



Fueling and Hydration Strategies: From Weekend Warrior to Boston Marathoner

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Objectives

- Recognize endurance athletes' increased food/hydration needs and how to create/ implement fueling plans for everyday weekend warriors to elite athletes
- Understand and be able to apply pre, during, post-exercise fueling and hydration protocols
- Learn nutrition strategies for appropriate weight loss/gain amidst intense training



Outline

- Fueling needs of athletes and active individuals
 - Carbohydrate, protein and fat
- Hydration
 - Pre, during, post-exercise recommendations
 - Cramping and hydrating foods
- Fueling exercise
 - Pre, during, post-exercise recommendations
- Fueling sample workout days
- Maintaining weight/healthy weight loss/weight gain



Fueling Needs of Athletes and Active Individuals



Carbohydrates

- Amount of carbohydrate required depends on frequency, intensity, and duration + the individuals level of fitness
- CHO used during exercise can come from:
 - Endogenous production of glucose by the liver (gluconeogenesis uses lactate, alanine, glycerol & pyruvate from muscles)
 - Blood glucose
 - Muscle and liver glycogen stores
 - CHO consumed during exercise



Carbohydrate Needs of Athletes

- No real % recommendations for carbohydrate intake for athletes
- Based on size of athlete and type of activity
- Carbohydrate Recommendations
 - 3 g CHO/kg BW for athletes in off-season & attempting to lean out
 - 5-7 g CHO/kg BW for general training needs
 - 7-10 g CHO/kg BW for endurance athletes
 - 11 g CHO/kg BW for ultra-endurance athletes



Carbohydrate Needs of Active Adults

- Most everyday fitness clients will fall into these two categories:
 - 3 g CHO/kg BW for individuals trying to lose weight/body fat
 - 150 lb person = 68 kg = 204 gm carb/day
 - 200 lb person = 91 kg = 273 gm carb/day
 - 5 g CHO/kg BW for individuals who train 5-6 days a week intensely and are eating for energy and performance
 - 150 lb person = 68 kg = 340 gm carb/day
 - 200 lb person = 91 kg = 455 gm carb/day



Carbohydrate Recommendations

- Recommend complex carbohydrates over the course of the day at meals and snacks for sustained energy
 - Whole grains and wheat products
 - Fruits
 - Vegetables
 - Dairy products like milk and flavored yogurts
- Recommend simple carbohydrates around exercise and training
 - Sports drinks/gels/gu/blocks, fruit, etc.



Carbohydrate Goals

- **Pre-Workout Goal:**
 - Provide long-lasting energy to start and sustain beginning part of exercise
 - Bagels, oatmeal, brown rice, pasta, whole grains
- **During-Workout Goal:**
 - Maintain energy levels
 - Provide carbohydrate to spare glycogen stores
 - Energy bars, gus, energy chews, sports drinks
- **Post-Workout Goal:**
 - Replenish glycogen stores
 - Provide body with energy
 - Quick digesting carbohydrate
 - Sports drinks, fruit, milk, flavored milk, honey, etc.



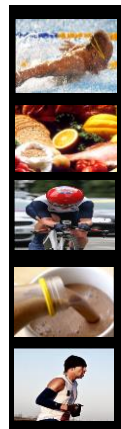
Protein Needs

- 0.8 gm/kg BW per day
 - Sedentary individuals
- 1.0 gm/kg BW per day
 - "Workout" people
- 1.2-1.4 gm/kg BW per day
 - Endurance athletes, runners, cycling
- 1.4-1.7 gm/kg BW per day
 - Basketball, hockey, soccer, tennis, swimming, track
- 1.6-1.7 gm/kg BW per day
 - Strength athletes
 - Baseball, football
- 2.0 gm/kg BW per day
 - Extreme exercise & heavy weight lifting



Protein Need Examples

- 150 lb endurance runner
 - 68 kg x 1.2 gm/kg = 81 gm protein
 - 68 kg x 1.4 gm/kg = 95 gm protein
- 175 lb triathlete
 - 79.5 kg x 1.2 gm/kg = 85 gm protein
 - 79.5 kg x 1.4 gm/kg = 111 gm protein
- 130 lb female athlete/client training for endurance & strength
 - 59 kg x 1.4 gm/kg = 83 gm protein
 - 59 kg x 1.7 gm/kg = 100 gm protein
- 175 lb male athlete/client training for endurance & strength
 - 79.5 kg x 1.4 gm/kg = 111 gm protein
 - 79.5 kg x 1.7 gm/kg = 135 gm protein
- 200 lb strength athlete/client trying to maintain mass
 - 91 kg x 1.6 gm/kg = 146 gm protein
 - 91 kg x 1.7 gm/kg = 155 gm protein
- 250 lb strength athlete/client trying to gain mass
 - 113.6 kg x 1.6 gm/kg = 182 gm protein
 - 113.6 kg x 2.0 gm/kg = 227 gm protein



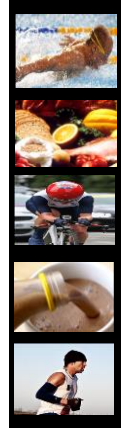
Protein Recommendations

- **Animal proteins are better absorbed**
 - Chicken, turkey, lean ham, lean red meat, fish, tuna, turkey bacon, turkey sausage, etc.
 - Eggs and egg whites
 - Low-fat dairy products
 - Whey protein powders
 - Good for smoothies/shakes
 - Whey protein is a quick digesting protein
- **Plant proteins are not absorbed as well so vegetarian/vegan athletes might need more protein than their exercise level**
 - Quinoa, oats, other whole grains
 - Nuts, seeds, nut butters
 - Beans and lentils



Fat Needs and Recommendations

- 20-35% of total calories
 - Anything less than 20 does not show performance enhancement
- Essential Fatty Acids
 - Consume at least 3-5% of dietary fat from food sources such as fish and plant oils
- Consequences of low-fat diets in athletes
 - Low-fat diets may not meet energy demands for growth & development in young athletes
 - Low-fat diets over time could cause deficiencies in fat-soluble vitamins & essential fatty acids
 - In females, low-fat diets can contribute to menstrual dysfunction due to a diet too low in calories



Fat Needs and Recommendations

- Consuming large quantities of fat is not recommended during intense exercise lasting less than 4 hours
 - Slows gastric emptying
 - Stays in the gastrointestinal tract longer
 - Enter the blood more slowly than other sources of energy typically used
- If exercising in ultra-endurance events, some fat is recommended to help possibly spare muscle glycogen, satisfy hunger and provide calories
 - May not be tolerated well by gastrointestinal tract so athlete needs to practice



Hydration Needs



Hydration Terminology

- **Dehydration**
 - Decrease in total body water; occurs anytime that fluid intake doesn't meet fluid loss
- **Euhydration**
 - Normal hydration
- **Involuntary Dehydration**
 - Occurs during exercise
- **Hypohydration (voluntary dehydration)**
 - Self-imposed before competition
- **Hyponatremia**
 - Abnormally low plasma sodium concentrations (<130 mmol/L)
 - Usually occurs when excess water accumulates in extracellular water compartments
 - General symptoms – fatigue and nausea



Signs of Dehydration

EARLY WARNING

- Excessive sweating
- Tiredness (fatigue)
- Loss of appetite
- Flushed skin
- Headache & Dizziness
- Nausea
- Small amounts of dark yellow urine
- Sticky mucus membranes in mouth

SEVERE

- Difficulty swallowing
- Stumble/clumsiness
- Shriveled, numb skin
- Sunken eyes
- Painful urination
- Muscle spasms



Hydration Recommendations

- **Pre-exercise**
 - 2-3 hours prior exercise: 16-20 oz fluid
 - 10 minutes prior exercise: 5-10 oz fluid
- **During-exercise**
 - Really individualized to sweat rate
 - Every 15-20 minutes: 5-10 oz fluid
 - Water and sports drinks
 - Sports drinks especially after 1 hour of exercise and/or in very hot/humid conditions
- **Post-exercise**
 - 16-24 oz fluid for every pound lost
 - 24 oz if in 2-a-days or need to rehydrate quickly



Calculating Sweat Rate

- **Sweat rate**
 - Pre-exercise weight – post-exercise weight = pounds lost
 - Multiply lbs lost by 16 to get into ounces
 - Add fluid consumed during exercise
 - Result = how many total ounces of fluid were lost during exercise
 - Take total number of exercise minutes and divide into 15-20 minute segments
 - Divide total ounces needed by 15 or 20 to get how many ounces should be consumed at each drinking interval



Calculating Sweat Rate

- **Sweat Rate Calculation Example**
 - Pre-exercise weight = 155 lb
 - Post-exercise weight = 152 lb
 - Ounces drank during exercise = 32 oz
 - Athletes exercised for 2 hours or 120 minutes
 - Goal is athlete drinking every 20 minutes so 3 times an hour or in this case 6 times in a 2 hour workout
 - $155 \text{ lb} - 152 \text{ lb} = 3 \text{ lbs}$
 - $3 \text{ lbs} \times 16 \text{ oz} = 48 \text{ oz}$
 - $32 \text{ oz drunk} + 48 \text{ oz lost} = 80 \text{ total oz of fluid lost during exercise}$
 - $80 \text{ oz} / \text{drinking } 6 \text{ times in } 2 \text{ hour workout} = \sim 13 \text{ oz every } 20 \text{ minutes}$



Fluid Considerations in the Heat

- **Training and heat acclimatization can...**
 - Increase sweat rates by 10-20% per hour
 - Increase the use of glycogen as fuel
 - Hastens onset of fatigue and RPE
 - Impairs mental performance
- **Ideally, athletes need 10-14 days of training in hot, humid environments to acclimate**
- **Recommendations:**
 - Increase fluid intake to match or exceed sweat rates
 - Monitor urine color
 - Increase sodium intake if total daily sodium from food and drink is $<3 \text{ gm/day}$



Fluid Considerations in the Cold

- Cold can increase urinary fluid losses
- Fluid intake seems to be less when cold
- Exercising in cold can increase fluid losses through respiration
 - Body has to warm/humidify air as it enters the body
- Can produce high sweat losses, especially if heavy insulated clothing is worn



Fluid Considerations When Flying

- Recommendation is add 8 oz fluid for every 1 hour in the air flying
- **Altitude**
 - Altitude can dehydrate you
 - General recommendation is an extra 1-1.5 L of fluid a day when at higher altitudes
 - Ideally, allow yourself 1-3 days to acclimate before having to compete
 - Avoid alcohol as this can exacerbate dehydration
 - Monitor urine color

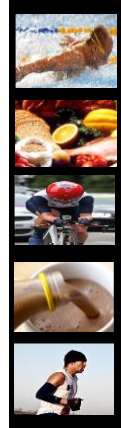
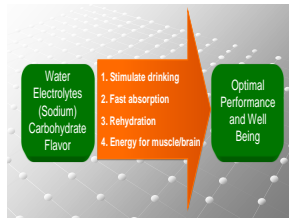


Hydration – Pre-workout

- **2 hours before**
 - Consume 7 mL/kg BW fluid
 - General recommendation 16-20 oz
- **20 min before**
 - 3-4 mL/kg BW fluid
 - General Recommendation 5-10oz
- Monitor urine color, odor, and volume to ensure adequate hydration
- Concentrated CHO beverages ($>10\% \text{ CHO}$) may not empty from the gut fast enough



Hydration – During Workout



G Series Products

- **Fluid need – match sweat losses**
 - Consume 5-10 oz fluid every 15-20 minutes
 - Water and sports drink to replace electrolytes
- **GATORADE PERFORM: GATORADE THIRST QUENCHER® (8-oz. serving)**
 - Trusted, scientifically proven Gatorade Thirst Quencher® helps athletes replace fluids, replenish electrolytes and refuel working muscles during activity.
 - Carbohydrates: 14 grams of carbohydrate (50 calories)
 - Electrolytes: 110mg sodium and 30mg potassium



G Series Products

- **GATORADE PERFORM: G2®**
 - (8-oz. serving)
 - A low-calorie thirst quencher that delivers functional hydration for active people during exercise, but with less than half the calories (and carbohydrates to fuel working muscles) of Gatorade Thirst Quencher.®
 - Carbohydrates: 5 grams of carbohydrate (20 calories)
 - Electrolytes: 110mg sodium and 30mg potassium



Hydration - Rehydrate

- **Rehydrating with sports drinks**
 - Good ones should contain 6-8% carbohydrate
 - Gatorade = 6% solution carbohydrate
 - 14 gm carbohydrate per 8 oz
 - Empty rapidly from stomach
 - Enhance intestinal absorption
 - Promote fluid retention
 - Provide adequate carbohydrate for energy during exercise



Hydration - Cramping

- **Typical causes:**
 - Fatigue
 - Dehydration due to loss of electrolytes
- **Foods to improve/prevent cramping**
 - High salt foods
 - Crackers, popcorn, baked chips, pretzels
 - Tomato sauces, soups, pickles & pickle juice
 - Salt your food!
 - High potassium foods
 - Bananas, strawberries, cantaloupe, raisins
 - Avocados, potatoes, beans, broccoli, spinach
 - Yogurt, milk, tomato juice, soybeans
 - Sports Drinks
 - Gatorade, G2



So what counts as fluid?

- Water
- Flavored waters like Crystal Light
- Sports drinks
- Tea
- Coffee
- Fruit juice
- Smoothies
- Jell-O
- Soup
- Fruits
- Vegetables



Fueling Exercise



Carb-loading Pre-Race

- Stuffing your face with as many carbs as possible the night before is not ideal
- Instead follow these tips
 - Eat a little extra carbohydrate at each meal and snack 1-2 days before the race
 - You can eat more carbs the night before, but focus on all day the day before
 - Try eating some saltier foods
 - Drink plenty of fluids
 - If you wake up in the middle of the night, try a carb-rich snack or drink



Pre-Exercise Meal Timing

- How much time do I need for digestion?
 - Allow 3-4 hours for large meal
 - Meat, pasta, vegetables, salad, roll
 - Allow 2-3 hours for smaller meal
 - Sandwich, crackers/baked chips, fruit
 - Allow 1-2 hours for a blenderized meal to digest
 - Smoothie, protein drink/shake
- Carbohydrate snack 30 minutes before exercise provides “energy burst” for performance
 - 50-70% carbohydrate, low-moderate protein

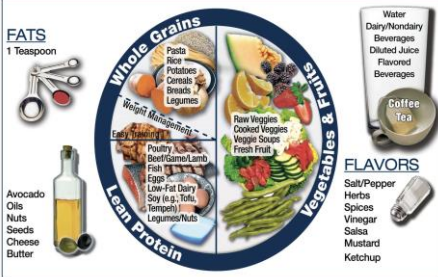


Pre-Exercise Eating

- Pre-exercise meal
 - High carbohydrate
 - Low in fat & fiber
 - These slow down digestion
 - Moderate protein
 - Combine protein + carbohydrate
 - Plenty of fluids
- Immediate Pre-exercise Snack
 - 30 minutes before workout/game
 - High carbohydrate, small amount of protein to provide you with a boost of energy



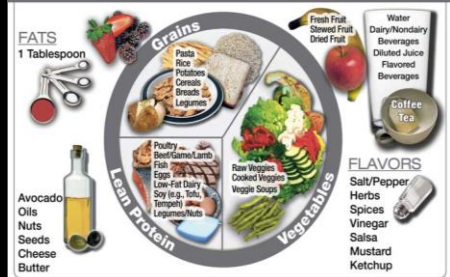
EASY TRAINING / WEIGHT MANAGEMENT:



The Athlete's Plates are a collaboration between the United States Olympic Committee Sport Dietitians and the University of Colorado (UCCS) Sport Nutrition Graduate Program.



MODERATE TRAINING:



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Morning Training

- **Lots of carbohydrate; easy-to-digest foods**
- **Good choices for early morning**
 - Shake with carbohydrates & some protein
 - Shake powder mixed with water or skim milk, fruit, 1 scoop protein powder, ice and water
 - Energy bar like Gatorade FUEL Bar
 - Low-fat granola bar like Kashi crunchy/chewy, Nature Valley, Quaker Oatmeal Square
 - Fruit (i.e. banana, nothing very acidic)
 - Plain bagel or dry cereal/granola mix



Morning Competitions/ Long Workouts

- Try to eat at least 2 hours before race
 - Allows time to get in enough nutrition and let it digest before starting
- Race Day Breakfast Examples
 - Bagel with peanut butter and honey, banana, sports drink
 - Oatmeal with a little nuts and dried fruit, 1-2 eggs, fruit, sports drink
 - 2 slices thick whole wheat toast with almond butter and honey on each and a smoothie with a little protein powder, fruit and juice
 - 1 cup granola with a little milk, banana with peanut butter, sports drink



G Series Products – PRIME FUEL

- **GATORADE PRIME Pouch (4-oz. pouch)**
 - Pre-workout or pre-game fuel.
 - Carbohydrates: 25 grams of carbohydrates (100 calories)
 - Electrolytes: 110mg sodium and 35mg potassium
- **GATORADE PRIME Chews (6 chews)**
 - Pre-Workout or pre-game fuel.
 - Carbohydrates: 25 grams of carbohydrates (100 calories)
 - Electrolytes: 110mg sodium and 35mg potassium



During Workouts

- **Carbohydrate-rich foods/drinks**
 - Carbohydrates digest the quickest & thus provide energy faster!
- **Avoid fat and fiber when exercise**
 - Slows digestion and increases time in which energy is available to be used
- **Carbohydrate needs during exercise**
 - <30 minutes = None Required; Water works
 - 30-60 minutes = Mouth rinse or small amounts
 - 1-2.5 hours = 30-60 gm carbohydrate/hour
 - >2.5 hours = Up to 90 gm carbohydrate/hour
 - Ideally around 1 gm carbohydrate per kg body wt



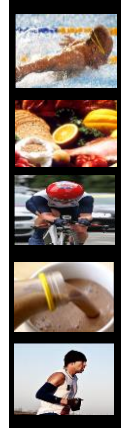
Getting your carbohydrates in while training and racing

- **Race/Long Run/Ride Nutrition:**
 - Goal of 30-60 gm carbohydrate per hour (probably divided into 2 little snacks an hour)
 - 4 Gatorade Endurance Energy Chews = 31 gm
 - Gatorade Endurance Carb Energy Drink = 30 gm
 - 1 gu = 25 gm
 - ½ Bonk Breaker Bar + 6-8 oz Gatorade Endurance = 25-30 gm
 - 1 pack sports jelly beans (1 oz) = 25 gm
 - ½ Clif Bar = 20-22 gm
 - 8 oz Gatorade Endurance = 14 gm
 - ½ banana = 15 gm
 - 15 grapes = 15 gm



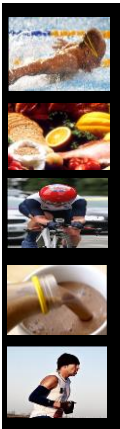
In-Between Workout Snacks

- **When there may not be time for a meal**
- **Carbohydrates, some protein, little fat**
 - Energy bars
 - Granola bars
 - Half peanut butter jelly sandwich and fruit
 - Peanut butter crackers
 - Peanut butter-filled pretzels and a fruit
 - Beef jerky and a banana
 - Beef jerky and a granola bar
 - Trail mix and a banana
 - Sports drinks and water as hydration



Post-Exercise Nutrition

- **The three R's to post-workout recovery:**
 - **Replenish** carbohydrate burned during exercise
 - **Rebuild** damage done to lean muscle mass
 - **Rehydrate** the body to euhydration



Post-Exercise 2-Hour Window

- **2-Hour Window of Recovery**
- Your body has a **specific time period, post-exercise**, when you are able to more effectively take up nutrients
 - **0-45 minutes**
 - Best time to eat at least a snack...muscles more sensitive to absorb nutrients!
 - **45 minutes – 2 hours**
 - Try to get a nice-size meal or larger snack
- The window is the most important time to consume plenty of carbohydrate, protein, & fluids to replenish & refuel
- Essential if participating in twice a day training



Post-Exercise Eating

- **Carbohydrate - Replenish**
 - Body **NEEDS** lots of carbohydrate post-exercise to replace energy stores
 - Simple carbs are best: milk, sports drink, fruit, juice
- **Protein - Rebuild**
 - Body needs some protein to start repairing tiny muscle tears
 - Ideally 20 gm protein immediately post-workout
 - Whey protein is the highest in BCAAs, specifically leucine which has been shown to re-synthesize muscle the fastest after a workout



Recovery Drinks: Endurance Sports

- **Ratio of 4:1 Recovery Drink Examples**
 - 4 grams carbohydrate for every 1 gram of protein
 - Low-fat chocolate milk
 - Accelerade
 - 8 oz low-fat milk & 1 small banana blended
 - 3 scoops Muscle Milk Collegiate in water
 - 2 scoops Muscle Milk Collegiate in 12 oz 1% milk
 - 32 oz Gatorade & ½ scoop whey protein powder
 - Shake (4 oz 1% milk, 8 oz orange juice, 1 banana, ¾ scoop whey protein powder)



Recovery Drinks: Strength Sports

- **Ratio of 2-3:1 Recovery Drink Examples**
 - 2-3 grams carbohydrate for every 1 gram of protein
 - Low-fat milk and a fruit
 - Muscle Milk
 - 8 oz low-fat milk & 1 small banana blended
 - 32 oz Gatorade & 1 scoop whey protein powder
 - Shake (6 oz 1% milk, 1 cup berries, banana, 1 scoop whey protein powder, ice & water)



Post-Exercise Eating

- **Carb-Protein Combo Food Examples**
 - Carb-Protein Replacement Shakes
 - Muscle Milk, Rockin' Refuel or EAS
 - Energy bar & Gatorade
 - Smoothie made with 1-2 cups low-fat milk, fruit, cold water, ice, and 1 scoop whey protein powder
 - 16-20 oz low-fat chocolate milk
 - Granola bar and 12 oz low-fat milk
 - Greek yogurt with honey and granola



G Series Products – RECOVER

- **GATORADE RECOVER Protein Shake**
 - (16.9-oz. serving)
 - Protein: 20 grams of protein
 - Carbohydrates: 45 grams of carbohydrates
 - Electrolytes: 320mg sodium and 680mg potassium
 - Calories: 270
- **GATORADE RECOVER Whey Protein Bar**
 - Protein: 20 grams of protein
 - Carbohydrates: 42 grams of carbohydrates
 - Calories: 350



Sample Morning Workout Day Eating Example

- Small pre-workout snack 4:30-6:30am
- Hydrate during workout
- Breakfast – within 30 minutes
 - If going to be longer, drink chocolate milk or small protein-rich shake
- Mid-morning snack – 10:00am
- Lunch – 11:30am-1:00 pm
- Afternoon snack – 3:30-4:30pm
- Dinner – 6:00-7:30 pm
- Evening snack – 9:00 pm



Sample Afternoon Workout Day Eating Example

- Breakfast – 6:00-8:30 am
- Mid-morning snack – 10:00am
- Lunch – 11:30am-1:00 pm
- Small pre-workout snack – 3:00-4:00pm
- Hydrate during workout
- Post-workout snack – within 30 minutes
- Dinner – 6:00-7:30 pm
- Evening snack – 9:00 pm



2-a-day Practice Eating Example

- 5:00am snack
 - Granola bar, energy bar, banana, baggie of cereal
- Workout
- Post-workout snack: chocolate milk
- Breakfast within 45 min-1 hour after practice
- Lunch 11:00am-12:00pm
- Afternoon (pre-workout) snack around 3-4pm
- Workout: Consuming water & Gatorade
 - Might want to consume energy bar or granola bar in the middle of practice if possible
- Dinner within 45 min-1 hour after practice
- Evening snack approximately 3 hours after dinner

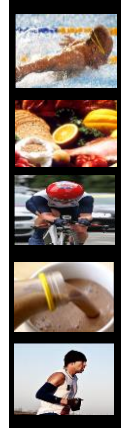


Body Weight Science: Manipulating Weight



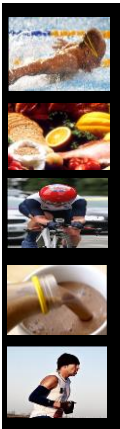
Defining Body Weight Science

- 4 things make up body weight
 - Lean muscle mass
 - Fat mass
 - Water
 - Bone
- Only one of these things do we want athletes to lose: fat mass
- Typically only one thing we want athletes to gain: lean muscle mass
 - Maybe bone mineral density if low levels



Weight Loss/Leaning Out Tips

- Try to lose weight/lean out in off-season
- Eat small meals often: Ideally 5-7 times/day
- Don't skip meals and eat adequate portions to your activity level
- Eat quality, nutrient-rich foods combining complex carbohydrates, lean protein, & healthy fat at each meal/snack and lots of water
- Avoid refined carbohydrates, fried food, alcohol, high fat foods, baked goods/pastries/donuts, creamy sauces/spreads/dips
- Avoid sugary beverages outside of training



Healthy Weight Gain

- Eat 6-8 meals/day
- Do not skip breakfast; guys trying to gain weight typically need lots of calories in the morning
 - Can eat and go back to bed if they have to
- Drink 2% milk and/or juice with meals
- Eat: a 30-min pre-exercise snack, every hour during exercise, and immediately post-exercise
 - Post exercise eat w/i 30 minutes and again w/i 2 hours
- Eat a high-calorie meal or shake right before bed
 - Shake is a good choice
- Make high-calorie food exchanges
- Consistency!!!



Weight Gain Food Ideas

- Add 2 Tbs. peanut butter, honey & brown sugar to oatmeal
- Add peanut butter & honey to waffles, pancakes, toast, & bagels
- Add low-fat granola to cereal, oatmeal, or yogurt, trail mix
- Put nuts on salad, tuna, in cereal & trail mix
- High calorie trail mix = high calorie cereal, granola, nuts, dried fruit, & M&M's
- Mix high-calorie protein powder with 2% milk
- Drink Boost Plus or Ensure Plus between meals
- Drink & make shakes with low-fat chocolate milk
- Eat a PBJ sandwich as a "dessert" post meals



Sports Nutrition Goals

- **Fuel:** Eat often during the day; approximately 5-7 meals/day
 - Fuel adequately every day; try not to skip meals or snacks; be prepared
- **Recovery:** Just as important as training
 - If recovery is not adequate, carbohydrate stores will not be replenished & you will start with a decreased amount of energy next time you train or compete
- **Hydration:** Drink fluids all day, not just around exercise



References and Questions

- 2016 American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and Athletic Performance Position Stand
- Dunford M and Coleman EJ. Sports Nutrition: A Practice Manual for Professionals, 5th ed.

○ Thanks to Gatorade Sports Science Institute for sponsoring today's presentation