Sport nutrition is the practical science of hydrating and fueling before, during, and after exercise.

**Fueling Systems**

- **Phosphagen System** (ATP – PCr) – fast, powerful, short burst
  - Vertical Jump, Sprints, Olympic Lifting

- **Anaerobic Glycolysis** – moderate power/moderate duration
  - 1-2 mins w/o oxygen, >4 mins w/ oxygen
  - Moderate glycogen stores required
  - 50 m swimming, basketball, 200-400 m sprinting

- **Aerobic Glycolysis** – low power/long duration
  - Heavy reliance on glycogen and FA (when low intensity)
  - Distance running, cycling, swimming

**The Cross Over Concept**

- Low to moderate intensity CHO & lipids play major role
- Relative aerobic power (60%-65%) CHO become increasingly more important
- Better trained athletes can stay in the aerobic/fat training zone longer

**Outline**

- Fueling Systems Review
- Nutrient Timing
- Making Weight
- Energy Availability (EA) and Relative Energy Deficiency in Sport (RED-S)
- Disordered Eating/Eating Disorders in Athletes
- Concerning Dietary Trends in Athletes
**Carbohydrates**

- Enables athletes to exercise longer and harder
- Recommendation:
  - 30-60g CHO/hour (120-240cal)
- Medium to High GI
  - Gels, Gatorade

**Determining Protein Needs**

- Protein: 10-35%
  - Non-athlete: 0.8 g/kg
  - Strength Athlete: 1.6-2.0 g/kg
  - Endurance Athlete: 1.2-1.4 g/kg

**Athletes and Fat Intake**

- 20-35% of total energy intake
- Very low fat diets (less than 19% fat) **not recommended**!
- Triad, RED-S

**Fat Metabolism**

- Endurance
  - >90 minutes
  - 65-75% VO2 max
  - Fat oxidation
- High intensity exercise
  - 70-80 VO2 max
  - Carbohydrate oxidation
- Training
  - Improves fatty acid oxidation

**Building a Powerful Plate**

- Step 1: Slow-Digesting Carbohydrates
  - Oatmeal, Cream of Wheat, Whole grain (WG) Bagels, WG Sandwich Bread, Rolls, and buns, Brown Rice, Multigrain Pasta, Whole wheat Couscous, Corn or whole wheat Tortillas, Potatoes, Sweet Potatoes
- Step 2: Fruits + Vegetables
  - Bananas, Apples, Oranges, Grapes, Grapefruit, PIneapple, Peaches, Cherries, Berries, Mangos, Tangerines, Dried Fruit, Fruit Juice, Broccoli, Green peppers, Red peppers, Green Beans, Zucchini, Squash, Spinach, Field Greens, Romaine, Mushrooms, Carrots, Cauliflower, Snap Peas, Lactose-free, Calcium/vitamin D rich foods daily
- Step 3: Protein-Rich Foods
  - Add two servings of calcium/vitamin D rich foods daily
  - Add healthy fat to each meal

**The Athlete’s Plate**

- Animal Sources
  - Add two servings of calcium/vitamin D rich foods daily
  - Add healthy fat to each meal
Macronutrients by Sport

<table>
<thead>
<tr>
<th>Sport</th>
<th>CHO g/kg/d</th>
<th>PRO g/kg/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseball</td>
<td>&gt;5</td>
<td>1.2-1.7</td>
</tr>
<tr>
<td>Basketball</td>
<td>&gt;5, 7-12</td>
<td>1.4-1.7</td>
</tr>
<tr>
<td>Figure Skating</td>
<td>5-7</td>
<td>1.2-1.7</td>
</tr>
<tr>
<td>Football</td>
<td>&gt;5, 7-12</td>
<td>1.4-1.7</td>
</tr>
<tr>
<td>Gymnastics</td>
<td>3-7</td>
<td>1.2-1.7</td>
</tr>
<tr>
<td>Ice Hockey</td>
<td>&gt;5, 8-10</td>
<td>1.4-1.7</td>
</tr>
<tr>
<td>Rowing</td>
<td>5-7</td>
<td>1.2-1.7</td>
</tr>
<tr>
<td>Soccer</td>
<td>&gt;5, 7-12</td>
<td>1.4-1.7</td>
</tr>
<tr>
<td>Swimming</td>
<td>7-10</td>
<td>1.2-1.7</td>
</tr>
</tbody>
</table>

Energy Needs Example Calculations

19 year old female open weight collegiate rower. Trains 2-3 hours per day and lifts twice weekly. Ht: 175 cm. Weight: 68kg. Looking to maintain weight.

68 x 6 = 408 g carbs/day = 1632 kcals (60%)
68 x 1.5 = 102 g protein/day = 408 kcals (15%)
68 x 1 = 68 g fat/day = 612 kcals (23%)

Total daily calories = 2652

How does it Compare?

Harris Benedict Equation:

1533 (RMR) x 1.725 (Activity factor) = 2,644 kcals

2652 vs 2644 !!

NUTRIENT TIMING

Pre-Activity

• 1 ½ hours before
  • low-fiber, and low fat
  • carbohydrate/protein
  • Will leave the stomach and intestine more quickly

Post-Activity

• Consumption of 10-20 grams of protein
  • The Recovery Window
  • 4:1 ratio
  • Carbohydrate : Protein
  • Restoration of muscle and liver glycogen stores

• 1.5g CHO/kg immediately after exercise
• 1.5g CHO/kg 2 hours later
## Pre-Post Workout Fueling

<table>
<thead>
<tr>
<th>Pre-Workout</th>
<th>Post-Workout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mainly Carbs</td>
<td>Carb + Protein</td>
</tr>
</tbody>
</table>

- Granola Bar
- Yogurt and Fruit
- Banana + Pretzels
- Apple Sauce and Nuts
- Pretzels and Nuts
- Low Fiber Dry cereal
- Sports Drinks
- Energy Chews

- Chocolate Milk
- Banana & PB/AB
- Fruit and Yogurt/Milk Smoothie
- Graham Crackers and PB/AB
- Yogurt with Granola
- Turkey Sandwich (1/2 or whole)

## Let’s Talk Weight…

### Weight Management & Training

- Take it SLOW (0.5 – 1 lb/week)
  - Rapid weight loss (>1 kg/week) – water, glycogen, muscle
- Conservative decrease in energy intake
  - Never during winter training
  - Short period of time
  - After recovery from last session of day
- Carbohydrate
  - Kept high; protein-sparing
- Protein
  - Slight increase or no change

### Making Race/Competition Weight (24-48h)

- Low residue diet
- Decreased fiber
- Safe fluid restriction
  - Note: performance deficit at water loss equaling 2% body weight
  - Rehydration immediately after weigh in
- Weigh: once a week, first thing in AM

### Energy Availability & the Athlete

Are RDs asking enough questions to support prevention of injury and promotion of long-term health?

“You need to find a Balance”

Calories Consumed - Training Calories

Energy Availability
The Female Athlete Triad

RED-S Relative Energy Deficiency in Sport

Signs/Symptoms of Low EA

RED-S at BCH Sports Med

Assessing EA/RED-S
DXA

- Body fat % on results can be misleading
  - Includes fat on ear lobes, bottom of feet
- ‘Spiderman’
  - Low in essential body fat
  - Body composition shift to support bone health and menstrual function

Disordered Eating (DE) and Eating Disorders (EDs) in Athletes

- Prevalence of DE/EDs is higher among athletes than non-athletes
  - Higher risk in female than male athletes
  - Higher risk among athletes in leanness sports
- 46% of elite females in leanness sports and 20% in non-leanness sports struggle with clinical eating disorder

Common Obstacles for Athletes

- Not eating enough
- Not drinking enough
- Skipping meals
- Missing out on recovery nutrition
- Uninformed vegetarianism
- An obsession with scale/body image
- Unsafe dieting
- Unhealthy relationship with food

Similarities between Good Athlete Traits and Anorexia Characteristics

<table>
<thead>
<tr>
<th>GOOD ATHLETE</th>
<th>PERSON WITH ANOREXIA NERVOSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mental Tougthness</td>
<td>Asceticism</td>
</tr>
<tr>
<td>Commitment to training</td>
<td>Excessive exercise</td>
</tr>
<tr>
<td>Pursuit of excellence</td>
<td>Perfectionism</td>
</tr>
<tr>
<td>Coachability</td>
<td>Overcompliance</td>
</tr>
<tr>
<td>Unselfishness</td>
<td>Selflessness</td>
</tr>
<tr>
<td>Performance despite pain</td>
<td>Denial of discomfort</td>
</tr>
</tbody>
</table>

RD’s Approach

- All Athletes:
  - Performance goals
  - Injury prevention
  - Education on basic fueling concepts
  - Meal/Snack Timing

- ED/DE Athlete:
  - Food exposure therapy
  - Food legalization → no “good foods” or “bad foods”
  - Pre/post/during fueling
  - Balance out calories and output → adjust as needed

Incorporating Exercise in ED Treatment

- Allowing an athlete to remain on his/her athletic team and participate at any level deemed appropriate helps to maintain the athlete identity and self esteem
- Helps athlete learn how to fuel for sport while still in treatment
CONCERNING DIETARY TRENDS IN ATHLETES

GLUTEN FREE: THE FACTS

Gluten

What it is (we all know this):
• Protein found in wheat, barley, and rye
• Gives dough an elastic texture

What it is not (what athletes may think it is):
• The magic bullet for:
  – Weight loss
  – Athletic performance
  – ALL GI issues

Why Are Athletes Going Gluten Free?

• Performance enhancement
• Non celiac gluten intolerance or celiac disease
• Decrease inflammation
• Weight loss/body comp optimization
• GI distress* (number one reason)
• Because _________ athlete went GF!

Other GI effects

• GI distress is reported in 30-50% of endurance athletes
• This can be attributed to:
  – Psychological factors, splanchnic hypoperfusion,
    dehydration, fiber, carbohydrate type, or timing of
    nutrient intake

Bottom line: Eliminating gluten may not be the solution!

Arranz E. OmniaScience 2015
The Research

• Short-term GFD had no overall effect on performance, GI symptoms, well-being, or inflammatory markers in non-celiac endurance athletes

• "Belief effect" $\rightarrow$ 1-3% improvement in performance regardless of any actual ergogenic effect

• In patients with celiac or non-celiac gluten intolerance:
  – Relieves GI symptoms
  – Improves intestinal absorption

LOW CARB/HIGH FAT DIETS FOR ATHLETIC PERFORMANCE?

What is all the hype?

• The body stores unlimited fat, but is limited in the amount of carbs it is able to store

  • “Bonk proof?”
  • Increase utilization of fat for fuel and expose the body to circulating ketones
  • Become less reliant on carbs

High Carb vs. High Fat

• LCHF diet associated with higher rates of whole body fat oxidation

  • 20% more oxygen required to liberate fat compared to carbs

  • Improved performance in chronic high carb or periodized high carb but not in LCHF group

  • Train low and race high?

Summary

• Adaptation to an LCHF diet impairs performance in elite endurance athletes despite a significant improvement in peak aerobic capacity

  • Athletes may be utilizing fat more efficiently, but if you are bonking then what does it matter?

  • Optimizing power/weight ratio via weight loss can improve performance but that can be done on a balanced diet as well
FEMALE ATHLETE CONFERENCE

SAVE THE DATE: JUNE 6-8, 2019
Elson College, Webster, MA

Sign up at: bostondechildrens.org/femaleathletesconference

AN ATHLETE EATS AND TRAINS. AN ATHLETE DOES NOT DIET AND EXERCISE.