

tackling exercise on an insulin pump



1 | getting started

- One of the biggest challenges with moderate aerobic exercise and type 1 diabetes is the ability to balance activity with carbs and insulin in order to prevent low blood sugars.
- Exercise longer than 30 minutes will likely require extra carbs or adjustments to your basal insulin to avoid a lows blood sugar.
- You may find that after exercising consistently for several weeks, your blood sugar will not drop as significantly or as often as when you first started out.
- The start time of your exercise can play a big role in your body's response. For instance, you are less likely to experience lows if you exercise before breakfast, especially before taking any insulin.

2 | know what insulin to adjust

Adjust the insulin that will have the most effect on your blood sugar while you are exercising:

- if your activity start time is going to be within 2 hours after your meal you may need to adjust your pre-meal bolus*
- if your activity start time is NOT within 2 hours after a meal bolus you will likely need to run a temporary basal rate** - the rate you choose will depend on the intensity of your activity
- NOTE. you will likely need to adjust both, especially if you are exercising in the evening hours.

*3 | know how to use ExCarbs

ExCarbs quantifies how many carbs an exercise will consume based on your body weight. See more exact recommendations on Table 1, page 2.

Calculate yours:

| Weight | _____ kg | Approximate amount of ExCarbs for Activity |
|--------------------|------------------|--|
| Moderate Activity? | ~0.50g/kg/hr | _____ g |
| Intense Activity? | Up to 1.0g/kg/hr | _____ g |

Use this number to assist you in planning your activity (see following scenario) + consider *your* goals when choosing whether or not to eat the extra carbs, adjust your meal bolus, run a temporary basal rate or a combination!

Scenario

- Consider a 70kg person planning to do 1 hour of a moderate intensity aerobic activity approximately 1.5 hours after eating a lunch containing 60g of carbohydrate.
- Current Basal Rate = 0.80u/hr
- Insulin to Carb Ratio = 1:15
- ExCarb amount = 70kg x 0.50g/kg/hr = 35g

OPTION A | consume the carbs

- She would have to consume an additional 35g of carbohydrate to compensate for this activity. She can choose to drink it prior, during and/or after her activity
- Ex. Gatorade™ (14g carbs/8oz). Therefore, she would need a total of 20oz found in 2/3 of a bottle.

OPTION B | adjust meal bolus

- Subtract the ExCarb amount from the total amount of carbohydrates planned for that particular meal, bolus for the difference.
- Planned Carbs - ExCarbs = 60g - 35g = 25g
- She would have to tell her pump that she is only eating 25g of carbs to account for this activity.

OPTION C | run a temp basal

- She calculates her basal rate adjustment based on her ExCarb amount of 35g.
- ExCarbs / insulin:carb ratio = 35g/15g = 2.3U reduction needed over 4 hours (90 min prior + 1 hour activity + 90 min after)
- =2.3U/4 hours = 0.6 unit/hour reduction in basal rate
- Therefore, she would reduce her basal rate to 0.2u/hr (or, a 75% reduction) starting 90minutes prior to her jog and lasting for a total of 4 hours.

**4 | temporary basal rate?

- Start a temporary basal rate at least 90 minutes before you plan to start exercising and run it for the duration of the activity, as well as up to 1-2 hours after you are finished
- If you are doing intense activity or notice your blood sugars tend to drop later on, you may want to extend it for a longer duration and possibly overnight (if you are exercising in the evening).

aerobic | ExCarbs

Different aerobic activities (listed below) require different amounts of fuel. If you want to be more accurate with your ExCarb amount, use this table to assist you.

| Estimation of ExCarbs (g/h) according to type of activity and weight (Canadian Journal of Diabetes. 2006;30(1):72-79) | | | |
|---|----------------------------|--------------|--------------|
| Activity | Weight (mass in kg) | | |
| | 45 kg | 68 kg | 90 kg |
| Baseball | 25 | 38 | 50 |
| Basketball | | | |
| moderate | 35 | 48 | 61 |
| vigorous | 59 | 88 | 117 |
| Bicycling | | | |
| 10 km/h | 20 | 27 | 34 |
| 16 km/h | 35 | 48 | 61 |
| 22 km/h | 60 | 83 | 105 |
| 29 km/h | 95 | 130 | 165 |
| 32 km/h | 122 | 168 | 214 |
| Dancing | | | |
| moderate | 17 | 25 | 33 |
| vigorous | 28 | 43 | 57 |
| Digging | 45 | 65 | 83 |
| Golf (with pull cart) | 23 | 35 | 46 |
| Handball | 59 | 88 | 117 |
| Jump rope (80/min) | 73 | 109 | 145 |
| Mopping | 16 | 23 | 30 |
| Mountain climbing | 60 | 90 | 120 |
| Outside painting | 21 | 31 | 42 |
| Raking leaves | 19 | 28 | 38 |
| Running | | | |
| 8 km/h | 45 | 68 | 90 |
| 13 km/h | 96 | 145 | 190 |
| 16 km/h | 126 | 189 | 252 |
| Shoveling | 31 | 45 | 57 |
| Skating | | | |
| moderate | 25 | 34 | 43 |
| vigorous | 67 | 92 | 117 |

infusion site considerations

site & tubing

- consider the type of activity – swinging motions from baseball, golf, or tennis could dislodge an infusion set on the abdomen
- keep in mind if you are using your arms or legs for your infusion sets, your insulin may be absorbed much more quickly after those areas of the body are exercised
- ensure that tubing isn't exposure for snagging. You may have to secure the site with additional tape.

sweating

- ensure site is adhered properly, as sweating from activity can loosen the attachment. Try skin-tac or IV prep to help with this.

anaerobic | ideas

- High intensity anaerobic activity (i.e. sprinting, power lifting) can initially cause high blood sugars and increase your risk of exercise-induced ketoacidosis.
- One option to prevent this would be to administer a correction bolus for the immediate post exercise blood sugar. Start with 50% of your usual correction dose, as your blood sugar may still drop later on.
- If you find that you have to correct after every intense activity, consider increasing basal insulin 90 minutes prior to the start of the activity. i.e. Start with a rate of 110% of your usual basal rate.
- Many activities are a combination of aerobic and anaerobic exercise so it can be challenging to adjust insulin doses. Try keeping an exercise log to see if there are any patterns to the effects on your blood sugars.

prevention of exercise induced keto-acidosis

- Blood sugar levels higher than 14.0mmol/L prior to exercise may mean a lack of insulin delivery.
- In this case, ketones should be monitored.
 - ✗ If there are NO ketones present, evaluate whether or not the high blood sugar is due to recent food intake, exercise with caution and test regularly.
 - ✓ If there ARE ketones present, a correction bolus will be needed and exercise should be delayed until the ketones are negative.
 - ✓ If ketones persist, you may have to change your infusion set and ensure that insulin delivery is adequate and you may consider contacting your healthcare team.

**** If you have blood ketones >3mmol/L at any point, it is recommended that you to go to the Emergency Room.**

additional resources

Diabetes Athletes Handbook. Your Guide to Peak Performance. Sheri R. Colberg, PhD. 2009.

Pumping Insulin 5th Edition. John Walsh. 2012.

Canadian Journal of Diabetes. 2006;30(1):63-71

Canadian Journal of Diabetes. 2006;30(1):72-79