Nourishing the Injured Athlete

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Overview

• High-level review of the healing process
• Considerations during healing and rehabilitation
• Nutritional management of the injured athlete
• Specific nutrients of interest
• Foods to discourage during injury
• Emerging areas
• Final takeaway recommendations
Process of Healing

• Inflammation
  o Initiation of the healing process
  o Clear the site of bacteria and cellular debris
  o Angiogenesis

• Proliferation
  o Deposition of the fibroblast and collagen matrix
  o Osteoblast formation and cartilaginous callus
  o Growth of new capillary networks

• Remodeling
  o Cycle of breaking down, rebuilding, and organization
  o Osteoblast/osteoclast activity
  o Simultaneous protein synthesis and degradation

• Net result – hypermetabolic state & ↑ protein needs
Injury Considerations

• Immobilization
  o Loss of muscle mass
  o Decrease in strength
  o Decrease in muscle function

• Metabolic impact of immobilization
  o Negative net muscle protein balance
  o Anabolic resistance
    • Amino acids
    • Decrease in insulin sensitivity
  o Bone collagen synthesis does respond to increased amino acid levels

• Decrease in activity
Considerations During Rehabilitation

• Anabolic state
  o Increase muscle
  o Increase strength

• Increasing activity
The Impact from a Nutrition Perspective
Nutritional Consideration

• Increased basal metabolic rate
  o All phases of healing require energy
  o 15-25% increase
  o Depends on the severity of the injury

• Changes in activity
  o Immobilized limb
  o Not participating in sport

• Energy needs will depend on activity level of the athlete
  o MET value of crutch walking = 5.0
  o MET value of walking for pleasure = 3.5
  o Stage of rehabilitation

• Increased requirement for protein

• Micronutrients

• Goals of rehabilitation
Nutrition Management

- Minimize catabolism
- Meet protein needs
- Meet energy needs
  - Balancing act
  - Individualized
  - Keep protein from being used as energy
- Ensure micronutrients are adequate
- Consider who is at highest risk
- Malnutrition will impede the healing process
How to Calculate Calories

Healthy

- Basal Metabolic Rate
- Activity Factor

Total Energy Expenditure

Injured

- Basal Metabolic Rate
- Activity Factor
- Stress (injury) Factor

Total Energy Expenditure
### Comparison of Recommendations

<table>
<thead>
<tr>
<th>Healthy State</th>
<th>Injured State</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy Needs</strong></td>
<td><strong>Energy Needs</strong></td>
</tr>
<tr>
<td>- 1.8 moderate activity</td>
<td>- 1.0 – 1.2 Minor surgery</td>
</tr>
<tr>
<td>- 2.3 very heavy physical activity</td>
<td>- 1.1 – 1.3 Major surgery</td>
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<tr>
<td>- 30 kcal/kg FFM</td>
<td>- 1.25 – 1.3 Long-bone fracture</td>
</tr>
<tr>
<td><strong>Protein Needs</strong></td>
<td><strong>Protein Needs</strong></td>
</tr>
<tr>
<td>- 1.2 -1.4 g/kg for endurance</td>
<td>- 1.0 – 1.5 g/kg initial injury</td>
</tr>
<tr>
<td>- 1.2 -1.7 g/kg for strength</td>
<td>- 1.2 -1.7 g/kg rehab</td>
</tr>
<tr>
<td><strong>Fat</strong></td>
<td><strong>Fat</strong></td>
</tr>
<tr>
<td>- 20 – 35% calories</td>
<td>- 20 - 30% calories</td>
</tr>
<tr>
<td><strong>Carbohydrates</strong></td>
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</tr>
<tr>
<td>- 7 – 8 g/kg</td>
<td>- 7 – 8 g/kg</td>
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</table>
Female 5’6”, 135 lb, 20 y/o

**Healthy State**
- Calories
  - 2600 - 3350
- Protein
  - 74 – 105 grams

**Injured State**
- Calories
  - 2450 - 3050
- Protein
  - 74 – 105 grams
Male 6’0”, 190 lb, 20 y/o

**Healthy State**

- Calories
  - 3750 - 5000
- Protein
  - 104 - 147

**Injured State**

- Calories
  - 3500 - 4300
- Protein
  - 104 – 147
Specific Nutrients

How some minerals, vitamins, and amino acids play a role in healing
May be helpful in healing

- **Zinc** plays a role in immune function, protein, and collagen synthesis, cellular proliferation, and wound healing
- **Vitamin C** functions in the synthesis of collagen connective tissue protein, acts on fibroblast proliferation, capillary formation, and neutrophil activity
- **Vitamin A** stimulates the immune system, enhances wound healing by stimulating epithelialization, and increases collagen deposition by fibroblasts
- **Glutamine** critical for the synthesis of fibroblasts, epithelial cells, and macrophages, essential for gluconeogenesis, and important in stimulating the inflammatory response
- **Arginine** substrate for protein synthesis, collagen deposition, and cellular growth
- **Calcium** essential for normal bone structure
- **Vitamin D** facilitates the absorption of calcium
Food Sources

- Zinc – meat, liver, eggs, and seafood
- Vitamin C – citrus fruit, green vegetables, tomatoes, and potatoes
- Vitamin A – liver, yellow vegetables, green leafy vegetables, eggs, and milk products
- Calcium – milk, yogurt, and cheese
- Vitamin D – sun exposure, fortified foods – milk and cereals
What to Avoid During Injury

- Low-density foods
- High-sugar
- High-fat
- Alcohol
How does all of this translate?

A day in the life through food
Typical Intake - Female

- Breakfast
  - Whole wheat bagel, cream cheese, yogurt & fruit smoothie with spinach and orange juice
- Snack
  - Apple, almonds, crackers
- Lunch
  - Turkey sandwich with lettuce and tomato, carrot sticks, orange, pretzel rod, and sports drink
- Snack
  - Hummus, veggie sticks, and a pita
- Dinner
  - Salmon, spinach, winter squash, brown rice, and milk
- Snack
  - Graham crackers, peanut butter, strawberries
- Totals
  - 2800 calories, 435 g CHO, 112 g Pro
Typical Intake - Male

- **Breakfast**
  - Whole wheat bagel, cream cheese, hard boiled egg, yogurt and fruit smoothie with spinach, peanut butter and orange juice

- **Snack**
  - Clementine, almonds, crackers

- **Lunch**
  - Turkey sandwich with lettuce, tomato, and cheese, carrot sticks, apple, pretzel rod, and sports drink

- **Snack**
  - Yogurt, granola, and sports drink

- **Dinner**
  - Chicken breast, whole wheat pasta with red sauce, broccoli, winter squash, and salad with dressing

- **Snack**
  - Cereal, milk, and pear

- **Totals**
  - 3900 calories, 600 g CHO, 172 g Pro
What Are We Still Learning?

Some Emerging Topics
Emerging Information

- Supplementation with immobilization
  - Protein supplementation
    - Branched-chain amino acids
    - Leucine
  - Omega-3
  - Creatine
Oral creatine supplementation facilitates the rehabilitation of disuse atrophy and alters the expression of muscle myogenic factors in humans

- Hespel, et al.
- Double-blind trial
- Methods
  - 22 young healthy volunteers
  - Cast was used to immobilize the right leg for two weeks
  - Half the subjects received creatine monohydrate – 20 g down to 5g daily
  - Subjects participated in a knee-extension rehabilitation program
  - Measured the cross-sectional area of the quadricep with NMR imaging
  - Measured maximal knee extension power with isokinetic dynamometer
  - Needle biopsy taken from the vastus lateralis were examined for myogenic regulatory factors
- Results
  - Oral creatine supplementation stimulates muscle hypertrophy during rehabilitation strength training

*Journal of Physiology (2001) 536.2*
The Effect of Creatine Supplementation on Strength Recovery After ACL Reconstruction

- Tyler, et al.
- Double-blind, prospective, and randomized clinical trial

**Methods**
- 60 patients were randomized into placebo and creatine
- 20 g/day for the first 7 days then dosage was reduced to 5g/day
- Formal rehabilitation began at 1 week
- Quadriceps and hamstring strength and power were measured isokinetically. Hip flexor, abductor, and adductor were measured with a handheld dynamometer prior to surgery, at 6 wks, 12 wks, or 6 months after surgery.

**Results**
- Patients do not benefit from creatine supplementation during the first 12 weeks of rehabilitation after ACL reconstruction
Take Away

• Encourage athletes to continue their normal intake
• High quality protein, whole grains, fruits, & veggies
• Carefully watch those at most risk
• If you have concerns speak with your team dietitian and/or doctor
Thank You

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References