International Food Information Council

Sugar Alcohols Fact Sheet

September 2004

BACKGROUND

Sugar alcohols or polyols, as they are also called, have a long history of use in a wide variety of foods. Recent technical advances have added to the range of sugar alcohols available for food use and expanded the applications of these sugar replacers in diet and health-oriented foods. They have been found useful in sugar-free and reduced-sugar products, in foods intended for individuals with diabetes, and most recently in new products developed for carbohydrate controlled eating plans.

Sugar alcohols are neither sugars nor alcohols. They are carbohydrates with a chemical structure that partially resembles sugar and partially resembles alcohol, but they don't contain ethanol as alcoholic beverages do. They are incompletely absorbed and metabolized by the body, and consequently contribute fewer calories. The polyols commonly used include sorbitol, mannitol, xylitol, maltitol, maltitol syrup, lactitol, erythritol, isomalt and hydrogenated starch hydrolysates. Their calorie content ranges from 1.5 to 3 calories per gram compared to 4 calories per gram for sucrose or other sugars. Most are approximately half as sweet as sucrose; maltitol and xylitol are about as sweet as sucrose.

Sugar alcohols occur naturally in a wide variety of fruits and vegetables, but are commercially produced from other carbohydrates such as sucrose, glucose, and starch. Along with adding a sweet taste, polyols perform a variety of functions such as adding bulk and texture, providing a cooling effect or taste, inhibiting the browning that occurs during heating and retaining moisture in foods. While polyols do not actually prevent browning, they do not cause browning either.

FORMS OF SUGAR ALCOHOLS

The table below shows commonly used sugar alcohols along with some of their food applications. The relative sweetness value fluctuates due to the fact that sweetness will vary depending on the product in which the polyol is used. Manufacturers frequently use sugar alcohols in combination, as well as with other sweeteners to attain the desired taste and sweetness level.

Polyols can be classified by chemical structure as monosaccharide-derived (e.g., sorbitol, mannitol, xylitol, erythritol), disaccharide-derived (e.g., isomalt, lactitol, maltitol), or polysaccharide-derived mixtures (e.g., maltitol syrup, hydrogenated starch hydrolysates [HSH]). The polyols shown in the Table are regulated by the Food and Drug Administration as either GRAS (Generally Recognized As Safe) or approved food additives.[1]

HEALTH ISSUES

Metabolism

Sugar alcohols are slowly and incompletely absorbed from the small intestine into the blood. Once absorbed they are converted to energy by processes that require little or no insulin. Some of the sugar alcohol is not absorbed into the blood and is passed out of the small intestine and is fermented by bacteria in the large intestine. Thus, overconsumption may produce abdominal gas and discomfort in some individuals.[2] Total daily consumption should be considered since it is the total intake that may primarily drive laxative effects. As a result, foods that contain certain sugar alcohols and that are likely to be eaten in amounts that could produce such an effect must bear the statement "Excess consumption may have a laxative effect." The American Dietetic Association advises that greater than 50g/day of sorbitol or greater than 20g/day of mannitol "may cause diarrhea."[1]

Given the increasing availability of polyolsweetened foods due to the expanded number of lowcarbohydrate foods, the total daily intake needs to be considered since it is the total intake that may primarily drive laxative effects. Other important factors to consider include the time of day consumed, the amount eaten in one sitting, type of food, individual response, and adaptation over time, empty versus full stomach (if you eat a product containing large amounts of polyols for breakfast

on an empty stomach, you will probably experience a different effect than consuming the same product later in the day with a fuller stomach).

Diabetic Diets

The primary goal for nutritional management of diabetes is to maintain near-normal blood glucose levels. Due to their incomplete absorption, the polyol sweeteners produce a lower glycemic response than sucrose or glucose and therefore may be useful in diabetic diets. The American Diabetes Association notes the lack of long-term studies comparing the effects of high and low glycemic diets in diabetic individuals. The Association further notes that "with regard to the glycemic effects of carbohydrates, the total amount of carbohydrate in meals or snack is more important than the source or type."[3] There is a range of glycemic responses to the various sugar alcohols and much work is being done to determine the appropriate recommendations. People with diabetes should consult their physician, dietitian or other health professional about incorporating sugar alcohols into their daily meal plans.

An American Dietetic Association publication recommends that persons with diabetes managing their blood sugars using the carbohydrate counting method "count half of the grams of sugar alcohol as carbohydrates since half of the sugar alcohol on average is digested."[4]

Reduced Calorie and Low Carbohydrate Diets

Because of their lower energy density (calories per gram) the replacement of other carbohydrates with sugar alcohols can reduce the energy density of food products and could play a useful role in weight management. Polyols also may have a role in reducing the overall glycemic challenge of the diet. Presently, researchers have no conclusive evidence that glycemic index is related to weight control.[5]

Health experts advise that excessive energy intake in any form leads to weight gain. Consumers should consider the total calorie content of the diet and should avoid overconsumption of all foods including those containing sugar alcohols.

Tooth Decay

Sugar alcohols are not acted upon by bacteria in the mouth, and therefore do not cause tooth decay.[2] Xylitol has been found to inhibit oral bacteria, and is often used in sugarless mints and chewing gums for this reason. The Food and Drug Administration authorizes the use of a health claim in food labeling that sugar alcohols do not promote tooth decay.

LABELING

Consumers interested in the polyol content of foods can find relevant information in several places on the food label.

Ingredient List:

The ingredient list will show the individual name of each polyol the product contains.

Nutrition Facts Panel:

The Nutrition Facts panel shows the total carbohydrate content of a food that includes the amount of any sugar alcohols in the product. The manufacturer may also declare voluntarily the number of grams of polyols in a serving of the product. If the product label uses the terms "sugar free" or "no added sugar," the polyol content must be declared separately under carbohydrates in the Nutrition Facts panel. If the product contains more than one polyol, the Nutrition Facts panel must use the term "sugar alcohol."

Principal Display Panel:

Consumers may see relatively new phrases such as "net carb," "low carb," or "impact carb" on the principal display panel of some products. These terms are not defined by the Food and Drug

Administration. Generally, food manufacturers calculate “net carbohydrates” by subtracting the grams of fiber and sugar alcohols from the total carbohydrates.

Much like dietary fiber, with sugar alcohols the rationale is that even though they are technically carbohydrates, they have a lower energy density (calories per gram), because of their incomplete absorption and shouldn’t be counted as part of total carbohydrates.[6] This is being debated in the scientific community.

The Bottom Line

An increasing variety of polyol-containing foods is appearing on supermarket shelves. These products may have a role in weight management and in diabetic eating plans. Long-term benefits have not been established for sugar alcohols and further research is needed to document their health effects. Sugar alcohols and foods containing them should be consumed as part of an overall healthy eating plan, such as that outlined by the Dietary Guidelines for Americans.

The Sugar Alcohols			
	Calories per gram	**Approximate Sweetness (sucrose =100%)**	**Typical Food Applications**
Sorbitol	2.6	50 - 70%	Sugar-free candies, chewing gums, frozen desserts and baked goods
Xylitol	2.4	100%	Chewing gum, gum drops and hard candy, pharmaceuticals and oral health products, such as throat lozenges, cough syrups, children’s chewable multivitamins, toothpastes and mouthwashes; used in foods for special dietary purposes
Maltitol	2.1	75%	Hard candies,chewing gum, chocolates, baked goods and ice cream
Isomalt	2.0	45 - 65%	Candies, toffee, lollipops, fudge,wafers, cough drops, throat lozenges
Lactitol	2.0	30 - 40%	Chocolate, some baked goods (cookies and cakes), hard and soft candy and frozen dairy desserts
Mannitol	1.6	50 - 70%	Dusting powder for chewing gum, ingredient in chocolate-flavored coating agents for ice cream and confections
Erythritol	0.2	60 - 80%	Bulk sweetener in low calorie foods
Hydrogenated Starch Hydrolysates (HSH)	3	25 - 50%	Bulk sweetener in low calorie foods, provide sweetness, texture and bulk to a variety of sugarless products

References:

[1] Position of the American Dietetic Association: Nutritive and nonnutritive sweeteners. Journal of the American Dietetic Association 2004; 104:256.

[2] Wolever, T.M.S., et. al. Sugar alcohols and diabetes; a review. Canadian Journal of Diabetes 2002; 26:356.

[3] American Diabetes Association. Nutrition principles and recommendations in diabetes-Position Statement. Diabetes Care, Jan.2004.

[4] Powers M. American Dietetic Association Guide to Eating Right When You Have Diabetes. Hoboken, NJ: John Wiley & Sons; 2003:130,139

[5] American Dietetic Association. The glycemic index: what is it? March 19, 2004, http://www.eatright.org/Public/NutritionInformation/index_1 9161.cfm.

[6] Marcason, W. What do “net carb,” “low carb,” and “impact carb” really mean on food labels? Journal of the American Dietetic Association, Jan, 2004.