



Exercise and Diabetes

»» **What does a fire need to burn? Fire needs oxygen from the air and fuel like wood. Your muscles work the same way. They need oxygen and the right kinds of fuel.**

The kind of fuel depends on the type of exercise. Fat burns slow and steady, like adding wood to a fire, and are good for exercises like walking or a slow jog. Carbohydrates, or sugar, burn hot and fast, like pouring gasoline on a fire. Sugars are good for a burst of high intensity exercise like sprinting and weightlifting. Most exercise uses a mix of fat and sugar.

When you exercise hard, your muscles need sugar. Some sugar is already stored in your muscle. This is called muscle glycogen, and the muscle mostly relies on this source of sugar during short or medium exercise. We also have sugar from the blood, called blood glucose. This sugar, taken into the muscle from blood during long exercise, helps fuel the muscle and refill the muscle glycogen fuel tank in exercise recovery. As blood sugar goes down during exercise and exercise recovery, the liver senses the low blood sugar and releases sugar to help keep blood sugar levels normal.

Generally, this system seems straightforward. However, in people with diabetes, the process of using and replacing sugar may not work normally, which could affect exercise performance, health and safety. Here are some tips to keep people with Type I and Type II diabetes safe during exercise.

Type I Diabetes



Insulin tells the body to lower blood sugar (glucose). This hormone works by telling tissues, like muscles, to take sugar from the blood and store it. It also tells the liver to stop putting more sugar into the blood. This happens normally after you eat as food increases blood sugar levels. In those with Type I diabetes, the body does not produce enough insulin to lower blood sugar. Type I diabetes can only be treated with insulin injections or an insulin pump.

What happens to sugar during exercise?

During exercise, muscles do not rely on insulin to accept sugar from blood, yet exercise makes insulin work better. People who take insulin to control blood sugar often see their normal dose (or the dose that works well when not exercising) causes blood sugar to be too low during or after exercise.

The National Youth Sports Health & Safety Institute will be the recognized leader and advocate for advancing and disseminating the latest research and evidence-based education, recommendations and policy to enhance the experience, development, health and safety of our youth in sports.

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Things to Consider during Exercise

When someone injects insulin, blood sugar goes down. If they start to exercise soon after the injection, the exercise also lowers the blood sugar. This combined effect can cause *hypoglycemia*, or low blood sugar. If this happens, a child may seem shaky or trembling, confused, dizzy; have an overly fast heartbeat and cold and clammy hands; and may even lose consciousness. Hypoglycemia can be confirmed by checking blood sugar level with a meter. If a child is awake, hypoglycemia can be treated with a small drink or snack with simple sugars like juice, soda, sport drink or hard candies. These should always be available and nearby during exercise. The coach, parent, child and any other important adult should know where the snack is located. The child should be allowed to check their blood sugar throughout exercise and eat/drink the snack, if necessary. Hypoglycemia can be prevented during and after exercise. A family should work with their diabetes doctor to determine when a pre-exercise snack may be helpful or how to decrease insulin dosing before exercise.

Hyperglycemia, or blood sugar that is too high, can also happen during exercise. It can happen if blood sugar is high before starting exercise or if a child consumes a lot of high sugar snacks or drinks during exercise. Certain types of maximal intensity exercise such as sprints and weightlifting,



and even the excitement of a competitive event, can also increase blood sugar. A child should closely monitor their blood sugar during these types of activities and consider adding some light/moderate intensity aerobic exercise or a very small amount of insulin to help lower blood sugar, if necessary.

Things to Consider after Exercise

After exercise, the muscle's sugar or glycogen fuel tank is low. The muscles refill the glycogen fuel tank by taking in sugar from blood after exercise. With Type I diabetes, the risk of hypoglycemia is not over when practice finishes; it can last 12 to 24 hours after hard exercise. A child should eat/drink something with carbohydrates or sugar after exercise and closely watch their blood sugar levels.

Type II Diabetes

People with Type II diabetes normally make their own insulin, yet their body has trouble using the insulin. This is due to inflammation in the body from extra weight gain and inactivity. With Type II diabetes, muscles do not sense insulin to know when to take sugar out of the blood and store it when blood sugar is high, like after a meal. This causes high levels of sugar and insulin in the blood. Also, in Type II diabetes, the liver may not sense the insulin and may continue to add sugar, making blood sugar even higher.

What happens to sugar during exercise?

Exercise makes insulin work better. With Type II diabetes, exercise helps the body use the insulin it already produces to keep blood sugar levels normal. If someone with Type II diabetes takes insulin injections, the same issues apply as for Type I diabetes (see *Things to Consider during/after Exercise for Type I Diabetes* above).



Diabetes and Exercise: Do's and Don'ts

Type I Diabetes		Type II Diabetes	
<p>Do</p> <ul style="list-style-type: none"> • Exercise and play sports! It is safe and healthy. • Talk with your doctor before starting any new exercise routine. Also, communicate with the coach or exercise leader. • Check blood glucose before and during exercise. • Aim for a pre-exercise blood sugar between 150-200mg/dL or 8.3-11.1mmol/L. • Have a plan for low blood glucose and share that plan with coaches and important adults. Always have a sugar-rich snack available. Make sure others know where the snack is located. • Watch for signs of <i>hypoglycemia</i> like shaking or trembling, confusion, dizziness, overly fast heartbeat, or cold and clammy hands. 	<p>Don't</p> <ul style="list-style-type: none"> • Exercise if blood glucose is low (<100mg/dL or <5.5mmol/L). • Exercise if blood glucose is too high (≥250mg/dL or ≥13.9mmol/L) or if large ketones are present. • Stop checking blood glucose after exercise. A child should continue to closely monitor blood glucose for 12 to 24 hours after exercise. • Go to bed if blood glucose is <130mg/dL (7.2mmol/L). Have a small snack if glucose is too low. Work with a child's diabetes doctor to learn when you might use a snack at bedtime to prevent overnight hypoglycemia. 	<p>Do</p> <ul style="list-style-type: none"> • Regular and structured aerobic and resistance exercise! It is the best treatment for Type II diabetes. • Build up to 60 minutes of moderate-to-vigorous intensity exercise 7 days per week or 420 total minutes per week. • Take care of your feet! Watch for cuts and bruises after exercise and treat any injuries. • Walking or light exercise after a meal. It may help reduce blood glucose. • Control portions and eat a healthy diet. 	<p>Don't</p> <ul style="list-style-type: none"> • Have sugar-rich drinks or snacks, especially during or after exercise. • Focus on exercise only. Healthy nutrition is also very important!

Things to Consider during Exercise

People with Type II diabetes should exercise normally, without any special considerations. If a child does not regularly participate in exercise, they should start exercising with low intensities and short durations and work up to high intensities and long durations.

Benefits of Exercise

Exercise and weight management are the safest and most effective treatments for Type II diabetes.

Regular exercise will make the body more sensitive to insulin. Excess body fat, especially around the abdomen/stomach, can cause damaging inflammation in the liver. Reducing excess body weight lowers inflammation and helps the body become more sensitive to

insulin. The most effective kinds of exercise are a combination of aerobic (cardio) and resistance (weightlifting) focused on large muscle groups like legs, hips, arms and chest. Note that although exercise is one of the best treatments for Type II diabetes, a healthy diet with portion control is also very important.

Insulin-Dependent Type II Diabetes

In some cases, those with Type II diabetes will no longer be able to make their own insulin and will require insulin injections or an insulin pump. In these cases, people should follow the same precautions as those with Type I diabetes to prevent hypoglycemia.

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