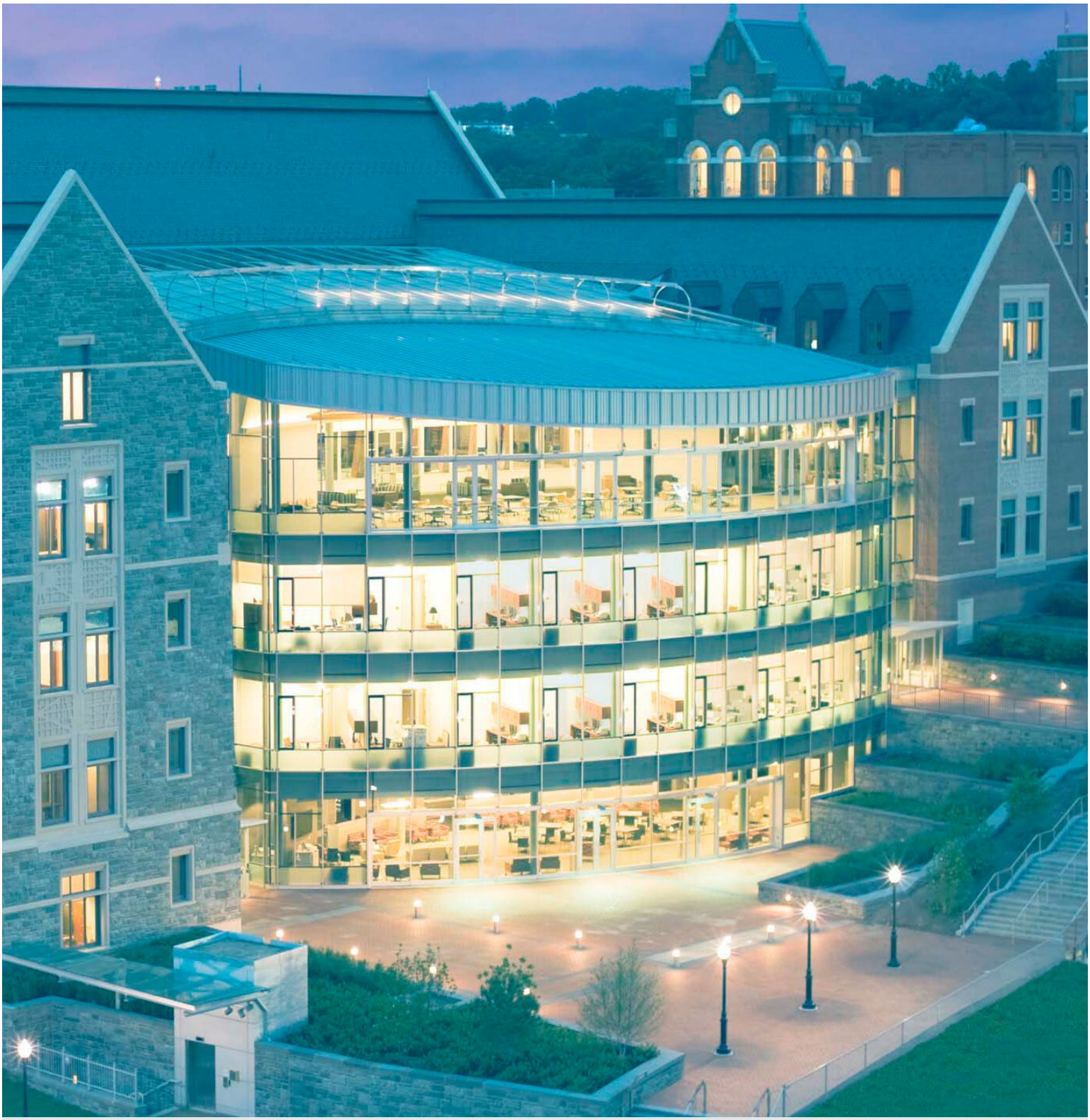

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