

Diabetes Management for Physical Activity When On Insulin Injections

KEY MESSAGES

- Blood glucose (BG) tends to be lower during activity, but it depends on the person and the type of activity. Monitoring your BG is the best way to find out how a certain activity affects YOU.
- You *may* need to eat extra carbohydrates or reduce your insulin for activity.
- The effect of exercise can last up to 24 hours so you may need to make changes after the activity as well.

Activity and BGs

- Glucose and fat are the main energy sources for muscle during activity.
- With diabetes, we need to make adjustments for activity, to prevent highs and lows.
- The adjustments we make will depend on the type of activity.
- There are two main types of exercise. These are:
 - **Aerobic** (i.e. running, swimming, biking)
 - Insulin may be absorbed more quickly and glucose is used up faster.
 - Increased risk of hypoglycemia (low BG).
 - **Anaerobic** (i.e. sprinting, weight lifting)
 - Adrenaline is released. Adrenaline increases our blood glucose.
 - Increased risk of hyperglycemia (high BG).
- Activity/exercise can be a combination of both aerobic and anaerobic (i.e. hockey, soccer).

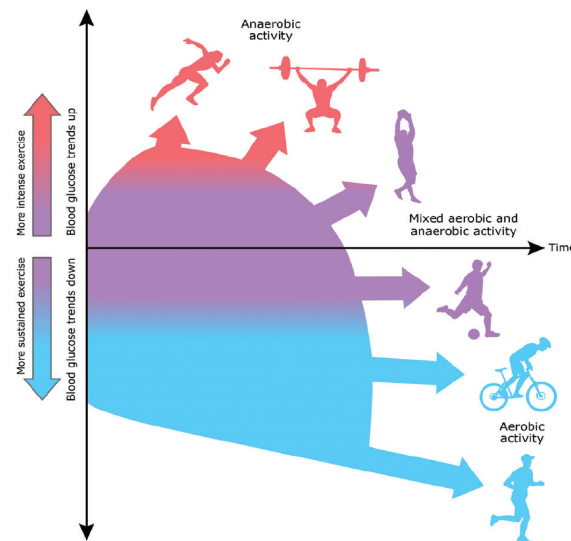


FIGURE 2 Illustration of different types of exercise including mutual differences in intensities and the way this affects glucose levels. Illustration by Anne Greene, Senior Medical Illustrator, reproduced with permission from UpToDate, Inc. Copyright © 2017 Duration and intensity

IMPORTANT!

Monitoring your blood glucose is the key to figuring out how YOU respond to each different activity. These guidelines may not work for everyone with every exercise!

Blood Glucose (BG) Monitoring For Physical Activity

When Should I Be Checking My Blood Glucose With Activity?

- Check BG before and after activity, especially if you haven't done the type of exercise before.
- If you're active for a long time (> 1 hour), BG checks during the activity can be helpful.
- Check BG if you feel low or you feel like you're not performing as well as normal.
- Continuous glucose monitoring (CGM) can be especially helpful to monitor trends during activity.

Why Should I Be Checking My Blood Glucose Before Activity?

- Checking **before** activity tells you if you need to take action before starting exercise.
 - This helps to prevent highs and lows which keep you safe and allows you to perform better.
 - If you have an unexplained BG over 17 before your activity, check for ketones.
 - If blood ketones are >0.6 mmol/L or urine ketones are small or higher, do not exercise and refer to ketone management.
 - See "Adjustments to prevent highs and lows" on the next page to learn what to do based on your BG level before activity.

Why Should I Be Checking My Blood Glucose After Activity?

- BG can be high right after activity but in many cases will drop on its own. Monitoring after activity will tell you if your BGs tend to drop or remain high after that activity.
- Your body can remain more sensitive to insulin for up to 24 hours after activity, so regular BG checks will help you to understand how you respond to each activity.
- If you are starting a new activity in the afternoon or evening, an overnight BG check to watch for lows is helpful - a common time for overnight lows is between 10pm and 2am.

How Can I Use My Blood Glucose Trends To Improve My Control With Future Activity?

- Look and see if your BG goes up, down, or stays stable during each type of exercise.
- Track the differences in your BG trends with a practice vs a game.
 - For example, it is common for someone to go low during a hockey practice when they are skating hard and doing drills however they may go high after a game when they are doing shifts and have a lot of adrenaline from the rush of the game.
- If you tend to go low, you may need more carbs or less insulin.
- If you tend to go high, it will be important to see how long you stay high.

Adjustments To Prevent Highs and Lows

- There are different strategies to prevent glucose fluctuations during and after activity.
- *In general*, if your BG goes low during the activity you can lower the amount of insulin given or increase the amount of carbs eaten.
- Which is better? Lowering insulin or eating more? This depends on a number of things.
 - If an activity is unplanned and you have already taken your insulin, then you will need to eat extra carbs.
 - If you want to eat more carbs, this is your chance! Growing children and teens may like this choice better.
 - If you prefer not to eat for activity, then you may prefer to lower your insulin.

Adjustments BEFORE Activity – (Choose 1 option, or you may need a bit of both.)

1. Adjusting INSULIN for Activity That Lowers BG

Some things to consider are:

- a) What insulin is active when the activity is planned?

Time of activity	On 2 or 3 injections per day (rapid + N/NPH)	On MDI (basal insulin + rapid with each meal)
Morning	AM (or breakfast) rapid	AM (or breakfast) rapid
Afternoon	AM N/NPH	Lunch rapid
Evening	PM (or supper) rapid	PM (or supper) rapid

- b) How much to lower the insulin? **Everyone is different, but this is a good place to start:**
- If the exercise is 1-2 hours after a meal with **rapid** insulin, **lower rapid by 25-50%**. (How much to lower the insulin depends on how much you eat and the length of the activity.)
 - Another way to think about this is to estimate how many carbs you will burn during your activity and subtract this amount from the total carbs in your meal. Only take insulin for the remaining carbs.
 - Example – Cross-country skiing. You estimate you will burn 25 grams of carb during the hour of activity which is one hour after breakfast. The meal total is 45 grams of carb.
45 grams carb – 25 grams carb (will be burned) = 20 grams carb remaining.
 - Only take insulin for the 20 grams of carb. (If you don't already have a ratio, ask the team.)
- If taking **AM N/NPH** and the activity is over lunch or early afternoon, lower this insulin by **10-30%**.
 - If you have an all-day activity, consider lowering your **basal** insulin by **10-30%**. If you are taking basal insulin in the morning, consider reducing your morning basal insulin. If you take your basal insulin in the evening, consider lowering your evening basal insulin.
 - Think of doing this for all-day activities and things like summer camps, long distance walking, skiing, water sports, sports tournaments with multiple games, etc.

2. Adjusting FOOD for Activity That Lowers BG

Some things to consider are:

- What is your BG before the activity?
 - As a general guide, we suggest eating something before starting the activity if your BG is less than 7 mmol/L.
 - This is just a starting point. You might find that for a certain activity, i.e. swimming, you need to have a BG of 9 to prevent a low. Or you may find that you go too high if you eat for a BG of 7 – that 6 is a better number for you for that activity.
 - If your BG is below 5, then you should delay the activity until BG is above 5

How much should I eat? With activity and food, you need to think of 2 things:

a) Extra food for fueling your diabetes (You don't take insulin for this extra food.)

- Just before the exercise: 10-15 g of carbs (if BG is less than 7)
- During the exercise:
 - For anaerobic/short duration exercise, extra food is not usually needed
 - For aerobic/longer duration exercise, start with 10-15 g for every hour of moderate to intense activity
 - If you want to be more precise, another rule of thumb you can use is: 0.5 to 1 gram of carb/kg body weight for each hour of activity (roughly 0.2 to 0.4 grams of carb/pound).
 - A 20 kg child would then eat 10-20 grams per hour of activity
 - A 60 kg teen would eat 30-60 grams per hour of activity

These are suggested carb amounts. You will learn over time what amount is right for you.

b) Extra food for fueling your exercise (You do need insulin for this extra food.)

- Someone without diabetes who goes on a long bike ride is likely to be hungrier and want to eat more. You can do this too. The difference is that you should take extra insulin for this extra food if it is more than you will be burning for activity. If you are on MDI or have a ratio, you have been taught how to do this. If you are on 2 or 3 injections a day, ask your diabetes team about ratios.

Adjustments AFTER Activity

- You may be high after an activity, especially if it's a game or activity with lots of adrenaline. If you correct with rapid insulin right away, you may go too low.
 - We suggest that you *either* wait an hour before correcting, or you only give half of the usual correction.
- Exercise effects may last up to 24 hours as muscles need glucose to replenish their reserves. Usually this puts you at risk for a "delayed low" after activity. To prevent this you can:
 - Eat extra carbohydrate if your blood glucose usually drops.
 - Take less insulin for your meal or snack post-activity.
 - Consider reducing your basal insulin dose as above if you typically have lows post-activity.

Other Factors Affecting Blood Glucose With Physical Activity

- Insulin may be absorbed quicker if injected at a site where the muscles are very active
 - For example, using legs when going for a bike ride may increase risk of hypoglycemia.
- Hotter temperatures may increase blood flow to injection sites
 - This can cause insulin to be absorbed more quickly as well.
- Your exercise performance can be negatively affected if you run high or low in the days leading up to the event.
 - Having good control leading up to important sporting events or activity will help you to perform to the best of your ability.

**Please don't hesitate to connect with your diabetes team
about managing diabetes around activity.**

Diabetes Management with Exercise when on Injections - QUIZ

1. If you don't make adjustments for physical activity, which types of exercise put you more at risk of hypoglycemia? Select all that apply.
 - a) Hockey
 - b) Biking
 - c) Swimming
 - d) Sprinting
 - e) Running

2. When should you be checking your blood glucose with exercise?
 - a) If you are feeling low.
 - b) Before activity
 - c) After activity
 - d) During the activity if you're active for more than 1 hour
 - e) All of the above

3. True or False. Once you checked your blood sugar before your soccer practice and you know how your body reacts to it, you don't have to check blood sugar the next time you're playing soccer.

4. Which hormone is released and increases your blood sugar when you are doing an anaerobic type of exercise?
 - a) Glucagon
 - b) Insulin
 - c) Adrenaline
 - d) Melatonin
 - e) Leptin

5. What are two things you can do to keep blood sugars stable during and after activity?
 - 1.
 - 2.

6. If your blood sugar is 12.4 **before** activity, how much extra carbs do you need to take prior starting a new activity?
 - a) No extra carbs
 - b) 5g of carbs
 - c) 10g of carbs
 - d) 15g of carbs

7. If your blood sugar is 5.5 **before** activity, how much extra carbs do you need to take prior starting a new activity?
 - a) No extra carbs
 - b) 5g of carbs
 - c) 10g of carbs
 - d) 15g of carbs

8. If your blood sugar is 19.6 **before** activity, what should you do?
 - a) Take 15g extra carbs
 - b) Start the activity
 - c) Check for ketones
 - d) None of the above

9. Which strategy can you use **during** activity to avoid hypoglycemia while you are doing an **aerobic** type of exercise?

Answer:

10. What are the strategies you can do to prevent a delayed hypoglycemia after activity?

1.

2.

11. If you are running, which injection site puts you more at risk of hypoglycemia?

- a) Arms
- b) Abdomen
- c) Legs
- d) Back
- e) All of the above