Sports and Exercise
Type1NOW

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You

ADA Guidelines

- Exercise is an important part of the diabetes management plan.
- Regular exercise has been shown to improve
  - Blood glucose control
  - Reduce cardiovascular risk factors
  - Contribute to weight loss
  - Improve well-being

Benefits of Exercise

- Lifespan increases with exercise
  - Steady increase from 500 cal/day to 3500 cal/day
- Exercise needed to burn 3,500 cal/day
  - Walking 3 mph for 7 hours/week
  - Bicycling 10 mph for 5 hours/week
  - Running 9 mph for 2.7 hours/week
**AHA Physical Activity Recommendations**

### Guidelines for healthy adults under age 65
- Do moderately intense aerobic exercise 30 minutes a day, five days a week.
- Do vigorously intense aerobic exercises 20 minutes a day, three days a week.
- Do 8 to 12 strength training exercises, 8 to 12 repetitions of each exercise, twice a week.

### Guidelines for adults over age 65 (or age 50 to 64 with chronic health conditions)
- Do moderately intense aerobic exercise 30 minutes a day, five days a week.
- Do vigorously intense aerobic exercises 20 minutes a day, three days a week.
- Do 8 to 12 strength training exercises, 8 to 12 repetitions of each exercise, twice to three times per week.
- If you are at risk of falling, perform balance exercises.
- Have a physical activity plan.

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**Getting Started**

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**Getting Started**

**Pre-Exercise Evaluation**

- Assess for conditions that might contraindicate certain types of exercise or predispose to injury
  - Such as uncontrolled hypertension
  - Severe autonomic neuropathy
  - Severe peripheral neuropathy
  - History of foot lesions
  - Unstable proliferative retinopathy
- Age and previous physical activity level should be considered
Getting Started
Pre-Exercise Evaluation

- Prior guidelines suggested that before recommending a program of physical activity, the provider should assess patients with multiple cardiovascular risk factors for coronary artery disease (CAD).
- CHD Screening and Treatment, the area of screening asymptomatic diabetic patients for CAD remains unclear, and a recent ADA consensus statement on this issue concluded that routine screening is not recommended.
- Providers should use clinical judgment in this area. Certainly, high-risk patients should be encouraged to start with short periods of low-intensity exercise and increase the intensity and duration slowly.

Diabetes Treatment Tools
for Sports and Exercise

Basal-Bolus Insulin Therapy: Detemir or Glargine at HS and Mealtime Aspart, Lispro, or Glulisine

Insulin Pumps

Variable Basal Rate: Insulin Pump

Continuous Glucose Monitor

Transmitter then sends these values wirelessly to the insulin pump every 5 minutes, where data can be viewed and acted on* in real-time.
Energy Usage in Exercise:

Considerations in Diabetes

Energy Usage in Exercise

- Anaerobic system
  - Stored ATP and muscle glycogen
  - Fuel muscle for up to 2 minutes
  - Powerlifting, sprints, pitching (short burst exertion)
  - Stop and start events, 800 meter runs, 200 meter swimming events
  - Doesn’t reduce blood glucose
- Aerobic system
  - Steady supply of ATP from glucose needed to supply muscle for prolonged or endurance activities
  - ATP generated from glucose source and fatty acids from muscle triglyceride
  - Does reduce blood glucose
- Optimal cardiovascular fitness,
  - Aerobic component,
  - Regular resistance training into your exercise routine as recommended

Relative energy system involvement for competitive sports.

- Anaerobic
  - Weightlifting, Powerlifting
  - Track (sprinting and field events), Diving (platform & springboard)
  - Golf, American football, Swimming (sprints), Gymnastics, Fencing
  - Swimming, Baseball, Softball, Volleyball, Ice hockey, Track cycling
  - Basketball, Soccer, Tennis, Lacrosse
  - Speed skating (500-1000 m)
  - Skiing (slalom & downhill), Field hockey
  - Rowing
  - Running (middle distance), Speed skating (>1500 m)
  - Road cycling
  - In-line skating
  - Cross country skiing
  - Race walking
  - Marathon running
  - Iron Man triathlon
  - Ultra-marathon running
Exercise Effect on Glucose

- Increase in glucose raising hormones
  - Intense exercise
- Increase in insulin sensitivity (higher insulin induced glucose uptake in muscle)
  - Persistent routine exercise
- Glucose consumption
  - Especially longer duration exercise

Hormones With Glucose Raising Effects During Exercise

- Catecholamines (adrenalin)
  - Epinephrine
  - Norepinephrine
- Growth Hormone
- Cortisol

- Exercise (especially intense) can cause an increase in glucose due to an elevation of the glucose raising hormones

Variables Influencing Blood Glucose Response to Exercise

- Exercise Characteristics
  - Type of exercise
  - Intensity
  - Duration
  - How quickly advance with training (progression)
Diabetes and Sports/Exercise: Management Principles

- Start exercise/sport in a safe glucose range
  - Aim for >100 and <200 mg/dl (aim for 150 mg/dl)
  - Take extra insulin if high
  - Take carb if low
- Reduce insulin level if appropriate
  - Depending on type of exercise
- Monitor, monitor, monitor
  - Before, during, and after exercise
  - You have a unique exercise response
- Support glucose level with extra carb if appropriate

Suggested Sample Regimen for Athlete with Diabetes for Practice or Competition

- Check Blood Glucose Prior to Practice or Event
- Check Blood Glucose at Break/End of Quarter/Period/Inning/Etc.
- Most Athletes should try to keep Blood Glucose ~ 150 mg/dl for competition
- Reduce insulin if appropriate
  - Bolus reduction if exercise 1-4 hour post meal
  - Basal reduction if exercise is prolonged
- Snack every 30-60” during practice/event
- Hyperglycemia and/or Hypoglycemia is not only potentially damaging/dangerous, they AFFECT PERFORMANCE
Adjusting Insulin for Sports Activities

■ Running
  – If the glucose is >200-250 mg/dl prior to the run, need sliding scale insulin to lower
  – Reduce the bolus or fast acting insulin for the meal prior to running by 10-30%
  – Reduce the basal or long acting insulin by 20-50%
  – Consider 15-20 gms of carbohydrate supplement for every 30-45° of running

Adjusting Insulin for Sports Activities

■ Swimming
  – If the glucose is >200-250 mg/dl prior to swimming, need sliding scale insulin to lower
  – Reduce the bolus or fast acting insulin for the meal prior to swimming by 10-30%
  – Reduce the basal or long acting insulin by 20-50%
  – Consider 15-30 gms of carbohydrate supplement for every 60° of swimming
Adjusting Insulin for Sports Activities

Basketball
- If the glucose is >200-250 mg/dl prior to swimming, need sliding scale insulin to lower
- Reduce the bolus or fast acting insulin for the meal prior to playing by 10-30%
- Reduce the basal or long acting insulin by 20-50%
- Consider 15-30 gms of carbohydrate supplement for every 60° of play

Colberg, Sheri. Diabetic Athlete's Handbook

Basal-Bolus Insulin Therapy: Detemir or Glargine at HS and Mealtime Aspart, Lispro, or Glulisine


Variable Basal Rate: Insulin Pump
ExCarbs

- ExCarbs - carbs needed to replace carbs burned by physical activity or exercise
- Eating excarbs before, during, and/or after the exercise, helps maintain blood sugar control
  - No insulin is taken to compensate for ExCarbs.
- ExCarbs can guide insulin dose reductions
  - For those who want to lose weight, and
  - For those who don’t want to eat large amounts of carbohydrates during long periods of exercise
- Choices—once known # of ExCarbs needed for an exercise:
  - 1. Eat all of these ExCarbs (advantages: easy to do, good for maintaining your current weight)
  - 2. Use the ExCarbs as a guide to lowering insulin doses (advantages: good for weight loss, great for limiting quantities of food during long periods of exercise)
  - 3. A combination of the two.

ExCarbs – Carbs Needed For Exercise

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<th>200 lbs.</th>
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<td>23</td>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
<tr>
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ExCarbs Conversions

- Carla’s 68 grams of ExCarbs:
  - can be eaten as free carbs
  - can be converted into insulin to reduce carb boluses or basal rates

- 68 gr carb:
  - 14 gm per 1u (Carla’s carb factor) = 4.9 units

Table 23.9 translates exercises with different intensity and duration into combinations of likely carb intakes and bolus or basal reductions

Translate Intensity & Duration Into Extra Carbs Or Bolus Or Basal Reduction

| Exercise Intensity | Carb Intake Factor
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<tr>
<td>Light</td>
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<tr>
<td>Moderate</td>
<td>0.75</td>
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<tr>
<td>Hard</td>
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Carla’s run after breakfast was between moderate – so she lowered her breakfast bolus by 30%, ate an extra 12 grams of free carb before her run and 26 grams afterward.

Distance Runner:
45 y/o Male with Type 1 Diabetes

- When I initially was trying to figure out insulin/carb intake for training I used the insulin reduction rule I read about in The Diabetic Athlete book. This didn’t really work for me. I ended up with very high numbers after a run.
- Here is what I do now:
  - My am runs are 5 miles and take a little over 40 minutes. If my sugar is normal I do nothing. No carb intake and no adjustment of my basal. This am started at 116 ended at 120.
  - If I run the same distance but have to resume my run due to hypoglycemia then I adjust my basal.
  - Weekends runs are longer—up to about 18 miles. I eat breakfast about 50 gm of carbohydrates and take about 2.4 of a normal bolus dose and leave the basal alone.
  - I now use the constant glucose monitoring to guide intake during the run.
  - Usually at 30-40 minutes my numbers start to fall and I take a glucose gel, 100 mg of maltodextin and fructose.
  - I only need to repeat this if the run is going to exceed 1 hr 20 min or so. I like to run with insulin on board and control the sugar with insulin.
  - Cutting insulin seems to tire me much easier.
  - Bike rides last about 1.5 hours. I use the same breakfast strategy and add glucose gels as needed based on my monitor.
  - The constant glucose monitoring makes everything a lot easier.
Distance Runner: 48 y/o Female with Type 1 Diabetes

- I have been a runner since 1995 and a Type 1 diabetic since 1997 (on the pump in 1998).
- I used to simply be a casual jogger (3 miles every other day), but in 1999, after I felt I had a good handle on how to manage my diabetes with an insulin pump, I decided to train for longer distances.
- After much trial and error, I have since used the following guidelines to run numerous 30Ks (18.6 miles each), six marathons (26.2 miles each), and two 50K ultras (31 miles each).
- I am currently in training to run another 50K on April 15th. While I am not a top overall finisher, I usually place somewhere in the top 5 in my age group, especially in the ultras.
- I always run in the mornings, usually well before dawn, unless I am doing a race, which usually starts at 7am. I think it is easier to do this, since I can monitor the lowering effect of exercise on my blood sugar throughout the remainder of the day, and not have to worry about it too much overnight.

For a typical weekday morning run (5-6 miles):
- 1. Test my fasting blood sugar, if it is not around 130, I will take some glucose inhaler up to 0.1 units of insulin to lower it (0.1 units for each 10 over 130).
- 2. Use the temporary basal rate to set my basal rate to 0.2 units/hour for 1.5 hours.
- 3. Drink 20 ounces of water, stretch, and head out the door.
- 4. After a run, stretch, and drink 20 more ounces of water.
- 5. Shower and eat a healthy breakfast (usually oatmeal, soy milk, and fruit).

For a longer training run/race (anything from 6 to 31 miles):
- 1. Test my fasting blood sugar (deme or down). If it is a race day, I usually eat a bagel (15g carbs) the night before to keep it around 100.
- 2. Use the temporary basal rate to set my basal rate to 0.2 units/hour for the entire length of time I am going to be running. My normal basal rate changes to 0.05 units/hour of 6am and then to 0.30 units/hour of dawn, as I don’t normally keep the temporary on past the end of my long run/race. I tend to have in with my blood sugar lower, and if you do this temporary I tend to take each.
- 3. Drink 20 ounces of water, stretch, and head on the run/race.
- 4. During the race, I will take additional glucose (up to 50 grams of glucose) using a bolus of 0.5 units of insulin. These dosages will give me 22 grams of carbs each and I usually will wash them down with 2 ounces of water (the further distances) or 12 ounces of HammerHead Sports drink (which has an additional 12 grams of carbs).
- 5. After the Finish, walk, stretch, test my blood sugar, and eat. Depending on the race, I may do another insulin check during the race, but I have gotten quite good at consistently knowing where I am based on how I feel.
- I tend to run two days on, then cross-train the third day with weights, core-strengthening exercises, and stretches.

Exercise/Sports Special Considerations

- 32y/o on pump
  - Going to Port A to play in a multiday volleyball tournament
  - ? Stay on pump
  - Plan
    - Convert to Lantus/Levemir
    - Tabulate total basal dose and give as Lantus/Levemir, ½ dose am and ½ dose pm
    - Convert back to pump morning after event complete
Resources

- Diabetestrainingcamp.com
- Fit4D.com
- "Pumping Insulin"
- Diabetic Athlete’s Handbook