

Adjusting Food Intake

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Knowing when and how to adjust your food intake for physical activity is one of the most important tools for keeping your blood glucose levels as normal as possible.

This is not always an easy feat to accomplish, however. It does help to know more about how the different macronutrients (that is, carbs, protein, and fat) are metabolized and how quickly they are available for use by your body.

Carbs: These are the most important energy source for all types of exercise. At rest, our bodies typically use about 60 percent fat, 40 percent carbs. Once you start to exercise and reach any intensity higher than an easy stroll, you switch to higher carb usage (even when your cardio machine tells you you're in a "fat burning" range--just ignore it, please!). All exercisers doing long duration exercise benefit from supplementing with carbs throughout, even if they don't have diabetes. Most research has shown that trained athletes without diabetes can burn a maximal amount of carbs that they consume during exercise, around 78 grams per hour while doing fairly hard cycling. Having high levels of insulin on board may increase that amount, but probably not by too much.

What types of carbs should you eat during exercise? Carbs with a higher glycemic index (GI) are absorbed more rapidly and raise blood glucose levels more quickly. They're also easier to digest while you're exercising than ones with a lower GI (such as black beans). So, even if you don't eat a lot of high GI carbs regularly, you may need to supplement with them while you're exercising. Examples of higher GI carbs include sports drinks, regular sodas, Gu (or anything made with glucose or dextrose), bagels, saltine or Graham crackers, pretzels, hard candy, etc. Any carbs in foods with a high fat content (such as potato chips) will be absorbed much more slowly and may not be that helpful during exercise.

How much carbohydrate should you normally eat? Your brain and nerves use about 130 grams of glucose daily as their primary fuel, so if you eat fewer carbs than that on a daily basis, some protein will have to be converted into glucose. It may be harder to restore your muscle glycogen levels between workouts on subsequent days if you don't eat probably at least 40 percent of your calories as carbohydrate (and enough calories), although adapting to a low-carbohydrate diet over several weeks can help. If you take in less carbohydrate, it may raise your risk of developing hypos overnight and during subsequent workouts. The carbs you eat on a daily basis, though, can have a lower GI than exercise ones.

A note about low-carb eating: The diets people follow may impact their performance and ability to be active. Many people are currently following low/lower-carb meal plans to better manage their blood glucose. So how low on carbs can "low-carb athletes" with diabetes safely go? In all likelihood, it depends on the sport and the level of athlete. Without a doubt, most people with diabetes can benefit from avoiding or limiting intake

of refined carbohydrates and foods with a higher GI to better manage diabetes but going to the extreme of avoiding nearly all carbohydrates or severely restricting intake may not be necessary. If you do decide to try a low-carbohydrate diet, keep in mind that adapting to training with fewer daily carbohydrates requires several weeks—do not just cut carbohydrates for a few days and expect to feel good during any type of exercise. For real-life athlete examples of diets followed for different sports and impact of low-carb eating, refer to Chapter 4 ("Eating Right and Supplementing for Activity") in [The Athlete's Guide to Diabetes](#) (2019).

The general recommendations that follow for grams of carb intake apply solely to during the activity (based on duration and intensity), not before or afterward, and they also assume that you have not taken any extra insulin recently:

Table 2.2 Carbohydrate Increases for Aerobic Activities in Grams

Duration (min)	Intensity ^a	Pre-Exercise Blood Glucose in mg/dL (mmol/L)			
		<100 (5.6)	100–150 (5.6–8.3)	150–200 (8.3–11.1)	>200 (11.1) ^b
30	Easy	5–10 g ^c	0–10 g	0–5 g	None
	Moderate	10–20 g	10–20 g	5–15 g	0–10 g
	Vigorous	15–30 g	15–30 g	10–25 g	5–20 g
60	Easy	10–25 g	10–20 g	5–15 g	0–10 g
	Moderate	20–50 g	20–40 g	10–30 g	5–20 g
	Vigorous	30–75 g	30–60 g	15–45 g	10–30 g
>60	Easy	10 to 20 g of carbohydrate per additional hour			
	Moderate	20 to 40 g of carbohydrate per additional hour			
	Vigorous	30 to 60 g of carbohydrate per additional hour ^d			

Table Notes:

- Easy activities are defined as less than 40%, moderate 40% to 59%, and vigorous 60% to 89% of heart rate reserve
- For a starting blood glucose above 250 mg/dL with moderate or high ketones, you may need a dose of rapid-acting insulin to lower glucose during an activity, not any extra carbohydrate

- You should consume rapidly absorbed carbohydrates except possibly after the first hour when a mixture of carbohydrate sources or other foods may be helpful
- You may need up to 75 grams per hour to prevent lows when you have higher insulin levels (if you take insulin)

If you don't use insulin and don't take certain diabetes pills that cause insulin release (sulfonylureas, such as Amaryl, DiaBeta, Diabinese, Glucotrol, Glynase, and Micronase), then you likely won't need to eat anything for exercise lasting less than an hour. Most exercisers (with or without diabetes) supplement with carbs during longer duration activities, though.

Protein: During most exercise, protein contributes less than 5 percent of the total energy and is never considered a key fuel, but it is important for other reasons. You must take in enough protein in your diet to repair your muscles after exercise, to make hormones and enzymes, and to stay healthy. Likely, you should consume at least 12 to 35 percent of your daily calories as protein. Typically, an ounce of chicken, cheese, or meat contains about 7 grams of protein.

Taking in more protein and slightly fewer carbs after exercise can help keep your blood glucose more stable for longer because it takes 3 to 4 hours for protein to be fully digested, and a certain percentage of it (variable) is converted into blood glucose. You can eat protein strategically to prevent later-onset hypos if you are an insulin user.

Fat: While your body has almost unlimited stores, "fat burns in a carbohydrate flame," which means that your body can't use fat effectively during exercise, even as an alternate fuel, once you've depleted your carb stores (muscle glycogen and blood glucose). You simply won't be able to continue exercising at the same intensity or at all if you get low or your glycogen is used up. Consuming fat after exercise can help keep glucose higher later on as it takes up to 5 to 6 hours to fully digest. When the digested fat that you ate earlier hits your bloodstream, you'll be insulin resistant, which spares blood glucose.

What is the effect of exercise training on fat use? While you become better at using fat with training, fat use is dependent on how hard you're working out. If you run 9-minute miles now and after training you run 8-minute miles instead, you'll only increase your fat use if that's a lower relative percentage of your maximal aerobic capacity. In other words, if 9 minutes per mile was 50% of your maximal and an 8-minute mile after training is still 50% of your new (higher) max, your fat use is close to the same or only slightly higher. The only time fat use increases significantly is when your relative intensity decreases. If you still choose to run 9-minute miles after training, that's a lower relative intensity, and you will use more fat than before.

Also, it doesn't really matter how much or how little fat you use when you're exercising--it's all about how many calories you use up when it comes to weight loss. Using more

fat will make you to use less glucose, though, which is why training reduces the carbs you need doing the same activity after training.

Other considerations and advice:

- The above carb intake recommendations assume you're not changing your insulin doses before or during the activity, but you may need to do both (i.e., eat more and lower insulin) for longer duration activities
- They only give you a starting point for carb intake--it will take some trial-and-error to determine what works best for you in every situation
- When doing intense, near-maximal exercise, you will likely not need any carbs during the activity, but watch out for hypos a few hours later
- Competitions usually have more of a glucose-raising effect (especially when nervous) than practices, and you may need fewer carbs for events
- If you use a pump and disconnect it during exercise, your carbohydrate needs may be significantly less than suggested
- You may need to take in extra carbs or other food before, during, and after activity (depending on your intensity, duration, starting blood glucose, etc.)
- Consume some protein and fat after exercise and also at bedtime to prevent lows later on and overnight
- Check your blood glucose more often if you had a bad low or exercised hard in the 24 hours prior to your latest workout--you may need more carbs
- Doing new or unaccustomed exercise is more likely to result in hypos, both during and afterwards, and will likely require a greater carb intake overall
- Eat something during the "window of opportunity" (30 minutes to 2 hours after exercise) when muscle glycogen is being replenished at the fastest rate with little need for insulin to help prevent later-onset lows
- If you take any insulin to eat anything within 2 hours after exercise, you will likely need less insulin to cover it than normal
- Prevent the lows that can occur 6 to 12 (and up to 48) hours following exercise with balanced intake of carbs, protein, and fat

How to deal with spontaneous exercise: Let's say someone asks you to go play tennis, but you just took some insulin to cover a meal, and you didn't cut it back. Now you are going to have to compensate for playing tennis entirely with food intake (unless you wear a pump and can lower your basal insulin delivery).

Although your body usually only has about 5 grams of glucose total in the blood, if you just took some rapid-acting insulin that will peak in 30 minutes and last about 2 hours, you will either have to eat some glucose every 10-15 minutes or consume some other types of carbs to cover your needs (depending on how much insulin you took, the exercise intensity and duration, etc.). A more balanced food (e.g., peanut butter crackers) or an additional mini meal may be necessary to prevent lows later on during and after the activity.

The fastest treatment to counter extra insulin is anything containing straight glucose (also marketed as dextrose): glucose tablets, glucose gels, Gu, most sports drinks, Smarties candy, etc. Sucrose (white sugar) in regular sodas and candy also works because it is half glucose. In this case, fruit or juice (fructose) can be used to help prevent lows a little later on since it is absorbed more slowly.

Caution: If you need more help estimating how many carbs to eat, check with your health care provider for recommended changes and further guidance.

***Disclaimer:** The information that is provided does not replace your relationship with your doctor. The information is for your general use, so be sure to talk to a qualified healthcare professional before making medical decisions or if you have questions about your health.*