

The Protein Trifecta for Muscle Mass and Strength

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Protein contributes to the synthesis and maintenance of muscle tissue, and directly influences muscle mass, strength, and function in people of all ages.¹ Skeletal muscle protein synthesis is optimized by consuming dietary protein and by considering three important criteria: *protein quality, protein quantity, and timing of protein intake.*





Three Important Criteria

1

Protein Quality

The quality of dietary protein is determined by its amino acid composition as well as its digestibility, or how well the body absorbs and utilizes the protein. Animal protein sources, including eggs, milk (including whey and casein powders), lean beef, skinless poultry, and fish, are considered high-quality protein sources because they contain optimal levels of the nine essential amino acids. Most plant proteins contain inadequate amounts of one or more essential amino acids.² While some plant proteins, such as soy protein, provide all nine essential amino acids, they are less digestible compared with animal protein. There are many measures of protein quality in use today, and the protein in eggs consistently ranks well with all systems, followed by whey protein. In fact, the protein quality in eggs is so high that scientists often use eggs as the “gold standard” for measuring the protein quality of other foods.

2

Protein Quantity

Protein needs for adults are specific to an individual's body weight, age, activity and health status. Research on the effects of diet composition during exercise indicates that dietary protein intakes up to 1.6 grams of protein per kilogram of body weight daily may have benefits on body composition and may enhance response to resistance exercise, especially for aging adults and athletes.³ Protein needs are based on activity level. Endurance athletes require 1.2-1.4 grams of protein per kilogram body weight and strength athletes 1.2-1.7 grams of protein per kilogram body weight.⁴ **Several studies have shown that 25-30 grams of high-quality protein consumed at each meal may be most favorable to maintain healthy muscles and bones for adults.**^{5, 6, 7} The addition of high quality protein at snacks in between meals can also help meet protein needs and aid with satiety throughout the day.⁸ One study demonstrated that women who increased protein intake and decreased carbohydrate consumption while maintaining exercise lost more total weight and fat mass and better maintained lean mass than those who ate more carbohydrates and less protein while exercising.⁹

3

Timing of Protein Intake

Research has noted that the consumption of approximately 30 grams of protein per meal stimulates maximal protein synthesis and provides greater muscle synthesis in 24 hours.^{2, 10} This is particularly important for older adults and individuals who are consuming a reduced-calorie diet as part of a weight loss effort. Additionally, adequate protein intake at breakfast has been shown to help increase satiety throughout the day.⁸ Timing of protein intake around workouts can be of particular importance as well. Research has shown that consuming up to 20 grams of protein after resistance exercise can aid in optimal muscle protein synthesis.¹¹ Furthermore, pairing post-exercise protein with simple carbohydrate in a ratio of 3:1 or 4:1 (carbohydrate to protein) is recommended within 30 minutes of exercise, which translates to 1.2 – 1.5 g/kg of simple carbohydrate with 0.3 – 0.5 g/kg of a high-quality protein.¹²

¹ Layman D and Rodriguez N. Egg Protein as a source of power, strength and energy. *Nutrition Today*. 2009;44: 43-7.

² Gropper S, Smith J, Groff J. *Advanced nutrition and human metabolism*, Belmont, California: Thomson Wadsworth, 2005.

³ Evans WJ. Protein Nutrition, Exercise and Aging. *J Am Coll Nutr* 2004;23(6):601S-609S.

⁴ Position of the American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and Athletic Performance. *J Am Diet Assoc*. 2009;109:509-527.

⁵ Paddon-Jones D, Rasmussen BB. Dietary protein recommendations and the prevention of sarcopenia. *Curr Opin Clin Nutr Metab Care*. 2009;12:86-90.

⁶ Rasmussen BB, Tipton KD, Miller SL, Wolf SE, Wolfe RR: An oral essential amino acid-carbohydrate supplement enhances muscle protein anabolism after resistance exercise. *J Appl Physiol* 2000;88:386-392.

⁷ Krieger JW, Sitren HS, Daniels MJ, Langkamp-Henken B: Effects of variation in protein and carbohydrate intake on body mass and composition during energy restriction: a meta-regression. *Am J Clin Nutr* 2006;83:260-274.

⁸ Leidy HJ, Tang M, Armstrong CL, Martin CB, Campbell WW. The effects of consuming frequent, higher protein meals on appetite and satiety during weight loss in overweight/obese men. *Obesity*. 2011;19:818-24.

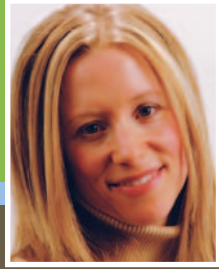
⁹ Layman DK, Evans E, Baum JJ, Seyler J, Erickson DJ, Boileau RA. Dietary protein and exercise have additive effects on body composition during weight loss in adult women. *Hum Nutr Metab* 2005;135:1903-10.

¹⁰ Layman DK. Dietary Guidelines should reflect new understandings about adult protein needs. *Nutr & Metab* 2009;6:12.

¹¹ Moore DR, Robinson MJ, Fry JL, Tang JE, Glover EI, Wilkinson SB, Prior T, Tarnopolsky MA, Phillips SM. *Am J Clin Nutr* 2009;89:161-8.

¹² Kerkick C, Harvey T, Stout J, Campbell B, Wilborn C, Kreider R, Kalman D, Ziegenfuss T, Lopez H, Landis J, Ivy JL, Antonio J. International Society of Sports Nutrition position stand: Nutrient timing. *J Int Soc Sports Nutr* 2008;5:17.

¹³ Skolnik H, Chermus A. "The Protein Profile." *Nutrient Timing for Peak Performance*. Champaign: Human Kinetics, 2010. 37-48.



The following case study is by Chrissy Barth, RD, BHT, RYT, a Registered Dietitian specializing in performance nutrition from Scottsdale, AZ. Remember that an optimal nutrition plan is unique to your client, how long they exercise, their exercise intensity and their fitness goals.

A Case Study

Kelly is a 17-year-old competitive high school soccer athlete playing for her school and club teams with aspirations of playing at a Division I college. Kelly trains and practices 4-6 days a week for 3-4 hours a day, along with multiple soccer matches each week where she may play up to three matches in one day. She came to me in hopes of improving her diet, energy level, and body composition. At the time, Kelly had 30% body fat and wanted to drop down to 20% while maintaining her lean muscle mass.

For Kelly, a typical day of eating looked like this:

Breakfast:
Bagel with cream cheese and a large glass of orange juice – 10 grams (g) protein
Lunch:
Peanut butter and jelly sandwich on whole grain bread with a bag of chips, a snack pack of cookies and bottled water – 12 g protein
Before Practice:
Granola bar – 9 g protein
Practice:
32 ounces of water – 0 g protein
Dinner:
Bowl of white pasta with red sauce – 2 g protein
Snack:
Frozen yogurt – 4 g protein

A few things were clear about Kelly's diet: it lacked key fiber-rich carbohydrates for sustainable energy for her body and brain, lean protein for building and repairing muscle tissue, and healthy fats to minimize oxidative stress. She also simply wasn't eating enough, so her metabolism was slowing down, draining her energy levels, and causing her body to use muscle mass as an expensive fuel source. Kelly could also benefit from an antioxidant boost with additional fruits and vegetables as well as key vitamins and minerals like calcium and vitamin D for building and maintaining bone strength. After establishing nutrition goals and making changes to Kelly's nutrition game plan, she had more energy and was able to successfully decrease body fat while maintaining muscle mass and a healthy weight.

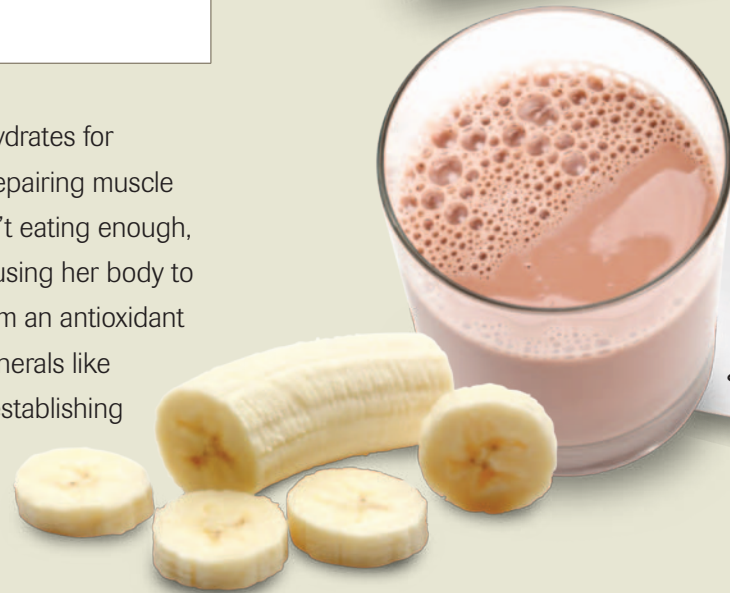
Goals:

1) Build a healthy foundation daily with 3 balanced meals and 2-4 nutrient-rich snacks, fueling every 2 ½ - 3 hours.

2) Aim for lean protein with fiber-rich carbohydrates at each meal and snack. Meals should include 3-4 food groups and snacks should include 2-3 food groups.

3) Focus on performance nutrition – fueling before, during, and post-exercise to help the body and brain prep for the next bout of exercise. For the first 60 minutes of exercise, hydrate with 3-4 cups of plain water. Every 15-20 minutes thereafter, hydrate with a sports drink that provides 6-8% (14-19 g) of carbohydrate and 100-110 milligrams of sodium.

Refuel within 15-30 minutes post-exercise and aim for a 2:1 to 3:1 ratio of carbohydrate to protein, such as low-fat chocolate milk, or a hard-boiled egg with a small banana or cup of berries.



Post-counseling Menu



7^{am}	Breakfast: Scrambled eggs (2) with a sprinkling of 2%-fat shredded cheese, 2-3 slices of avocado, and a few heaping tablespoons (tbsp) of red salsa wrapped in a whole wheat tortilla
8⁰⁰	1 cup/carton of low-fat milk Protein: 24 g
9⁰⁰	Snack: Half of a peanut butter (1 tbsp) and 100% fruit jelly sandwich OR string cheese
10⁰⁰	Water Protein: 6-8 g
11⁰⁰	Lunch: 6-inch whole grain sub with lean turkey, cheese, veggies and a drizzle of olive oil and vinegar
12^{pm}	Single serving bag of baked chips Apple 1 cup/carton of low-fat milk Protein: 28 g
1⁰⁰	
2⁰⁰	Snack: A sports bar OR a hard-boiled egg with juice for eating on the go Protein: 6-8 g
3⁰⁰	Performance Nutrition: 1st hour: water (3-4 cups or 4-6 gulps every 15-20 minutes) After the first hour: Sports drink (3-4 cups per hour or 4-6 gulps every 15-20 minutes) Protein: 0 g
4⁰⁰	
5⁰⁰	Dinner: "Athlete's Plate" within an hour after practice – Divide Plate into Thirds
6⁰⁰	STEP 1: Antioxidants – 1 cup green beans with slivered almonds or buttery spread made with olive oil
7⁰⁰	STEP 2: Lean Protein – palm-size portion of grilled salmon STEP 3: Complex Carbohydrates – 1 medium sweet potato OR a large fistful of brown rice Protein: 25 g
8⁰⁰	Snack: Low-fat yogurt with a handful of berries Protein: 10 g

Eggs should be cooked until the whites and yolks are firm or, for dishes containing eggs, until an internal temperature of 160 degrees Fahrenheit is reached.



What Does Adequate Protein Intake with Exercise Look Like?

Pre-workout Snack: Start well-hydrated and aim to consume both protein and carbohydrate about an hour before exercise to protect muscle tissue and reduce muscle soreness after exercise.¹³ Fuel up with an egg and a banana, a cup of skim milk with a handful of crackers, or a cup of yogurt with berries.

During Workout: Hydrate with water. After an hour, consider a sports drink to replace carbohydrate and electrolytes.

Post-workout Snack: Continue hydrating! Within 15 minutes to an hour, aim to consume a small snack composed of both high-quality protein and adequate carbohydrate to aid in recovery, protecting muscle tissue, and reducing soreness.⁹ Replenish with a cup of chocolate milk, scrambled egg in a pita pocket with OJ, or a small serving of tuna with crackers.

Stacking up the Protein Content of Popular Breakfasts



33 Grams of Protein

Not all breakfasts are created equal when it comes to protein. Examine the protein content of four popular American breakfast options that are all similar in calories. While each of these breakfasts provides a similar amount of calories, the amount and type of protein provided varies significantly.

1 Whole Egg + 1 Egg White
 Canadian Bacon, 1 ounce
 Low-fat Cheese, 1 ounce
 English Muffin, ½
 Melon, 1/2 cup
 Tomato, 1 slice
 Non-fat Milk, 1 cup

350 Calories

13 Grams of Protein

Ready-To-Eat Whole-Grain Cereal, 1 cup
 Non-fat Milk, 1/2 cup
 Banana, 1 small
 Orange Juice, 1/2 cup

330 Calories

12 Grams of Protein

Pancakes, 2
 Maple Syrup, 1 Tablespoon
 Strawberries, ¼ cup
 Non-fat Milk, 1 cup

325 Calories

3 Grams of Protein

Glazed Doughnut
 Coffee, 1 cup
 Cream, 1 Tablespoon
 Sugar, 1 Teaspoon

295 Calories

Egg Nutrition Center

