The Good, the Bad and the Ugly: Protein & Athletes

Eastern Athletic Trainers Association
Presented on: January 8
Presented by: Kayla Matrunick, MS, RD, CSSD, LDN
Disclosures

Travel and accommodations for this presentation provided by:

[Image of Gatorade Sports Science Institute logo]
Learning Objectives

After attending this workshop, attendees will:

- Have a better understanding of the current regulations and recommendations for protein consumption by athletes
- Be armed with practical advice for their athletes on how to best incorporate protein into training regimens to maximize recovery and performance
- Have a better understanding of the latest research related to protein consumption and athletes
What Will Be Discussed

Agenda

- Definition of Protein
- The Role of Protein for Sports Nutrition
- Practical Application
- Case Studies
Food for Thought

“I want to lose weight”

PROFILE:
100 Calories
18g Carbohydrates
2g Fat
1g Protein

6oz – Juice / 1 cup Grapes
25 g Carbohydrate

“I want to gain weight”

PROFILE:
100 Calories
3g Carbohydrates
0g Fat
22g Protein

5oz - 100 Calorie Greek Yogurt
12-18 g protein
Definition of Protein

- 1 of the 3 Macronutrients = Calories
  Proteins, Carbohydrates, Fats

- **Protein** ↔ chain of **amino acids**

- **Amino Acids** (AA) = Building Blocks “bricks”
  20 (8 essential, 12 non-essential)

- Proteins - required for everything active & metabolic
  DNA “motherboard”

- Every protein has unique function
Role & Metabolic Influences of Protein

- **Structural**: Skeletal & muscular
- **Metabolic Processing**: DNA, RNA, myoglobin, organs, glands, multi-cellular synthesis (muscular)
- **Biochemical Reactions**: chemical precursors (serotonin), facilitation-uptake
- **Hormonal**: production, interactions (adrenaline, cortisol, testosterone)
- **Enzymatic**: precursor, catalization
- **Immune Antibody Response**: defense, inflammation, illness
- **System Balance**: homeostasis (fluid-electrolyte, acid-base)
- **Transportation**: nutrients, minerals, oxygen
- **Energy**: 4 calories per gram
Definition of Protein

Amino Acids = Building Blocks

Complete vs. Incomplete Proteins

<table>
<thead>
<tr>
<th>Complete</th>
<th>Incomplete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>Vegetables</td>
</tr>
<tr>
<td>Eggs</td>
<td>Fruits</td>
</tr>
<tr>
<td>Beef</td>
<td>Oats</td>
</tr>
<tr>
<td>Cheese</td>
<td>Bread</td>
</tr>
<tr>
<td>Yogurt</td>
<td>Rice</td>
</tr>
</tbody>
</table>

Incomplete proteins contain only some of the essential amino acids the body needs daily
Incomplete Protein Quality
# Protein in Food

<table>
<thead>
<tr>
<th>Type of Food</th>
<th>Typical Serving</th>
<th>Grams of Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg</td>
<td>1 whole egg 1 white</td>
<td>7 grams 4 grams</td>
</tr>
<tr>
<td>Beef, poultry, pork, seafood</td>
<td>1 oz. 5 oz.</td>
<td>7 grams 35 grams</td>
</tr>
<tr>
<td>Cheese</td>
<td>1 oz. / slice/string</td>
<td>7 grams</td>
</tr>
<tr>
<td>Yogurt</td>
<td>5- 6 oz. cup</td>
<td>8 grams 12 grams</td>
</tr>
<tr>
<td>- flavored</td>
<td></td>
<td>15 grams</td>
</tr>
<tr>
<td>- plain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- greek</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cottage cheese</td>
<td>½ cup</td>
<td>14 grams</td>
</tr>
<tr>
<td>Milk</td>
<td>8 oz.</td>
<td>8 grams</td>
</tr>
<tr>
<td>Beans</td>
<td>½ cup beans 1 oz. peanuts</td>
<td>7 grams 7 grams</td>
</tr>
<tr>
<td>- legumes</td>
<td>7 walnuts/almonds</td>
<td></td>
</tr>
<tr>
<td>- seeds, nuts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grains</td>
<td>½ cup 1 slice bread</td>
<td>5 grams 3 grams</td>
</tr>
<tr>
<td>- oats, quinoa, rice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>½ cup cooked / 1 cup raw</td>
<td>2-3 grams</td>
</tr>
</tbody>
</table>

**PLANT**
- Incomplete
- Higher antioxidant

**TISSUE**
- Complete
- High AA Profile

**DAIRY**
- Complete
  - "Milk" Protein
  - Whey = Rapid Transport
  - Casein = Slow Transport

**EGG**
- Complete
- Highest BV
- Standard for protein

USDA Nutrient Database: https://ndb.nal.usda.gov/ndb/search/list
So What Happens When I Eat This Steak?
The Role of Protein in Sports Nutrition

Muscle Structure

The plate

Protein in food (meat, fish, poultry, dairy, soy, eggs, nuts, legumes)

The gut

Digested into individual amino acids (or small peptide sequences) & absorbed from the gut into the blood

The blood

Amino acids & peptides circulate in the blood & perform various roles:
- Signal functions in the body
- Used to build new proteins in the body
- Excess used as a fuel source

The muscle

Amino acids arranged into a chain based on the genes that are stimulated.

The chain is arranged into a helix structure, which is then combined with other helix structures to form a three-dimensional protein.

Muscles are stimulated by exercise & Leucine to produce new muscle proteins, which drives the body's adaptation to training.

More is not better; more is more calories...
Leucine is the SWITCH that turns on Muscle Protein Synthesis

BCAA: Primary AA utilized by athletes
Leucine, Isoleucine, Valine

Branch chain amino acid leucine...

...starts the signaling cascade to initiate the assembly of amino acids into new muscle protein structures
Equation to Regenerate

- Adequate Calories
- Adequate Carbs
- Lift
- Practice
- Adequate Protein
- Optimal Timing

Consuming protein at the right time in the right amounts can help an athlete either maintain or increase muscle mass, depending on the type of training.
Practical Application

Protein Amounts – Post Exercise

RECOMMENDED AMOUNT
MORE ISN’T BETTER.
Research shows that ~20 g of protein is the right amount to stimulate post-exercise muscle protein synthesis for most athletes.

If you want to get specific for your athlete, calculate 0.25 g/kg.

Example:
130lb Athlete = 15g = Greek Yogurt
180lb Athlete = 20g = Gatorade Recovery Shake
Practical Application

Protein Types

The ✔ Check List:
✔ Digestibility
✔ Absorbability
✔ Leucine Content

TYPES OF PROTEIN
Consume high-quality, complete protein sources that are rapidly absorbed and rich in leucine.

WHEY AND MILK PROTEIN ARE GREAT CHOICES

WHEY AND MILK PROTEIN
- meet all the criteria
- have been shown to be effective for recovery

LEUCINE
- one of the amino acid building blocks for new muscle
- acts as a signal for the muscle to start the process of assembling new muscle proteins
## Foods High in Leucine

Consume ~3 grams of Leucine within 30 minutes post workout

<table>
<thead>
<tr>
<th>Type of Protein</th>
<th>Serving size</th>
<th>Grams of Leucine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicken, Steak...</td>
<td>~4oz</td>
<td>3.5 g</td>
</tr>
<tr>
<td>Salmon</td>
<td>~4oz</td>
<td>3.5 g</td>
</tr>
<tr>
<td>Canned, Light Tuna</td>
<td>3oz</td>
<td>3.5 g</td>
</tr>
<tr>
<td>Legume: Peanuts, Soy Bean</td>
<td>½ cup</td>
<td>1.5 g</td>
</tr>
<tr>
<td>Yogurt</td>
<td>½ cup</td>
<td>1.5 g</td>
</tr>
<tr>
<td>Plain popcorn</td>
<td>1 oz</td>
<td>1.5 g</td>
</tr>
<tr>
<td>Colby / Cheddar cheese</td>
<td>1 oz</td>
<td>0.5-0.7 g</td>
</tr>
<tr>
<td>Seeds: Pumpkin</td>
<td>1 oz</td>
<td>.7 g</td>
</tr>
</tbody>
</table>

3 grams of Leucine is found in ~20-25 grams of protein

Optimal Recovery with Leucine

**Highest Leucine:**
- **Milk Protein** – Combination of whey and casein
  - 80% casein, 20% whey (>40% casein by weight)
- **Whey** – rapid transport, “Right-a-whey”
- **Casein** – Slow transport, “Drip feed”

**Non-Dairy - Higher Leucine:**
- **Soy**
- **Egg**

**Non-Dairy - Less Leucine:**
- **Plant Proteins:** Rice, Hemp, Pea Protein...

**Meats are also rich in Leucine →** Ground meat may be most effective since it is digested a bit quicker (Pennings et al. Am J Clin Nutr. 98:121-128, 2013.)
Protein Recovery Options
To Eat or To Supplement?

Grilled Chicken (4-oz)

<table>
<thead>
<tr>
<th>Amino Acid</th>
<th>MG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tryptophan</td>
<td>436</td>
</tr>
<tr>
<td>Threonine</td>
<td>1553</td>
</tr>
<tr>
<td>Isoleucine*BCAA</td>
<td>1698</td>
</tr>
<tr>
<td>Leucine*BCAA</td>
<td>2864</td>
</tr>
<tr>
<td>Lysine</td>
<td>3327</td>
</tr>
<tr>
<td>Methionine</td>
<td>900</td>
</tr>
<tr>
<td>Cystine</td>
<td>363</td>
</tr>
<tr>
<td>Phenylalanine</td>
<td>1397</td>
</tr>
<tr>
<td>Tyrosine</td>
<td>1247</td>
</tr>
<tr>
<td>Valine*BCAA</td>
<td>1792</td>
</tr>
<tr>
<td>Arginine</td>
<td>2340</td>
</tr>
<tr>
<td>Histidine</td>
<td>1290</td>
</tr>
<tr>
<td>Alanine</td>
<td>2021</td>
</tr>
<tr>
<td>Aspartic acid</td>
<td>3255</td>
</tr>
<tr>
<td>Glutamic acid</td>
<td>5127</td>
</tr>
<tr>
<td>Glycine</td>
<td>1532</td>
</tr>
<tr>
<td>Proline</td>
<td>1099</td>
</tr>
</tbody>
</table>

4 oz = 35 gms protein

Source: USDA National Nutrient Database; [http://ndb.nal.usda.gov/ndb/search/list](http://ndb.nal.usda.gov/ndb/search/list)

Amino Acid Blend Supplement (1 serving = 3 capsules)

<table>
<thead>
<tr>
<th>Amino Acid</th>
<th>MG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tryptophan</td>
<td>43</td>
</tr>
<tr>
<td>Threonine</td>
<td>227</td>
</tr>
<tr>
<td>Isoleucine*BCAA</td>
<td>194</td>
</tr>
<tr>
<td>Leucine*BCAA</td>
<td>347</td>
</tr>
<tr>
<td>Lysine</td>
<td>302</td>
</tr>
<tr>
<td>Methionine</td>
<td>73</td>
</tr>
<tr>
<td>Cystine</td>
<td>64</td>
</tr>
<tr>
<td>Phenylalanine</td>
<td>86</td>
</tr>
<tr>
<td>Tyrosine</td>
<td>89</td>
</tr>
<tr>
<td>Valine*BCAA</td>
<td>189</td>
</tr>
<tr>
<td>Arginine</td>
<td>85</td>
</tr>
<tr>
<td>Histidine</td>
<td>62</td>
</tr>
<tr>
<td>Alanine</td>
<td>164</td>
</tr>
<tr>
<td>Aspartic acid</td>
<td>361</td>
</tr>
<tr>
<td>Glutamic acid</td>
<td>607</td>
</tr>
<tr>
<td>Glycine</td>
<td>63</td>
</tr>
<tr>
<td>Proline</td>
<td>219</td>
</tr>
</tbody>
</table>

1 svg < 2 gms protein

Source: General Nutrition Center Website; [www.gnc.com](http://www.gnc.com); "Amino Acid Top Sellers"

Drug Free Sport

Slide Credit: LUffers@drugfreesport.com
Practical Application

Protein Amounts – Individualized Needs

Biological/Physiological Components:
- Gender
- Frame Size
- Body Composition
- Activity: Type-Duration-Intensity
- Injury/Illness – Special Needs

Dietary Components:
- Energy Intake vs. Output
- Carbohydrate Intake
- Protein Quality & Intake
- Timing of Nutrient Intake
- Restrictions: Food Allergy/Dietary Belief/Disease
Practical Application

Protein Amounts – Sport Specific

Table 1: Daily Protein Recommendations for Athletes

<table>
<thead>
<tr>
<th>TYPE OF ATHLETE</th>
<th>RECOMMENDED INTAKE (G/KG/D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team Sport</td>
<td>1.2-1.7</td>
</tr>
<tr>
<td>Endurance</td>
<td>1.2-1.4</td>
</tr>
<tr>
<td>Strength</td>
<td>1.6-1.7</td>
</tr>
<tr>
<td>Power</td>
<td>1.5-1.7</td>
</tr>
</tbody>
</table>
The Role of Protein in Sports Nutrition

Muscle Structure

• It is optimal to break up protein evenly between each meal.
• Breakfast, Lunch, Dinner may be larger than snacking sessions.

**Optimal Example:**
Meal: 30-40g
Snacks: ~20g

**Typical American Diet:**
Meal: 10g, 30g, 50g
Snack: 0-5g

EXAMPLE PROTEIN CONSUMPTION CYCLE

To get the most out of their workout, athletes should consume protein regularly throughout the day.

30-40g Protein/ Meal
# Practical Application

<table>
<thead>
<tr>
<th></th>
<th><strong>ATHLETE A</strong></th>
<th><strong>TOTAL PROTEIN 48 g</strong></th>
<th><strong>ATHLETE B</strong></th>
<th><strong>TOTAL PROTEIN 136 g</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Breakfast</strong></td>
<td>Lucky Charms w/ cows milk</td>
<td>2g 4g</td>
<td>Oatmeal</td>
<td>7g 7g 0g</td>
</tr>
<tr>
<td><strong>Snack</strong></td>
<td>Banana</td>
<td>0g</td>
<td>String Cheese</td>
<td>7g</td>
</tr>
<tr>
<td><strong>Lunch</strong></td>
<td>PB &amp; Jelly Apple juice Pretzels</td>
<td>13g 0g 3g</td>
<td>Turkey sandwich Veggies &amp; Hummus Banana</td>
<td>24g 1g 0g</td>
</tr>
<tr>
<td><strong>Pre-Practice</strong></td>
<td>Apple, Gatorade</td>
<td>0g 0g</td>
<td>Granola Bar</td>
<td>4g</td>
</tr>
<tr>
<td><strong>PRACTICE</strong></td>
<td>Gatorade</td>
<td>0g</td>
<td>Gatorade</td>
<td>0g</td>
</tr>
<tr>
<td><strong>Post-Practice</strong></td>
<td>n/a</td>
<td>0g</td>
<td>Gatorade Recovery Shake</td>
<td>20g</td>
</tr>
<tr>
<td><strong>Dinner</strong></td>
<td>6 chicken nuggets 1c mac &amp; cheese</td>
<td>13g 8g</td>
<td>5oz. Grilled chicken 1 ½ cups Spaghetti</td>
<td>35g 16g</td>
</tr>
<tr>
<td><strong>Snack</strong></td>
<td>3 Cookies 1 glass Milk</td>
<td>1g 4g</td>
<td>Greek Yogurt</td>
<td>15g</td>
</tr>
</tbody>
</table>

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The ✔ Check List:
✔ Meal Frequency
✔ Protein Quality Identifier (“x” grams)
✔ Needs i.e.: power, strength, endurance, team sport, injury
✔ Modify i.e.: intermittent feeding, food swaps
Latest Research:
Protein Consumption During Endurance Performance

Prevailing thought...

Protein intake during exercise *does not* improve endurance performance
Latest Research: The Role of Protein During Sleep

- AA Pool naturally declines during sleep → regeneration occurs → recovery period
- Eating protein prior to bed increases plasma amino acid availability → stimulates muscle protein synthesis during sleep → increase in muscle mass & strength during heavy training
- Provide 20g-40g protein prior to sleep
- Exact dose/grams depends on population
- Workout in the evening? May require more...

Note: GSSI: handout, web resources Snijders et al. J Nutr In pres Apr 29,2015
Case Study

Understand your demand. A calorie is not a calorie.

- Rower
- Female 19 y/o
- 5’11
- 180lbs – 30% body fat
- Potential to make USA Team IF her weight was closer to 170lbs
- Power-to-weight ratio sport

- Diet Recall:
  ~ 2,800 calories, 400g CHO, 85g PRO, 90g FAT
  Simple sugars ➔ desserts, frequent snacking, often skips lunch, dine out frequently, care packages….
Case Study – Power /Strength Athlete

<table>
<thead>
<tr>
<th>Assessment #</th>
<th>Test Date</th>
<th>% Fat</th>
<th>Fat Mass #</th>
<th>Fat Free Mass #</th>
<th>Wt.</th>
</tr>
</thead>
<tbody>
<tr>
<td># 1 Initial Assessment</td>
<td>8/26/2011</td>
<td>30.2</td>
<td>53.9</td>
<td>124.9</td>
<td>178.8</td>
</tr>
<tr>
<td># 2 Online Tracking</td>
<td>11/11/2011</td>
<td>30</td>
<td>54.6</td>
<td>(127.5)</td>
<td>182.1</td>
</tr>
</tbody>
</table>

Mtg. 1 Initial Assessment:
- ~ 2,800 calories, 400g CHO, 85g PRO, 90g FAT
- Meet athlete where she is (knowledge, emotion, readiness)

Mtg. 2 Goals:
- Clean eating; whole food based diet; eliminate processed
- Balanced Meals (lean protein, complex carbohydrates, healthy fats)
- Intermittent feeding; planned
- Hydration 100% body weight; account for ~ 4 hours training /day
# Case Study – Power /Strength Athlete

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Test Date</th>
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<th>Fat Mass #</th>
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<tbody>
<tr>
<td># 1 Initial</td>
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</tr>
<tr>
<td># 2 Tracking</td>
<td>11/11/2011</td>
<td>30</td>
<td>54.6</td>
<td>127.5</td>
<td>182.1</td>
</tr>
<tr>
<td># 3 High Pro</td>
<td>4/10/2012</td>
<td>25.6</td>
<td>46.1</td>
<td>134.3</td>
<td>180.4</td>
</tr>
<tr>
<td># 4 Injury</td>
<td>9/11/2012</td>
<td>25.4</td>
<td>45.9</td>
<td>134.9</td>
<td>180.8</td>
</tr>
<tr>
<td># 5 RTP</td>
<td>11/29/2012</td>
<td>23.5</td>
<td>41.9</td>
<td>136.3</td>
<td>178.17</td>
</tr>
<tr>
<td># 6 Maintain</td>
<td>2/6/2013</td>
<td>23.3</td>
<td>41.8</td>
<td>137.8</td>
<td>179.6</td>
</tr>
<tr>
<td>#7 ME</td>
<td>4/22/2013</td>
<td>22.9</td>
<td>40.4</td>
<td>136.12</td>
<td>176.5</td>
</tr>
<tr>
<td># 8</td>
<td>9/5/2013</td>
<td>20.7</td>
<td>36.8</td>
<td>140.8</td>
<td>177.61</td>
</tr>
</tbody>
</table>

- **Modify diet, maintain calories**
  182.1 lbs / 2.2g kg = 82.77 kg
  1.7g/kg bw = ~141 g protein/day
  (.3g/kg/meal) ~ 25g/meal
- All meals – lean protein source
- **All snacks >10 g protein**
- Pocket carbohydrates around workouts
- Introduce protein to pre- post workout
- Taper carbohydrates as day progresses → encourage dairy rich protein prior to bed

- Lower Lumbar injury; decreased activity.
  Limited cardio output; restricted to strength training 2 months
- **Injury: Increase protein needs by 20% or 2.0-2.5g/kg**
  141g x .20% = 28g → 169g protein
- Maintain weight; avoid gain
- Must reduce other macronutrients

- Metabolic Efficiency: Fatty Acid Oxidation → Stimulation & Adaptation
- Consistency... Makes first National team
# Case Study – Power /Strength Athlete

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<td>30.2</td>
<td>53.9</td>
<td>124.9</td>
<td>178.8</td>
</tr>
<tr>
<td>Final</td>
<td>9/5/2013</td>
<td>20.7</td>
<td>36.8</td>
<td>140.8</td>
<td>177.6</td>
</tr>
</tbody>
</table>

**Body Comp:** 10%

**Fat Loss:** 17 lbs.

**Lean Mass:** 16 lbs.

**Weight:** 1 lb.

*Athlete is Olympic hopeful...*

*Has made 5 National Teams*
Practical Application Summary

The ✔ Check List:

✔ Meal Frequency
  1) Breakfast, Lunch, Dinner
  2) 30-40g protein/ meal

✔ Performance Feeding Zones
  1) 20 g post-workout + Carb
  2) > 20 g pre-bed

*Based on an average of 180 lbs. If you’re smaller you may need a little less, if you’re larger a little more. But around 20 g is the right amount for most athletes. The information in this document is grounded in sports nutrition science, translated for athletes.
Thank you!