ADVANCED TRACK

ADVANCED EXERCISE CONCEPTS

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EPIC DIABETES CONFERENCE

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EMPOWERING PATIENTS FOR INDIVIDUALIZED CARE

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OBJECTIVES

1. Identify energy systems working during anaerobic (without oxygen) and aerobic (with oxygen/low intensity) exercise.
2. Identify optimal blood sugar ranges before, during and after exercise and how to achieve those targets.
3. Identify optimal recovery strategies post-exercise for performance enhancement and blood sugar stability.

ENERGY UTILIZATION PER SPORT

Power/Anaerobic	Endurance/Aerobic
Fuel used: Phosphocreatine (PCr), anaerobic glycolysis	**Fuel used:** aerobic glycolysis
Sports: Powerlifting/Olympic Weightlifting Sprinting High intensity intervals Intense bursts in team sports	**Sports:** Endurance- running, cycling, triathlon Team sports Walking

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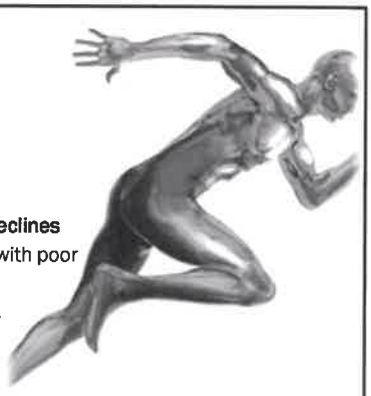
IMPACT OF DIET ON ENERGY UTILIZATION



- **Low creatine availability: low PCr**
  - Seen in vegan populations
- **Low protein availability: muscle wasting, strength declines**
  - Seen in some vegan/vegetarian athletes or those with poor food variety
- **Low fat availability: total energy availability possibly impaired, hormone disruption**
  - Seen in individuals with chronic dieting history
- **Low carbohydrate availability: low glycogen storage, inadequate metabolism anaerobic/aerobic glycolysis**
  - Most common, promoted by current fad diets.

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GUIDELINES FOR FUELING: PRE-EXERCISE

Timing of meal/snack: 30 minutes – 2 hours pre-exercise

Choose: carb choices based on blood sugar, easily digestible foods

Carb Ex): bread, crackers, potatoes, rice, fruit

Low-carb Ex): protein shake, deli meat, eggs, peanut butter, cheese, sugar-free Greek yogurt

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GUIDELINES FOR FUELING: PRE-EXERCISE

Power/Anaerobic: blood sugar rise common at beginning of exercise, increased insulin sensitivity post-ex

High-stress events (i.e. competition): blood sugar rise common at beginning of exercise, increased in*sulin sensitivity post ex*

Aerobic: consistent blood sugar drop common, increased insulin sensitivity post-ex

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GUIDELINES FOR FUELING: PRE-EXERCISE

Blood Glucose Level	Rec's for Exercise	Rec's Snack Based on Length of Exercise
<100mg/dL	Eat a snack pre-exercise	**>30min exercise**: 1-2 carb choices **1hr exercise**: 2 carb choices plus protein **2+ hr exercise**: Wait until >100 to exercise. Fueling during exercise imperative
100-150mg/dL	Safe to exercise, may need a snack	**>30min exercise**: 0-1 carb choices **1hr exercise**: 1-2 carb choices **2+ hr exercise**: 2 carb choices plus protein
150-200mg/dL	Safe to exercise	**>30min exercise**: no snack needed **1hr exercise**: 0-1 carb choices **2+ hr exercise**: Test glucose every hour

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GUIDELINES FOR FUELING: PRE-EXERCISE

Blood Glucose Level	Rec's for Exercise	Rec's Snack Based on Length of Exercise
200-250mg/dL	Safe to exercise, may not feel well	**>30min exercise**: No carb choices **1hr exercise**: No carb choices **2+ hr exercise**: Test glucose every hour
250-300mg/dL	Safe to exercise, may not feel well	**>30min exercise**: No carb choices **1hr exercise**: No carb choices **2+ hr exercise**: Test glucose every hour
300mg/dL or higher	May be too high to exercise	**>30min exercise**: No carb choices **1hr exercise**: No carb choices **2+ hr exercise**: Test glucose every hour

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GUIDELINES FOR FUELING: DURING EXERCISE

Purpose: maintaining performance throughout activity

Strength: likely not necessary, test glucose to learn predictions

Aerobic:

- low intensity <1hr – water only
- moderate/high intensity <1hr – test glucose to learn predictions;
- >1hr – carb/electrolyte replacement needed, test glucose to learn predictions

Goal of fuel: maintain energy availability, maintain normal/safe blood sugar, maintain adequate hydration

GUIDELINES FOR FUELING: DURING EXERCISE

	Carbohydrate Needed Per 60 Minutes of Physical Activity				
	50 lbs (23 kg)	100 lbs (45 kg)	150 lbs (68 kg)	200 lbs (91 kg)	250 lbs (114kg)
Low Intensity	5-8 g	10-16 g	15-25 g	20-32 g	25-40 g
Moderate Intensity	10-13 g	20-26 g	30-40 g	40-52 g	50-65 g
High Intensity	15-18 g	30-36 g	45-55 g	60-72 g	75-90 g

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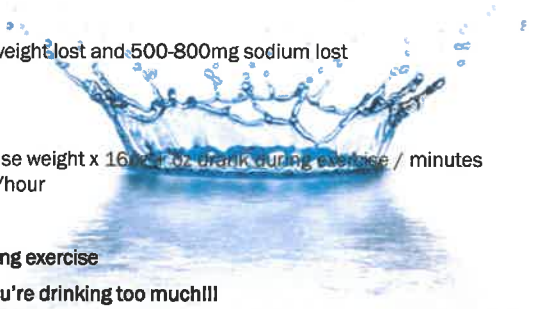
GUIDELINES FOR HYDRATION: DURING EXERCISE

Drink every 15-20 minutes during exercise. Amount depends on type and intensity of exercise and sweat rate.

1 L (32oz) fluid lost= 2lb body weight lost and 500-800mg sodium lost



Sweat rate testing:

Pre-exercise weight - post-exercise weight x 16 oz + oz drank during exercise / minutes performed * 60 = fluid lost/hour

Goal: <2% body weight lost during exercise

Weight gain during exercise= you're drinking too much!!!

Glucose impact. . .

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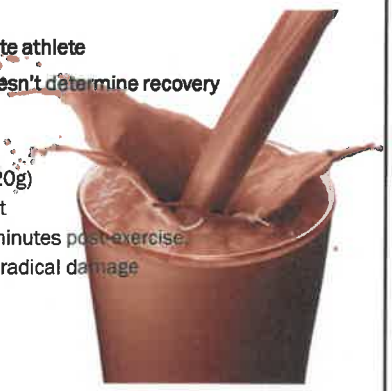
GUIDELINES FOR FUELING: POST-EXERCISE

Considerations for level of sport and goals

- **Recreational athlete vs weigh loss goals vs elite athlete**
- **Recovery is 24-48 hour process; one meal doesn't determine recovery**
- **Considerations to improve performance:**
  - Leucine content of recovery meal: 2g target
  - Total protein: 0.25-0.3g/kg body weight (15-20g)
  - Carb content of recovery meal: 1-2g/kg target
  - Sooner is better. Peak absorption within 60 minutes post-exercise
  - High nutrient density/antioxidant lowers free radical damage
  - 1.25-1.5L fluid for every kg lost



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GUIDELINES FOR FUELING: POST-EXERCISE

Test. . . Test. . . Test

Ideal meal/snack options:

Protein shake- with or without carbs based on blood glucose
Deli meat sandwich
Fruit and cheese
Yogurt parfait
Shelled edamame
Eggs and toast or fruit

Insulin sensitivity elevated post-exercise

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CREATE YOUR WORKOUT PLAN

- Keep a log of workouts, meals, med changes and blood sugar
- Test and retest
- What works for one person doesn't necessarily work for another
- Consider time of day

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THANK YOU!

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GUIDELINES FOR FUELING: PRE-EXERCISE

PRE-EXERCISE MEAL INSULIN ADJUSTMENTS

Activity Multipliers ↘	Short Duration (15-30 minutes)	Moderate Duration (31-60 minutes)	Long Duration (1-2 hours)
Low intensity (relatively easy)	.90	.80	.70
Moderate intensity	.75	.67	.50
High intensity (very challenging)	.67	.50	.33

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GUIDELINES FOR FUELING: PRE-EXERCISE

Meds that CAN cause hypoglycemia (in addition to insulin)	Meds that DO NOT cause hypoglycemia
• **Sulfonylureas** (glipizide, glyburide) • **Meglitinides** (Prandin, Starlix) • **Combinations** that contain any of the above medications	• **Metformin** (Glucophage) • **DPP-4 Inhibitors** (Januvia, Onglyza) • **Acarbose** (Precose) • **Thiazolidinediones** (Actos, Avandia) • **GLP-1 Agonists** (Byetta, Victoza)

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