

ENLITEN[®] — **Stevia** sweetener for
creating naturally-based sweetness
in reduced-sugar, **reduced-calorie**
chocolate milk

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ENLITEN[®] rebaudioside-A (Reb-A) stevia sweetener — 95% or greater purity — is a high purity ingredient produced using farm-to-formulation attention to control and consistency. It is derived from a proprietary cultivar with the same lot-to-lot consistency customers have come to trust from the wide variety of ingredients and expertise Ingredion offers. The strength of ENLITEN stevia sweetener as a naturally-based sweetness solution as part of Ingredion's DIAL-IN[®] Sweetness approach can provide the assistance in formulating great tasting chocolate milk and other flavored milk beverages.

Both white and flavored milks are excellent sources of nine essential nutrients: calcium, vitamin D, riboflavin, phosphorus, protein, potassium, vitamin A, vitamin b12, and niacin.¹ Children are encouraged to drink milk as an essential part of a healthy diet, and studies show that “children who consume sweetened dairy products, including flavored milks, get more calcium, consume less added sugars and saturated fat and are more likely to meet recommendations for calcium, folate, and iron compared to those who consume sugar-sweetened beverages like sodas and fruit drinks.”²

In the interest of promoting milk, research has been conducted that indicates that kids in school drink more milk when it is flavored.³ However, there is a growing trend of childhood obesity in the U.S. (and globally) that has brought the food available to children into sharper focus. Part of the scrutiny is on flavored milk's place in a well-balanced diet, especially the role of calories contributed from added sugars.

Reformulating flavored milk for a healthy diet

With growing concerns around artificial high intensity sweeteners like aspartame, ENLITEN stevia sweetener can provide the naturally-based sweetness that people can feel good about. It is now important for companies to respond with healthy solutions that do not sacrifice the taste and eating experience that consumers have



come to expect, and help keep flavored milk as a part of a healthy diet, as recommended by a host of medical organizations.⁴

Chocolate milks on the market today contain anywhere from 12-21g of added sugar per serving with total sugars reaching as high as 35g per serving. Though the amount of added sugar kids consume from flavored milk is small when compared to soft drinks and juice products,⁵ formulators need to be agile in responding to the demands of customers and to understand the options in meeting the dietary needs in the market place. Ingredion has over 100 formulas for chocolate milk that address a wide range of claims, calorie targets, and value driven and value added benefits utilizing the full range of the company's products. This work has developed through understanding the market, understanding the available ingredients and bringing solutions that meet a broad spectrum of needs as part of our Dial-IN Sweetness capabilities. DIAL-IN Sweetness is the unique combination of data, experience and process that Ingredion experts use to help you quickly achieve just the right sweetness profile and product functionality in your foods and beverages, utilizing Ingredion's diverse portfolio of ingredients and solutions to help you cut time and cost from new product development while improving product likability.

Not only are consumers clamoring for healthier options, there is a perceived equivalency between healthy and more natural, or naturally, sweetened options.

The convergence of healthy reductions and naturally-based sweetness is the ideal application for ENLITEN stevia sweetener. Using this high intensity naturally-based sweetener can provide the complete sweetness profile that producers and their customers require. While looking to meet the sugar and calorie targets of the evolving market, it is important to understand the sweetness characteristics and sweeteners that are being replaced.

Identifying the ideal sweetness profile

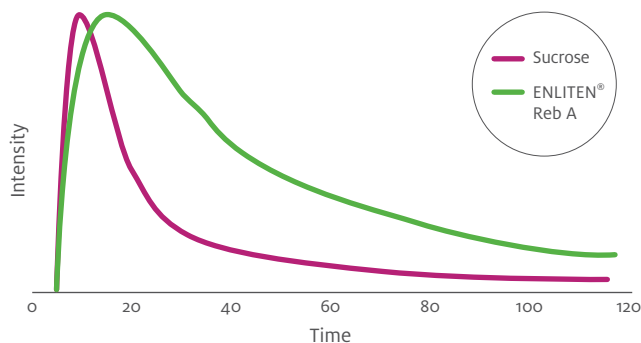
There is no sweetener quite like the combination of glucose and fructose present in traditional nutritive sweeteners such as sucrose or high fructose corn syrup (HFCS).* The upfront sweetness and clean release of these sweeteners

are the benchmark for sweetness in many products including flavored milks. The sweetness of stevia can work together with other sweeteners to present a complete sweetness profile. With optimal sucrose equivalence between 6% and 8%, ENLITEN® stevia sweetener is ideal for reduced sugar flavored milks. With small amounts of added sugar and the naturally occurring lactose, expert formulators can provide a desirable sweetness profile while also achieving significant calorie reductions.

In the Figure 1 below, the time intensity curves of sucrose and Rebaudioside A show the difference in sweetness profiles. When formulating for sugar reduction and not sugar replacement, ENLITEN stevia sweetener can work in conjunction with other sweeteners to create a more complete sweetness profile. It is well established in industry practice as well as academic literature on sweeteners that combinations of sweeteners are often used to round out the flavor and present a complete sweetness profile. A popular example of this would be the use of aspartame and acesulfame potassium. Using a small amount of a nutritive sweetener like HFCS with ENLITEN stevia sweetener shifts the entire sweetness profile and bridges that small time gap between the curves that can be seen below.

Utilizing this knowledge and the internal formulation experience as part of Ingredion's DIAL-IN® Sweetness approach, a system was designed to dial in the sweetness profile utilizing a combination of nutritive sweeteners, ENLITEN stevia sweetener and the naturally occurring lactose. To create a complete sweetness profile while reducing sugar and calories, a ternary mixture will activate different sweetness receptors on the tongue to build the perception of a complete sweetener profile. Ingredion's DIAL-IN Sweetness approach is designed to react rapidly to a customer's needs and provide great tasting solutions for a wide variety of applications.

FIGURE 1: ENLITEN® stevia sweetener VS SUCROSE TIME INTENSITY CURVES



*Both traditionally used in flavored milks in the United States and globally.
 **23.4% at least 3 days a week and 45.7% more than 4 days a week

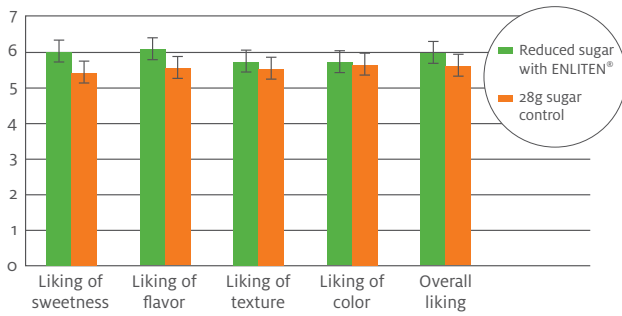
Preserving consumer acceptability

In addition to the understanding of sweetness, it is also important to understand the physical contributions of sweeteners. The bulk of the nutritive sweetener provides mouthfeel, which can contribute to the perception of sweetness. This is a contributing factor to the formulation of reduced versus no sugar added chocolate milk. The solids contributed by the nutritive sweeteners can allow for more acceptable overall sweetness profile, even when the nutritive sweetener is drastically reduced. These formulations often require adjustment of the existing stabilizer system or the addition of hydrocolloids. Ingredion has a range of natural, physically modified starches suitable for clean label applications, in addition to a wide range of modified food starches that can build back mouthfeel and body that is lost from the reduction or elimination of fats or added sugars. Ingredion understands that each customer and each market requires a different characteristic texture, and the addition of these ingredients will help achieve the results that are targeted using the sensory and formulation driven DIAL-IN® Texture technology to find a customer's specific texture. Ingredion achieves that by utilizing background sensory information on sweeteners and combinations with other ingredients, as well as up-front discussions with customers and their other suppliers on current processing procedures and ancillary ingredients.

In addition to viscosifiers and texturizing agents, the targeted use of value driven and value added ingredients can add functionality as well as improve the perception of sweetness. Ingredients such as fibers, oligosaccharides, and polyols can provide the missing bulk. Certain ingredients can be more successful than others, but its important to recognize the options and what they can provide when targeting a naturally sweetened or all natural/clean label product. As with all value driven or value added ingredient choices, Ingredion is ready to work with each customer for their formulation needs. The formulation experience with bulking agents, especially when coupled with ENLITEN stevia sweetener, are part of Ingredion's ability to dial in on the desired eating experience expected by customers.

In a study conducted with 7th graders from ages 12 to 14, chocolate milk with 20g sugar per serving and sweetened with ENLITEN 95% Reb A stevia sweetener was found to be generally more acceptable than the 28g sugar per serving control (values based on 8oz. serving size). Students were initially asked about their milk drinking habits. Over 80% of respondents said they liked both white milk and chocolate milk, and over 70% said they consume milk with lunch at least 3 times a week.** The tasting was conducted in a classroom setting and students were presented with

FIGURE 2: LIKING COMPARISON OF 20G SUGAR PER SERVING CHOCOLATE MILK WITH ENLITEN® VS 28G SUGAR PER SERVING CONTROL



randomized and blinded samples of a range of chocolate milks. Students were asked to rank each sample on a range of characteristics including sweetness, texture, color, flavor, and overall liking; and then were asked to choose a preference between the two samples they tasted at each sitting. Based on the results, the 7th graders rated the ENLITEN stevia sweetener sweetened chocolate milk higher than the control for Liking of Sweetness, Liking of Flavor, and Overall Liking. Figure 2 above presents a summary of these results and Figure 3 below shows the nutrition information.

FIGURE 3: FORMULATIONS AND NUTRITION PANELS

FULL SUGAR
29g per 8oz serving

Nutrition Facts	
Serving Size (238g)	
Servings Per Container	
Amount Per Serving	
Calories 150	Calories from Fat 5
% Daily Value*	
Total Fat 0g	0%
Saturated Fat 0g	0%
Trans Fat 0g	
Cholesterol 5mg	2%
Sodium 135mg	6%
Total Carbohydrate 29g	10%
Dietary Fiber 1g	4%
Sugars 28g	
Protein 7g	
Vitamin A 8%	Vitamin C 0%
Calcium 25%	Iron 4%
*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:	
	Calories 2,000 2,500
Total Fat	Less Than 65g 80g
Saturated Fat	Less Than 20g 25g
Cholesterol	Less Than 300mg 300 mg
Sodium	Less Than 2,400mg 2,400mg
Total Carbohydrate	300g 375g
Dietary Fiber	25g 30g
Calories per gram:	
Fat 9 • Carbohydrate 4 • Protein 4	

30% REDUCED SUGAR
20g per 8oz serving

Nutrition Facts	
Serving Size (238g)	
Servings Per Container	
Amount Per Serving	
Calories 110	Calories from Fat 5
% Daily Value*	
Total Fat 0g	0%
Saturated Fat 0g	0%
Trans Fat 0g	
Cholesterol 5mg	2%
Sodium 140mg	6%
Total Carbohydrate 21g	7%
Dietary Fiber 1g	4%
Sugars 20g	
Protein 8g	
Vitamin A 10%	Vitamin C 0%
Calcium 30%	Iron 4%
*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:	
	Calories 2,000 2,500
Total Fat	Less Than 65g 80g
Saturated Fat	Less Than 20g 25g
Cholesterol	Less Than 300mg 300 mg
Sodium	Less Than 2,400mg 2,400mg
Total Carbohydrate	300g 375g
Dietary Fiber	25g 30g
Calories per gram:	
Fat 9 • Carbohydrate 4 • Protein 4	

INGREDIENTS: Non-Fat Milk, High Fructose Corn Syrup, Cocoa Powder, Natural Flavor, Salt, Carrageenan, Vanillin.

INGREDIENTS: Non-Fat Milk, High Fructose Corn Syrup, Cocoa Powder, Natural Flavor, Salt, Carrageenan, Reb A (ENLITEN® stevia sweetener), Vanillin.

A naturally-based solution

With the right naturally-based sweetener and proper understanding of the available building blocks, it is possible to achieve a wide variety of claims and targets in chocolate milk. Whether the goal is to provide “100 calorie” chocolate milk for consumers looking for a lower calorie recovery beverage, or to formulate for healthier drinks for kids in schools, ENLITEN stevia sweetener can be the answer for providing great tasting dairy beverages for a wide range of markets. ENLITEN stevia sweetener naturally-based high intensity stevia sweetener, when combined with formulation expertise and sensory analysis, can be the building block that can be used to construct a solution for meeting customer and consumer desires for reduced sugar, reduced calorie, “better for you,” naturally-based and (most importantly) great tasting flavored milk.

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