Nutrition Strategies to Protect Muscle Health During Aging: The Value of Protein

Redacted version from the original presentation given at the seminar.

Douglas Paddon-Jones, Ph.D., FACSM
Sheriden Lorenz Distinguished Professor of Aging and Health

Department of Nutrition and Metabolism,
Center for Recovery, Physical Activity and Nutrition

University of Texas Medical Branch, Galveston, TX, USA
Disclosures

I have received funding, participated on a Scientific Advisory Board or Speaker’s Bureau for:

- National Dairy Council
- US Dairy Export Council
- American Egg Board
- National Cattlemens Beef Association
- Abbott Nutrition
- Agropur
- Leprino Foods
- Sabra Wellness
- National Space Biomedical Research Institute
Outline

- Inactivity
- Disease
- Inflammation
- Mitochondrial Dysfunction
- Inadequate Nutrition
- Aging
- Perfusion

Muscle Loss

Nutrition

Pharmacology

Activity
How much protein do we need?

+ when, why, how and who….
How much protein per meal do we need?

- a message of moderation -

References: Symons et. al. AJCN, 2007
Symons et. al. JADA. 2009
Synergistic Effect of Protein and Exercise

Reference: Symons et. al. JNHA, 2010
Net Muscle Protein Synthesis (mg Phe/leg)

More than ~25 g protein

Less than ~15 g protein

Young

Elderly

Reference: Katsanos et. al. AJCN, 2005
Protein Quantity and Daily Distribution
Concept: Skewed / typical protein intake

We can’t store excess protein for later anabolism

Total Protein
90 g

Usable Protein
55 g?

~ 1.3 g/kg/day

Reference: Paddon-Jones and Rasmussen 2009
Concept: Optimizing protein at each meal?

Anabolism

- 30 g
- 30 g
- 30 g

Maximum rate of protein synthesis

Catabolism

- Total Protein 90 g
- Usable Protein 90 g

\[ \approx 1.3 \text{ g/kg/day} \]

\[ \rightarrow \text{greater 24 h protein synthesis response?} \]

Reference: Paddon-Jones and Rasmussen 2009
Protein distribution impacts muscle protein synthesis

Sarcopenia is a syndrome characterized by progressive and generalized loss of skeletal muscle mass and strength with a risk of adverse outcomes such as physical disability, poor quality of life and death.
Catabolic crisis model

Muscle mass (kg) vs. Age (y)

Bed rest / disuse in clinical settings

Nutrition and Metabolism

- Inactive (0 steps/min)
- Low Activity (< 15 steps/min)
Inactivity and Muscle Loss

- Bed Rest -

Loss of lean leg mass (g)

Young

Middle-aged

Older

Older Patients

28 Days

14 Days

10 Days

4 Days

Best case situation
NUTRITION
Leucine (4 g/meal): partially protects muscle function

Healthy middle-age adults; 14 days bed rest

Zachwieja, et al. 1999  JCEM

English, et al. 2015  AJCN

Note: Testosterone did not protect strength during bed rest
Leucine: partially / temporarily protects muscle mass

Healthy middle-age adults; 14 days bed rest
# Leucine content of common foods / supplements

<table>
<thead>
<tr>
<th>Protein source</th>
<th>Leucine</th>
</tr>
</thead>
<tbody>
<tr>
<td>whey protein isolate</td>
<td>13 %</td>
</tr>
<tr>
<td>milk protein</td>
<td>10 %</td>
</tr>
<tr>
<td>egg protein</td>
<td>8.5 %</td>
</tr>
<tr>
<td>muscle protein</td>
<td>8 %</td>
</tr>
<tr>
<td>soy protein isolate</td>
<td>8 %</td>
</tr>
<tr>
<td>wheat protein</td>
<td>7 %</td>
</tr>
<tr>
<td>collagen</td>
<td>2 %</td>
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</tbody>
</table>
Recommendations: *Prevention* and Treatment

For all healthy adults....

Establish a dietary framework that includes a moderate amount of **high quality** protein at each meal.

Modify as necessary to accommodate individual needs:
- energy requirements
- physical activity
- health status
- body composition goals
- dentition, satiety
Recommendations: Prevention and *Treatment*

**React aggressively** with targeted nutrition interventions to preserve muscle health and reduce the negative metabolic consequences of physical inactivity.
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