The Science of Protein

The Continued Exploration of the Impact of High-Quality Protein on Optimal Health
The Following Will Be Discussed

1. What is Protein?
2. Evolution of Protein Research
3. Protein’s Role in Beneficial Health Outcomes
4. Current Protein Recommendations
5. Optimal Daily Protein Intake
6. Putting Protein Recommendations into Practice
Protein: Read All About It!
Consumer Interest Has Skyrocketed

- 91% of Americans think that it is important to get enough protein in their diets (IFIC, 2014)
- 57% of Americans consider how much protein is in a food or beverage before purchase (IFIC, 2014)

What Is Protein?
Protein Is Made From Amino Acids, Which Are Essential Building Blocks for the Body

• Amino acids play numerous roles in the body, including:
  • Structural
    - Build, maintain and repair muscle
    - Build stronger bones
  • Transport
    - Deliver oxygen to tissues
  • Immune boosters
Protein and Amino Acids Have Life-Sustaining Benefits

• There are **20 amino acids needed** for the body to make proteins

• Benefits include:
  • Providing energy
  • Building better brains
  • Aiding the metabolism of other nutrients
  • Promoting feelings of satiety/fullness
  • Managing weight
Amino Acids Are Classified as “Essential” And “Nonessential”

- **Essential**: The body cannot make essential amino acids, so we must eat them in the diet
  - Essential amino acids stimulate and support muscle protein synthesis, which allows the body to make new muscle and repair old muscle
- **Nonessential**: The body can make these, so they don’t have to be consumed in the diet
Essential and Nonessential Amino Acids

- **9 essential amino acids:**
  - Histidine
  - Isoleucine
  - Leucine
  - Lysine
  - Methionine
  - Phenylalanine
  - Threonine
  - Tryptophan
  - Valine

- **11 nonessential amino acids:**
  - Alanine
  - Arginine
  - Asparagine
  - Aspartic acid
  - Cysteine
  - Glutamine
  - Glutamic acid
  - Glycine
  - Proline
  - Serine
  - Tyrosine
Proteins Are Classified as Either “Complete” or “Incomplete”

- **Complete** proteins contain all of the essential amino acids
- **Incomplete** proteins are missing one or more of the essential amino acids
- **Complete** proteins are considered “high biological value”
  - High biological value proteins contain all of the amino acids in a proportion similar to what is required by humans
  - Easy for your body to fully digest, meaning that all of that essential protein is available to be absorbed and used by the body
Animal Sources and a Few Plant Sources Provide Complete Proteins

- **Complete proteins include:**
  - Meat, including beef, pork, chicken and fish
  - Eggs
  - Dairy, including milk, cheese and yogurt
  - Quinoa
  - Soy

- **Incomplete proteins have a lower biological value and are found in other plant sources:**
  - Beans and legumes
  - Nuts and seeds
  - Whole wheat
  - Rice
# Top Sources of Protein in the American Diet: Poultry and Meats

<table>
<thead>
<tr>
<th>Food</th>
<th>Rank</th>
<th>%Total Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poultry</td>
<td>1</td>
<td>10.0</td>
</tr>
<tr>
<td>Meats</td>
<td>2</td>
<td>9.5</td>
</tr>
<tr>
<td>Mixed dishes – meat, poultry, fish</td>
<td>3</td>
<td>7.5</td>
</tr>
<tr>
<td>Breads, rolls, tortillas</td>
<td>4</td>
<td>6.4</td>
</tr>
<tr>
<td>Milk</td>
<td>5</td>
<td>6.4</td>
</tr>
<tr>
<td>Cured meats/poultry</td>
<td>6</td>
<td>6.0</td>
</tr>
<tr>
<td>Mixed dishes – pizza</td>
<td>7</td>
<td>4.8</td>
</tr>
<tr>
<td>Cheese</td>
<td>8</td>
<td>4.8</td>
</tr>
<tr>
<td>Mixed dishes – grain-based</td>
<td>9</td>
<td>4.4</td>
</tr>
<tr>
<td>Mixed dishes – sandwiches</td>
<td>10</td>
<td>4.1</td>
</tr>
<tr>
<td>Eggs</td>
<td>11</td>
<td>3.2</td>
</tr>
<tr>
<td>Plant-based protein foods</td>
<td>12</td>
<td>3.2</td>
</tr>
<tr>
<td>Seafood</td>
<td>13</td>
<td>3.1</td>
</tr>
</tbody>
</table>

NHANES (2007-2010; N = 17,386), Unpublished
Achieving Nutrient Adequacy Via Commonly Consumed Protein Foods

Protein from Lean Sources: Portion Comparisons

- Grilled steak
- Smartphone
- Basket of red kidney beans
- Light bulb

- Baked salmon
- One dollar bill
- Peanut butter sandwich
- Golf ball

- Grilled chicken
- Playing card
- Block of Swiss cheese
- Dice
Protein Research
Continuing the Exploration of Protein on Optimal Health

2007
Exploring the Impact of High-Quality Protein on Health

2013
Evaluating the Role of Protein in Public Health

PROTEIN SUMMIT 2.0
Extensive Research Emerged From Protein Summit 2007

Introduction to Protein Summit 2007: Exploring the Impact of High-Quality Protein on Optimal Health

Nancy R Rodriguez and Peter J Garlick

Dietary protein recommendations have traditionally been based on Allowance (2). The RDA would set population mean requirements at about 0.8 mg protein/kg body weight for a population except those with the very high protein intake has also occurred because different values have been derived by other organizations, which have no recommended daily the protein intake in America: analysis of the National Health and Nutrition Examination Survey, 2003–2004

Victor L Fulgoni III

Protein, weight management, and satiety

Douglas Paddon-Jones, Eric Westman, Richard D Mattes, Robert R Wolfe, Arne Astrup, and Margriet Westerterp-Plantenga

Amount and type of protein influences bone health

Robert P Heaney and Donald K Layman

Protein quality assessment: impact of expanding understanding of protein and amino acid needs for optimal health

D Joe Millward, Donald K Layman, Daniel Tomé, and Gertjan Schuursma

Protein in optimal health: heart disease and type 2 diabetes

Donald K Layman, Peter Clifton, Mary C Gannon, Ronald M Krauss, and Frank Q Nuttall

Role of dietary protein in the sarcopenia of aging

Douglas Paddon-Jones, Kevin R Short, Wayne W Campbell, Elena Volpi, and Robert R Wolfe

Protein Summit: consensus areas and future research

Robert R Wolfe
Body of Evidence on Role of Protein in Promoting Health

A Moderate-Protein Diet Produces Sustained Weight Loss and Long-Term Changes in Body Composition and Blood Lipids in Obese Adults

Introduction
Obesity is a major public health issue in the United States. Diet plays an important role in the prevention and management of obesity. A high-protein diet has been associated with reduced energy intake and improved body composition. However, the optimal protein intake for weight loss and fat loss remains unclear. The purpose of this study was to investigate the effects of a moderate-protein diet on body composition and blood lipids in obese adults.

Methods
A total of 16 obese adults were randomly assigned to either a control group (CG) or an intervention group (IG). The CG received a control diet, while the IG received a moderate-protein diet. Both groups were followed for 12 months.

Results
At the end of the study, the IG showed significant decreases in body weight, body mass index (BMI), and waist circumference compared to the CG. The IG also showed significant decreases in total cholesterol, low-density lipoprotein (LDL) cholesterol, and triglycerides compared to the CG.

Conclusion
A moderate-protein diet is an effective strategy for weight loss and improving body composition and blood lipids in obese adults.
Continued Exploration of Protein on Optimal Health at Protein

• Discussions identified effective strategies to help health professionals translate protein science to optimize their clients' protein intake for health and combat misperceptions related to protein
Meeting Proceedings Advance Science and Detail Protein’s Role Optimal

- A supplement to the June 2015 edition of the *American Journal of Clinical Nutrition* contains five comprehensive reviews from presentations and discussions from Protein Summit 2.0
Supporting Protein’s Role in Beneficial Health Outcomes

- Weight Loss
- Appetite Control
- Reduced Weight Regain
- Preservation of Lean Mass
- Healthy Metabolism

Protein
The Role of Protein In Weight Loss and Maintenance

- Eating more protein, as part of a reduced-calorie diet, can support weight loss and maintenance by:
  - Boosting metabolism
  - Controlling/curbing appetite
  - Helping the body retain muscle while losing fat

Science suggests that a good goal for total protein intake, as part of a reduced-calorie diet, is about 1.2-1.6 grams of protein per kilogram of body weight, mostly from high-quality sources.
Defining Meal Requirements for Protein to Optimize Metabolic

- Eating high-quality protein foods helps support a healthy metabolism, which can help optimize health by improving markers of health.
- The body’s ability to effectively use the amino acids found in dietary protein can decline with age and with reduced physical activity.

Eating about 20-30 grams of high-quality protein at each meal can help support a healthy metabolism to improve markers of health.
Protein and Healthy Aging

• Eating more high-quality protein combined with regular physical activity can help slow or prevent sarcopenia, the gradual muscle loss associated with aging.

Consuming between 1.0-1.5 grams of high-quality protein per kilogram of body weight (or 0.45-0.68 grams per pound of body weight) evenly throughout the day may be most effective to maintain muscle and support a healthy, vibrant life.
Research Questions and Future Needs

- What is the sustained protein satiety effect over the long-term?
- What is the impact of dietary protein distribution at meals?
- What are optimal levels of protein?
- What are the ideal types of protein-containing foods to help achieve nutrient adequacy?
- Should we be using the Protein Digestibility Corrected Amino Acid Score (PDCAAS) or the Digestible Indispensable Amino Acid Score (DIAAS) to evaluate dietary sources of protein?
Current Protein Recommendations
Recommended Dietary Allowance For Protein: 0.8 g/kg body weight/day

• “An estimate of the minimum daily average dietary intake level that meets the nutrient requirements of nearly all (97-98%) healthy individuals”

  • **Protein:**
    • Women: 46 g/day
    • Men: 56 g/day
    • Or 0.8 g/kg body weight/day

  • **Fat:**
    • *Not determined*

  • **Carbohydrate:**
    • 130 g/day
Acceptable Macronutrient Distribution Range
For Protein: 10-35% of total calories

- The intake range “associated with reduced risk of chronic diseases, while providing adequate intakes of essential nutrients.”

  - **Protein:**
    - 10-35% of total calories
  
  - **Fat:**
    - 20-35% of total calories
  
  - **Carbohydrate:**
    - 45-65% of total calories
Across all age groups and in both males and females, nearly 60 percent of the U.S. population meets the protein foods intake recommendation.

“…intakes of protein (as grams/day) are adequate across the population and protein is not a shortfall nutrient.”

Americans Are Eating Red Meat At Levels Consistent With The 2015 DGAs Modeled Patterns

<table>
<thead>
<tr>
<th>Food group</th>
<th>Healthy US-style Pattern</th>
<th>Healthy Med-style Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit</td>
<td>2 c per day</td>
<td>2 ½ c per day</td>
</tr>
<tr>
<td>Vegetables</td>
<td>2 ½ c per day</td>
<td>2 ½ c per day</td>
</tr>
<tr>
<td>-Legumes</td>
<td>1 ½ c per wk</td>
<td>1 ½ c per wk</td>
</tr>
<tr>
<td>Whole Grains</td>
<td>3 oz eq per day</td>
<td>3 oz eq per day</td>
</tr>
<tr>
<td>Dairy</td>
<td>3 c per day</td>
<td>2 c per day</td>
</tr>
<tr>
<td>Protein Foods</td>
<td>5 ½ oz eq per day</td>
<td>6 ½ oz eq per day</td>
</tr>
<tr>
<td>--Meat</td>
<td>12 ½ oz eq/wk</td>
<td>12 ½ oz eq/wk</td>
</tr>
<tr>
<td>--Poultry</td>
<td>10 ½ oz eq/wk</td>
<td>10 ½ oz eq/wk</td>
</tr>
<tr>
<td>--Seafood</td>
<td>8 oz eq/wk</td>
<td>15 oz eq/wk</td>
</tr>
<tr>
<td>--Eggs</td>
<td>3 oz eq/wk</td>
<td>3 oz eq/wk</td>
</tr>
<tr>
<td>--Nuts/seeds</td>
<td>4 oz eq/wk</td>
<td>4 oz eq/wk</td>
</tr>
<tr>
<td>--Processed soy</td>
<td>½ oz eq/wk</td>
<td>½ oz eq/wk</td>
</tr>
<tr>
<td>Oils</td>
<td>27 g per day</td>
<td>27 g per day</td>
</tr>
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</table>

Scientific Report of the 2015 Dietary Guidelines Advisory Committee, Table D1.32.
Americans Are Consuming Protein Foods, Fresh Red Meat, Beef Consistent With Dietary Guidelines

<table>
<thead>
<tr>
<th></th>
<th>Total Protein Foods(^3)</th>
<th>Total Animal Protein(^4)</th>
<th>Total Meat, Poultry, and Seafood(^5)</th>
<th>Total Fresh Red and Cured Meat(^6)</th>
<th>Total (Fresh Red) Meat(^7)</th>
<th>Total Cured Meat(^8)</th>
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<tbody>
<tr>
<td></td>
<td>Usual</td>
<td>Rec</td>
<td>Usual</td>
<td>Rec</td>
<td>Usual</td>
<td>Rec</td>
</tr>
<tr>
<td>2015 DGA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>FPED 2009-2010</td>
<td>5.74</td>
<td>5.5</td>
<td>5.19</td>
<td>4.86</td>
<td>4.61</td>
<td>4.43</td>
</tr>
<tr>
<td></td>
<td>[meat=1.52]</td>
<td></td>
<td>[cured meat=1.04]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 From WWEIA FPED 2009-2010
2 From 2015 DGA Healthy US-Style Pattern
3 Includes lean red meat/poultry, lean seafood, lean cured/processed meat (both red meat and poultry), organ meat, eggs, nuts and seeds & soybean products
4 Includes lean red meat/poultry, lean seafood, lean cured/processed meat (both red meat and poultry), organ meat & eggs
5 Includes lean red meat/poultry, lean seafood, lean cured/processed meat (both red meat and poultry) & organ meat
6 Includes lean red meat, lean cured/processed meat (both red meat and poultry) & organ meat
7 Includes lean red meat
8 Includes lean cured/processed meat (both red meat and poultry)
9 Beef, Pork and Cured Meat Intakes calculated from WWEIA FPED 2009-2010 Report & 2015 DGA Table E3.1A2
Perspective: As waistlines have expanded, beef intake has declined

Average Annual Per Capita Consumption (in pounds)

Year


Pounds

0.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0 90.0 100.0

Beef - Pork - Chicken - Turkey

Funded by The Beef Checkoff

2007-2010 NHANES and Consumer Beef Index (CBI), July 2013, funded by The Beef Checkoff.
Addressing Current Uneven Daily Protein Distribution

National Health and Nutrition Examination Survey (NHANES) data shows:

- People consume more than 65% of their daily protein in a single large dinner meal
- That leaves less than 35% distributed among other meals and snacks
Recognizing Typical Daily Protein Distribution

- Catabolism
- Anabolism

8 g 8 g 50 g

maximum rate of protein synthesis

Total Protein
66 g
Achieving Optimal Protein Intakes

Repeated maximal stimulation of protein synthesis → increase / maintenance of muscle mass

Total Protein 90 g

maximum rate of protein synthesis

~ 30 g  ~ 30 g  ~ 30 g

Anabolism
Catabolism
Is There A Case For More Protein?

% Daily Calories as Protein

- **Upper Range (35%)**
- **Lower Range (10%)**

Protein Intake (% Calories)

20-30%
Case Study Part 1: Protein Needs

Two 41-year-old women, Amy and Betty, both weighing 125 lbs.

Protein needed to meet the RDA:

\[
125 \text{ lbs.} / 2.2 \text{ kg/lb.} = 56.8 \text{ kg}
\]
\[
56.8 \text{ kg} \times 0.8 \text{ g pro/kg} = 45.5 \text{ g protein}
\]

- Amy is sedentary and consumes about 1,400 calories/day. If she consumes the RDA, what percentage of her calories will come from protein?

\[
45.5 \text{ g protein} \times 4 \text{ kcal/g} = 182 \text{ kcals}
\]
\[
182 \text{ kcals} / 1,400 \text{ kcals} = 13\% \text{ kcals}
\]

- Observation: This percentage is within the AMDR, but on the low end.

- Betty is moderately active and consumes 2,000 calories/day. If she consumes the RDA, what percentage of her calories will come from protein?

\[
45.5 \text{ g protein} \times 4 \text{ kcal/g} = 182 \text{ kcals}
\]
\[
182 \text{ kcals} / 1,850 \text{ kcals} = 9.1\% \text{ kcals}
\]

- Observation: This percentage is below the AMDR, which is particularly concerning because this woman is more active.
Case Study Part 2: Prescribing Protein Intake

Betty: 125 lb. moderately active female consuming 2,000 calories/day

• We know she needs 45.5 g of protein to meet the RDA, but this is only 9% of her total caloric intake, which falls below the minimum amount recommended by the AMDR.

• Using what you know about the AMDR and Betty’s level of physical activity, how would you calculate her protein needs?
  ▪ Estimated protein needs: ~20-25% total caloric intake
  ▪ 2,000 kcal x 20% = 400 kcal / 4 kcal/g protein = 100 g protein
  ▪ 2,000 kcal x 25% = 500 kcal / 4 kcal/g protein = 125 g protein

• Recommendation: Betty should consume between 100-125 g protein per day, which is above the RDA but still well within the AMDR.
Applying Protein Recommendations to Everyday Life
Focus On High-Quality Protein Sources

Consume a variety of protein foods, but focus on high-quality sources of protein from nutrient-rich foods such as:

- Lean meats
- Poultry
- Fish
- Eggs
- Low-fat milk/dairy products
A Look At Beef’s Caloric Advantage

Peanut Butter
6 tablespoons
564 calories

Black beans
1 ¾ cups
382 calories

Quinoa
3 cups
666 calories

Edamame
1 ½ cups
284 calories

Lean Beef
3 ounces
154 calories

Take a look at what 25 grams of protein looks like and see the caloric cost of plant protein.
Effective Translation of Current Dietary Guidelines: Understanding and Communicating the Concepts of Minimal and Optimal Levels of Dietary Protein

• Significant research shows that when they consume more high-quality protein within calorie goals, some people can:
  • Lose and maintain a healthy weight
  • Support a healthy metabolism
  • Age more healthfully

• On average, consuming between 20-30 grams of high-quality protein at each meal is associated with benefits for:
  • Improved metabolism
  • Healthy aging
  • Weight loss and maintenance, as part of a reduced-calorie diet
Calculate the Amount of Protein Needed

- Use the AMDR (10-35% of calories) and/or absolute amounts of protein ranging from 0.8 to 1.6 g/kg/day to design practical diets to optimize protein intake based on health outcome goals.

25-30 GRAMS

Aim for this amount (according to new research³) in each breakfast, lunch and dinner meal to:

- Improve daily muscle maintenance
- Protect against muscle loss
- Help with growth and repair
- Increase satisfaction and fullness
Emphasize a Balanced Intake Approach

• Spread protein intake throughout the day at meals to increase the body's use of protein and optimize protein's health benefits
Take the Protein Challenge!

TAKE CONTROL
Protein gives you the control you need to take on the day and make the right food choices.
Use Tools and Resources
www.beefitswhatsfordinner.com/proteinchallenge.aspx
Get Recipes for Satisfying Meals
Delivering 25-30 grams of Protein

Breakfast  Lunch  Dinner

Optimize protein intake throughout the day
Final Thoughts

• High-quality protein has unique benefits for health, especially to achieve and maintain a healthy body weight, improve the way the body metabolizes food and support healthy aging

• Research shows that health benefits can be achieved by enhancing high-quality protein intake within daily calorie goals and shifting timing of intake more evenly throughout the day

  • The ideal protein intake is approximately 1.0 to 1.6 g/kg/day (above the RDA but well within the AMDR for protein) and distributed throughout the day.

  • Evenly distributing high-quality protein intake throughout the day, or about 20-30 grams at breakfast, lunch and dinner, is optimal to achieve health benefits
Final Thoughts

• Failure to consume nutrient-dense foods, in particular nutrient-dense protein sources, makes it difficult to meet recommended dietary goals for various nutrients.
• Animal proteins provide more and higher quality protein than plant foods, often for fewer calories.
• Protein should be balanced with other nutrient-rich foods on the plate like fruits, vegetables and whole grains.
• Dietitians and health professionals should be encouraged to promote protein as the first choice in meeting energy requirements and to emphasize spreading protein intake throughout the day.
Thank You!

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