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# PEAK PARTICIPANT CURRICULUM

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# FUELING FOR THE GAME

## **Participant Curriculum General Session**

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# Session agenda

- Why nutrition matters for exercise and performance
- There is more to nutrition than carbohydrate: A brief look at important micronutrients (“the small stuff”)
- Getting the basics right (macronutrients): Protein, carbohydrate, and fats (“the big stuff”)
- Fueling for exercise and competition
- Weight management tips



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# GENERAL PRINCIPLES OF A GOOD DIET

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## GENERAL PRINCIPLES

Nutrition is the key to success



**Nutrition**  
Training program | Sleep



**Exercise and sports performance goals**

**Diabetes management**



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## GENERAL PRINCIPLES

# Poor nutrition can hinder your performance goals



- Common nutritional deficiencies include:
  - Magnesium, iron, iodine
  - Vitamins C, A & D
  - Calcium (in children and adolescents)
- A poor diet has numerous consequences:
  - Compromises your immunity
  - Disrupts your digestion and gut ecosystem
  - Leads to weight gain
  - Compromises your ability to build muscle

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Hamner et al. *Nutrients*. 2016; 8:486; Agarwal et al. *J Am Coll Nutr*. 2015; 34(2).



## GENERAL PRINCIPLES

# Sources of key nutrients

Nutrient	Function	Sources
Vitamin D	<ul style="list-style-type: none"><li>• Important for bone health</li><li>• Required for healthy immune function</li></ul>	Fatty fish (e.g. herring, tuna, rainbow trout, mackerel, salmon, sardines), eggs from pastured hens, cod liver oil
Vitamin A	<ul style="list-style-type: none"><li>• Critical for vision</li><li>• Acts as an antioxidant</li></ul>	Organ meats (e.g. liver, kidney), egg yolks from pastured hens, butter from pastured cows, cod liver oil
Vitamin C	<ul style="list-style-type: none"><li>• Needed for the growth and repair of tissues</li><li>• Helps to make collagen</li></ul>	Citrus fruits, kiwi, cantaloupe, papaya, tomato, broccoli
Magnesium	<ul style="list-style-type: none"><li>• Involved in many physiological pathways, including energy production</li></ul>	Nuts and seeds (especially pumpkin), dark leafy greens, dark chocolate, avocado, yogurt, banana, molasses, figs
Iron	<ul style="list-style-type: none"><li>• Makes up part of the haemoglobin molecule</li><li>• Required to transport oxygen to cells in the body</li></ul>	Clams, oysters, liver, beef, lamb, spinach, pulses
Iodine	<ul style="list-style-type: none"><li>• Required to make thyroid hormones</li></ul>	Seaweed, fish, shrimp, iodized salt, potatoes, dairy
Calcium	<ul style="list-style-type: none"><li>• Essential for strong bones and teeth</li><li>• Key role in muscle contraction</li></ul>	Dairy products (e.g. milk, yogurt, cheese), canned fish with bones, molasses, dried figs, almonds, sesame seeds

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<https://cronometer.com/help/foods>



## GENERAL PRINCIPLES

# Build a solid nutritional foundation

### UPGRADE YOUR NUTRITION

- Quantity and quality of macronutrients
  - Protein
  - Carbohydrate
  - Fat
- Timing of nutrients
  - Protein
  - Carbohydrate

### NO ONE SIZE FITS ALL

- Consider your personal goals, which could include:
  - Weight loss
  - Increases in muscle mass or weight
  - Improve performance
  - Better general health
  - Improved diabetes management

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# PROTEIN

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## PROTEIN

# The nuts and bolts of your body



- Why is protein essential?
  - Builds lean muscle mass
  - Aids in the recovery process from training
  - Supports recovery from injury/surgery
  - Supports training adaptations
  - Essential for growth in children
  - Important for weight loss as promotes feeling of fullness (satiety)

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## PROTEIN

# Protein requirements for sports

Protein intake is important for muscle recovery and repair, growth, and sports performance

1.2 – 2g/kg body weight/day  
(0.5 – 0.9g/lb body weight)

Lower Protein Requirements  
Meeting energy requirements  
Endurance exercise

Higher Protein Requirements  
Children & adolescents  
Older adults  
Weight loss  
Strength & power sports

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Phillips, SM. *Sports Medicine*, 2014;44 Suppl 2:149-153; Phillips, SM, et al. *International journal of sport nutrition and exercise metabolism*, 2007; 17: S58; Mettler S, Mitchell N, Tipton KD. Increased protein intake reduces lean body mass loss during weight loss in athletes. *Med Sci Sports Exerc*. 2010;42(2):326-337.



## PROTEIN

# Recommended amount and best sources

- Aim for **1.2 - 2.0g/kg body weight per day** OR **0.5 - 1.0g/lb body weight**
- For example:
  - 64 kg female x 1.2 - 2.0g/kg = 77 - 128g protein per day
- Animal sources such as meat, fish, poultry, eggs, dairy:
  - Contain all of the essential amino acids
  - Have the highest protein absorption rates
- Athletes eating a vegetarian diet lacking in animal protein:
  - May be deficient in **iron** and vitamin **B12**
  - Should get their blood levels checked periodically

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Thomas DT, et al. *J Acad Nutr Diet* 2016; 116 (3): 501-28



## PROTEIN

# Protein content in common foods

Food	Serving size	Grams of protein
Nuts, e.g. almonds	1 oz	6
Egg	1	6-7
Quinoa	1 cup	8
Milk	1 cup	8
Yogurt, regular, natural	6 oz	8
Pulses, e.g. lentils	1 cup	~ 8
Tofu	1 oz	~ 8
Seeds, e.g. pumpkin	1 oz	9
Cottage cheese	4 oz	14
Yogurt, Greek	6 oz	18
Fish, e.g. tuna	3 oz	~ 20
Chicken, beef, other meats cooked	3 oz	~ 25

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## PROTEIN

# Serving sizes

### ■ Protein serving size

- 1.5 - 2 palm sizes = 30 - 40g protein - typical male serving size
- 1 - 1.5 palm sizes = 20 - 30g protein - typical female serving size

How to achieve a protein target of **80g** per day:

Meal	Food example	Grams of protein
Breakfast	2 eggs / 5.3-7 oz Greek yogurt	15-20
Lunch	Chicken (1 palm size)	20
Snack	Handful nuts / 1 oz cheese / glass milk	5-10
Dinner	Salmon fillet (1.5 palm sizes)	30
TOTAL		<b>80</b>

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## PROTEIN

# Timing of consumption

- Protein needs are easily met when calorie intake is high- still need to pay attention to **timing**
- For muscle growth and recovery aim to have **20 - 25g protein** within the first 2 hours post-exercise
  - Higher amounts of protein may be beneficial for some
  - Higher amounts of protein may reduce risk of hypoglycemia in the hours following exercise
- Distribute protein **throughout the day**
  - Don't neglect protein at breakfast
  - Whole food, protein-rich snacks include:
    - Yogurt with fruit + seeds
    - Sandwich with protein filling
    - Milk
    - Nuts

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Phillips SM. *Sports Med.* 2014;44(suppl 1): S71-S77; Thomas DT, et al. *J Acad Nutr Diet* 2016; 116 (3): 501-28.



## PROTEIN

# Quality of consumption

- Quality matters
  - Eat unprocessed protein foods where possible
- Ideally only use supplemental protein (protein powders):
  - Around exercise bouts
  - If protein needs are high and cannot be met with food alone
  - If a convenient protein source is needed on-the-go
  - Ideally avoid protein supplements in adolescents and children



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# FATS

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## FATS

# The athlete's oil



- We need a **balance** of all fats:
  - Mono-unsaturated fatty acids (MUFAs)
  - Poly-unsaturated fatty acids (PUFAs)
  - Saturated fatty acids (SFs)
- Favour **MUSFs** for general use
  - Use olive oil instead of corn, soy and sunflower oils
- **Omega-3** fats are essential
  - Aim to eat fatty fish 2 - 3 times per week
  - Fatty fish includes salmon, sardines, mackerel, oysters, anchovies, herring, and tuna
- **Quality** matters!
  - “You are not only what you eat, but you are what your food ate”

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Evert *et al.* *Diabetes Care*. 2013; 36(11): 3821-3842

# CARBOHYDRATES

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## CARBOHYDRATES

# Your body's main fuel source - daily recommendations



- Carbohydrate recommendations for exercise may need to be adapted for people with Type 1 diabetes
- Personalize carb recommendations to meet diabetes and exercise goals
- Consider the absolute **amount** and **type** of carbohydrate and **timing** of consumption
- Some athletes adopt a flexible approach with carbohydrates in order to suit different training phases

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# CARBOHYDRATES

## Daily intake recommendations

Grams of carbohydrates per day

100-150g

**Appropriate conditions:**

- >24-48 hours between exercise sessions
- Low intensity exercise
- Weight loss
- Smaller individuals
- Unstable blood glucose

150-200g

**Appropriate conditions:**

- Exercise daily (~1 hour/day)
- Low and moderate intensity exercise
- Sedentary lifestyle

250-300+g

**Appropriate conditions:**

- Exercise daily (~1-3 hours/day)
- Moderate to high intensity exercise
- Optimize sports performance
- Active lifestyle or job
- Larger individuals

**Always consult your healthcare professional/dietitian before making significant changes to your carbohydrate intake to ensure that appropriate insulin adjustments are made.  
Be sure to consider your individual goals and activity level.**

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## CARBOHYDRATES

# Daily carbohydrate recommendations based on ideal body weight and exercise

### ■ Conditions:

- Lower intensity exercise
- Shorter duration
- >24 hours between sessions
- Weight loss

Weight (kg)	CHO per day (g)
50	100-125
65	130-160
80	160-200

### ■ Conditions:

- Higher intensity exercise
- Longer duration
- Exercising daily or twice daily
- Weight gain

Weight (kg)	CHO per day (g)
50	150-250
65	200-300
80	240-400

Note: The above recommendations serve as a starting point. The lower end of the recommendations may suit female athletes.

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CHO, carbohydrate





## CARBOHYDRATES

# Low carbohydrate diets – friend or foe?

- How many grams of carbohydrates is "low"?
  - “Low” is determined by your body weight and calorie (energy) intake
    - Less than 30% calories from carb = moderate to low
    - Less than 10% calories from carb = very low
- Not advisable for growing children
  - Carbohydrates are necessary for normal development and growth
- Possible delayed and prolonged glucose rise after high fat and high protein meal
  - Consider use of extended wave/dual wave insulin bolus
- May lead to ketone production
  - Unclear as to if there is a safe amount of ketones

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## CARBOHYDRATES

# Low carbohydrate diets – are they good for performance?

- Not recommended for high performance
  - Focus should be on **quality and timing** of carbohydrates
- Low-carb diets can be useful for weight loss and diabetes management
  - But performance in high intensity exercise may suffer
- Not a good option if you are:
  - Frequently doing high intensity exercise
  - Not recovering between exercise sessions
  - Under significant stress
  - Not sleeping well
  - Have an under active thyroid

Limited evidence on low-carb diets and performance, but standard sports nutrition recommendations likely too high for most recreational athletes with Type 1 diabetes

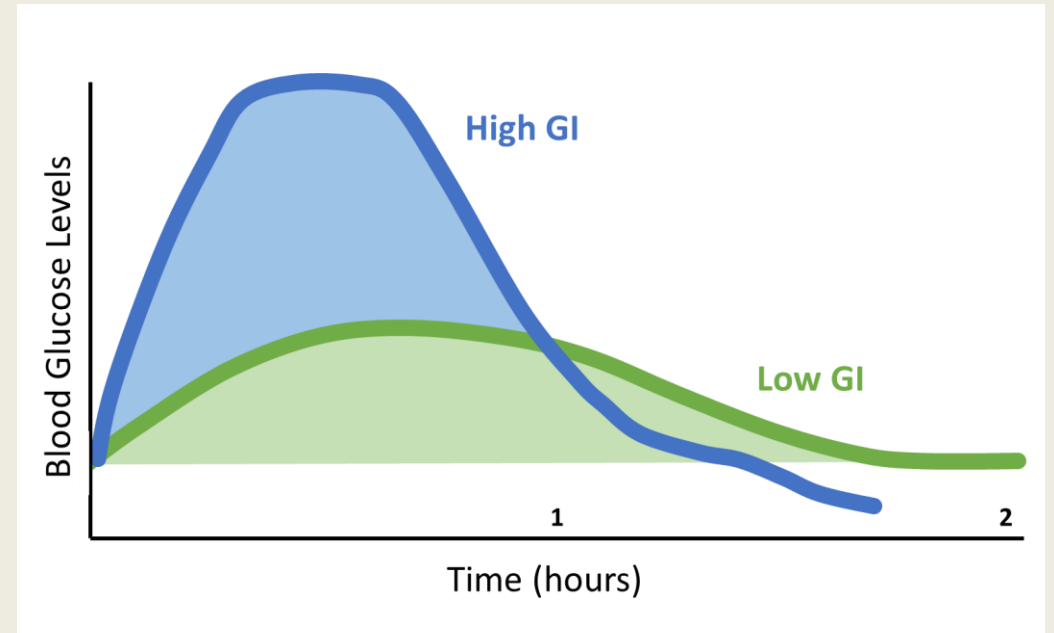
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## CARBOHYDRATES

# Make your carbohydrates count!

- Except when fueling for exercise, **quality** (slow burning) carbohydrates should make up the bulk of your diet
- Criteria for good carbohydrates:
  - Slow and low rise in glucose - **self experimentation** is required
  - High in fiber
  - Minimally processed
  - High in vitamins and minerals
- If meal is less than 2 hours before exercise choose slow burning carbohydrates and low to moderate amounts in order to keep IOB low during exercise



Example of glycemic index curves

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IOB, insulin-on-board; GI, glycemic index



## CARBOHYDRATES

Quality carbohydrates are slower burning and “nutrient dense”

Whole fruits	Beans and legumes	Root vegetables	Breakfast cereals	Dairy	Whole grains	Bread
<ul style="list-style-type: none"> <li>✓ <u>Not</u> juice</li> </ul> 	<ul style="list-style-type: none"> <li>✓ Peas</li> <li>✓ Lentils</li> <li>✓ Chickpeas</li> <li>✓ Edamame</li> </ul> 	<ul style="list-style-type: none"> <li>✓ Sweet potato</li> <li>✓ Boiled new potato</li> </ul> 	<ul style="list-style-type: none"> <li>✓ Steel cut oats</li> <li>✓ Muesli (raw oats + nuts)</li> </ul> 	<ul style="list-style-type: none"> <li>✓ Milk</li> <li>✓ Natural yogurt</li> </ul> 	<ul style="list-style-type: none"> <li>✓ Quinoa</li> <li>✓ Buckwheat groats</li> <li>✓ Barley</li> <li>✓ Wild rice</li> <li>✓ Bulgur wheat</li> </ul> 	<ul style="list-style-type: none"> <li>✓ Sourdough rye</li> <li>✓ Dense pumpernickel bread</li> </ul> 

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# FUELING FOR EXERCISE

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## FUELING FOR EXERCISE

# Meal and insulin planning before exercise

- Longer exercise sessions require more planning
- Factors to consider:
  - Duration of exercise
  - Intensity and type of exercise
  - Active insulin (IOB) – time between last meal or correction bolus and exercise; background insulin and basal rate
- IOB determines how much carbohydrate needed to be ingested before and during exercise
- Low IOB during exercise
  - Easier to manage blood glucose during exercise
  - Preferable for weight loss and “fat burning”

- Resources to track IOB:
  - Pumps
  - Bolus calculators on meters
  - Apps (e.g. Engine 1)



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IOB, insulin-on-board

## FUELING FOR EXERCISE

# Meal and insulin planning before exercise

- **3 hours prior to exercise:**
  - No bolus adjustment required
  - Mixture of slow and fast burning carbohydrates
- **1.5 to 1 hour prior to exercise:**
  - Consume meal of protein and good fats (no bolus unless need to correct) AND fuel with carbohydrates during session if required AND/OR eats carbohydrates post exercise
  - Eat a meal with a small amount of slow burning carbohydrates with full or reduced bolus dose
  - Consume very slow burning carb (e.g. Generation UCAN with no bolus)
  - If need to correct take no more than 50% of suggested correction bolus
- **Within 30 minutes prior to exercise:**
  - Amount and type of carbohydrates dictated by blood glucose (+ glucose trend) and basal adjustments (pump)
  - Rapid-digesting carbohydrates if exercising shortly after eating
  - Avoid bolusing for carbohydrates in this window

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## FUELING FOR EXERCISE

# Fueling with carbohydrates just before exercise

- Ingestion of extra carbohydrate (10-15g) prior to exercise is recommended if **blood glucose <100 mg/dL**
- Examples of snacks include:
  - Foods/drinks to treat hypoglycemia if glucose needs to be raised quickly
  - Small banana
  - Small or half dried fruit/energy bar
  - 100-150 mL fruit juice
- Factors to consider:
  - **Trend** of blood glucose
  - **Time** of exercise
  - **Type** of exercise



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## FUELING FOR EXERCISE

# Fueling with carbohydrates during exercise

- General carbohydrate recommendations during exercise:
  - **30 - 60g CHO per hour of exercise** or 10 - 15g CHO every 15 - 20 minutes (low end of range when little IOB and/or basal adjustments have been made)
  - Recommendations for children:
    - 0.5-1.0g CHO/kg body weight
  - Even when carbohydrates may not be needed for performance they may still be required to prevent hypoglycemia
  - “Fast-acting” carbohydrates are the preferred choice if the exercise is short in duration
  - “Fast” and “slower” carbohydrates (e.g. banana) are preferred if the exercise is longer in duration
  - Practice race/event nutrition strategy
    - This may mean making smaller basal insulin reductions during some training sessions

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CHO, carbohydrate; IOB, insulin-on-board

Riddell MC, et al. *Lancet Diabetes Endocrinol* 2017, Published Online January 23, 2017; Robertson K, Riddell MC, Guinhouya BC, Adolfsson P, Hanas R. Exercise in children and adolescents with diabetes. *Pediatric Diabetes* 2014; 15 (Suppl. 20): 203–223; Thomas DT, et al. *J Acad Nutr Diet* 2016; 116 (3): 501-28.



## FUELING FOR EXERCISE

# Factors influencing carbohydrate needs and distribution during exercise

Blood glucose below  
90 mg/dL



Aerobic exercise



Competition



Anaerobic exercise



Short duration



Fasting exercise



Insulin adjusted with meal  
prior to exercise



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## FUELING FOR EXERCISE

# Fueling with carbohydrates after exercise

- Refuel with carbohydrates:
  - Ingesting carbohydrates soon after higher intensity exercise allows muscles to rapidly restore their glycogen stores
  - Mainly a priority when training twice a day or if next session is within 8 hours
  - May prevent late-onset hypoglycemia
  - Good blood glucose levels in the post-exercise period is essential for optimizing this process
    - If blood glucose is high post-exercise and refueling is not a priority, consider delaying carbohydrates until blood glucose levels are closer to normal range

Aim for **1-1.2g carbohydrate/kg body weight** after exercise and consider reducing insulin bolus as sensitivity may be increased post-exercise

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Riddell MC, et al. *Lancet Diabetes Endocrinol* 2017, Published Online January 23, 2017; Thomas DT, et al. *J Acad Nutr Diet* 2016; 116 (3): 501-28.



## FUELING FOR EXERCISE

# Fueling with protein after exercise

- For muscle growth and recovery aim to have 20 - 25g protein post-exercise
- Foods that provide ~10-12g protein:
  - 40g (½ palm size) cooked beef/pork/lamb
  - 40g (½ palm size) cooked chicken
  - 50g canned tuna/salmon or cooked fish
  - 10oz milk
  - 3.5oz Greek yogurt or cottage cheese
  - 30g cheese
  - 2 eggs



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<https://cronometer.com/help/foods>

## FUELING FOR EXERCISE

# Fueling for competition

- What is carb loading?
  - 36 - 48 hour of ingesting 10-12g carb/kg body weight per 24 hours
- To carb load or not?
  - Preparation for events >90 min of sustained/intermittent exercise
  - May contribute to hyperglycemia the day and night before an event
  - Best to avoid if leads to hyperglycemia
- Meal before an event:
  - Aim to have last big meal 3 - 4 hours before the event
  - Balance between easily digested carbohydrates and lower GI (slow burning) carbohydrates
  - 1 - 4g carbohydrate/kg body weight

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Thomas DT, et al. *J Acad Nutr Diet* 2016; 116 (3): 501-28.



## FUELING FOR EXERCISE

# Carbohydrate recommendations for competition

Amount of exercise	Carbohydrate recommendations
< 45 minutes	Not required
45 – 75 minutes	Consider small amounts
> 60 minutes	Consider consuming carbohydrates (30 - 60g CHO per hour of exercise or 10 - 15g CHO every 15 - 20 minutes)
Longer duration endurance exercise (> ~2.5 hours)	Consider up to 90g CHO per hour (glucose + fructose) with little or no basal insulin reduction (or an increase in usual basal rate)

Be prepared to adjust fueling strategy according to blood glucose

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CHO, carbohydrate

Riddell MC, *et al. Lancet Diabetes Endocrinol* 2017, Published Online January 23, 2017; Thomas DT, *et al. J Acad Nutr Diet* 2016; 116 (3): 501-28.



## FUELING FOR EXERCISE

# Nutrition for competition

- When planning your nutrition strategy for competition consider your nutritional concerns:
  - Heat and hydration
  - Glycogen depletion
  - Hypoglycemia
  - Gastro-intestinal issues
- Other factors to consider:
  - Have a plan for when blood glucose levels get too high or too low
  - Practice in training



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# FLUID AND HYDRATION

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## HYDRATION

# Fluid management is essential



- Important for athletes with diabetes
  - Always carry a bottle of water
  - Increase fluid intake if blood glucose levels are high
- Useful to have some idea of sweat loss
- Aim for ~10% carbohydrate solution
- ~4-8% carbohydrate solution
  - 4-8g carbs in 100mL
  - 24-48g carbs in 600 mL (20 fl oz)

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American College of Sports Medicine, Sawka MN, Burke LM, Eichner ER et al. American College of Sports Medicine position stand. Exercise and fluid replacement. *Med Sci Sports Exerc.* 2007;39(2):377-390.



## HYDRATION

# Calculating sweat rate during exercise

1. Empty your bladder and record your weight = \_\_\_\_\_ lbs(A)  
(pre-exercise weight )
2. Record how much you drank during exercise = \_\_\_\_\_ fluid ounces(E)
3. Post-exercise weight: towel dry, empty your bladder and then record your weight = \_\_\_\_\_ lbs(B)
4. Subtract post-ex weight from pre-ex weight to get number of pounds lost during exercise  
Weight lost = \_\_\_\_\_ lbs(A) – \_\_\_\_\_ lbs(B) = \_\_\_\_\_ lbs(C)
5. To find out how many fluid ounces of water lost, multiply pounds by 16: \_\_\_\_\_ lbs(C) x 16 = \_\_\_\_\_ fluid ounces(D)
6. To determine hourly sweat rate, add number of fluid ounces lost during exercise (D) to the number of fluid ounces consumed during exercise (E) and divide by the total hours spent training:

$$(\text{___ fluid ounces(D)} + \text{___ fluid ounces(E)}) \div \text{___ hours} = \text{___ fluid ounces lost/hour}$$

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# SPORTS NUTRITION SUPPLEMENTS

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## SPORTS SUPPLEMENTS

# Evaluating commercial sports nutrition products

- Type of sugars found in most products:
  - Maltodextrin, dextrose, glucose
  - Fructose, sucrose
- Other sweeteners added:
  - Xylitol, agave nectar, stevia
- Other ingredients found in sports supplements include caffeine
- When to consider sodium:
  - When sweat losses are high (> 1.2L/hour)
  - “salty sweater”
  - > 2 hrs of exercise



<b>Nutrition Facts</b>	
Serving Size 2.5oz (71g)	
Servings Per Pouch 1	
Amount Per Serving	
<b>Calories</b> 220	Fat Cal 0
% Daily Value*	
<b>Total Fat</b> 0g	<b>0%</b>
Saturated Fat 0g	0%
Trans Fat 0g	0%
<b>Cholesterol</b> 0mg	<b>0%</b>
<b>Sodium</b> 5mg	<b>0%</b>
<b>Potassium</b> 478mg	<b>16%</b>
<b>Total Carbohydrate</b> 52g	<b>16%</b>
Dietary Fiber 2g	8%
Sugars 44g	
<b>Protein</b> 0g	
Vitamin A 0%	Vitamin C 15%
Calcium 6%	Iron 6%

\*Percent Daily Values are based on a 2,000 calorie diet

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Shirreffs SM, Sawka MN. Fluid and electrolyte needs for training, competition, and recovery. *J Sports Sci.* 2011;29(Suppl 1):S39-S46.



# WEIGHT MANAGEMENT

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# WEIGHT MANAGEMENT

## Factors to consider



Diet



Diabetes



Lifestyle

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## WEIGHT MANAGEMENT

### Diet

- Keep it simple – extras add up!
- Have protein at every meal
- Limit snacking
- Do not drink your calories
- Consider tracking calories periodically
- Eat enough
- Be a “mindful eater”



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## WEIGHT MANAGEMENT

# Diabetes

In order to limit the need for carbohydrates during exercise:

- **Option #1** – Perform exercise when insulin levels are lower
  - Exercise in a fasted state (e.g. before breakfast)
  - Reduce basal rate up to 90 minutes before exercise
  - Exercise 3-4 hours after a meal (e.g. before evening meal)
- **Option #2** – Exercise after meals, with significant bolus reduction
- **Option #3** – Perform low intensity exercise, such as walking, shortly after a meal
- **Option #4** – Choose types of sports or exercise that raise blood glucose (or keep it stable)



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## WEIGHT MANAGEMENT Lifestyle

- Aim for 7 - 9 hours of sleep per night
- Exercise almost daily
- Include movement **throughout the day**
  - Activity trackers can be helpful
  - Incorporate standing breaks at work
- Do fun activities as a family
- Use your support systems such as community/extra-curricular programs or school activities



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# Summary

- Pay attention to the “big and small stuff”
- Make protein a part of every meal
- Find the right balance of daily carb intake for your diabetes and exercise regimen
- Find what works for you by periodically tracking blood glucose, diet, and exercise
- Practice and refine your race or event day nutrition strategy
- Prioritize sleep

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Acknowledgements:



Thank you!