Both products are promoted as a healthful and low-calorie sugar alternative or dietary supplement, but the jury is still out on which one provides the sweetest option. The reality is that usage is a question of taste. This article reviews stevia, extracted from the Stevia rebaudiana plant, and xylitol, a crystalline alcohol derived from fruits or vegetables.

At a time when people are increasingly more health conscious and seek alternatives for health related or dietary reasons, food, beverage and ingredient manufacturers continue to explore ways to meet these demands. Sold as a dietary supplement in European countries (1) and as a natural health food in Canada, the use of stevia is approved in nations including the US, Japan, Korea, Taiwan, China, Russia, Australia, Mexico, Argentina, New Zealand, Colombia, Peru, Paraguay, Uruguay, Brazil and Malaysia (2).

According to the Freedonia Group Inc., “US demand for alternative sweeteners is expected to grow 3.4% annually to more than $ 1.3 billion in 2013”. The Freedonia Group Inc’s report Alternative Sweeteners also indicates the beverage industry should represent $ 392 million of alternative sweetener use by 2013 (3).

A report by the Beverage Institute – The Beverage Institute for Health & Wellness is part of The Coca-Cola Company – highlights studies that support the use of low-calorie sweeteners including stevia and xylitol (2). Despite the growth of this category, the beverage industry continues to rely heavily on sucrose and corn syrup to sweeten its products. However, the use of stevia and xylitol is noteworthy and should not be overlooked as they can be found in diverse product categories.

ABOUT STEVIA

Native to South America’s Paraguay stevia, stevia extract rebaudioside A (Reb A), was approved in 2008 by the US Food and Drug Administration as generally recognized as safe (GRAS) for use as a tabletop sweetener. It is available as a leaf, white powder or clear liquid. “Stevia sweeteners are a natural, zero-calorie source of sweetness. They are composed of highly purified steviol glycosides, which are extracted from the sweetest part of the stevia plant. Like other low-calorie sweeteners, they are “intense” sweeteners, meaning a very small amount is required to achieve the desired sweetness. Stevia sweeteners are 200-300 times sweeter than sugar” (4).

While it was approved only a few years ago, interest in this sweet leaf preceded its official acceptance as a sweetener. Numerous cookbooks and nutritional titles extol the benefits of this sweet leaf. “In the early 1970s the Japanese learned of stevia and they have been using it in soy
products, soft drinks, and a number of other foods,” wrote Ray SAEHELIAN and DONNA GATES, authors of The Stevia Cookbook. At the time the book was published the American market knew little about the leaf but that has since changed – first in 1995 when stevia could be sold as a dietary supplement (5).

Reb A Research
Toxicity is the main concern regarding human consumption of any product. Over two decades of studies have examined the effects of stevia intake on humans. While studies do not indicate concern, SAEHELIAN and GATES noted that estimated human daily consumption of stevia is minimal to begin with, as people generally “partially substitute stevia for sugar…the intake on a daily basis would be even less than 330 milligrams” (Ref 6, p 28).

According to the American Dietetic Association’s paper, Hot Topics which publishes expert opinion on various dietary issues, “Derived from the leaves of the Stevia rebaudiana Bertoni plant, Reb A is one of two main steviol glycosides – The other is stevioside. Both are 200-300 times sweeter than sugar and are calorie-free. The safety of Rebudioside A – and to a lesser extent, stevioside – for human consumption has been tested through peer reviewed research, including metabolic and pharmacokinetic studies, general and multi-generational safety studies, including carcinogenicity studies; intake studies; and randomized, placebo-controlled human clinical trials (6). Studies with type 1 and 2 diabetics, as well as those with hypertension, have all shown no adverse effects with Reb A doses of approximately 4 to 15 mg/kg body weight per day” (6). Consequently, individuals who suffer from diabetes don’t need to give up sweet tasting food options with stevia as consumption of it does not increase blood glucose levels. Similarly, people concerned about weight maintenance and weight loss can use stevia liberally in their diets. Most recently, a study published in the journal Appetite confirmed how low-caloric alternatives to sugar can assist individuals with weight loss management. “When consuming stevia and aspartame preloads, participants did not compensate by eating more at either their lunch or dinner meal and reported similar levels of satiety compared to when they consumed the higher calorie sucrose preload” (7).

While stevia has no calories, moderation and caution is suggested for some individuals. Mayo Clinic nutritionist, KATHERINE ZERATSKY, R.D., L.D. noted on the Mayo Clinic’s web site: “Stevia is virtually no calories and doesn’t raise blood sugar levels…the current knowledge is that it is probably safe in moderate doses. However, until we have more research, women who are pregnant or breastfeeding should probably avoid using stevia. Similarly, people taking diabetes or blood pressure drugs should use stevia with caution because of the risk that it might cause hypoglycemia or hypotension when combined with these drugs” (9).

ABOUT XYLITOL
Xylitol, a late 19th century discovery, is another white powdery substance that has been used as a sugar substitute since the 1960s. According to the Calorie Control Council, xylitol is currently approved for use in foods, pharmaceuticals and oral health products – known for its role in cavity prevention – in more than 35 countries. This sugar substitute is found in a variety of products such as “chewing gum, gum drops and hard candy, and in pharmaceuticals and oral health products such as throat lozenges, cough syrups, children’s chewable multivitamins, toothpastes and mouthwashes” (10). Also recognized as a polyol or sugar alcohol, the American Diabetics Association explains that xylitol contains fewer calories and less carbohydrate than the other sweeteners; the calorie content ranges from 0.2 calories per gram to 3.4 calories per gram (compared to 4 calories per gram for sugar) (11).

Listed in The Encyclopedia of Healing Foods, recommended intake for xylitol is moderate. “Higher dosages – for example, a single dosage of more than 10 to 30 or a daily intake of more than 40-80 grams – may produce laxative effect” (12). Dr. FIAN GARE, co-author of four of Dr. Atkins books, former Director of Nutrition of The Atkins Center For Clinical Nutrition, and CEO of Sweet Life, touts the benefits of xylitol in the products she develops. In her book, The Sweet Miracle of Xylitol (13), she writes that for a quarter of a century consumers in countries like Finland, Russia and China – which is major producer along with Brazil – have been using xylitol. “It could potentially improve the health of millions while allowing us to eat those sweet foods that we’ve grown to love. It is all natural and tastes like sugar, and has been proven to prevent diabetes, help with weight loss, and improve dental health” (13).

Research Highlights
In a recent national survey of pediatricians evaluated and commented on the use of xylitol to treat Acute Otitis Media (AOM) a recurring reason for doctors visits. According to the study, “treatments for AOM – antimicrobial therapy and surgery – sometimes have questionable effectiveness, risks, and high costs. Thus, Peds (pediatricians) should consider using prophylactics for AOM that are easy to administer, cost-effective, and have minimal side effects. Xylitol, a naturally occurring sugar alcohol, is widely used to prevent AOM and for other health conditions in Europe and as a dental caries prophylaxis in the United States” (14). Results of the study indicated that pediatricians were not well informed about suggesting xylitol as an alternative medicinal method. These physicians “also believed that those under 6 months of age with AOM should receive antibacterial therapy beginning with amoxicillin but did not use complementary and alternative medicine (CAM). Only about half knew about medical uses for xylitol, but of those, most were aware of its use in chewing gum to prevent AOM but had not used it with patients. They were not sure of xylitol’s effectiveness or appropriate dosages but cited stomach cramping and diarrhea as possible side effects. Most would use xylitol if evidence supported it and wanted information about it via reprints or electronically” (14).

Products to treat ear infections – AOM or recurring AOM (RAOM) – recommend the daily administration of xylitol to reduce occurrences by developing resistance to bacterial infections. “In a double-blind, randomized, placebo-controlled study, children ≥7 months of age receiving xylitol daily for 3 months had a 30% cumulative decrease in the occurrence of AOM episodes compared to the children in the placebo group” (15).

A noted side effect for sweeteners among users is diarrhea. “The use of sugar alcohols [like xylitol] appears to be safe; however, they may cause diarrhea, especially in children” (16). Comments on the effect of sugar alcohols like xylitol on people with diabetes was similar: “be cautious with sugar alcohols, including mannitol, sorbitol and xylitol. Sugar alcohols can increase your blood sugar level. And for some people, sugar alcohols cause diarrhea” (17). In another study published in the European Journal of Clinical Nutrition, Gl, or gastrointestinal tolerance was examined. “Diarrhea, flatulence and bloating have been reported by DURBACH et al. (1969) in adults following consumption of xylitol, although no dose dependency was noted. In another study by CULBERT et al. (1986) in which participants consumed 30-100 g xylitol per day, a dose-dependent effect was observed. Although xylitol is a sugar alcohol, it has similar physicochemical properties and are being used in a wide variety of food applications, little is known about their comparative GI tolerance, especially when consumed at higher doses in liquid (18).
STEVIA AND XYLITOL PRODUCTS

Stevia can be found in a slew of name brand products. A quick review includes Truvia, a table top sweetener by Cargill and The Coca-Cola Co.; PureVia, produced by Wild Flavors Inc.; Morita Kagaku Kogyo Co. Ltd. (Table I); as well as OnlySweet, sold by Sunwin USA and Pepsi Flavors Inc.

Xylitol products include: Spry Dental products (gum, mints, toothpaste, rinses); Xlear’s Xlear Nasal Wash; and Xlear’s All Natural SteviaPlus. Arbor Pharmaceuticals’ xylitol (Xylarex) oral solution – available by prescription only – for the dietary management of recurrent acute otitis media (RAOM) in children (15). The recommended intake for this oral solution is 1 teaspoon (5 ml) three times daily after meals and/or snacks, for a total of 3 teaspoons (15 ml) daily (15). For sinus congestion, there is Xlear® Nasal Spray, recommended to hydrate and moisturize sinus and nasal passages. Published in Proceedings of the National Academy of Sciences of the USA were the results of a study that monitored xylitol nasal spray use. “In a double-blind, randomized, crossover study, xylitol sprayed for 4 days into each nostril of normal volunteers significantly decreased the number of nasal coagulase-negative Staphylococcus compared with saline control. Xylitol may be of value in decreasing ASL salt concentration and enhancing the innate antimicrobial defense at the airway surface” (19).

Market Forecast

According to Food Insight “Stevia sweeteners represent more than 40% of the low-calorie sweetener market in Japan” (5), although impressive growth is palpable in other global markets. Consequently, it is no surprise that medical professionals do not express reservations about stevia use: Ray Savelian, M.D. and co-author of The Stevia Cookbook was quoted in Better Nutrition magazine as saying “I am not concerned with stevia causing any medical conditions; in fact from all the studies I have reviewed, stevia is a very safe supplement and most likely much, much safer than artificial sweeteners” (20).

According to the Freedonia Group Inc., “U.S. demand for alternative sweeteners is expected to grow 3.4% annually to more than $1.3 billion in 2013.” Whatever is in store for the next generation of sweeteners, stevia and xylitol appear to be strong contenders as non-caloric, low-glycemic additives to beverages and food products. Research in this area will be ongoing as researchers experiment and explore the nutritional derivatives that will positively complement desired healthful and flavor profile objectives.

Table 1 – Stevia sweeteners

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<tr>
<td>Enliten®</td>
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PureCircle, Whole Earth Sweetener and Pepsi-Cola North America; and Enliten, Corn Products International Inc. in partnership with Morita Kagaku Kogyo Co. Ltd. (Table I); as well as OnlySweet, sold by Sunwin USA and Wild Flavors Inc.

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