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BREAKOUT SESSION #1
THE FUNDAMENTALS OF EXERCISING WITH T1D
Exercise Has Many Benefits for People with T1D

- Weight management
- Reduced heart disease risk
  - Lower blood pressure
  - Lower bad cholesterol, raise good cholesterol
- Improved HbA1c and insulin sensitivity
- Psychological benefits
  - Improved sense of well-being
  - Improved self-esteem
- Reduced other complications
  - Eye
  - Kidney

There are Barriers to Exercise Among People with T1D – But They Can be Overcome!

<table>
<thead>
<tr>
<th>Health and medical</th>
</tr>
</thead>
<tbody>
<tr>
<td>• How blood glucose could be affected by activity</td>
</tr>
<tr>
<td>• Low blood sugars</td>
</tr>
<tr>
<td>• Complications (problems with eyes, feet, kidneys)</td>
</tr>
<tr>
<td>• Other non-diabetes-related health problems</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time, work, and lifestyle</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Demands on people with diabetes can be greater than for most people</td>
</tr>
<tr>
<td>• Demands in the home or caring for children or relatives</td>
</tr>
<tr>
<td>• Perceived lack of time</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Low level of motivation to exercise</td>
</tr>
<tr>
<td>• Embarrassment or fear of failure</td>
</tr>
<tr>
<td>• Body image concerns</td>
</tr>
<tr>
<td>• Cost and access to facilities</td>
</tr>
<tr>
<td>• Weather</td>
</tr>
</tbody>
</table>
Factors that Contribute to Increased Lows During Exercise in T1D

<table>
<thead>
<tr>
<th></th>
<th>People Without Diabetes</th>
<th>People With Diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insulin</strong></td>
<td>Don’t make insulin during exercise</td>
<td>Can’t turn off the insulin that has been injected (aka insulin on board)</td>
</tr>
<tr>
<td><strong>Absorption and action of insulin</strong></td>
<td>Insulin action is fast</td>
<td>Insulin action can take a while to start and remains longer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Too much insulin causes the muscles to take in more sugar from the blood leading to less sugar in the blood being available for the brain)</td>
</tr>
<tr>
<td><strong>Counter-regulation</strong></td>
<td>Working properly</td>
<td>Diabetes blunts counter-regulation (The body’s natural defense against low blood sugar is not working in people with diabetes)</td>
</tr>
<tr>
<td><strong>Liver sugar</strong></td>
<td>Liver stores sugar properly</td>
<td>Reduced production of sugar in the liver</td>
</tr>
</tbody>
</table>

PHYSIOLOGY IN ACTION
A CASE-BASED LOOK AT T1D AND EXERCISE
KEY POINT #1
DIFFERENT FORMS OF EXERCISE HAVE DIFFERENT EFFECTS
Intense Exercise Can Cause High Blood Sugars and May Increase Insulin Needs Afterwards

- Glucose is exclusive fuel used during intense exercise
- An intense sprint (10 second) can cause blood sugars to go up
Resistance Exercise Is a Good Way To Avoid Lows

- Resistance exercise (for example weight lifting) causes sugar levels to drop very little (over 40 minute time period)
- Aerobic exercise causes sugar levels to drop a lot (over 40 minute time period)
- Adding resistance training before aerobic activity can help minimize lows
  - Reduces declines in blood glucose
  - May reduce need for carbs during exercise
- Carry carbohydrates when exercising
Key Considerations for Managing Glucose Levels in Physically Active Patients with T1D

1. Type of exercise
2. Duration and intensity of exercise
3. Timing of exercise in relation to time of day and food intake
4. Insulin on board
5. Impact of previous exercise and previous low blood sugar
KEY POINT #2
PEOPLE MAINTAIN “NORMAL” GLUCOSE LEVELS THROUGH PHYSIOLOGY
Without Diabetes: Physiologic Mechanisms Maintain Tight Glucose Levels During Exercise

- **Brain**
  - Adrenaline: sugar up

- **Pancreas**
  - Insulin: sugar down
  - Glucagon: sugar up

- **Liver (sugar stores):**
  - Sugar released

- **Muscles**
  - Stores sugar as well
KEY POINT #3
EXERCISE IN T1D LEADS TO GLUCOSE IMBALANCE DUE TO ALTERED PHYSIOLOGIC RESPONSES
Exercise in T1D Can Lead to Low or High Blood Sugar Levels

- During normal blood sugars
  - ↓ insulin
  - ↑ counter-regulation (hormones such as glucagon, growth hormone, cortisol, catecholamines)

- During Lows
  - Too much insulin on board
  - Broken counter-regulation

- During Highs
  - Too little insulin on board
  - ↑ counter-regulation (hormones including catecholamines, etc)
  - Anaerobic metabolism (lactate production)

Aerobic Exercise Without Adjusting Insulin Can Cause Blood Sugars to Drop (at Variable Rates!) and May Cause Lows


<table>
<thead>
<tr>
<th>Exercise time (min)</th>
<th>Change in Blood Sugar (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>-25</td>
</tr>
<tr>
<td>35</td>
<td>-50</td>
</tr>
<tr>
<td>55</td>
<td>-75</td>
</tr>
<tr>
<td>75</td>
<td>-100</td>
</tr>
<tr>
<td>105</td>
<td>-100</td>
</tr>
</tbody>
</table>

Difference in blood sugar changes among persons studied was approximately 63 mg/dL; 43% become hypoglycemic.

49 persons with T1D (age 8-17 years), no insulin adjustment

Carry carbohydrates when exercising.
Symptoms of Lows May Be Blunted in T1D

Individuals without diabetes
- Release of hormones
- Warning symptoms
- Brain impairment

Individuals with T1D and low blood sugar level unawareness
- Deficient glucagon and poor Adrenaline, reduced symptoms of low blood sugar

Glucose (mg/dL)
- 72
- 54
- 36

KEY POINT #4
BLOOD SUGARS CAN DROP DUE TO BOTH INSULIN ACTION AND MUSCLE CONTRACTION
Both Insulin and Muscle Contraction Increase Glucose Uptake into Muscles

At rest insulin causes muscles cells to take glucose from the blood

Muscle contraction alone can cause glucose to enter the cell
Exercise: Both Insulin and Muscle Contraction Increase Glucose Uptake into Muscles—Increased Risk For Lows!

- **Muscle cell**
  - **GLUT-4 vesicles**
  - **Insulin Receptor**
  - **Insulin**

  **Rest**
  - **Too much insulin/muscle contraction, increased blood flow and more glucose enters the cell**

  **Muscle contraction, increased blood flow more glucose enters cells**
  - **Low blood sugar**
  - **Insulin**
  - **GLUT-4 vesicles**
  - **Insulin Receptor**

- **Exercise: Both Insulin and Muscle Contraction Increase Glucose Uptake into Muscles—Increased Risk For Lows!**

  - **Increased Risk For Lows!**
KEY POINT #5
COOLDOWN MINIMIZES INCREASE IN AFTER EXERCISE HIGH BLOOD SUGARS
Cool Down Can Reduce High Blood Sugar Risk After Vigorous Exercise

- Sitting after anaerobic activity can easily spike blood glucose
  - Due to low insulin, no muscle contraction
- High blood sugars shortly after exercise can be reduced by a 15-20 min passive cool down at a moderate intensity
- Monitoring of glucose is essential

KEY POINT #6
EXERCISE HAS BOTH IMMEDIATE AND DELAYED EFFECTS ON BLOOD SUGAR
After Exercising, Blood Sugars “Burn” Remains High for Hours to Replenish Muscle Glycogen Stores (i.e. overnight)

Starting approximately 7–11 hours after exercise, lasting ~6 hours

KEY POINT #7
THE BODY ADJUSTS ITS SOURCE OF ENERGY AS INTENSITY OF EXERCISE AND OVERALL FITNESS CHANGE
The More Intense the Exercise, the More Glucose Is Burned as Fuel to Keep You Going

- The more fit you are the more insulin sensitive you are
- Lower intensity exercise more fat is burned
- Higher intensity exercise more glucose and glycogen are burned
- Training increases fat burning and spares muscle and liver sugar stores

Training Increases Insulin Sensitivity and May Lower Insulin Requirements

Schematic; derived from expert opinion.
KEY POINT #8
SHORT TERM RISK OF LOWS DURING EXERCISE IS INCREASED BY RECENT HYPOGLYCEMIA AND RECENT EXERCISE
Repeated occurrence of post-exercise low blood sugar levels can lead to reduced counter-regulation, which in turn may increase risk of low blood sugar levels and hypoglycemic unawareness.

Andrew

- 45-year old man who has had T1D for 30 years
- HbA1c usually 7.0-7.5%
- No significant complications
- Current diabetes treatment:
  - Insulin pump and CGM
- Andrew wants to increase the intensity and frequency of his exercise
- Has had occasional low blood sugar with exercise, resolved with increases in carbohydrates
Andrew’s Recent High Blood Sugar Experiences

- **High blood sugar PRIOR to exercise**
  - Ate a banana, energy bar and had coffee 1 hour before a run
  - Reduced insulin bolus by 50%
  - Blood sugars rose to 280 mg/dL

- **High blood sugar DURING exercise**
  - On race day (10K), reduced basal rate by approximately 50% 1 hour before race
  - 30 min before race blood sugar was lower than he’d like to start the race (110 mg/dL) so he had a banana
  - 10 min before race, blood sugar was still low, so he had 5 glucose tabs
  - Started the race at 250 mg/dL

- **High blood sugar AFTER exercise**
  - After a bike ride, blood sugar was 120 mg/dL
  - Pump was set at 50% of basal starting 90 min before the ride
  - Consumed 20g carbohydrate every 30 min during the 1 hour ride
  - After shower, blood sugars rose to 220 mg/dL
Recommendations for Managing High Blood Sugar Before Aerobic Exercise

- Why does it happen?
  - Reducing insulin on board before exercise to avoid low blood sugar levels during workout is associated with increased risk of high blood sugar, especially when eating foods that contain carbohydrate

- How can you reduce risk?
  - Eat 3–4 hours before exercise or workout in fasting state
  - If meal is closer to workout, choose slowly digested carbohydrates
  - Insulin adjustments before short-duration (30 minutes or less) workouts should be in pre-meal insulin only (25% reduction) ; no change in basal insulin is needed

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Recommendations for Managing High Blood Sugar During Aerobic Exercise

- **Why does it happen?**
  - Rapid-acting carbohydrate just before exercise
  - Anxiety about blood sugars
  - Excitement during the competition
  - Too great a reduction in basal insulin rate

- **How can you reduce the risk?**
  - Take 20 g carbohydrates before exercise if sugar is below target at start
  - Minimize basal insulin reduction
  - Meditation or visualization exercises may be helpful to reduce anxiety and therefore a high blood sugar level spike
  - Use insulin boluses via pump during long aerobic exercise carefully; 1 unit of insulin may be as effective as 2 units (or more) when you are at rest
Andrew’s Recent High Blood Sugar Experiences

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  - After shower, blood sugars rose to 220 mg/dL
Recommendations for Managing High Blood Sugar After Aerobic Exercise

Why does it happen?

- Persistent adrenaline hormones causing insulin resistance combined with a drop in muscle glucose uptake after exercise
- Decreased basal rate or delayed glucose absorption from carbohydrate eaten during workout

How can you minimize the risk?

- Consider a conservative bolus of 50% of usual correction for post-workout hyperglycemia
- Low-intensity cooldown of 10–15 minutes of walking would also reduce the spike in blood sugars
Summary

1. Different forms of exercise have different effects
2. People maintain normal blood sugar through physiology
3. Exercise in T1D can lead to glucose imbalance
4. Blood sugar can change due to both insulin action and muscle contraction
5. Cooldown minimizes increase in blood sugar after exercise
6. Exercise has both immediate and delayed effects on blood glucose
7. The body adjusts its source of energy as intensity of exercise and overall fitness change
8. Short term risk of low blood sugar levels during exercise is increased by recent hypoglycemia and recent exercise
BREAKOUT SESSION NUMBER 2
FUNDAMENTALS OF GLUCOSE AND INSULIN MANAGEMENT BEFORE, DURING, AND AFTER EXERCISE FOR PEOPLE WITH T1D
GLUCOSE AND INSULIN MANAGEMENT
A CASE-BASED LOOK AT T1D AND EXERCISE
Sara

- 18 year old woman who has had T1D for 15 years
- Current diabetes treatment:
  - Insulin pump
- Target blood glucose: 100 mg/dL during day, 120 mg/dL during nights
- HbA1c 8.1%
- Has struggled with her weight since mid-teen years, now considered obese
- Also struggles with mild anxiety and depression
- Interested in starting an exercise program for fitness, mental health, weight management, and glycemic control
Current Eating Patterns

- Carbohydrate counting
- No dietary restrictions
- Often omits entering carbs into pump, mainly using experienced estimation
- Total calories 2300/day; 3 meals with 1 snack daily
  - Carbs: 178 g
  - Protein: 147 g
  - Fat: 108 g
- Wants to lose weight: her primary goal is to avoid college weight gain; she also wants to limit the need to treat low blood glucoses during exercise
Current Exercise Plan

- Modest exercise, works with children at day camp
- Plans to go to college gym twice weekly to use the elliptical machine
- May try weight lifting, too
- Sara agrees to resume CGM use
- So what happens to Sara when she starts exercising?
- How should Sara’s insulin and nutrition be adjusted?
KEY CONSIDERATIONS
Blood Glucose Effects of Different Types of Exercise

**Aerobic**
- Glucose trends: Intensity and duration of exercise, insulin to glucagon ratio, fitness, nutrition, initial glucose concentration

**Mixed**
- Glucose trends: Intensity and duration of exercise, insulin to glucagon ratio, counter-regulatory hormones, lactate concentration, fitness, nutrition, initial glucose concentration

**Anaerobic**
- Glucose trends: Intensity and number of intervals, insulin concentration, counter-regulatory hormones, lactate concentration, fitness, nutrition, initial glucose concentration

General Carbohydrate Recommendations Related to Exercise

- Carbohydrate is the major fuel source for exercise
- Requirements will vary widely
- **Carbohydrate may be needed during exercise for performance, low blood sugar prevention, or both**
- Distribution and timing of carbohydrate intake is important
- Consider including part of daily carbohydrate intake in the period 4–5 hours after exercise

Frequent Glucose Monitoring Is Critical During Exercise

1. The best way to avoid low blood sugar is to regularly monitor/check glucose level before, during, and after exercise
2. People with T1D should not exercise if their glucose meter (or CGM) and strips are not readily available
BEFORE EXERCISE
# Bolus Insulin Dose Adjustment Before Aerobic Exercise

<table>
<thead>
<tr>
<th>Recommendations</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insulin on board</strong></td>
<td>This is the most important recommendation! The key to exercising successfully is matching the amount of insulin on board to the exercise and carb intake</td>
</tr>
<tr>
<td><strong>Exercise 2 hours or less from last bolus insulin dose</strong></td>
<td>Reduce pre-exercise insulin dose by 25–75% and consume carbohydrate with a low glycemic index at mealtime</td>
</tr>
<tr>
<td><strong>Exercise more than 2 hours from last bolus insulin dose</strong></td>
<td>If blood glucose is running low, must consume carbohydrate</td>
</tr>
</tbody>
</table>

Higher doses of insulin have a bigger impact on blood sugar levels

With higher insulin doses, circulating insulin levels will be higher for longer
Taking Additional Carbs Can Offset Insulin On Board

- Reduce pre-exercise insulin dose
- Consume carbohydrate with low glycemic index

- If blood glucose is running low, must consume carbohydrate

## Basal Insulin

| Background insulin -- even in the fasted state (overnight and between meals) and for exercise | Changes to basal insulin delivered by injection need to be individualized due to differences in long-acting analogs |
| Delivered either by pump or long-acting insulin analog; reaches a steady, stable level | After exercise, **basal** insulin can be reduced in the evening or at bedtime to reduce risk of nocturnal hypoglycemia |

In preparation for exercise, basal insulin needs to be reduced **in advance** of planned exercise
## Basal Insulin Dose Adjustment Before Aerobic Exercise

### Patients on Multiple Daily Insulin Injections
- Basal insulin dose adjustment is not routinely recommended
- If on BID basal, one could consider reducing one or both of the basal doses by 20%

### Patients on Insulin Pumps
- Basal insulin dose reduction of 50–80% may be useful for exercise over 45–60 minutes
- Dose could be reduced up to 90 minutes before exercise

---

### Nutrition Before Exercise

<table>
<thead>
<tr>
<th></th>
<th>1–4 Hours</th>
<th>Within 10–15 Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Carbohydrate</strong></td>
<td>A meal based on low-fat, low-GI carbohydrate 0.5–2 g/lb body weight</td>
<td>Depending on blood glucose level, insulin on board and activity type</td>
</tr>
<tr>
<td><strong>Protein</strong></td>
<td>Include 20–30 g low-fat, high-quality protein (eg, lean meat, fish, milk, yogurt)</td>
<td>Not required</td>
</tr>
<tr>
<td><strong>Fluid</strong></td>
<td>2–5 mL/lb body weight in the 2–4 hours before exercise</td>
<td>Between 5 to 10 ounces fluid depending on age/sex/environment</td>
</tr>
</tbody>
</table>

## Recommendations Based on Starting Blood Glucose

<table>
<thead>
<tr>
<th>Blood Glucose Concentrations</th>
<th>Recommendation</th>
</tr>
</thead>
</table>
| <90 mg/dL                    | ▪ Ingest 10–20 g of glucose before exercise  
                              ▪ Delay exercise until blood glucose >90 mg/dL |
| 90–124 mg/dL                 | ▪ Ingest 10 g of glucose  
                              ▪ Exercise can be started, anaerobic and high-intensity interval training may be started without carbohydrates |
| 125–180 mg/dL                | ▪ Aerobic exercise can be started  
                              ▪ Anaerobic exercise and high-intensity interval training may be started, but levels may rise |
| 181–270 mg/dL                | ▪ Aerobic exercise can be started  
                              ▪ Anaerobic exercise can be started, but glucose concentrations may rise |
| >270 mg/dL                   | ▪ Check blood ketones and perform low-intensity exercise if ketones are not elevated, small corrective dose of insulin may be needed  
                              ▪ If modestly elevated (0.6–1.4 mmol/L), exercise should be restricted to a light intensity for only a brief duration (<30 min), small corrective dose of insulin may be needed  
                              ▪ If blood ketones are ≥1.5 mmol/L, exercise is contraindicated and corrective insulin dose should be given |

DURING EXERCISE
Carbohydrate Needs Vary Based on Many Factors

<table>
<thead>
<tr>
<th>Carbohydrate Need</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>▪ Blood glucose below 90 mg/dL</td>
</tr>
<tr>
<td></td>
<td>▪ Aerobic exercise</td>
</tr>
<tr>
<td></td>
<td>▪ New sport/unfamiliar activity</td>
</tr>
<tr>
<td></td>
<td>▪ Anaerobic exercise</td>
</tr>
<tr>
<td></td>
<td>▪ Short duration</td>
</tr>
<tr>
<td></td>
<td>▪ Exercise without insulin on board</td>
</tr>
<tr>
<td></td>
<td>▪ Insulin dose reduced (adjusted) with meal before exercise</td>
</tr>
<tr>
<td></td>
<td>▪ Competition</td>
</tr>
</tbody>
</table>

## Nutrition Needs During Exercise

<table>
<thead>
<tr>
<th></th>
<th>30 mins</th>
<th>30–60 mins</th>
<th>&gt;60 mins</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Carbohydrates</strong></td>
<td>• Not needed unless blood glucose dropping</td>
<td>• May be needed if very strenuous activity or no insulin adjustment</td>
<td>• May be needed for fuel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 30–60 g/h (0.5–1 g/kg body weight for child)</td>
<td>• 30–60 g/h (0.5–1 g/kg body weight for child)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• For ultraendurance (&gt;3 hr) Up to 90 g/h; consider high-GI choices</td>
<td>• For ultraendurance (&gt;3 hr) Up to 90 g/h; consider high-GI choices</td>
</tr>
<tr>
<td><strong>Fluid</strong></td>
<td>• Water should be adequate for hydration</td>
<td>• Drink appropriate amount* of fluids to replace sweat losses so that total body fluid deficit is &lt;2% body weight</td>
<td>• May benefit from use of sports drinks</td>
</tr>
</tbody>
</table>

* Depends on exercise intensity, duration, fitness, heat acclimatization, altitude, and environment (eg, humidity)

## Water or Sports Drink During Exercise?

<table>
<thead>
<tr>
<th>Water</th>
<th>Sports Drinks</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Most commonly used</td>
<td>▪ Beneficial for longer events (&gt;60–90 mins)</td>
</tr>
<tr>
<td>▪ Minimal side effects</td>
<td>▪ Sodium: 230–690 mg/1000 mL</td>
</tr>
<tr>
<td>▪ Adequate for shorter events (&lt;60 mins)</td>
<td>▪ Be careful not to over-consume</td>
</tr>
</tbody>
</table>

AFTER EXERCISE
Basal Insulin Dose Adjustment After Exercise: Multiple Daily Insulin Injections vs Insulin Via Pump

Multiple Daily Insulin Injections
- Reduce nighttime dose by 20%
- Increase carbohydrate consumption to prevent low blood sugar overnight
- Check blood glucose during the night

Insulin Pump
- Reduce insulin dose by 20% for up to 6 hours (eg, 9 p.m. to 3 a.m.)
- Increase carbohydrate consumption
- Check blood glucose during the night

Nutrition After Moderate-to-Intense Exercise

Carbohydrate
- Aim for approximately 0.5 g of carbohydrate per pound of body weight within 1–2 hours after exercise to replenish glycogen stores

Protein
- Protein should be consumed within 30-60 minutes of training for optimal muscle protein synthesis
- Addition of 15–25 g protein to a meal along with carbohydrate can help to reduce low blood sugar risk and enhance glycogen synthesis

Fluid
- Drink fluids after exercise with food to maximize rehydration

OTHER CAVEATS
Some Therapies Will Require Additional Considerations

- Insulin adjustments may be more challenging for patients using hybrid closed-loop pumps or ultra-long-acting basal insulins
- There are differences in absorption times for various insulin preparations (inhaled, faster acting, etc.)
- Impact of new and coming therapies (such as SGLT inhibitors) for T1D on glycemic control during exercise are largely unknown
SPECIAL CONSIDERATIONS
Supplements Require Caution and Some Should Be Avoided

**Sports Foods**
- Useful when active and impractical to consume everyday foods
- Sports drinks
- Sports gels
- Liquid meals
- Whey protein
- Sports bars
- Electrolyte replacement

**Medical/Nutritional Supplements**
- Used to treat clinical issues
- Iron supplements
- Calcium supplements
- Multivitamins
- Vitamin D
- Probiotics

**Performance Supplements**
- Caffeine
- B-alanine
- Bicarbonate
- Beetroot juice
- Creatine

GLUCOSE AND INSULIN MANAGEMENT
CASE WRAP UP
Fear of low blood sugar with exercise leads Sara to start exercise with high blood sugar levels.

Sara also wants to avoid carbs with exercise as she hopes to lose weight.

Consistent use of CGM may help manage worries about low blood sugar with exercise.

It’s important to be aware of CGM alert settings, including low, high, and trend alerts.

Review of past CGM patterns is important to see trends.
Exercise Recommendations

- For planned 30 minutes of elliptical at gym:
  - Decrease pump basal rate by 50% 1 hour before, during, and 1 hour after exercise
  - Reduce carbohydrate bolus by 50% for meals and correction doses within 2 hours of planned exercise—both before and after—to limit the need for extra carbohydrates to prevent low blood sugar
  - Reduce basal rate by 20% for 4–6 hours at bedtime to avoid overnight low blood sugar
Eating Plan Recommendations

- Continue carbohydrate counting
- Aim for 1800–2000 calories per day; eat 3 meals and 1 snack each day, shooting for the following ratios:
  - Carbohydrates: 50% of calories
  - Protein: 20% of calories
  - Fat: 30% of calories
- Before and after exercise snacks should be a 2:1 ratio of carbs-to-protein
Key Considerations for Balancing Glucose Control and Exercise

- Talk to your healthcare team about your goals for exercise
- Things to consider when planning exercise and insulin changes are:
  - Exercise type, duration, intensity, and time of day
- Timing of exercise and meals is important
- Consider insulin “on board” (active insulin) at exercise time
- Think about the impact of previous exercise and/or low blood sugar levels when planning exercise
- How insulin is taken (pump versus injections) will change how blood sugar is managed with exercise
- Know your glucose targets and talk to your healthcare team about best tools for monitoring and treating