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July 10 – 13, 2013  |  Las Vegas, NV

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RECOMMENDATIONS FOR PROTEIN AND AMINO ACID TIMING FOR STRENGTH AND HYPERTROPHY

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HUMAN MOVEMENT SCIENCE CURRICULUM

NSCA 36th Annual National Conference
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Outline

• Acute Muscle Protein Synthesis
• Chronic Supplementation
• Protein Type
• How Much
• Recommendations
Protein Synthesis

• Resistance training results in a **negative NPB**

• Amino acid supplementation results in a **positive NPB**

• Training and amino acid supplementation synergistically ↑ NPB
Protein Synthesis - Timing

**Pre vs Post**

- Immediate pre-resistance exercise ingestion of a EAA-CHO solution resulted in a **greater and more sustained** MPS response than post. (Tipton et al. 2001)

- **No difference** in MPS when ingesting 20 g of whey pre and post-resistance exercise. (Tipton et al. 2007)

- Pre-supplementation of a EAA-CHO solution 1 hr before resistance exercise **does not** enhance post-exercise MPS when compared to exercise w/out supplementation. (Fujita et al. 2009)

**Post**

- **No difference** in MPS responses when an EAA-CHO solution ingested 1 or 3 hr after resistance exercise. (Rasmussen et al. 2000)

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*Studies examining the timing of protein supplementation on MPS appear inconsistent.*
Chronic Supplementation & Training

Does protein supplementation and its timing translate into greater gains in strength and hypertrophy?
Chronic Supplementation & Training

Supplementation
- Oral protein (10g protein; 7g carb; 3g fat)

Groups – elderly (74 yrs)
- (P0) Immediately after (n=7)
- (P2) 2 hr after (n=6)

Training
- 12 wks/ 3/wk

Assessments - MRI
- Quadriceps CSA
- Mean fiber CSA
- 5RM and Isokinetic Strength

Timing of protein supplementation is important for the development of skeletal muscle hypertrophy.
Chronic Supplementation & Training

**Supplementation**
- 1 g/kg/bw of the supplement (2 daily)
- 80kg subject example: 32g pro, 34.4 g carb, 0.4 g fat, 5.6g CrM

**Groups**
- 23 recreational male bodybuilders
- (PRE-POST) before and after training (n=8)
- (MOR-EVE) before breakfast and sleep (n=9)

**Training**
- 10 wks; 3/wk

**Assessments**
- Body comp (DEXA)
- 1-RM strength
- Muscle biopsies

Supplement timing was an important strategy to enhance RT adaptations.
Chronic Supplementation & Training

Supplementation
- 42g protein blend (collagen, whey, casein)

Groups
- 33 strength/power athletes
- (PRE-POST) before and after training (n=13)
- (AM/PM) morning and evening (n=13)
- Control (n=7)

Training
- 10 wks; 4/wk

Assessments
- 1-RM strength
- Power (5reps @ 80%1RM)
- Body composition (DEXA)

Supplement timing did not influence RT adaptations.

Hoffman et al. 2009 IJSNEM
Chronic Supplementation & Training

Protein supplementation augments the adaptive response of skeletal muscle to resistance-type exercise training: a meta-analysis

Naomi M Cermak, Peter T Res, Lisette CPGM de Groot, Wim HM Saris, and Luc JC van Loon

The American Journal of Clinical Nutrition

“... there is much discrepancy in the literature regarding the proposed benefits of protein supplementation during prolong resistance-type exercise training...”

Attributed to research design variables:
• Duration of intervention
• Training status
• Age
• Amount, type, and timing of protein supplementation
Protein supplementation resulted in:

- Greater ↑ Type I fiber CSA (241 μm²)
- Greater ↑ Type II fiber CSA (477 μm²)
Chronic Supplementation & Training

Fat and Fat-Free Mass

Protein supplementation resulted in:

• Greater ↑ FFM (0.81 kg)

• No difference in the ↓ FM (-0.11 kg)
Chronic Supplementation & Training

Protein supplementation resulted in:

Untrained
• Greater ↑ FFM (0.75 kg)

Trained
• Greater ↑ FFM (0.98 kg)
Chronic Supplementation & Training

Protein supplementation resulted in:

• Greater ↑ leg press 1-RM strength (14.4 kg)
Chronic Supplementation & Training

Groups
- Whey protein hydrolysate + CHO
- CHO only

Training – 12 wks; 3/wk
- 1 leg – eccentric
- 1 leg – concentric

Assessments - MRI
- Quadriceps CSA
- Tendon CSA

Protein supplementation resulted in greater gains in tendon CSA.

Farup et al. 2013. SJMSS
Does Protein Type Matter??

Groups – recreational bodybuilders
- Whey protein isolate (n=6)
- Casein protein (n=7)

Training – 10 wks
- Phase 1 (70 – 75% 1-RM) Wks 1-2
- Phase 2 (80 – 85% 1-RM) Wks 2 - 4
- Phase 3 (90 – 95% 1-RM) Wks 5 - 10

Assessments
- Body composition - DEXA
- 1-RM strength

Whey supplementation resulted in greater changes in body composition and strength
Does Protein Type Matter??

Meta-analysis
- 9 studies (n=241)

Training
- 8 – 16 wks (mean = 11.2 wks)

Mean lean mass gains (mean±SD)
- Milk: 2.7 ± 1.3 kg
- Whey: 2.9 ± 1.6 kg
- Soy: 1.4 ± 0.6 kg
- CHO/PL: 0.9 ± 0.6 kg

“... milk and soy appear to be better than energy (CHO) alone, .... the data in total suggest that whey supports muscle hypertrophy most effectively...”

Does Protein Type Matter??

Table 1: Approximate Essential Amino Acid Profile of Various Protein Sources

<table>
<thead>
<tr>
<th>ESSENTIAL AMINO ACID</th>
<th>MILK PROTEIN ISOLATE</th>
<th>WHEY PROTEIN ISOLATE</th>
<th>WHEY PROTEIN HYDROL.</th>
<th>CASEIN</th>
<th>SOY PROTEIN ISOLATE</th>
<th>EGG PROTEIN</th>
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</thead>
<tbody>
<tr>
<td>Isoleucine</td>
<td>4.4</td>
<td>6.1</td>
<td>5.5</td>
<td>4.7</td>
<td>4.9</td>
<td>5.7</td>
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<tr>
<td>Leucine</td>
<td>10.3</td>
<td>12.2</td>
<td>14.2</td>
<td>8.9</td>
<td>8.2</td>
<td>8.4</td>
</tr>
<tr>
<td>Lysine</td>
<td>8.1</td>
<td>10.2</td>
<td>10.2</td>
<td>7.6</td>
<td>6.3</td>
<td>6.8</td>
</tr>
<tr>
<td>Methionine</td>
<td>3.3</td>
<td>3.3</td>
<td>2.4</td>
<td>3.0</td>
<td>1.3</td>
<td>3.4</td>
</tr>
<tr>
<td>Phenylalanine</td>
<td>5.0</td>
<td>3.0</td>
<td>3.8</td>
<td>5.1</td>
<td>5.2</td>
<td>5.8</td>
</tr>
<tr>
<td>Threonine</td>
<td>4.5</td>
<td>6.8</td>
<td>5.5</td>
<td>4.4</td>
<td>3.8</td>
<td>4.6</td>
</tr>
<tr>
<td>Tryptophan</td>
<td>1.4</td>
<td>1.8</td>
<td>2.3</td>
<td>1.2</td>
<td>1.3</td>
<td>1.2</td>
</tr>
<tr>
<td>Valine</td>
<td>5.7</td>
<td>5.9</td>
<td>5.9</td>
<td>5.9</td>
<td>5.0</td>
<td>6.4</td>
</tr>
<tr>
<td><strong>Total BCAAs</strong></td>
<td><strong>20.4</strong></td>
<td><strong>24.2</strong></td>
<td><strong>25.6</strong></td>
<td><strong>19.5</strong></td>
<td><strong>18.1</strong></td>
<td><strong>20.4</strong></td>
</tr>
<tr>
<td><strong>Total EAAs</strong></td>
<td><strong>42.7</strong></td>
<td><strong>49.2</strong></td>
<td><strong>49.8</strong></td>
<td><strong>40.7</strong></td>
<td><strong>36.0</strong></td>
<td><strong>42.3</strong></td>
</tr>
</tbody>
</table>

Concentration of EAA and BCAA within commercially available protein (g/100g)

Leucine may play an important role in the stimulation of MPS.

Hulmi et al. 2010. Nutr Metab
How Much Protein??

Subjects
- 6 men (age=22 yrs)

Exercise
- 4 sets each of leg press and leg extension and flexion
- 8-10 reps

Supplementation
- Whole egg protein (400ml water)
- Randomized conditions:
  - 0, 5, 10, 20, 40 g

Ingestion of 20 g of protein maximally stimulated MPS after resistance exercise.

How Much Protein??

Subjects
- 3 body mass matched groups (N=24; age=25yrs)

Training
- 2 warm-ups (50-60% 1RM)
- 4 x 10 (80% 1RM)

Supplementation
- 80 g of whey protein isolate over 12 hrs
- PULSE: 8 x 10g (1.5hr)
- INT: 4 x 20g (3hr)
- BOLUS: 2 x 40g (6hr)

How does the quantity and timing of protein ingestion after resistance exercise influence MPS throughout the entire day?

How Much Protein??

Subjects
- 3 body mass matched groups (N=24; age=25yrs)

Training
- 2 warm-ups (50-60% 1RM)
- 4 x 10 (80% 1RM) leg extension

Supplementation
- 80 g of whey protein isolate over 12 hrs
- PULSE: 8 x 10g (1.5hr)
- INT: 4 x 20g (3hr)
- BOLUS: 2 x 40g (6hr)

During the 12hr recovery period → 20 g of whey protein ingested every 3hr was optimal for enhancing MPS.

“Providing sufficient deviation from habitual intake appears to be an important factor in determining the success of additional protein in enhancing muscle and strength gains from resistance training.”

Protein intakes/recommendations should be individualized.

Bosse et al. 2012. JISSN
Recommendations for Strength-Trained Athletes

• Daily intakes of 1.2 – 1.7 g/kg/d *(ACSM & ADA of Canada et al. 2009 MSSE)* that are individualized

• Emphasize high quality proteins enriched in leucine (i.e. whey protein)

• Consume protein in doses ~20g per serving about every 3hrs

• Consume near the resistance exercise bout

THANK YOU!

Dr. Terry Housh

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QUESTIONS?