Basic Nutrition for Athletes

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Objectives

• Review the role and importance of optimal nutrition in physical activity, athletic performance and recovery
• Review general energy metabolism and the role of energy balance in athletic performance
• Review current recommendations regarding macronutrient (carbohydrate, fat and protein) ingestion for training, competition and recovery

Optimal Nutrition

• Nothing basic about nutrition...
• Very individualized
• Goal dependent
• Complex

Variation in Nutrition Requirements

• Type of exercise
• Intensity of exercise
• Duration of exercise
• Weight/body composition challenges
• Age/sex
• Training/competition schedule
• Goals?
• Travel and time zone changes

Basic Nutrition Goals

• Adequate...
  - Energy intake to meet the demands of training
  - Replenishment of muscle and liver glycogen with dietary carbohydrates (CHO)
  - Protein intake for growth and repair of tissue, particularly muscle
  - Overall diet (e.g., proteins, antioxidant vitamins) to maintain a healthy immune system
  - Hydration

Energy Balance

Dietary energy intake
- Exercise energy expenditure
= Energy Availability
Nutrients that give us energy

Carbohydrates  
Fats  
Proteins  

Digestion → Glucose  
Free Fatty acids  
Amino Acids

Three Major Energy Systems

Creatine phosphate  
Anaerobic glycolysis  
Oxidative phosphorylation

ATP = adenosine triphosphate

ATP and Energy Use by Muscle

Muscle fiber

Myosin ATPase

Energy

Force

ADP

Energy Balance

Dietary energy intake - Exercise energy expenditure = Energy Availability

- Consume adequate energy to maintain body weight and health and maximize training effects
- Negative energy balance can result in:
  - Loss of muscle mass
  - Menstrual dysfunction
  - Loss or failure to gain bone density
  - Inc risk of fatigue, injury, illness
  - Prolonged recovery process

New Female Athlete Triad

Optimal Energy Availability

Low Energy Availability

Low Bone Health

Functional Hypothyroidism

Osteoporosis

Eumenorhea

Optimal Bone Health

Low Energy Availability

Low Bone Health

Functional Hypothyroidism

Osteoporosis

Eumenorhea

Optimal Bone Health
Adequate Energy Needs

- **Variation!**
  - Male endurance athletes: 3000-5000 kcal/day
  - Female athletes with energy intakes < 1800-2000 kcal/day at risk

- Majority additional energy needs supplied as CHO

Body Weight and Composition

- **“Ideal” Body Composition?**
  - No valid scientific rationale
  - Better to define a “range” of values, and monitor both health and performance
  - Limitations of current methods
  - May precipitate disordered eating behaviors

Body Weight and Composition

- Should not be a criterion for sports performance
- Frequent weigh-ins discouraged
- Optimum body fat level dependent on age, sex, heredity and may be sport specific

Body Weight and Composition

- Assessment techniques have variability and limitations
- Weight loss should take place in off season and involve sports dietician
- If weight (fat) loss is required, it should start before the competitive season and involve a trained health and nutrition professional

Basic Nutrition

- **CARBOHYDRATES**
- **PROTEINS**
- **FATS**
- **MICRONUTRIENTS**
  - VITAMINS AND MINERALS
- **WATER**

Carbohydrates

- Maintain blood glucose during exercise
- Replenish muscle glycogen after glycogen-depleting exercise
- As exercise duration increases, carbohydrate needs rise
Carbohydrates

- Carbohydrate needs increase particularly during:
  - periods of high intensity training w/ few rest days
  - multiple workouts/day
  - tournaments with multiple games per day
- 6-10 g/kg/day (2.7-4.5 g/lb)
- Dependent on energy expenditure, sex, sport, and environmental conditions

Protein

- Maintain and build muscle mass
- Repair and rebuild muscle tissue
- Maintain immune function
- Fluid balance
- Hormones
- Energy

Protein Recommendations

- General recommendation: 1.0-2.0 g/kg/day
- Sport-based recommendations:
  - Recreational athletes → 1.0 g/kg/day
  - Endurance athletes → 1.2-1.4 g/kg/day
  - Ultraendurance athletes → 1.2-2.0 g/kg/day
  - Strength athletes → 1.5-2.0 g/kg/day

Fats

- Source of energy
- Fat soluble vitamins A, D, E, K
- Essential fatty acids
- Should be < 30% of normal diet (<10% saturated fat)
- No evidence high-fat is ergogenic
- Fat provides 70% of energy at rest
- Fat supports vital organs, insulates and preserves body heat

Dietary Fat Recommendations

- Dependent on energy needs
  - Higher energy expenditure → higher fat needs
- Most athletes require ~ 1.0 g/kg/day
  - 20-35% of total calorie intake
- Endurance athletes
  - Up to 2.0 g/kg/day
- Ultraendurance athletes
  - Some reported to consume up to 3.0 g/kg/day

Dietary Fats

- Primarily monounsaturated and polyunsaturated
- Monounsaturated fats:
  - olives, oils, nuts, avocados
- Polyunsaturated fats:
  - fish, fish oil, flaxseed, walnuts, some oils
- <10% of total calories should be from saturated fat
Micronutrients

- Most common vitamins and minerals of concern in athletes diets:
  - Calcium, Vit D
  - B vitamins
  - Iron
  - Zinc
  - Magnesium
  - Antioxidants: C, E, beta carotene and selenium

Micronutrients

- Vitamin and mineral supplements not needed if proper foods consumed
- Supplements may be needed in athletes who:
  - Restrict energy intake
  - Use severe weight loss practices
  - Eliminate food groups from diet

The Training Diet

Before...

...During...

...After

Before/Pre-Exercise

- Fluid to maintain hydration
- Low in fat
- Low in fiber
- Facilitate gastric emptying and minimize gastric distress
- High CHO to maintain maintenance of blood glucose
- Moderate protein
- Familiar foods to athlete

Carbohydrate Before Exercise

- Carbohydrate (g) before training/competition
  - 1-4 gm/kg 1-4 hours prior

<table>
<thead>
<tr>
<th>Grams/kg</th>
<th>Grams/lb</th>
<th>grams 150 lb athlete</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>0.5</td>
<td>75g</td>
<td>1 hr prior</td>
</tr>
<tr>
<td>2.0</td>
<td>0.9</td>
<td>135g</td>
<td>2 hr prior</td>
</tr>
<tr>
<td>3.0</td>
<td>1.4</td>
<td>205g</td>
<td>3 hr prior</td>
</tr>
<tr>
<td>4.0</td>
<td>1.8</td>
<td>275g</td>
<td>4 hr prior</td>
</tr>
</tbody>
</table>

* If unable to eat breakfast before an early-morning workout, eating ~30g easily digested carbohydrates 5-15 minutes before exercise may improve performance

During Exercise

- Replace fluid loss
- Provide CHO for maintenance of BG levels
- Especially when:
  - Exercise > 1 hr
  - Inadequate pre-exercise intake
  - Extreme conditions
- Consumption in 15-20 min intervals better than 2 hour bolus
- Addition of protein inconclusive on performance
Carbohydrates During Exercise
Â Sport drinks, energy bars, fruit, breads
Â For long-duration, moderate to high intensity exercise
Â Consume 30-60 grams per hour (~1 gram/minute)
Â Dilute concentration (<10%) may be advantageous by optimizing fluid absorption/delivery

After Exercise
Â Provide adequate fluids and energy:
  í Replace muscle glycogen stores
  í Ensure rapid recovery
  í With protein, aids in the repair of muscle tissue after training/competition.
Â Recovery nutrition most important for:
  - athletes training intensely on a daily basis
  - athletes with more than one competition or workout in a day
  - after a major event or competition

Carbohydrate After Exercise
Â Recovery snack should be consumed immediately after exercise (within 30 min.)
Â Again q2H for 4-6 hours
Â 1.0-1.2 grams per kg (~0.5 g/lb)

<table>
<thead>
<tr>
<th>Weight Lbs</th>
<th>110</th>
<th>125</th>
<th>155</th>
<th>170</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kg</td>
<td>50</td>
<td>57</td>
<td>70</td>
<td>77</td>
</tr>
<tr>
<td>Carb (g)</td>
<td>50-60</td>
<td>57-68</td>
<td>70-84</td>
<td>77-92</td>
</tr>
</tbody>
</table>

Protein + Carbohydrate
Role of Protein Ingestion During Recovery from Exercise:
Â Studies assessing the addition role of protein (in a CHO + PRO mixture) to enhance muscle glycogen resynthesis are inconclusive
Â However, protein added to a CHO recovery drink may aid in the repair and synthesis of muscle protein after endurance exercise
Â Recommended (post-exercise): CHO 1.2 g/kg/hour, PRO 0.1-0.2 g/kg/hour
Â Ex. Low-fat chocolate milk → convenient, inexpensive

Recovery Foods
<table>
<thead>
<tr>
<th>Food Item</th>
<th>Serving Size</th>
<th>Carbohydrate (g)</th>
<th>Protein (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange juice</td>
<td>16 oz.</td>
<td>60</td>
<td>0</td>
</tr>
<tr>
<td>Bagel</td>
<td>Large (4 oz)</td>
<td>60</td>
<td>8</td>
</tr>
<tr>
<td>Chocolate milk</td>
<td>16 oz.</td>
<td>52</td>
<td>16</td>
</tr>
<tr>
<td>Yogurt Smoothie</td>
<td>10 oz.</td>
<td>44</td>
<td>10</td>
</tr>
<tr>
<td>Clif bar</td>
<td>1</td>
<td>45</td>
<td>10</td>
</tr>
<tr>
<td>PB &amp; J sandwich</td>
<td>1</td>
<td>45</td>
<td>12</td>
</tr>
<tr>
<td>Cereal &amp; milk</td>
<td>1 cup each.</td>
<td>42</td>
<td>11</td>
</tr>
<tr>
<td>Banana</td>
<td>Medium</td>
<td>23</td>
<td>0</td>
</tr>
</tbody>
</table>

Vegetarian Athletes
Â May be at risk for low energy intake
Â Low protein, fat intake
Â Low micronutrients:
  í Iron, calcium, Vit D, riboflavin, zinc, B-12
Summary

- Carbohydrates, Fats and Protein all play an important role in the Athlete Diet
- Importance of Energy Balance
- Individualized Nutrition Requirements
  - Variation due to type, duration, and frequency of activity; age, sex, environment
- Training Diet = Before, During and After Exercise

References