

Diabetes Support Services

Carbohydrate Factors

A Precise Method For Meal Planning

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Meal-planning is one of the cornerstones of diabetes management, and carbohydrate counting is one of the basics of diabetes meal planning. Keeping track of the amount of carbohydrate you eat is important because carbohydrate (rather than protein or fat) is the type of nutrient that affects blood glucose levels the most. Both eating moderate amounts of carbohydrate and spreading out the total amount of carbohydrate eaten over the day can help with blood glucose control. Carbohydrate counting additionally allows people who use short-acting or rapid-acting insulin before meals to fine-tune their premeal insulin doses based on the amount of carbohydrate they plan to eat.

There are several methods of counting carbohydrates, and one of the most precise is using carbohydrate factors to calculate the amount of carbohydrate in a portion of food. To use this method, the weight (in grams) of a portion of food is multiplied by the percentage of the weight of the food that is carbohydrate (and not protein, fat, water, or other substances).

For example, carbohydrate accounts for 15% of the weight of any apple. If a particular apple weighs 225 grams, the amount of carbohydrate in that apple can be calculated as follows: $225 \text{ grams} \times 0.15 = 34 \text{ grams}$ of carbohydrate.

This method can be particularly useful when eating foods that vary in size, such as fresh fruit, or that are not easily measured by other means. For example, if the label on a package of potato chips lists the serving size as 15 chips but most of the chips in the bag are broken, it's nearly impossible to know how many chip pieces make up 15 whole chips. But you can weigh even the smallest potato chip crumbs and multiply the weight by the carbohydrate factor for potato chips.

Even when a food can be measured easily in a measuring cup, weighing it and multiplying its weight by its carbohydrate factor can produce a more accurate carbohydrate count. For example, it's easy enough to measure out a cup of cornflakes. But a cup from the top of a newly opened box, with mostly whole flakes, has a different amount of carbohydrate from a cup from bottom of the box, which has just a few whole flakes and a lot of crumbs. Weighing the cup of cornflakes shows you exactly what you have.

FINDING CARBOHYDRATE FACTORS

Before you can use the carbohydrate factor of a food to evaluate your portion, you must know what it is. Perhaps the easiest way to get the carbohydrate factor for a food is to take the information from the Nutrition

Facts panel that is on the label of all packaged foods. The Nutrition Facts panel on a box of Rice Krispies, for example, says that one serving of the cereal is 1 1/4 cups, which weighs 33 grams (under laboratory conditions). The Total Carbohydrate line shows that one serving contains 29 grams of carbohydrate. To get the carbohydrate factor for this cereal, divide the total carbohydrates per serving (29 grams) by the weight per serving (33 grams) for a carbohydrate factor of about 0.88 (meaning that 88% of the weight of Rice Krispies is carbohydrate).

To use this information, put your cereal bowl on your gram scale and zero it out. Pour in whatever amount of cereal you want, and multiply the weight by the carbohydrate factor (0.88). Then, while the bowl of cereal is still sitting on the gram scale, zero out the scale and pour in the milk. Use the carbohydrate factor for milk (0.05) to figure how many grams of carbohydrate you've added to the cereal. If you want some banana slices in your cereal, zero out the scale again and slice in as much banana as you want. Multiply the weight of the banana slices by the carbohydrate factor for bananas (0.23), and add that to your running total. Result? One bowl of cereal with the exact amount of carbohydrate known—and only one bowl and one spoon to wash.

CARBOHYDRATE FACTOR REFERENCE LIST

The carbohydrate factor of a food is the percent of the food's total weight that is carbohydrate. Multiply the weight of a portion of food in grams by its carbohydrate factor to find the number of grams of carbohydrate in it. (The numbers listed here are based on the USDA Nutrient Database.)

BREADS & GRAINS		
Bagel	0.56	
Biscuits	0.45	
Bread	0.53	
Macaroni, plain	0.23	
Muffins	0.45	
Pancakes, prepared	0.44	
Rice, cooked	0.24	
Spaghetti, plain	0.28	
CEREALS, COLD		
Cherrios	0.70	
Corn Flakes	0.84	
Grapenuts	0.83	
Puffed Wheat	0.77	
Rice Krispies	0.88	
Total	0.79	
Wheaties	0.80	
CEREALS, HOT		
Cream of Wheat	0.14	
Oatmeal	0.10	
Roman Meal	0.14	
COMBINATION FOODS		
Lasagna	0.16	
Macaroni & Cheese	0.20	
Pizza	0.28	
DESSERTS & CANDIES		
Angel Food Cake	0.60	
Banana Bread	0.46	
Brownie with nuts	0.50	
Cookies		
Animal	0.80	
Chocolate Chip	0.59	
Oatmeal Raisin	0.72	
Doughnut, cake	0.52	
Fudge with nuts	0.69	
Peanut Brittle	0.73	
Pies		
Apple	0.37	
Lemon Meringue	0.38	
Pecan	0.23	
Pumpkin	0.23	
FRUITS		
Apple	0.13	
Apricots		
fresh	0.13	
dried	0.60	
Banana	0.20	
Cantaloupe	0.08	
Grapes	0.14	
Peaches, fresh	0.10	
Pears, fresh	0.15	
Prunes, dried	0.67	
Strawberries	0.08	
Watermelon	0.06	
SNACKS		
Almonds	0.19	
Cashews	0.26	
Corn chips	0.57	
Crackers		
Graham	0.73	
Saltine	0.70	
Marshmallows	0.78	
Peanut butter	0.17	
Popcorn, no butter	0.78	
Potato chips	0.50	
Walnuts	0.15	
VEGETABLES		
Avocado	0.05	
Beans		
Green, raw	0.07	
Green, cooked	0.05	
Kidney, lima, pinto, red	0.21	
Beets, boiled	0.07	
Carrots		
Raw	0.10	
Cooked	0.07	
Corn		
Steamed	0.19	
Creamed	0.20	
Potatoes		
Baked	0.21	
Boiled	0.15	
French Fries	0.34	
Squash		
Summer, cooked	0.03	
Winter, baked	0.15	
Winter, boiled	0.09	

CARBOHYDRATE FACTORS AT A GLANCE

To calculate the grams of carbohydrate in the foods you eat using carbohydrate factors, you need a scale that gives weights in grams (not pounds and ounces) and a source of carbohydrate factors (either a list, package labels, or the USDA Nutrient Database, www.nal.usda.gov/fnic/foodcomp.search). It also helps to have a calculator. Here's what to do:

- Place your plate (or bowl or cup) on your scale and set the scale to zero.
- Put the portion of food you plan to eat on the plate. Make sure the food is in the form you plan to eat it. For example, rice should be cooked before weighing, oranges should be peeled, and grapes should be removed from the stem.
- Note the total weight of the food in grams. Keep in mind that the total weight of the food is not the number of grams of carbohydrate in it.
- Find the food's carbohydrate factor using your list, the Nutrition Facts panel of a package label, or the USDA Nutrient Database.
- Multiply the food's total weight in grams by its carbohydrate factor. The result is the number of grams of carbohydrate in your portion of food.

EXAMPLE

- You are having white rice as part of your meal. You put your plate on the scale, set it to zero, and dish up a portion of the cooked rice. Your scale tells you it weighs 250 grams.
- From the Carbohydrate Factor Reference List, you find that the carbohydrate factor for white rice is 0.24 (meaning that 24% of the total weight of cooked rice is carbohydrate).
- You multiply 250 grams by 0.24 to find the amount of carbohydrate you will be eating: 250 grams of cooked rice x 0.24 = 60 grams of carbohydrate.

To use carbohydrate factors correctly, you must weigh the food exactly as you will eat it. If you peel the food before eating it, you should peel it before weighing it. If you cook the food before eating it, you should cook it before weighing it.

Here, however, some caution is in order. The Nutrition Facts information found on packages of rice, pasta, popcorn, dried legumes, and similar foods is for the raw or dry item, not the cooked product, so you cannot use the label information the way you can for cold cereal. For items like these, it's better to use a resource such as the USDA National Nutrient Database for Standard Reference, a searchable government Web site located at www.nal.usda.gov/fnic/foodcomp/search, which lists nutrients in cooked portions of food as well as uncooked.

ANALYZING RECIPES

Once you know how to figure and use

carbohydrate factors for individual foods or combinations of foods, you can use them to analyze recipes with multiple ingredients, as well. It's merely a matter of figuring the grams of carbohydrate for each ingredient, adding them up, preparing the dish, then weighing the entire dish and dividing the weight of the dish by the total number of grams of carbohydrate in the dish. The result is the carbohydrate factor of the dish. Say you're making a pot of chili using canned goods and packaged seasonings. Using the information on the labels, list the ingredients, amounts to be used, and grams of carbohydrate in those amounts. For the chili, it would look like this:

1 pound hamburger	0 g
1 can (14 1/2 ounces)	
diced tomatoes	14 g
1 can (15 1/2 ounces)	
kidney beans	80 g
1 package seasoning mix	20 g
TOTAL	114 g

After it's cooked, weigh the entire batch of chili on your gram scale. Take the total weight and divide that into 114 (the total grams of carbohydrate in the recipe). The result is the carbohydrate factor for your pot of chili. Now place the bowl you will eat from on your scale, zero it out, and ladle up however much you want to eat. Multiply the weight of your portion by the carbohydrate factor. Don't forget to also weigh any crackers, taco chips, or cheese that you like to eat with your chili and calculate its carbohydrate content as well using its carbohydrate factor.

A LIFETIME OF CALCULATIONS?

At first, using carbohydrate factors requires a fair amount of time and arithmetic, but over time, it gets easier. For one thing, most people eat the same 75 foods over and over again. If you remember to write down the carbohydrate factors of the foods

WHERE TO FIND CARBOHYDRATE FACTORS

No master list of carbohydrate factors has been published, but the USDA Nutrient Database can provide much of the information you need, and some partial lists have been published. However, because different lists may use different sources of nutrient information, you may notice slight variations in carbohydrate factors.

USDA NUTRIENT DATABASE

www.nal.usda.gov/fnic/foodcomp/search

This database lists more than 7,100 items, including processed, packaged, and fresh foods. To find carbohydrate factors using this database, first search for the food you want and select an amount of 100 grams. Scroll down the resulting table to "Carbohydrate, by difference" and note the "Value per 100 grams of edible portion." Divide that number by 100 (or move the decimal point two places to the left), and you have the carbohydrate factor for the food.

The POCKET PANCREAS

PUMPING INSULIN

STOP THE ROLLERCOASTER

These books, all coauthored by John Walsh, P.A., C.D.E., contain lists of more than 300 carbohydrate factors for various foods. They can be purchased in bookstores or ordered through www.amazon.com. The Pocket Pancreas and Pumping Insulin can also be ordered through www.diabetesnet.com.

you eat regularly, there's no need to recalculate them. Simply keep a list in a convenient place to use when you're ready to eat. For recipes, write the carbohydrate factor on the recipe card or in the cookbook (but remember that you'll have to recalculate if you substitute ingredients).

Steven, 16, has found a way to make using this system convenient and user-friendly. Steven has his own kitchen drawer, in which he keeps his scale and calculator. On the inside of the cabinet door above his drawer, he has taped his list of carbohydrate factors for the foods he eats regularly. Steven also keeps package labels for items such as granola bars and Halloween candy that are individually wrapped but bought in bulk, so that only the outside box or bag has a Nutrition Facts panel.

When it's time for dinner, Steven pulls out his scale and calculator, places his dinner plate on the scale, and zeros it out. He then serves himself, weighing each item as he adds it to the plate, and looking up the carbohydrate factor on his list. For example, he might first serve himself some rice, check its carbohydrate factor, and multiply the weight of the rice by its carbohydrate factor. He

places the result of that calculation in the calculator memory, zeros out the scale again, and adds some broccoli to his plate. Once again he looks up the carbohydrate factor, multiplies it by the weight of the broccoli, and adds that result to the grams of carbohydrate in the rice. He repeats this for each meal item, keeping a running tally of the grams of carbohydrate he is about to consume. When he's got his total, he programs his insulin pump to deliver just the right bolus dose to cover the carbohydrate in his meal. If Steven comes back for seconds, he repeats the whole process, and when it's time for dessert, he does it again.

WHO CAN BENEFIT?

Using carbohydrate factors can be a useful addition to the diabetes toolbox of anybody who wants to improve his overall blood glucose control. For people who use insulin, getting a really accurate carbohydrate count can mean more accurate dosing of pre-meal rapid-acting insulin and perhaps fewer episodes of high or low blood glucose.

For people who use oral diabetes medicines or who manage their diabetes with diet and exercise, using

accurate carbohydrate counts can make it easier to eat consistent amounts of carbohydrate from one day to the next, and that can make it easier to determine whether their intake of carbohydrate matches their pancreas's output of insulin. You know you have a good match when blood glucose levels two hours after the beginning of a meal are within target range. If your blood glucose levels after eating are consistently higher than your goal range, you can precisely lower your carbohydrate intake and assess the change. (Keep in mind, however, that not all blood glucose control problems can be resolved by eating less carbohydrate and that cutting out entire categories of food can leave your diet low in necessary nutrients. If you're having trouble with blood glucose control in spite of following a balanced diet, speak to your diabetes team.) So the next time you need to calculate your food intake, why not leave the measuring cups and spoons in the drawer and pull out a gram scale instead? Think of it as another "factor" in helping you manage your diabetes.