



# Dietary Sugar and Alternative Sweeteners

Janice R. Hermann, PhD, RD/LD  
Nutrition Education Specialist

## Simple Sugars versus Complex Carbohydrates

The term carbohydrates includes monosaccharides and disaccharides, which are sometimes called simple sugars; and polysaccharides, which are sometimes called complex carbohydrates or starch, and fiber.

The term monosaccharide means one sugar molecule. Foods contain three common monosaccharides:

- Glucose
- Fructose
- Galactose

The term disaccharide means two sugar molecules. Two monosaccharides combine to form a disaccharide. Three important disaccharides are:

- Maltose = Glucose + Glucose
- Sucrose = Glucose + Fructose
- Lactose = Glucose + Galactose

The term polysaccharide means many sugar molecules. Dietary polysaccharides contain hundreds of sugar molecules and include:

- Complex carbohydrates or starch
- Fiber

Simple sugars and complex carbohydrates or starches occur naturally in many foods that also supply other nutrients, including milk, fruits, vegetables, breads, cereals, and grains. Sugars also are added to foods during processing and preparation. Most sugars found naturally in foods or added to foods are disaccharides, or two sugar molecules. The body cannot tell the difference between naturally occurring and added sugars because they are chemically the same.

Our bodies can only absorb monosaccharides, or single sugar molecules. During digestion enzymes break down disaccharides into two monosaccharides, which can be absorbed by the body. Digestive enzymes also break down complex carbohydrates or starches, which contain hundreds of sugar molecules, into monosaccharides or single sugar molecules for absorption. The body cannot tell the difference between monosaccharides that come from the breakdown of a simple sugar or from a complex carbohydrate.

## Caloric Sweeteners

Caloric sweeteners include many regular sugars including: refined sugars, corn sweeteners, dextrose, high fructose

Oklahoma Cooperative Extension Fact Sheets  
are also available on our website at:  
<http://osufacts.okstate.edu>

corn syrup, honey, syrups, crystalline fructose, lactose, invert sugars, glucose, maltose, and concentrated fruit juices.

Sugars have several important roles in foods. For example, they give foods sweetness. Besides improving the flavor of foods, they improve the texture and color of baked goods. Sugar also helps to thicken, firm, or preserve foods such as puddings, jams, and jellies.

The main function of sugars (and all carbohydrates) in the body is to provide energy. Energy does indeed, "keep us going." It is necessary for good health, growth, and proper body function and activity. Foods in the USDA Daily Food Plan food groups that contain natural sugars supply energy and also provide important vitamins, minerals, protein, and fiber. Sugar by itself and foods high in added sugar, supply calories, but do not provide the added bonus of other nutrients.

## Intake of Added Sugar

The Dietary Guidelines recommend people choose and prepare foods and beverages with little added sugar.

Several national food intake surveys have reported that added sugar intake has increased. The largest source of added sugar comes from regular soft drinks, which accounted for 2/3 of intake. Other sources were table sugars, syrups, sweets, sweetened grains, regular fruitades, and milk products.

## Health Effects of Sugars

### Nutritional Deficiencies

In excess, sugar can contribute to nutritional deficiencies by supplying calories without providing nutrients. Bakery items, candies, and soft drinks provide calories with few nutrients. Honey does provide a few vitamins and minerals, but the amounts are very small. On the other hand, grains, vegetables, fruits, and dairy foods contain natural sugars and starches, but also protein, fiber, vitamins, and minerals. Sugar can contribute to nutrient deficiencies only by displacing nutrients.

For nutrition sake the appropriate attitude to take is not that sugars are "bad" and must be avoided, but that nutrient dense foods must come first. The goal is good nutrition and moderation. The amount of sugar a person can afford depends on how many calories are available beyond those needed for nutrients.

## Tooth Decay

In excess, both sugars and starches can contribute to tooth decay. Both sugars and starches begin breaking down to glucose in the mouth. Bacteria in the mouth ferment sugars and in the process produce an acid that can dissolve tooth enamel. Many factors are involved such as how long foods stay on the teeth, how often foods are eaten, and dental hygiene. Overall, the risk of dental caries increases with intake of nutritive sweeteners; however, sugars and carbohydrates do not work independently from other factors such as oral hygiene and fluoridation. For most people good oral hygiene will prevent dental caries.

## Diabetes/Hypoglycemia

The influence of food on blood glucose has led to the oversimplification that food controls blood glucose concentrations. Foods do not, the body does. In some people, blood glucose controls fail. When this occurs diabetes or hypoglycemia can develop. Glucose may be modified as part of the treatment, but hormonal regulation or obesity (in the case of type 2 diabetes) is the cause not glucose.

## Hyperactivity or Misbehavior in Children

Controlled studies have failed to show an adverse relationship between sugar and hyperactivity or misbehavior in children, even in children who by report are sensitive to sugar. The mechanism by which carbohydrate, including sugars, may affect mood is uncertain, but may involve the production and release of serotonin in the brain. High carbohydrate intake stimulates the brain production of serotonin, which actually can make a person sleepy.

## Heart Disease

Usual intakes of sugar do not increase blood triglycerides in most persons, provided calories are in balance. However, a small percent of people are carbohydrate sensitive. These people respond to high amounts of sugar or carbohydrate with abnormally high insulin, which promotes triglyceride formation, which can increase heart disease risk. However, it is important to keep the effects of sugars in perspective. Other dietary factors such as saturated fat, trans fat, and obesity have a much stronger association with heart disease than sugar intake.

## Obesity

Obesity is a complex issue and cannot be attributed to one factor. Excess body fat arises from energy imbalance caused by taking in too many calories and by using too few. Because sugar adds calories to foods and beverages, it has been suggested that sugar has a role in causing obesity. Research does not support a direct connection between sugar and carbohydrate intake with obesity, unless excess intake of sugar containing foods leads to excess calories and weight gain.

## Sugar on the Food Label

Sugars added to foods are listed in the food ingredient list. The Nutrition Facts Panel on the food label lists the grams of added sugar per serving of food under Total Carbohydrates. The following terms are used on food labels to describe the sugar content of foods:

- Sugar Free: Less than 0.5 g sugar/serving.
- Reduced Sugar: The sugar content of the product has been reduced by at least 25 percent.
- No Sugar Added: No sugar or any other ingredient containing sugar added to product.

## Healthy Choices to Lower Sugar

### Grain Group

- Many commercial bakery items are high in sugar. Look at the Nutrition Facts Panel to compare the sugar content of bakery items.
- Ready-to-eat cereals vary in sugar content. Read the Nutrition Facts Panel to compare the sugar content of cereals. The grams of sugar per serving is both sugar added by the manufacturer and naturally occurring sugar in fruits such as raisins and dates.
- Add fresh fruit or raisins to plain ready-to-eat breakfast cereals instead of sugar.
- Use yeast breads instead of sweets for the holidays. There is a variety to choose from and they use less sugar than traditional holiday treats.
- Gradually decrease sugar in recipes by one-quarter to one-third the amount called for in baked items as long as the product is acceptable. Bring out the sweetness with vanilla, lemon, or almond extract.
- Use fresh fruit toppings or unsweetened applesauce for pancakes, waffles, and French toast instead of syrup or honey.

### Fruit and Vegetable Groups

- Fruits canned in light syrup or natural juices have less sugar than fruits canned in heavy syrup.
- Use fruits instead of sugar to sweeten other foods such as breads, cereals, desserts, and main dishes.

### Protein Foods Group

- Try making your own breading and coating mixes for meat and poultry. Some commercially prepared ones contain more than 50 percent sugar.
- Grind your own peanut butter (many grocery stores now have machines for this) or look for peanut butter without added sugar.

### Dairy Group

- Choose yogurts with non-caloric sweeteners.
- Choose frozen dairy desserts, including ice creams, frozen yogurts, and ice milks with non-caloric sweeteners.

### Fats, Oils, and Sweets

- If you are trying to lower the sugar in your diet, the answer is not to cut out all foods such as milk, fruits, and vegetables that naturally contain sugar. The body needs nutrients found in these foods. The better place to start cutting sugar from the diet is from foods that contain large amounts of added sugar, but are not sources of other nutrients.
- Ingredient labels provide information on sugar content. Sugar goes by a number of names, so look for the following terms on the ingredient list: sugar, sucrose, powdered

sugar, maple sugar, brown sugar, glucose, dextrose, corn syrup, fructose, levulose, high fructose corn syrup, honey, milk sugar, lactose, or maltose.

### Beverages

- Substitute 1/2 fruit juice and 1/2 club soda for soft drinks, punches, and other drinks.
- Try unsweetened tea with a twist of lemon, lime, or a sprig of fresh mint.
- Try water, mineral water, or club soda with a slice of fresh lime or lemon.
- Reduce consumption of soft drinks containing sugar. Instead choose fruit juices, unsweetened iced tea, buttermilk, and low-fat milk.
- Try unsweetened coffee with a stick of cinnamon or an orange slice.

### Snacks

- Substitute popcorn, raw vegetables, and fresh fruits for sweet snacks. Make these healthful foods easy to find and eat. Prepare them ahead of time and store in the refrigerator. Store in an airtight plastic container labeled “snack foods.”
- Make your own dips, since commercially prepared ones often contain sugar. Then use raw vegetables as dippers in place of snack crackers, which often contain sugar.

### Condiments

- Try making your own salad dressing. Many commercial dressings, both bottled and packaged mixes, contain a large amount of sugar.
- Try coriander, basil, nutmeg, cinnamon, and ginger for a light, sweet taste.
- Read labels on bottled sauces and packaged seasoning mixes. You can easily make a similar version at home without the added sugar.

### Sugar Alcohols

Sugar alcohols provide calories, although they provide fewer calories than regular sugars because they are not completely absorbed. This allows products, which contain sugar alcohols to be labeled “sugar free,” or “reduced calorie.” Products may claim to be “sugar free” but this does not mean they are “calorie free.”

Sugar alcohols occur naturally in fruits and vegetables. The body absorbs sugar alcohols slowly and incompletely. As a result they enter the blood stream slower than natural sugars. Because of the incomplete absorption sugar alcohols produce a lower blood glucose response than sugars. However, side effects also occur because of the incomplete absorption. Large amounts can cause gas, abdominal discomfort, and diarrhea due to fermentation by intestinal bacteria (similar to

lactose intolerance). For this reason, food products containing sugar alcohols carry a label “Excess consumption may have a laxative effect.”

The real benefit of using sugar alcohols is that they do not contribute to dental caries. Bacteria in the mouth can not metabolize sugar alcohols as rapidly as sugar.

### Non-Caloric Sweeteners

Non-caloric sweeteners are used in many foods. Most non-caloric sweeteners do not provide significant calories; however, foods containing non-caloric sweeteners may not always be lower in calories than similar products that contain sugars.

The FDA has approved several non-caloric sweeteners; saccharin, aspartame, acesulfame K, sucralose, and neotame. The body does not metabolize saccharin, acesulfame K, or sucralose, they pass through the body unchanged. The body does digest aspartame, so technically it is a caloric sweetener, but the calories provided are insignificant. Two other non-caloric sweeteners have petitioned FDA and are awaiting approval; cyclamate, and alitame.

- **Saccharin.** Used around the world since the turn of the century. It is 300 times sweeter than sugar. It is very stable in foods, but has a bitter aftertaste. The common brand name is Sweet and Low.
- **Aspartame.** Aspartame is 200 times sweeter than sugar. It contains the two amino acids, phenylalanine and aspartic acid. It is an excellent sweetener with no aftertaste. Aspartame cannot be used in baking, because it breaks down with heat. Persons with PKU (phenylketonuria) should avoid its use. The common brand names are Nutra-Sweet and Equal.
- **Acesulfame-K.** Acesulfame-K is 200 times sweeter than sugar. Acesulfame K is stable and does not break down in cooking. The common brand name is Sunette.
- **Sucralose.** Sucralose is about 600 times sweeter than sugar. Sucralose is extremely stable and does not break down in cooking. The common brand name is Splenda.
- **Neotame.** Neotame is 8000 times sweeter than sugar. Although neotame contains phenylalanine it is not released in digestion. As a result products containing neotame do not have to carry a warning for people with PKU.

### References

- United States Department of Agriculture. ChooseMyPlate.gov. Accessed at: [www.choosemyplate.gov](http://www.choosemyplate.gov)
- United States Department of Agriculture. Dietary Guidelines for Americans 2010. Accessed at: <http://www.cnpp.usda.gov/DietaryGuidelines.htm>
- Whitney, E.N. and Rolfes, S.R. Understanding Nutrition, 10<sup>th</sup> ed. 2005. Thomson/Wadsworth Publishing Co., Belmont, CA.

## The Oklahoma Cooperative Extension Service

### *Bringing the University to You!*

The Cooperative Extension Service is the largest, most successful informal educational organization in the world. It is a nationwide system funded and guided by a partnership of federal, state, and local governments that delivers information to help people help themselves through the land-grant university system.

Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
- It is administered by the land-grant university as designated by the state legislature through an Extension director.
- Extension programs are nonpolitical, objective, and research-based information.
- It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
- It utilizes research from university, government, and other sources to help people make their own decisions.
- More than a million volunteers help multiply the impact of the Extension professional staff.
- It dispenses no funds to the public.
- It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
- Local programs are developed and carried out in full recognition of national problems and goals.
- The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
- Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.

Oklahoma State University, in compliance with Title VI and VII of the Civil Rights Act of 1964, Executive Order 11246 as amended, Title IX of the Education Amendments of 1972, Americans with Disabilities Act of 1990, and other federal laws and regulations, does not discriminate on the basis of race, color, national origin, sex, age, religion, disability, or status as a veteran in any of its policies, practices or procedures. This includes but is not limited to admissions, employment, financial aid, and educational services.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Robert E. Whitson, Director of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Dean of the Division of Agricultural Sciences and Natural Resources and has been prepared and distributed at a cost of 20 cents per copy. Revised 0811 GH.