Reducing Added Sugars

By Cindy Hazen, Contributing Editor

You needn't look far to see the attack on sugar. Take this recent internet headline: Sneaky sources of sugar. As if sugar is a wily ingredient sliding into foods undetected and wreaking havoc with our diets.

The sugar content of foods and beverages is a consumer hot button. The same week, my friend said, "There's just so much sugar in orange juice. We're better off eating an orange."

It had never occurred to me that the sugar in natural juice was a problem, so I looked up the nutritional breakdown in the USDA Nutrient Database.

One cup of raw orange juice has 112 calories, 20.83 grams sugars and 496 milligrams potassium. A Florida orange that weighs 141 grams has 65 calories, 12.89 grams sugars and 238 milligrams potassium.

The whole fruit wins with a lower calorie count, but are an extra 8 grams of sugar a diet buster? Isn't the additional potassium beneficial?

If consumers are avoiding sugars that are naturally occurring in nutritious foods, the backlash is magnified against added sugars. And that at least is something food formulators can address.

Sugar wars

The battle to win customers' favor begins with the label. A product with a front panel announcing lower-sugar content might win the customer's attention. Information on the back panel may also help guide the purchasing decision. The buyer may be swayed by an ingredient statement that meets their expectations for natural, artificial or a specific sweetener preference. The nutritional panel will reflect the food's actual sugar content.

What the consumer is actually looking for is as far ranging as their personal diversity. Some people will simply look at total sugars; others seek out low-calorie, artificial sweeteners. Still others want a label declaration.

Products that make a reduced-sugar claim need to follow FDA guidelines. In Title 21 of the Code of Federal Regulations, Part 101, Section 60(c), FDA proposes that, to warrant a reduced-sugar claim, products must contain "at least 25% less sugar per reference amount customarily consumed than an appropriate reference food." Sugars are defined by FDA as the sum of all free mono-and disaccharides such as glucose, fructose, lactose and sucrose. A claim cannot be used on meals, main dishes or dietary supplements.

When working with honey, remember that it contains fructose and glucose and about 7% other disaccharides including maltose, tutanose and isomaltose. It also contains oligosaccharides, which are larger units of carbohydrates.

The terms “no added sugar," “without added sugar," or “no sugar added" applies only to products where no amount of sugar, or ingredient containing added sugars—such as jam, jelly or concentrated fruit juice—is used. The product cannot contain sugar alcohols, either. If the food is not “low calorie" or “calorie reduced" it must be stated.

The term "sugar" is used loosely, but it covers a lot of ground. The food developer must understand the nuances. Sugar is the common name for sucrose, disaccharides of glucose and fructose units. It’s a nutritive sweetener, meaning it provides 4 calories per gram. However, the sweet monosaccharide fructose, commonly found in fruit, also falls in this category. It’s about 10% sweeter than sucrose. Dextrose is a glucose isomer. It’s about 70% as sweet as sugar, and has a slight cooling effect on the tongue. Technically speaking, these are all "sugars," and they all are used in food and beverage formulation.

Non-nutritive sweeteners, like stevia, acesulfame K, aspartame and sucralose contribute little or no sugars or calories, but they pack a lot of sweetness into a small package. Acesulfame K and aspartame are 200 times sweeter than sugar. Steviol glycosides are 200 to 300 times sweeter. Sucralose is 600 times sweeter. These high- intensity sweeteners can be used alone or in combination to reduce sugar, but they each have their own quirks. When used singly they can contribute off-flavors. Sucralose, for example, is best used as a 30% replacement for sugar because taste will be negatively impacted at higher levels.

Sugar alcohols, or polyols, are produced by hydrogenation of a base sugar. Caloric values vary. Erythritol, derived from glucose, yields 0.2 calories per gram. Maltitol, produced from maltose, has 2.1 calories per gram.

Naturally sweet

Stevia has become an important sweetener in the no-sugar-added category since it's considered a natural source of added sweetness. However, like "sugar", "stevia" also is somewhat a catchall term, although the sweeteners all have to begin with the Stevia rebaudiana plant. Peter Sokoloski, private label manager, NOW Foods, Bloomingdale, IL, explains, “There are many types of stevias on the market now, and unfortunately they often get lumped together in the general 'stevia' category."

Extracts from the stevia plant, glycosides or steviosides, vary in sweetness and flavor profiles. The combinations and percentages of these glycosides differ from manufacturer to manufacturer.

“They don’t all taste the same, so it’s important for food scientists to try out the different types that are available," Sokoloski says. “If one doesn't work for their needs there are plenty of others to choose from. Stevia extracts also come in a variety of percentages, (e.g., 95%) but the numbers don't really say anything about the taste profile. It’s still very much a formulator’s world where art meets science."

Stevia is super-sweet, but some extracts have a lingering aftertaste. Sokoloski describes it as almost a bitter or licorice note. “Reb A, which is a specific stevioside, tends to be very sweet, but also has a generally unacceptable aftertaste," he says. Masking agents can help improve the flavor profile.

Another high intensity sweeteners gaining ground is luo han guoor monk fruit, extracted from the fruit of Siraitia grosvenori. Formulators are finding it doesn't have the same impact on product flavor as stevia. The flavor is neutral in most applications or may have what's been called a "slight melon-rind note." FDA has recognized monk fruit extract as GRAS. It has a sweetness equivalency of 180 to 200 times that of sucrose, which comes from nonnutrative monk-fruit components called mogrosides. There are a number of different mogrosides (II, 111, IV, V, and VI), with mogroside V typically considered the sweetest.

The dried fruit has about 0.5% to 1.5% extractable mogrosides—the actual mogroside content varies with the maturity of the fruit. The sweetener is stable at acid and neutral pH, and in typical processes, such as pasteurization, beverage formulators find that it goes into solution easily and does not have foaming issues.

Fruit products can help increase sweetness and minimize added sugar because fructose is perceived as sweeter. Kevin Holland, product developer, Tree Top, Inc., Selah, WA, points out: “Apples contain 10.4 grams of sugar per 100 grams on a fresh weight basis, and over half of this is free fructose. Fruit concentrates or dried forms are often convenient to use and have a much higher percentage of sugar than fresh fruit (fresh apples contain 85% water). Not only do fruits provide naturally occurring sugars, but that sugar comes with vitamins, minerals, antioxidants and other healthy nutrients. Plus, they are label-friendly."

The ratio of sugars will vary among fruits. Apples, for example, contain slightly more than half of their sugars in fructose, but they also contain glucose and sucrose. “The perceived sweetness is going to result from the interactions of these sugars and taste buds," Holland says. "Generally, fruits are probably perceived as sweeter than sucrose. Fructose is sweeter than sucrose."

Enhancing sweetness

Just because consumers want to reduce the amount of sugar they are consuming doesn’t mean they are willing to sacrifice flavor. Mariano Gascon, vice president R&D, Wixon, Inc., St. Francis, WI, offers strategies for formulating product with reduced sugar or no sugar added. “Formulate with complementary flavors," he says. “If you are creating a citrus drink, use orange and tangerine rather than lemon or lime, because lemon and limes require you to add more acid than the orange and tangerine. Thus, less acid would increase the sweetness perception."

Whenever possible, add sweet flavors like vanilla, maple and honey. “These are naturally sweet," Gascon says. "For example, instead of orange citrus, make it orange cream."

When working with sweeteners, choose the flavor based on the sweetener system. “If you are using stevia, any citrus and fruit flavors would work great because the acidity enhances the sweetness of stevia and diminishes the bitterness," Gascon says. "Or, the bitterness of roasted flavors, such as

coffee or chocolate, can actually complement the bitterness of low-grade stevia." In most other cases, it's wise to minimize the use of naturally bitter products like coffee or tea. "These products require tons of sweetness to overcome the bitterness," he says.

The second strategy is to formulate with synergistic sugars. "If necessary, use high-intensity sweeteners, but play with the synergistic effect. For example, sucrose, glucose and fructose enhance stevia's sweetness, so you would need less," Gascon explains. "Or, stevia and aspartame, or stevia and acesulfame K, have a synergistic interaction."

Once you have chosen the flavor and sweetener system, then add taste modifiers. "Most flavor houses have flavor modifiers that are created to enhance the sweetness," Gascon says. "They are a combination of sweet flavor ingredients (not sweeteners) that can help you to enhance the sugar perception." Wixon has a flavor that has a synergistic effect with sugars to enhance sweetness. Another flavor has a synergistic effect with stevia to enhance its natural sweetness, mask the bitterness and achieve overall improvement in sweet profile and mouthfeel.

Senomyx, San Diego, CA, offers a flavor ingredient that enables up to 50% sucrose reduction in prototypes while maintaining sweetness characteristics. It is GRAS for use in baked goods, cereals, chewing gum, condiments and relishes, confectioneries, dairy and a host of other applications. Another GRAS ingredient from the company enables reduction of up to 75% sucralose in foods and beverages. A sucrose enhancer is in final safety tests and is expected to achieve GRAS regulatory status in the United States.

Don't forget function

Sugar adds more than a sweet taste to foods. "In food products such as beverages, sugar adds body and makes the product more palatable in the case of high-acid carbonated soft drinks and vitamin-enhanced nutritional beverages," says Eric Shinsato, technical sales support manager, Corn Products International/National Starch, Westchester, IL. "It provides texture and color in baked goods, contributing the crispness associated with cookies, and is a source of fermentables in yeast-raised doughs. In confectionery, sugar gives structure to hard candies and texture to grained confections. In other applications, it is the main source of sweetness and helps to balance other flavors, such as tart and sour."

Additionally nutritive sweeteners contribute soluble solids. Since soluble solids affect water activity, any characteristics affected by water activity, such as microbial growth, need to be re-examined.

Whenever sugar or any significant ingredient is removed from a formula, something has to be added back to maintain the proportions of the other ingredients and to sustain the desired mouthfeel. The bulking agent chosen will impact solubility and texture. In baked goods, it will affect browning.

"Depending on the established goals of reducing added sugar, there are many choices available in the product-development toolbox. The key is to know and understand how each ingredient can be used to replace the functionality of sugar in each specific application," says Shinsato. "As bulk needs to be added back, the use of texturants, such as starches and hydrocolloids, comes into play,"

Sweet soluble fibers like inulin and oligofructose are label-friendly possibilities. Inulin is 10% as sweet as sucrose. Oligofructose is 30% to 65% as sweet as sucrose. Both contribute only 1.5 calories per gram because they are not fully metabolized.

In beverages, Shinsato suggests sugar can be reduced and complemented with a reduced- calorie bulking agent like erythritol, plus a natural or artificial high-intensity sweetener like stevia.

“The same can be applied to some baked goods in the form of maltitol, certain soluble fibers and natural or artificial color," says Shinsanto. "Polyols are the main choice for reduced or sugar-free confections. However, in the case of most polyol usage, laxation often becomes an issue. Other slowly digestible carbohydrates, such as resistant starches, soluble fibers and gums, may be alternatives, depending on the application."

Product developers need to make sure the end goal of reducing added sugar is clear and realistic. “Although reducing sugar is not as difficult as eliminating sugar, there are many challenges, depending on the intended outcome," says Shinsanto. "More often than not, there are specific restrictions on the types of replacement ingredients that may be used, such as natural, clean-label or allergen-friendly. If a nutritional claim is also desired, then functional ingredients will need to be considered."

To replace added sugars, as with any development project, begin by defining the qualities of the finished product and avoid those ingredients that are currently on consumers’ hit lists. Forecasting the next ingredient to face scrutiny is another matter.

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