What you eat and how much you eat has an impact on your blood glucose levels. Your blood glucose level reflects how well your diabetes is controlled. There are many aspects to eating for target BG (Blood Glucose) levels, but these basic guidelines offer a starting point:

- Eat at least 3 meals and possibly 1 or 2 snacks spaced evenly throughout the day.
- Eat each meal and/or snack at about the same time each day.
- Do not skip meals.
- Eat about the same amount of carbohydrate at each meal every day.
- Notice how much you eat and compare that to how much you should eat.

What impacts blood glucose levels?

Foods that contain carbohydrates will affect blood glucose levels the most. How quickly and how much blood glucose levels rise depends on:

- Food composition
- Portion size
- Timing

Food composition

Blood glucose levels are affected differently depending on whether you eat foods containing carbohydrates, proteins, fats, or a combination of these three. Carbohydrates will cause blood glucose to rise the most and the most quickly. Liquids that contain carbohydrates (like milk and juice) will cause blood glucose to rise faster than solids that contain carbohydrates (like bread). Because of the impact that they have on blood glucose levels, carbohydrates are the most important macronutrient for people with diabetes to monitor.

Portion size

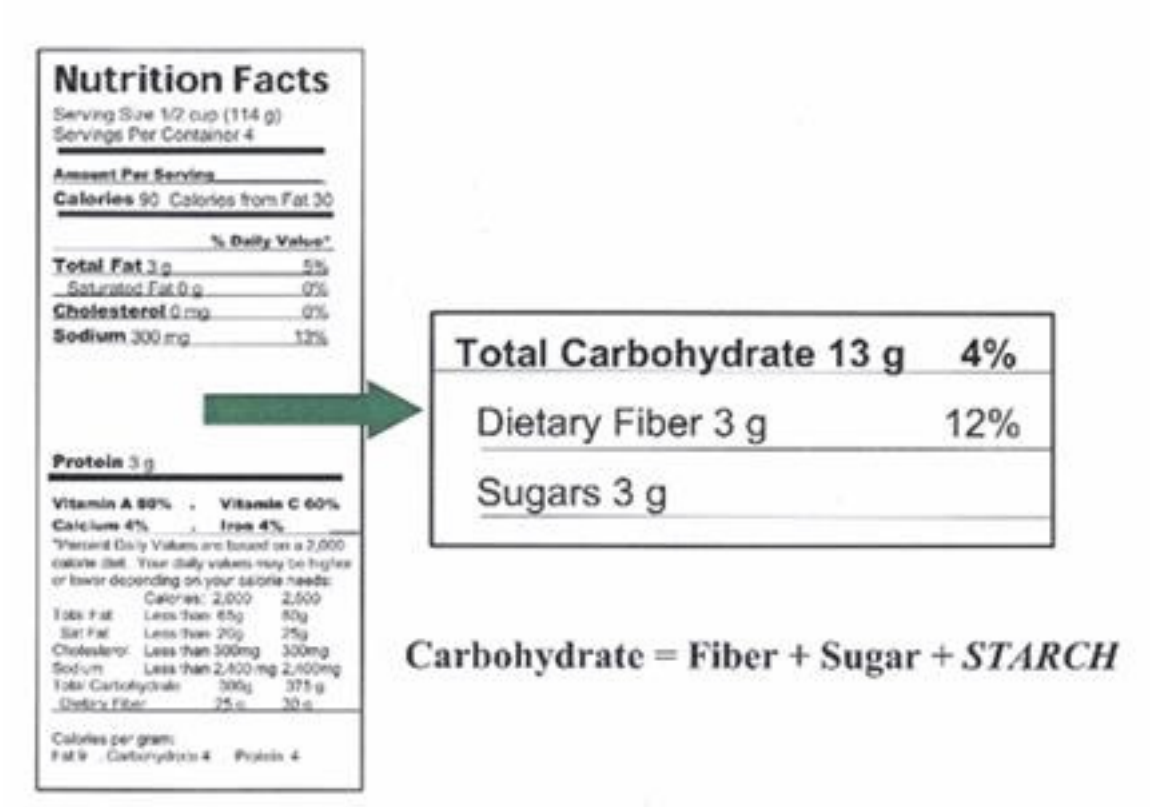
The amount of food that you eat also impacts blood glucose levels. Eating more food, or bigger portions, will cause your blood glucose levels to rise more than eating smaller portions. Since carbohydrates affect blood glucose levels the most, the amount of carbohydrate that you eat each day is very important in controlling your blood glucose levels. Talk to your health care provider or dietitian about how many grams of carbohydrates you should eat each day.

To find out how many grams of carbohydrates you are eating each day, it is important to be familiar with the food groups, serving sizes, and Nutrition Facts labels. As discussed in **Food Groups and Diabetes**, three food groups contain carbohydrate:

- The Starch and Starchy Vegetables Group
- The Fruit Group
- The Milk and Yogurt Group

One serving from each of these groups contains about 15 grams of carbohydrates. Therefore, eating one serving from any of these three groups will impact your blood glucose level in about the same way. For examples of one serving from these three groups see **Food Groups and Diabetes.**

Another way to find out how many grams of carbohydrates are in a particular amount of food is to read the Nutrition Facts label on the back of a product. This is a picture of the Nutrition Facts label found on almost all foods sold in this country. Look at the portion on the label that tells how much "Total Carbohydrate" is in the food in order to decide how much it might raise your blood glucose. As you can see, this product has 13 grams of total carbohydrates per serving.

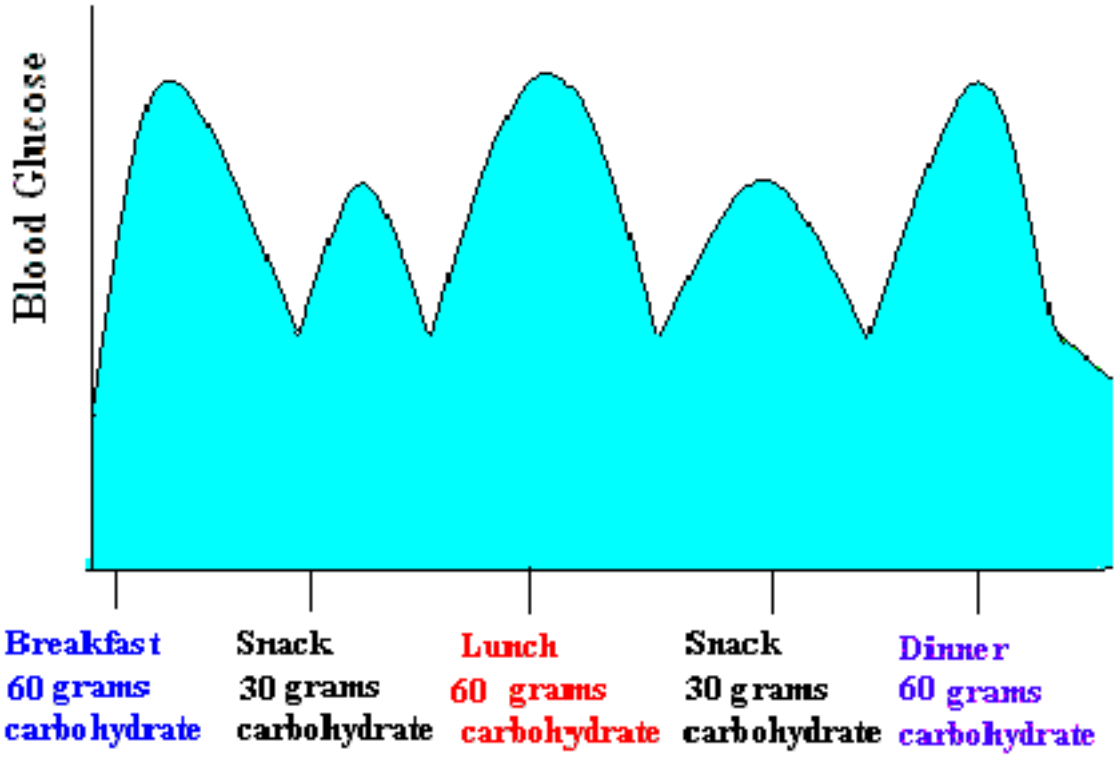


For comparison, one slice of bread (one serving from the Starchy and Starchy Vegetables Group) has about 15 grams of carbohydrate. Since our bodies change almost all of the carbohydrates we eat into blood glucose, be sure to look at "Total Carbohydrate" and not just at "Sugars" to see how much a food will raise your blood glucose. "Total Carbohydrate" will be greater than the sum of the listed "sugars" and "fiber" because starches are also counted in total carbohydrates. For some very high fiber foods that have 5 or more grams of fiber per serving, net carbohydrates may be used instead of total carbohydrates. Net carbohydrate is just total carbohydrate in a serving of food minus the grams of fiber. Net carbohydrates are used when considering very high fiber

foods, because the body cannot digest carbohydrates from fiber and therefore they do not raise blood glucose levels.

Timing

Blood glucose levels are affected by the timing of meals and snacks. Eating three meals and possibly one or two snacks at the same time every day will help keep your blood glucose levels more consistent. Ask your doctor or dietitian how many meals and snacks you should eat each day. It is also important to eat about the same amount of carbohydrate at each meal or snack to keep your blood glucose levels within target range, or to have your medication match your carbohydrate intake. Below is a graph of blood glucose levels from a person without diabetes who has eaten 3 meals and two snacks in one day. At each meal this person ate about the same amount of carbohydrate. As you can see, this person's blood glucose level rose and fell in about the same way after every meal or snack. Someone who does not have diabetes insulin secretion will automatically adjust to match the amount of carbohydrate that they eat. However, those who have diabetes do not react the same way. Since people with diabetes have difficulty regulating their blood glucose levels, they should eat the amount of carbohydrate recommended by their doctor, and space this carbohydrate evenly throughout the day. This will help keep blood glucose levels in their target range.



Do people with diabetes need to eat snacks?

It was once thought that people with diabetes needed to eat snacks to keep their blood glucose even throughout the day. It is now known that snacks are not needed to regulate blood glucose levels and actually may cause weight gain or increased blood glucose levels when excessive. Since people sometimes snack for other reasons besides hunger (like boredom), the snack calories are extra calories that can lead to weight gain. A good rule of thumb is to eat healthful snacks in moderation if you enjoy snacking.

Ask your dietitian or health care team if you should eat snacks or how many snacks you should eat each day.

Can fiber lower your blood glucose level?

Fiber is a substance found in plant-based food like fruits, vegetables, peas, beans, and whole-grain breads and cereals. Fiber is not digested or absorbed to the same extent that sugars or starches are. Studies have shown that eating 20 or more grams of fiber per 1,000 calories each day may help lower blood glucose and also may reduce your risk for heart disease (see the section titled "*Eating for Cardiovascular Health*"). For these reasons, eating a high fiber diet may be particularly beneficial for people with diabetes. The American Heart Association and USDA recommend that American adults consume 14 grams of fiber for every 1,000 calories that they consume daily. To find out how many grams of fiber you are eating each day, check the Nutrition Facts label of products you consume. If the product contains three grams of fiber per serving, or more, it is a good source of fiber. For products that do not have a Nutrition Facts label, like fruits and vegetables it is often hard to know how many grams of fiber they contain. Fruit and vegetable generally are good sources of fiber.

Should people with diabetes avoid eating sugars and sweets?

Although it was once thought that people with diabetes needed to avoid all sugars and sweets, we now know that sugar and sweets do not raise blood glucose more than other foods that are mostly carbohydrate. In fact, if people with diabetes had to avoid all sugars in order to be healthy, they would not be able to eat fruits or drink milk, because fruits and milk contain carbohydrates (sugar). However, people with diabetes, just like others without diabetes, should avoid substituting foods such as sweets for healthy foods.

If you do eat sweets and have diabetes, it is important to count the total grams of carbohydrate in a sweet food as part of your total carbohydrate allowance for the day and the meal. Just look at the "Total Carbohydrate" on the Nutrition Facts label to find out how many grams of total carbohydrate a sweet food contains and work these carbohydrates into your meal plan. It is also important to consider the total calories in a sweet food. Added calories can lead to weight gain, which makes it more difficult to control blood glucose levels. It is also better to eat a dessert with a meal than by itself. This will cause blood glucose levels to raise less and more gradually than they would if a dessert is eaten by itself.

Working sweets into your meal plan

Working sweets into your meal plan may at first seem difficult because of the large amount of carbohydrates that sweet foods contain. For instance, if your doctor advises you to eat about 45 grams of carbohydrate at each meal, you would not want to replace three servings of nutrient-dense foods that contain carbohydrate like whole wheat bread, milk, or fruit with a piece of cake that contains 45 grams of total carbohydrate. Consistently "using" your daily recommended carbohydrate on sweets instead of nutrient-dense food may not affect your blood glucose levels, but it may cause nutrient deficiencies. Fortunately, there is a way to have your nutrient-dense foods and eat your cake, too. First, remember that cake is not an "everyday food." Second, lower the calories in your cake, or other dessert as much as possible by making or buying products sweetened with artificial sweeteners. This way you can eat sweets that do not have as many carbohydrates or as many calories as those products made with sugar. Third, eat a smaller serving size. By eating a small piece of cake with only 15 grams of carbohydrate per serving (instead of 45 grams of carbohydrate per serving) you will still have 30 grams of your meal carbohydrate allowance left to "spend" on nutrient dense foods.

What are artificial or non-nutritive sweeteners?

Artificial or non-nutritive sweeteners are sweeteners that do not provide any carbohydrate or calories per serving. There are four main non-nutritive sweeteners:

- Saccharin - Sold as Sweet n Low® (pink packet) or as Sugar Twin® (a brown sugar substitute), this sweetener is very stable for baking, but it does have a noticeable aftertaste when used in large quantities.
- Aspartame – Sold as NutraSweet® (blue packet), has little aftertaste but becomes unstable at high temperatures so it is not appropriate for baking or cooking.
- Acesulfame potassium - Sold as Sweet One® or Swiss Sweet®, it has less of an aftertaste than saccharin and it is more stable when heated than aspartame. This sweetener, however, it is not available in all markets.
- Sucralose - With the trade name of Splenda® (yellow packet), it is an artificial sweetener that is made from sugar with certain chemical changes. It has the same volume and taste as sugar and it is stable to heat. Using large amounts of Splenda® will add calories. For this reason, products made with Splenda® will have fewer calories than if made with sugar, but will still have some added sweetener calories.

Are artificial sweeteners safe?

Many people would like to use artificial sweeteners, but avoid them because they fear that they may be unsafe. Saccharin, aspartame, acesulfame potassium, and sucralose underwent years of testing before manufacturers were permitted to add them to foods. They have each been determined by the Food and Drug Administration (FDA) to be safe for use by almost all people. The exception is for those very rare people who are born with a condition called phenylketonuria (PKU).

Many people would like to use artificial sweeteners, but avoid them because they fear that they may be unsafe. Saccharin, aspartame, acesulfame potassium, and sucralose underwent years of testing before manufacturers were permitted to add them to foods. They have each been determined by the Food and Drug Administration (FDA) to be safe for use by almost all people. The exception is for those very rare people who are born with a condition called phenylketonuria (PKU). These people cannot metabolize foods that contain large amounts of phenylalanine, one of the ingredients in aspartame. People with this condition must avoid aspartame and many other high-protein foods. Certain other people may report headaches or other symptoms after eating foods containing artificial sweeteners. These people should also avoid the artificial sweeteners since they are not a required part of the diet.

Can you cook and bake with artificial sweeteners?

Yes, it is possible to cook and bake with artificial sweeteners, but different sweeteners have different qualities. Therefore, it is important to know how to use them appropriately. Familiar home recipes for desserts may contain large amounts of sugar and it may be tempting to replace this sugar entirely with artificial sweeteners. Sugar, however, does more than just make a recipe sweet. Sugar helps a product be tender and moist. It also helps make the familiar golden brown color of baked desserts and breads. Sometimes sugar is a main ingredient, as in cakes and cookies.

When it is, replacing sugar entirely with artificial sweeteners may produce a product that is tough, flat, and dry, as well as gray in color. Remember that most artificial sweeteners only make a recipe sweet. Recipes that usually do well with sugar substitutes include beverages, frozen desserts, pie fillings, sauces, gelatins, and puddings. Cakes, cookies, and meringues depend on large amounts of sugar for more of their finished properties. You should not replace more than two cups of sugar with an artificial sweetener in these types of products. The product Splenda®, however, can be used for baking. The chart below can give you some further guidelines regarding cooking and baking with artificial sweeteners.

Replace Sugar	Saccharin types[1]				Aspartame types[2]			Acesulfame Potassium Packets	Sucralose Gran.
	Packets	Gran.	Brown	Liquid	Packets	Gran.	Equal for Recipes		
1-2 tsp	1	1 tsp	1 tsp	1 drop	1	1-2 tsp	1/4 tsp	1	1-2 tsp
1/4 cup	6	1/4 cup	1/4 cup	1½ tsp	6	1/4 cup	1 ¾ tsp	3	1/4 cup
1/3 cup	8	1/3 cup	1/3 cup	2 tsp	8	1/3 cup	2½ tsp	4	1/3 cup
1/2 cup	12	1/2 cup	1/2 cup	1 Tbsp	12	1/2 cup	3½ tsp	6	1/2 cup
1 cup	24	1 cup	1 cup	2 Tbsp	24	1 cup	7¼ tsp	12	1 cup
Heat stable	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes
Aftertaste	Yes	Yes	Yes	Yes	No	No	No	Some	No

1 Manufacturer does not recommend replacing more than ½ cup sugar with saccharin sweetener in baked recipes.

2 Contains phenylalanine. People with phenylketonuria must avoid this sweetener.

Check measurements on product packages for most accurate information.

What are sugar alcohols?

Sugar alcohols are used to add sweetness to food without adding sugar. They have fewer calories than sugar, but more calories than "non-nutritive sweeteners" such as Splenda®, Equal®, Sweet n'Low®, or Sweet One®. The name **sugar alcohols** is a little misleading because these substances are not sugar and not alcohol. They are carbohydrates that have a chemical structure similar to sugar and similar to alcohol – but are neither. The sugar alcohols are lactitol, mannitol, sorbitol, and xylitol - sometimes called **polyols**. Sugar alcohols can replace sugar, usually on a one-to-one basis and contain fewer calories than sugar, but remember they are not calorie-free. Sorbitol, mannitol, and xylitol are naturally found in some plant products such as fruits and berries, but they can also be made in a laboratory. Lactitol is made from lactose, the carbohydrate in milk. Sugar alcohols are often found in "sugar-free" candy, gum, and cookies. It is important to remember that these products still contain calories. Consuming a large amount of polyols (greater than 50 grams of sorbitol per day or greater than 20 grams of mannitol per day) may cause diarrhea. Products with sorbitol and mannitol may have the following statement on the label: "Excess consumption may have a laxative effect."