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## 1. Variables Affecting Blood Glucose Responses to Exercise

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Many factors can impact your blood glucose levels with activities. Below is a list of factors that should be considered when considering carbohydrate intake and insulin adjustments.

- Energy System used (exercise intensity and duration)
- Pre-exercises blood sugar levels
- Training Status (new vs usual activity)
- Prior exercise (same day or day before)
- Type of Insulin used.
- Timing of last meal and composition of meal
- Environmental factors (i.e. Temperature, humidity)
- Recent or current illness
- Type of exercise
- Time of day of exercise
- Previous episodes of hypoglycemia
- Timing of last insulin dose (circulating insulin levels)
- Other glucose-lowering medications
- Level of hydration
- Phase of menstrual cycle
- Pregnancy

## 2. General Bolus Insulin Reductions Before Aerobic Activities Based on Duration and Intensity

Duration (Min)	Intensity (%)		
	Easy	Moderate	Vigorous
30	0-25 %	25-50%	50-75%***
60	25-50%	50-75%	50-100%
120	25-75%	50-100%	75-100%

**Note:** The above changes assume no additional carbohydrates are consumed to compensate for blood sugar levels and that you will start exercise within 1 hour.

\*\*\* Vigorous activity lasting less than 30 minutes may in fact require increase in rapid-acting insulin (rather than decrease in insulin) to counteract the effect of blood glucose raising hormones (i.e. cortisol)

a See defining exercise intensity below.



## 3. Carbohydrate Increases for Aerobic Activities in Grams

Duration (Min)	Intensity	Pre-Exercise Blood Glucose Levels in mg/dL			
		< 100	100-150	150-200	> 200
30	Easy	5-10g	0-10g	0-5g	None
	Moderate	10-20g	10-20g	5-15g	0-10g
	Vigorous	15-30g	15-30g	10-25g	5-20g
	Easy	10-25g	10-20g	5-15g	0-10g

60	Moderate	20-50g	20-40g	10-30g	5-20g
	Vigorous	30-75g	30-60g	15-45g	10-30g
>60	Easy	10 to 20g of carbohydrate per additional hour of exercise			
	Moderate	20 to 40g of carbohydrate per additional hour of exercise			
	Vigorous	30 to 60g of carbohydrate per additional hour of exercise			

## Defining Exercise Intensity:

Exercise intensity can be defined in a number of ways. A quick and easy way to define exercise intensity is using the **talk test**.

### Talk Test

Exercise Intensity	Talk Level	Examples
Light	Normal breathing rate	- Can talk, sing, or whistle while doing the activity.
Moderate	Breathing getting faster	- Can talk, but not sing during activity.
Vigorous	Gasping for breath	- Short of breath/winded, unable to talk during activity.

A more accurate way to determine exercise intensity is to use the **heart rate reserve (HRR)** method. Recommended training intensity ranges using HRR by the American College of Sports Medicine are as below:

- Easy = 30-39% HRR
- Moderate = 40-59% HRR
- Vigorous = 60-89% HRR

### Calculating HRR:

- $HRR = \text{maximal heart rate} - \text{resting heart rate}$ 
  - Easy calculation of maximal heart rate is  $220 - \text{age}$ .

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## 4. Symptoms of Hypoglycemia

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It is important to understand signs/symptoms of low blood glucose levels. Every individual experiences these symptoms differently; thus, honing in on your symptoms over time is critical. Below is a list of common signs/symptoms of low glucose levels that should prompt testing of your blood sugar and appropriate treatment.

- Buzzing in Ears 🦟
- Cold or clammy skin
- Dizziness or lightheadedness 🤯
- Double or Blurred Vision
- Elevated pulse rate
- Fatigue
- Hand Tremors
- Headache
- Inability to do basic math
- Insomnia
- Irritability 😡
- Mental Confusion ?
- Nausea 🤢
- Nervousness
- Nightmares
- Poor Physical Coordination
- Restlessness
- Shakiness
- Slurred Speech
- Sweating 🥵
- Tingling of hands or tongue
- Tiredness 😴
- Visual spots
- Weakness

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## 5. Quick Tips for Managing Hypoglycemia - “Lows”

**ALWAYS CARRY SOMETHING WITH TO TREAT LOW BLOOD SUGAR LEVELS AND MAKE SURE PEOPLE YOU ARE TRAINING WITH KNOW WHERE THEY ARE!**



Treating hypoglycemia events with high glycemic index (GI) foods is best. This means that the carbohydrate/sugar will be digested and raise your blood glucose level quickly.

## 6. Post Exercise Considerations

Following exercise there is a **biphasic** increase in carbohydrate requirements to prevent hypoglycemia.

1. The **30 to 120 minutes after exercise** is a time when your muscles are primed to take up glucose without the need for much insulin. This is a time to refuel and replenish your glycogen stores within your muscles.
  - a. Eating a snack with approximately 15 grams of carbohydrate after strenuous activity within 30 minutes to 2 hours can help restore glycogen levels in muscle and prevent post-exercise lows.
    - i. Consuming protein and fat with this snack will also help prevent hypoglycemia which can occur later due to its slower absorption in the digestive track.
2. Additionally, approximately **7 to 11 hours after exercise** is when athletes can experience hypoglycemia.
  - i. This is particularly important when working out in the evening when monitoring for nighttime lows is essential!
3. Post-Exercise Hyperglycemia
  - a. Glycogen uptake into muscles is important for muscle recovery for recurrent bouts of exercise.
  - b. Generally after exercise muscles can take up glucose easier with less insulin; however, if your blood glucose runs high this may hamper glucose uptake into muscles resulting in quicker muscle fatigue the next time you exercise.
  - c. Therefore maintaining as normal glucose levels as possible after exercise can restore muscle glycogen more efficiently/effectively allowing you to train harder more frequently.