Nutrition strategies to attenuate loss of lean tissue mass in the injured athlete

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Injuries are an unavoidable aspect of participation in physical activity

Little information about nutritional support for injuries exists
Let food be your medicine

Let food be *compliment* your medicine
Let food be complement your medicine and your rehab

MUSCLES: USE 'EM OR LOSE 'EM

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Disuse Atrophy

Nutritional considerations:
- Dietary protein intake = 1.6–2.5 g/kg/day.
- Protein dosage: meal dose = 20–40 g (depending upon lean tissue content); frequency = every 3–4 h (4–6 meals daily).
- High-quality, high-travel protein, but considering slowly digested proteins (e.g., casein) prior to sleep.
- Additional supplements: HMB (5 g/day); creatine (10 g/day for 2 weeks, then 5 g/day); fish oils (4 g/day).

Optimising interventions during recovery in the injured athlete:
- Daily compressive sleeve treatment (3–4 times for 20 min)(weeks 0–6)
- Daily walking in a swimming pool 2 × 20 min(weeks 6–8)
- Daily 2 × 30 min bouts of NMES (frequency = 100 Hz; pulse width = 400 μs; contraction/rest = 5 s on/10 s off)(weeks 0–8)
- Daily physiotherapy (passive motion) 2 × 2–3 h(weeks 6–8)

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The Injured Athlete

- Injury
  - Immobilisation
    - (Surgery)
  - Rehabilitation
- Return to train
- Return to competition

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The Injured Athlete

- Alcohol
- Comfort eating
- Panic
- Crash diet!

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Nutritional Status

• Poor nutritional status will impede healing and recovery

• Protein and energy malnutrition exacerbates inflammatory process and slows healing

• Malnourishment unlikely to be common in healthy exercisers, but self imposed nutrition strategies are not recommended and nutrition must be monitored
Stimuli for Muscle Protein Synthesis (MPS)

- Exercise
- Nutrition

Injury

Immobilisation / Atrophy

Mobility / Recovery
Immobilisation / Atrophy

• The stimuli are less effective with injury
  • Exercise is limited
  • Any activity has a less potent response

• Nutrition is sub-optimal
  • Nutrition has a less potent response

• Decreased muscle protein synthesis (MPS)
• Decreased muscle mass
• Impaired muscle function

Mobility / Recovery

• Exercise is limited

• Nutrition must be optimal

• Increased muscle protein synthesis (MPS)
• Increased muscle mass
• Increased muscle strength and function

Note the time course to return is much longer than the loss with immobilisation
Key Considerations

- Adequate Energy
- Optimised Protein
- Manage Inflammation
- Consider Supplements

- Manage Expectations
- Know Your Limits

Adequate Energy

- Energy
  - Appropriate to needs
  - Tissue repair (+20%?)
  - Ambulation (crutches) (2/3 fold increase on walking)
  - Energy surplus required for MPS

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Optimised Protein

- Protein Intake
  - Quantity
  - Quality - BCAAs, in particular leucine
  - Distribution
    - To overcome anabolic blunting
    - Muscle-full concept
  - Studies investigating overcoming anabolic resistance (elderly)

Manage Inflammation

- Fats
  - No need for overall increase
  - Manipulate
    - Increase omega-3 fatty acids widely associated with anti-inflammatory and immunomodulatory properties
    - Found in high levels in the oil of many fish e.g. mackerel and salmon, as well as walnuts, flax seed oil and other sources
    - Suggestion that omega-6 fatty acids should be avoided to enhance anti-inflammatory properties (plant oils)
    - Opinion is not universal and more recent evidence suggests that omega-6 fatty acids also have anti-inflammatory properties
Manage Inflammation

• Avoid pro-inflammatory foods
  – Excess
    • Caffeine
    • Alcohol
    • Artificial sweeteners
    • Trans fats
    • Added sugars
    • Preservatives

Nutrition Support

• Avoid micronutrient deficiency
  – calcium and vitamin D, zinc, vitamin C, or vitamin A

• Adequate carbohydrates
Consider Supplements

• Leucine
  
  – Quantity
  – Quality - BCAAs, in particular leucine
  – Distribution

  – Studies investigating overcoming anabolic resistance (elderly / injured)

Consider Supplements

• Sources of leucine

Table 2. Quantity of supplemental protein (powdered form) required to provide 3 g of leucine. Nutrition information from the USDA National Nutrient Database or peer-reviewed publications. Estimates of protein content for micellar casein and whey hydrolysate are based on 90% protein concentration.

<table>
<thead>
<tr>
<th>Protein Supplement</th>
<th>Product (g)</th>
<th>Protein (g)</th>
<th>Leucine (g)</th>
<th>Energy (kcal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collagen Hydrolysate/Gelatin [39,40]</td>
<td>122.2</td>
<td>104.6</td>
<td>3</td>
<td>409</td>
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<tr>
<td>Pea Isolate [41]</td>
<td>46.9</td>
<td>27.8</td>
<td>3</td>
<td>182</td>
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<tr>
<td>Soy Isolate [39]</td>
<td>44.2</td>
<td>39.0</td>
<td>3</td>
<td>148</td>
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<tr>
<td>Micellar Casein [42]</td>
<td>36.5</td>
<td>32.9</td>
<td>3</td>
<td>167</td>
</tr>
<tr>
<td>Whey Hydrolysate [42]</td>
<td>27.9</td>
<td>25.1</td>
<td>3</td>
<td>130</td>
</tr>
<tr>
<td>Leucine</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>12</td>
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</tbody>
</table>
β-Hydroxy β-methylbutyrate (HMB) Supplements to Increase Muscle Mass

- Is a metabolite of Leucine
- ↓ protein degradation & ↑ protein stimulation
- Supplemental form: Ca HMB & Free acid forming HMB (FA-HMB)
- Studies report:
  - ↑ LBM
  - ↑ Strength
  - ↑ Power
  - ↑ Aerobic performance
  - Enhanced recovery

Caveat

Researchers calling for further studies but inclusion likely to be beneficial

Consider Supplements

Review:

HMB & Body Composition

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Consider Supplements

Glutamine

- Most abundant amino acid (AA) in the plasma
- Conditionally essential
- Major metabolic fuel for intestinal mucosa and cell proliferation
  - Fibroblasts, lymphocytes, epithelial cells, macrophages
- Increases protein synthesis and immunoglobulin a (IgA)
- Synthesized in muscle

Key considerations

- Daily protein intake of 1.6–2.5 g per kg of body mass:
  - Ideally through regular (4–6 times daily, every 3-4 hrs) consumption of adequate amounts (20-35 g) of rapidly digested protein sources with a high content of the branched chain amino-acid, leucine (2.5–3 g); and
  - Including dietary protein with breakfast and prior to sleep.

- Intake of specific nutritional compounds that may also promote the maintenance of muscle protein synthesis rates such as
  - Omega-3 fatty acids, branched chain amino acids (including leucine), creatine, and HMB (a metabolite of leucine).

- It is challenging for athletes to achieve optimal macronutrient intakes to maintain skeletal muscle mass but prevent any gains in fat mass, due to the reduced energy expenditure during the recovery period.
### Practical Application

#### Immobilisation Phase vs Rehabilitation Phase

<table>
<thead>
<tr>
<th>Immobilisation Phase</th>
<th>Rehabilitation Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate calories</td>
<td>Increased calories</td>
</tr>
<tr>
<td>Adequate protein (? + leucine)</td>
<td>Increased protein</td>
</tr>
<tr>
<td>Sufficient vitamins and minerals</td>
<td>Sufficient vitamins and minerals</td>
</tr>
<tr>
<td>Limit alcohol intake</td>
<td>Limit alcohol intake</td>
</tr>
<tr>
<td>Include omega 3-rich foods</td>
<td>Include omega 3-rich foods</td>
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<tr>
<td>Plenty of fruit and vegetables</td>
<td>Plenty of fruit and vegetables</td>
</tr>
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Consider risk benefit of supplement use

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Translating Acute Research Studies: Concept to Practice?

**THIS IS NOT ROCKET SCIENCE PEOPLE!**

BUT
**CHECKLIST**

<table>
<thead>
<tr>
<th>Day</th>
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<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Morning shake*</td>
<td>2x garlic cloves</td>
<td>1 avocado</td>
<td>2x fish oils</td>
<td>½ cup pineapple</td>
<td>½ cup blueberries/strawberries</td>
<td>1 t-spoon of ginger/turmeric or curry powder (add to food)</td>
<td>Full Cup of Dark Green Veg</td>
<td>Full Cup of Other Veg</td>
<td>4 full portions of protein</td>
</tr>
<tr>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
</tr>
<tr>
<td>1 multi-Vit</td>
<td>2.5 litres of water</td>
<td>1 handful of almonds</td>
<td>Night Shake**</td>
<td></td>
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**TOTAL SCORE**

<table>
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<td>11+</td>
<td>11+</td>
<td>11+</td>
<td>11+</td>
<td>10+</td>
<td>10+</td>
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</tbody>
</table>

FOOD FIRST!

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**The McGinley’s Super Food Curry**

**Veg**

- 1 large sweet potato
- 2 carrots
- 1 parsnip
- 1 onion
- 2 leeks
- 2 stem of broccoli

**Curry powder**

- 1 tsp coriander seeds
- 1 tsp cumin seeds
- 1 tsp caraway seeds

**Vegetables**

- 1 large onion
- 1 tsp turmeric

**Prep your veg**

Chop your veg and put into a large cooking pan with your red water and have the stew on the go. Feel free to shape and cut it with your own powder and root veg. Spread them out every 2 mins with 1 tsp of curry powder and 1 tsp of root veg powder.

**Cook your Curry paste**

Add your root veg to your curry powder and stir to a thick paste. You may need a little bit of water to adjust the consistency. You can add your veg to the root veg paste to adjust the consistency.

**Mix your curry powder**

Mash together the curry powder and root veg paste, then add in the vegetables and mix well. You can add a little water to adjust the consistency. You can add your veg to the root veg paste to adjust the consistency.

**Add your sauce**

Then add your sauce and cook the sauce until it is thick and has a thick consistency. You can add a little bit of water to adjust the consistency. You can add your veg to the root veg paste to adjust the consistency.

**Final tips**

- Make sure the veg is done cooking before the sauce is done cooking.
- You can add a little bit of water to adjust the consistency.
- You can add some red wine to adjust the consistency.

**Sprinkle some curry powder over the root veg**

The curry powder will give you a nice kick of flavor. You can add some red wine to adjust the consistency.
Cheat!

- http://www.resultsforlife.tv/category/nutrition/

Thank You
No tricky questions!

If a dog wore pants would he wear them
like this or like this?

Key References

Nutrition Support

• Creatine – lack of data but promising
• HMB – leucine metabolite, anti-catabolic
• Glutamine – conditionally essential AA (surgery / trauma)