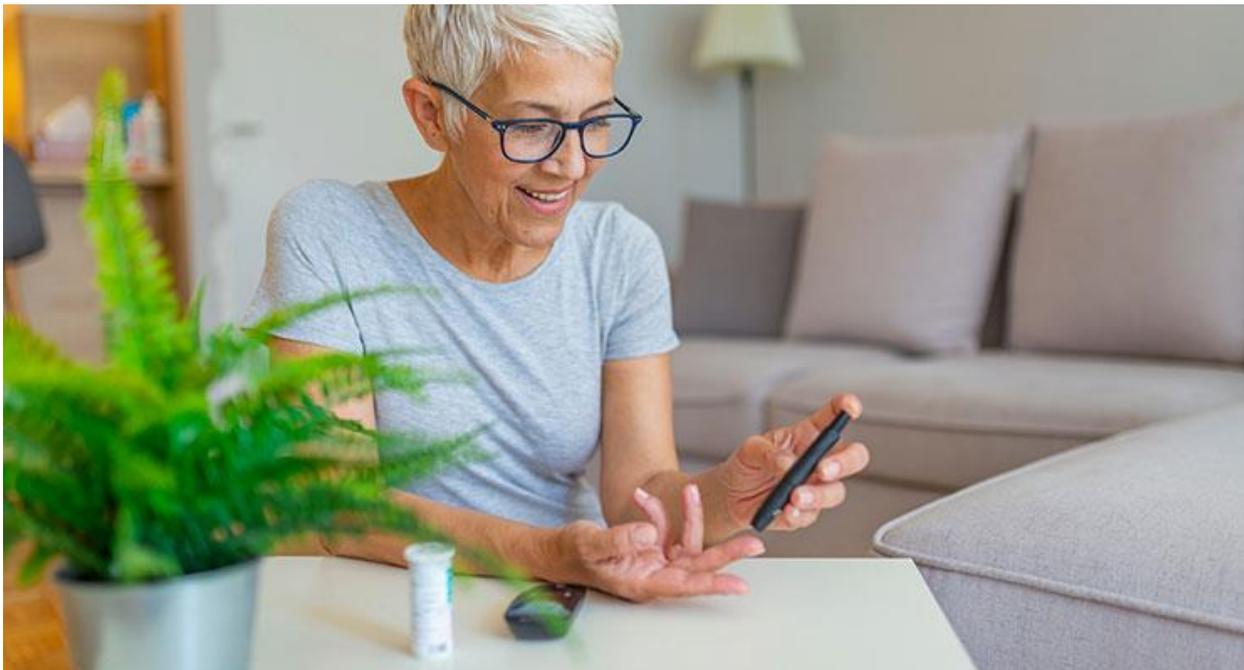


New and Evolving Formulation Options Must Be Mindful of Blood Sugar Maintenance

Allulose, stevia, monk fruit, and more help brands reduce sugar while supplements offer consumers additional solutions.



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By Danielle Rose, Contributing Writer 06.02.22

Eight in 10 U.S. adults are actively engaged in reducing sugar from their diets, according to a report from [ADM](#) Outside Voice. Certain consumers are attempting to reduce calories by limiting sugar and choosing health-forward foods and beverages. Meanwhile, according to FMCG Gurus Top Ten Trends for 2022, 65% of consumers believe it is okay to include indulgent treats as part of a healthy diet.

These stats make a compelling argument for improved food and beverage options that take blood sugar management into consideration. Whereas most consumers are seeking reduced sugar choices (rather than artificially sweetened), the growing number of plant-based, lower-calorie, and low- or zero- glycemic sugar alternatives offer a wide array of options for making traditionally sweet foods healthier.

New formulation options, advancements in sweetener technology that can improve the taste and experience of a finished product, along with a growing number of recognized blood sugar maintenance nutrients, allows for flexible and creative sugar-conscious food and beverage product development.

Healthy Blood Sugar Maintenance

One in 10 Americans have diabetes, while one in three have pre-diabetes, according to a National Diabetes Statistics Report from the Centers for Disease Control and Prevention (CDC). Related complications can include nerve damage, kidney disease, high blood pressure, and vision concerns.¹

Increased blood glucose levels can interfere with healthy antioxidant activity and increase inflammation, said Jim Roza, chief scientific officer for [Layn Natural Ingredients](#). Although potentially more prevalent in older consumers, this is true for all demographics.

Corey Scott, principal scientist at [Cargill](#), said low- and zero- glycemic level sweeteners such as stevia and erythritol have little to no effect on blood sugar.^{2,3}

“Managing a person’s blood glucose levels is significant in helping to promote long-term health,” said Anke Sentko, vice president of regulatory affairs & nutrition at [BENEQ](#). “The goal for any food producer should be the development of food choices that deliver a lower glycemic profile.”

Sugar and Age

Metabolic disease is a health concern for aging populations due to natural changes in metabolic and circadian rhythms over time. Diet changes have been shown to impact these rhythms and may help prevent age-related changes.⁴

A growing percentage of the population is, or will soon be, over the age of 60, according

to the World Health Organization (WHO).⁵ A recent BENEEO survey found that 67% of European consumers aged 65-75 are actively taking steps to improving their nutrition, while 78% are paying attention to their sugar intake. Additionally, two-thirds of consumers aged between 55 and 64 are willing to try new products and ingredients when there is an attached health benefit.⁶

This makes older populations an important demographic. According to a [HealthFocus International](#) survey, “staying fit for longer” is an important trend, and people are willing to pay a premium for functional health through diet.⁷

Meanwhile, younger consumers are seeking similar products, if for different reasons. According to a report from the [Dairy Farmers of America](#), Millennials are the most likely generation to snack throughout the day, many using snacks to replace some or all of their meals. They’re also more likely than older generations to experiment with new foods while seeking clean label nutrition.⁸

Clean label, reduced sugar, and nutritional snacking options are appealing to all generations. The common denominator is that young or old, health- or convenience-focused, no one wants to sacrifice taste or texture in their food choices.

Consumer Trends

Since the onset of the COVID-19 pandemic, 64% of consumers are more concerned about immune health and general wellbeing, while 55% are seeking food and drinks that boost mood and mental health, according to a 2020 survey commissioned by the market research company [FMCG Gurus](#) on behalf of BENEEO. The survey also found that chocolate is the first word that pops to mind when consumers hear the word “treat.”⁹

“These consumer attitudes are definitely driving a continuing trend toward the development of innovative products that are not only natural/non-GMO but that embody more than one healthful attribute,” Sentko said. “Consumers are looking for a range of benefits, from support for gut health, sugar reduction, weight management, energy, immunity, and even mood support.”

Consumers often opt for reduced sugar rather than sugar substitutes, according to Carla Saunders, senior marketing manager of high intensity sweeteners at Cargill. This is particularly true with flavored water and hard seltzer. Of 12 leading low- or no- calorie sweeteners, Cargill’s proprietary research found that labeling for stevia leaf extract had the most positive perception and was considered the most healthful.

Clean Label Concerns

When it comes to sugar substitutes, clean labeling can get tricky. Health-conscious shoppers are scrutinizing labels and seeking clean products that have simple, recognizable ingredients, as well as lower sugar choices, said Sarah Diedrich, marketing director for global sweetening & texturizing at ADM.

“Plant-based sweetening solutions that consumers are familiar with and perceive as ‘closer-to-nature,’ are winning with consumers,” she said.

[Icon Foods](#) focuses on clean label sugar reduction through the use of plant-based allulose, stevia, monk fruit, soluble tapioca, fructooligosaccharides (FOS), and one of its biggest, most flexible players, erythritol, according to CEO Thom King.

Stevia extracts, such as HOWTIAN’s SoPure, may be labeled as “stevia leaf extract,” or similar, according to [HOWTIAN](#) Technical Director Hank Wang, whereas fermented or bio-converted stevia molecules may not.

Stevia is so potent that usage rates are generally well below the FDA 0.5 gram labeling threshold for sugar-free, according to Christina Coles, senior associate marketing manager, sugar reduction & specialty sweeteners for [Ingredion Incorporated](#).¹⁰ Another zero-glycemic-index sugar, allulose, was exempted from contributing to the “total and added sugars” line on nutrition panels in 2019 by FDA. To keep added sugars underneath regulatory thresholds, King suggested trying sweetness modulators.

“Increasingly, we are seeing that consumers are looking for ‘clean labels’—food and drinks formulated with ingredients that are not artificial,” said Jim Carr, director of global ingredient technology at [Tate & Lyle](#). “It has also changed the manner in which we look at sugar reduction formulation, increasingly relying on a solutions ‘toolbox’ approach.”

Ingredients in the Toolbox

Companies are able to offer more sugar-reduced products that are increasingly similar—or often nearly identical—to their full-sugar counterparts, Carr said.

For example, the stevia plant offers different sweetener solution options through its various glycoside molecules.

By isolating and combining stevia compounds in unique combinations that are specific to the end product, companies can reduce sugar by up to 70%, Saunders said. Bitter aftertastes may not only be eliminated but certain flavor profiles can actually be enhanced, as with Cargill’s EverSweet and ClearFlow lines, allowing for more sugar-replacement options without a long ingredient list of masking ingredients.

Another sweetener that masks off-flavors with a lingering sweetness is thaumatin, a protein derived from the katemfe fruit of West Africa. It is 200-times sweeter than

sugar, King said.

BENEO's Isomalt, on the other hand, is derived from sucrose but with half the calories of sugar and a glycemic index of 2.¹¹ Sentko said it carries an FDA-approved health claim for not promoting tooth decay and can handle subtle fruit flavors while eliminating "stickiness," so candies do not need to be individually wrapped.

Sugar-Substitute Carbohydrates

"As blood glucose levels help promote long-term health, choosing the right carbohydrate is important," Sentko said.

Derived from sugar beets, BENEO's version of isomaltulose, Palatinose, is a 1:1 sugar replacement found naturally in honey. It is structurally similar to sucrose, but more stable, avoiding the intense "ups and downs" of "fast" carbohydrates while encouraging the body to burn fat.^{12,13}

Prebiotic chicory root not only acts as a sugar replacement, but enhances final products with fiber while supporting microbiome and gut health.¹⁴ Sentko said BENEO's chicory-based Orafit Synergy1 also provides texture, body, and creaminess to many dairy products while supporting taste and crunch in formulations such as cookies and cereals.

Mixing fibers creates more complex nutrition for the varied gut microbiome. This can result in less gas through the wider spectrum of bacterial growth, King said. He recommended add-ins such as chia and flax to further flesh out the use of varied fibers.

"Mixing up your fibers is always a good idea," King said. "You won't get the level of GI problems if you mix it up and use the spectrum [of fiber options]. "Using [only] soluble tapioca powder, which is the main input right now for gummy items, you can hit the bowel threshold pretty quick."



Vitamins and Nutrients

In addition to reducing sugar, product developers may consider supportive dietary supplements or fortification. Benfotiamine, a synthetic, fat-soluble form of thiamine (vitamin B1), may help reduce diabetes-related glycation, circulation issues, and organ failure while reducing diabetes-related inflammatory markers.^{15, 16, 17}

BenfoPure, [Xsto Solutions](#)' brand of benfotiamine, is up to three times more bioavailable than common sources of B1, according to Dan Murray, vice president of business development at Xsto. In addition to helping manage blood sugar, he said BenfoPure is targeted for related conditions such as neuropathy and nephropathy.

Diabetes and cell oxidation go hand-in-hand, noted Kalyanam Nagabhushanam, president of R&D at [Sabinsa Corporation](#). The company's amla extract ingredient, Saberry, is a standardized form of β -glucogallin that performed comparable to the prescription drug Metformin in a recent clinical trial. It is also a water-soluble antioxidant.

Other water-soluble nutrients from Sabinsa include its standardized c-glycosides (Pterosol and Mangiferin) derived from the Indian Kino tree, which may help kidneys eliminate sugar without reabsorption.¹⁸

Gymnemic acids standardized from *Gymnema sylvestre* (known in India as Gurmar, or "destroyer of sugar") formulate Sabinsa's GS4 Plus. Momordicin (from *Momordica dioica*) and Vanaphage (vanadium) have been recognized to play a controlling role in sugar levels, Nagabhushanam said. Sabinsa's pterostilbene, (Silbinol) is a bioavailable relative of

resveratrol, and has been found to help manage blood sugar as well.

Chromax chromium picolinate from [Nutrition21](#) has been studied for its blood sugar benefits, as well as weight management, body composition, appetite control, cognitive health, glucose metabolism, and insulin function. Typical dietary intake of chromium is low, said Katie Emerson, manager of scientific affairs at Nutrition21, but Chromax offers a bioavailability that optimizes insulin efficiency.

Layn Natural Ingredients' botanical library allows businesses to explore and learn about sweetener and botanical solutions while targeting desired applications and functions. Some of the glucose-supporting botanicals Layn shared from its database include:

- Cinnamon has been found to control glucose metabolism following meals, as well as lower fasting glucose levels.^{19, 20}
- Green Coffee bean (chlorogenic acid) helps manage weight gain, while improving glucose tolerance.^{21, 22}
- Magnolia bark supports improvement of insulin sensitivity.²³
- Pomegranate (ellagic acid) can suppress oxidative stress and inflammation while improving metabolism.²⁴
- In addition, both ellagic and chlorogenic acids have been found to support healthy blood sugar by releasing glucose from the liver and signaling insulin pathways in human trials.^{25, 26}

Formulating a Well-Rounded Product

“An important consideration for a blood sugar management product is that it should not result in hypoglycemia, nor should it adversely affect the metabolic status of the individual,” cautioned Nagabhusanam.

Innovations that reduce sugar while improving functionality are necessary where sugar is required for texture and appearance, such as baked goods, confectionery, and frozen desserts.

For example, allulose burns at a comparatively low temperature, but erythritol will suppress that action. Because both of these sweeteners are about 70% less sweet than sugar, King recommended adding stevia and monk fruit to round out the sweetness profile.

Stevia and monk fruit work well together, he noted, because they mask each other's off-notes while masking the off-notes of other flavors. This allows manufacturers to include bitter or astringent ingredients such as ashwagandha or mushrooms to improve nutritional functionality without sacrificing taste. Glycosides are non-nutritive compounds that can be added to enhance taste when desired flavors get lost in the

masking, too, he offered.

“The complementary performance of [sweetening] ingredients, when used in combination, has been a critical element in the formulation of great-tasting sugar- and calorie-reduced food and drink,” Carr said.

Sustainability Matters

Supply chain issues for alternative sweeteners are as varied as their sources. What remains constant is the consumer’s desire to know where their food is coming from. In 2016, Nielsen reported that 73% of global consumers feel more positively about companies that are transparent about where and how products were made, raised, or grown.²⁷

By collaborating directly with farmers, ADM creates consistency through traceability that can be included on product packaging.

Sabinsa also works through cooperatives for cultivation of medicinal plants such as the Kino tree cultivation needed for its glycosides.

BENEO’s sugar beets are grown near its production facility and processed onsite. The company said it utilizes local warehousing to ensure global access and convenient shipping.

Availability for stevia has decreased as the market has grown. Technologies such as fermentation also decrease or eliminate dependency on vulnerable supply chains, Coles said.

Cargill created a stevia sustainability standard to ensure ethical sourcing. The company meets with growers each spring to review these standards, and a third-party assessor confirms those practices each fall. Saunders said the company can trace each lot of stevia to the farmers that planted it. Fermentation, meanwhile, allows for commercial production of only the components being used, resulting in less need for water and land, and an overall smaller carbon footprint.

HOWTIAN, which uses whole-plant stevia, breeds and grows over 300 varieties through a network of contract farms and cooperatives. Wang said this provides consistency and uniformity in its extracts. Control of the supply chain has allowed the company to remain fully stocked through pandemic disruptions. It maintains this control through investment in farmers’ welfare with education and financial support. HOWTIAN continues this corporate responsibility with waste reduction efforts, getting the most from each leaf harvested, and by reducing its carbon footprint.

Global Supply Chain Concerns

While there may be ample availability of erythritol or allulose now, those stocks may not be so easily replenished, according to King, who predicted corn-based sweeteners, including allulose and erythritol, will increase in price as the corn supply chain tightens. He recommended locking-in rates considering the global climate, especially as Russia is an important supplier of fertilizer.

Another factor that may lead to instability within the allulose market derives from the intellectual property needed to create it, since each manufacturer uses a different crystallization activator.

King recommended formulations and labeling that allow manufacturers to pivot from crystalized allulose to syrup allulose, which has more supply chain stability, without requiring significant changes to the product's ingredient statement.

Similarly, fructooligosaccharides (FOS) are a common form of inulin fiber. Inulin is currently in short supply, but can usually be successfully swapped with another FOS. King recommended that manufacturers using inulin list it as FOS in their ingredient statement, offering the opportunity to switch to another FOS should supply chains falter.

“Given the high-profile nature of the blood sugar support category, it would be to a company's advantage to seek out science-backed branded ingredients,” Emerson advised. “In most cases, these ingredients are well protected by patents and other intellectual property.”

“While it would be nice if there was one magic bullet to address the myriad scenarios for blood sugar, it may be wise to try several ingredients along with a healthy diet and exercise,” Murray added. “Some ingredients and behaviors will be easier or better tolerated than others but a positive end result is the goal for healthy blood sugar management.”

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