RECOVERY: LOOKING FORWARD TO THE NEXT MATCH

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The Congested Calendar...

USA vs Portugal
Sunday, June 22

USA vs Germany
Thursday, June 26

Virginia Tech at Miami
Thursday, Oct 9

Virginia Tech at FSU
Sunday, Oct 12

NR United vs Richmond Strikers
Saturday, May 24 (9:00)

NR United vs Virginia United
Saturday, May 24 (2:00)
Training and Match Load

- Fatigue
- Recovery
- Injury Prevention
- Rehabilitation

Virginia Tech vs Notre Dame
Match Performance and Recovery

Session = Warm Up + 90 min Match + 20 min Overtime

<table>
<thead>
<tr>
<th></th>
<th>College Male</th>
<th></th>
<th>College Female</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Heart Rate</td>
<td>162 bpm</td>
<td></td>
<td>164 bpm</td>
<td></td>
</tr>
<tr>
<td>Total Distance</td>
<td>19,391 m (~12 mi)</td>
<td>15,996 m (~10 mi)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Intensity Dist</td>
<td>4,7058 m</td>
<td></td>
<td>3,282 m</td>
<td></td>
</tr>
<tr>
<td>Sprints</td>
<td>93</td>
<td></td>
<td>73</td>
<td></td>
</tr>
<tr>
<td>Collisions</td>
<td>12</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Energy Expended</td>
<td>1,905 kcal</td>
<td></td>
<td>1,220 kcal</td>
<td></td>
</tr>
</tbody>
</table>
Long-Term Recovery and Adaptation
Goals for Recovery

1. Recover for the next session *(day - short term)*

1. Recover for the next match *(week - intermediate term)*

1. Adapt to training *(months - long term)*
What Happens Post-Match?

Energy and Fluid Stores
*Glycogen Depletion and Dehydration*

Rest – Sleep

Muscle Recovery
- Performance
- Soreness
- Adaptation

![Graph showing percent change in strength and speed over 5 days after a match.](graph.png)
**Where Can We Intervene?**

<table>
<thead>
<tr>
<th>Term</th>
<th>Timeframe After Match</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate – Term</td>
<td>0-30 min Post-Match</td>
</tr>
<tr>
<td>Short - Term</td>
<td>0-45 min Post-Match</td>
</tr>
<tr>
<td>Intermediate – Term</td>
<td>Several Hours Post-Match</td>
</tr>
<tr>
<td>Long - Term</td>
<td>Several Days Post-Match</td>
</tr>
</tbody>
</table>
Diet and Hydration

Recovery Diet and Hydration
• Carbohydrates and fluids
• Within first 45-60 min post-exercise

Follow with a high carbohydrate meal

Solid, high carbohydrate, low fat diet

This week:
“Fueling Up for Match Day/Tournament“
Angel Planells, Nutrition Consultant, ACP Nutrition

"Nutritional Supplements to Enhance Soccer Performance: Debunking the Myths“
Dr. Ajit Korgaokar, Assistant Professor for Health & Human Performance, University of Tennessee-Martin
“Student-athletes say Sleep is the number one thing their athletic time commitments prevent them from doing, ultimately hindering their athletic and academic performance”

PAC 12 Survey, 2015
Sleep - Consequences

Athletes generally do not get enough sleep
• College and high school

Can impact physical and mental performance
• Cognitive, decision making
• Reaction time
• Strength
• Power
• Endurance
Sleep – Injury Risk in Young Athletes

Milewski et al., 2014

- Illness risk also increased
- Concussion diagnosis and recovery impaired
What is “Delayed Onset Muscle Soreness?"

**Definition**
- Occurs following “novel” exercise
  - Single or repeated contractions
  - Often eccentric exercise
  - Greater force, more novel

**Time Course**
- Appears within 24 hrs of exercise
- Peaks between 24-72 hrs post-exercise
- Disappears within 72 hrs

**Not Due To:**
- Strain, tear, cramps or chronic pain
- A pathological / disease condition
What Causes Muscle Soreness?

Muscle Fiber Damage
- Not metabolic (lactic acid)
- Not temperature
Effects of Damage

1. **Physical Damage**
2. **Autogenic Damage** (Oxidative Stress, Calcium)
3. **Pain / Inflammation**
4. **Repair**

**Muscle Proteins**
- Creatine Kinase

**Phagocytes**
- Inflammation

**Amino Acids**
- Protein Synthesis

**Autogenic Damage**
- Intracellular Proteases
- Oxidative Stress

1. Physical Damage
2. Autogenic Damage (Oxidative Stress, Calcium)
3. Pain / Inflammation
4. Repair
Muscle Damage and Repair

- Physical Damage
- Autogenic Damage
- Muscle Enzymes
- Pain
- Muscle Weakness
- Protein Synthesis

The graph shows the timeline for initial, autogenic, phagocytic, and regenerative stages from 0 to 5 days.
How Best to Deal with Muscle Soreness?

• Physical
  - Cool Down
  - Massage and Compression
  - Ice and Cryotherapy

• Nutrition / Supplements
  - Antioxidants
  - Medications

• Training

Physical Damage
Autogenic Damage
Pain / Inflammation
Repair
Physical Strategies – COOL DOWN

**Muscle Strength and Soreness**

Confusing effects
- Limited research data
- Small benefit
- No benefit

No adverse effects

Psychological benefits (??)
Physical Strategies – MASSAGE

**Theory:**
- Passively increase blood flow
- Alleviate pain, aid recovery

**Practice:**
- Some benefits but are highly variable, often temporary
- Large psychological effect
  - Relaxation
  - Meditation
Physical Strategies – COMPRESSION

Theory:
• Reduces blood pooling
• Limits autogenic damage

Physical Damage
× Autogenic Damage
× Pain / Inflammation
Repair
Physical Strategies – COMPRESSSION

Practice:
• Some benefits, but are highly variable
• Limit pain and damage
• Largest effect with inactive, long-term recovery
  • Bus / car ride home

Jakeman et al., 2010
Physical Strategies - ICE

Ice and Cryotherapy

*Theory:*
- Reduce inflammation and swelling
- Arrest autogenic damage (protein breakdown)
Physical Strategies - ICE

**Practice:**

- Perhaps a minor effect
- May be psychological
- Adverse effects ??? (more later)

*Bailey et al, 2007*
Nutritional and Supplement Strategies

Must consider the cycle of soreness and long-term adaptation

Physical Damage
Autogenic Damage
Pain / Inflammation
Repair
Long-Term Recovery and Adaptation

- Activity
- Fatigue
- DOMS
- Adaptation
- Recovery / Repair

Physical Damage
Autogenic Damage
Pain / Inflammation
Repair
Long-Term Recovery and Adaptation

Exercise → Damage → Repair → Adaptation

Training Effect
Does Muscle Have to Be Torn Down to Be Built Up?

- Muscle Mass
  - Protein Synthesis

- Training

- Aerobic Capacity
  - Energy Production

- Autogenic Damage
  - Oxidative Stress

- Adaptation
  - mTOR Pathway
  - PGC1-a Pathway

- Protein Synthesis
Supplements – ANTIOXIDANTS

Theory
• Reduce oxidative stress during exercise
• Limit autogenic damage
• Alleviate pain

Physical Damage
Autogenic Damage
Pain / Inflammation
Repair
Supplements – ANTIOXIDANTS

Short-Term

Bryer and Goldfarb, 2006
Supplements – ANTIOXIDANTS

Long-Term

Skaug et al., 2014

Physical Damage

Autogenic Damage

Pain / Inflammation

Repair
Does Muscle Have to Be Torn Down to Be Built Up?

- Muscle Mass
  - Protein Synthesis
- Training
  - Aerobic Capacity
    - Energy Production
- Autogenic Damage
  - Oxidative Stress
- Adaptation
  - mTOR Pathway
  - PGC1-a Pathway
  - Antioxidants
    - Ice ??
Supplements – BCAAs / PROTEINS

**Theory**
- Promote a positive protein balance
- Provide “building blocks” for protein synthesis
- Enhance recovery and repair
- Improves glycogen synthesis – energy replenishment

Amino Acids

Physical Damage

Autogenic Damage

Pain / Inflammation

Repair

USYOUTHSOCCER.ORG
Supplements – BCAAs / PROTEINS

BCAAs supplemented after exercise

Howatson et al., 2012
Supplements – HMB

**Practice:**
- Blunts protein & membrane breakdown
- Reduces soreness
- Enhances protein synthesis
Does Muscle Have to Be Torn Down to Be Built Up?

**Training**
- Muscle Mass
  - Protein Synthesis
- Aerobic Capacity
  - Energy Production

**Autogenic Damage Oxidative Stress**

**Adaptation**
- mTOR Pathway
- PGC1-a Pathway
- BCAAs
- HMB

**Muscle Mass**

**Protein Synthesis**
Training
Making the Activity “Less Novel”

- Physical Damage
- Autogenic Damage
- Pain / Inflammation
- Repair
Does Muscle Have to Be Torn Down to Be Built Up?

**Training**
- **Muscle Mass**
  - Protein Synthesis
- **Aerobic Capacity**
  - Energy Production

**Autogenic Damage**
- Oxidative Stress

**Soreness**
- Soreness
  - Soreness
  - Soreness

**Adaptation**
- mTOR Pathway
- PGC1-a Pathway
Recovery Strategies – What Works?

**Immediate Term** (<15 min)
- ✓ Cool Down
- ✓ Stretching

**Short Term** (15 – 120 min)
- ✓ Nutrition and Hydration
- ✓ Cryotherapy – Cold Water Immersion

**Intermediate Term** (2-6 hrs)
- ✓ Compression
- ✓ Massage
- ✓ BCAA / HMB

**Long Term** (4-48 hrs)
- ✓ Training
- ✓ Sleep
- ✓ BCAA / HMB
For More Info...

www.scienceofsocceronline
- FaceBook
- Twitter

Science Behind Soccer Nutrition
- Amazon

US Youth Soccer & NSCAA Websites
- Nutrition articles
- This presentation