Nutrition file

December 2018

Proteins to Enhance Hypertrophy and Combat Sarcopenia
Dr. Stuart Phillips

Written by: Kristyn Hall, MSc, RD

Key Messages

Sarcopenia is the age-related loss of muscle that can be offset with exercise and protein intake as follows:

- More protein is needed than the Recommended Daily Allowance (RDA) to optimize synthesis of muscle protein and maintain muscle mass.
- The impact of protein supplementation on muscle mass is less than the gains made by resistant training exercise.
- Anabolic resistance or difficulty in building muscle is a problem for the elderly; it can be overcome by consuming higher amounts of protein, especially with high leucine levels, at each meal.
- Excess protein intake is not a concern for healthy people.

Part three of this series summarizes a presentation given by Dr. Stuart Phillips at the Nutrition File® Seminar in February 2018 on *Proteins to enhance hypertrophy and combat sarcopenia*. His presentation offers advice for both athletes and mere mortals.

Dr. Phillips is a full professor in the Department of Kinesiology and the School of Medicine at McMaster University, where he is a Tier 1 Canada Research Chair in Skeletal Muscle Health. He is the Director of the McMaster Centre for Nutrition, Exercise and Health Research and the Physical Activity Centre of Excellence. Dr. Phillips is dedicated to understanding how exercise and dietary protein affects body composition, strength and function in aging. His research focuses on the impact of nutrition and exercise on human protein turnover, specifically in skeletal muscle. Dr. Phillips has authored more than 170 original research papers and 50 reviews. He has received many awards for his outstanding mentorship and teaching, and has many affiliations.

Dr. Phillips began his presentation with a quote from exercise guru Jack LaLanne which is still true today. When it comes to protein and exercise he says, "Exercise is king, nutrition is queen; together they form a kingdom." Doing resistance exercise builds muscle. After resistance training, muscle adaptation occurs provided there has been an adequate intake of carbohydrate (for fuel), protein (for repairs) and fluid (for rehydration). Current research shows that when it comes to protein intake, adults could benefit from more than the current RDA of 0.8 g protein/kg of body weight/day.

What can offset muscle loss in aging?

Sarcopenia, the age-related loss of muscle, can be mitigated with resistance training and adequate protein intake. Aging is associated with reduced food intake, predisposing older adults to protein-energy undernutrition. A three-year study (based on quintiles of protein intake) showed that those seniors who consumed higher protein in their diets lost less lean body mass (LBM).

The RDA for protein among adults is 0.8 g/kg/day. However, international expert groups question whether this amount of protein is optimal. They recommend older adults (>65 years) take in the following amounts of protein:

- a minimum of 1-1.2 g protein/kg/day to maintain muscle mass, and higher intakes for even greater benefit
- 1.2-1.5 g/kg/day for those with acute or chronic disease*
- up to 2 g/kg/day for those with severe illness, injury or marked malnutrition*

Most older adults are not consuming these intakes.

*The exception to these higher amounts is older people with severe kidney disease who are not on dialysis; they may need to limit protein intake.

How is muscle mass regulated?

Muscle mass is regulated through two important processes: muscle protein synthesis (MPS), where more "bricks are put in the brick wall" and muscle protein breakdown (MPB), where "bricks are removed." Variations in MPS determine net protein balance. When on a resistance exercise regime, adults can synthesize more protein in a fed state (higher MPS); and, in a fasted state, they break down less protein (lower MPB). This gain in muscle mass helps slow sarcopenia.

Changes in skeletal muscle mass result from changes in MPS, which in turn depends upon protein intake and resistance training. Therefore, it is important to consume adequate amounts of protein distributed evenly throughout the day: breakfast, lunch and supper.

Research shows that compared to young men, older men require 70% more protein than the RDA, on a per meal basis, to optimally stimulate MPS. And, in elderly men, a 40 g dose of protein maximally stimulates MPS after resistance exercise. This translates to 1.2 g protein/kg/day or 0.4 g/kg per meal over the day.

Do protein supplements increase muscle gain with resistance exercise training (RET)?

Taking protein supplements along with resistance exercise training (RET) leads to a gain in muscle mass and strength. Supplementation is more effective in resistance-trained individuals and less effective in older individuals for whom it is harder to gain muscle.

The average protein intake to maximize muscle gain is 1.6 g/kg/day (or 4 X 0.4 g/kg/meal) during RET. This translates into three meals and one planned snack to meet the recommended 0.4 g protein/kg/meal. Protein supplementation beyond this amount during RET provides no further gains in muscle mass or strength.

The impact of protein supplementation alone is not large compared to the gains made by working out. RET is more potent than taking dietary protein supplements for augmenting strength and gains in fat free muscle mass (FFM). Therefore, establishing resistance-training routines are important for gains in FFM.

The importance of leucine

Leucine is an amino acid that stimulates a protein called MTORc1, which turns on muscle protein synthesis. Inactive individuals have a high leucine trigger. This means they need more protein (specifically leucine) to turn on MPS. Adding a small dose of whey or a small dose of whey with added leucine resulted in increased MPS.

Exercise is always effective in stimulating MPS. However, you can get a greater MPS response when leucine is added to the diet. Leucine-enriched proteins are recommended for older women to enhance MPS in both a rested and exercised state. They are effective in short term and long term, at a dose of 1.0g/kg/day.

Whey protein isolate and whey protein concentrate produce the best anabolic response in muscle mass due to their leucine content. Other options, although not as effective as whey, include soy protein isolate and pea protein concentrate.

The consumption of protein foods at levels above the RDA may enhance nutrient intake, diet quality and nutrient adequacy.

Protein consumption from nutrient-rich foods contributes to improved nutrient adequacy among "shortfall nutrients" (calcium, vitamin D, vitamin K, fibre, iron, folate and vitamin B12) and promotes decreased intakes of "excess nutrients": sodium, fat and sugars. It also promotes reduced energy intake from less energy-dense, nutrient-poor foods. Without ingestion of high quality, nutrient-rich sources of protein, it is difficult to achieve optimal intakes of many nutrients, especially within current dietary practices.

Lean meats, poultry, milk and other dairy products, eggs and seafood are among the top 10 protein-containing foods according to the most recent NHANES data. It is possible to get adequate levels without these specific food sources of protein, but judicious dietary planning is required.

Will high dietary protein cause a decline in kidney function and bone loss?

There are no data that show (via causation or association) a high protein diet leads to renal disease. The protein content of a diet is not related to progressive decline in kidney function with age. It is time to stop saying that higher protein diets cause kidney disease. However, people with kidney disease who are not on dialysis may need lower protein intakes.

The acid-ash hypothesis which is the basis of the alkaline diet, states that protein and grain foods, along with a low potassium intake, produce a diet acid load, net acid excretion, increase of calcium in urine and release of calcium from the skeleton leading to osteoporosis.

However, research shows that at most bone sites there are no adverse effects of higher protein intake. In fact, it indicates moderate benefits in the lumbar spine. Dietary protein, therefore, is considered a bone-supportive nutrient when taken with adequate calcium and vitamin D.

Conclusions

Sarcopenia is offset with exercise and protein intake. Changes in skeletal muscle mass are the result of muscle protein synthesis. To optimally stimulate MPS and maintain muscle mass, resistance exercise and an intake of protein greater than the current RDA are needed. In the elderly, "anabolic resistance" is a problem that can be overcome by consuming higher amounts of protein at mealtimes, distributed throughout the day. Leucine is an amino acid that stimulates MPS. Intake of high quality, nutrient-dense protein often improves overall diet quality. Excess protein intake is not a concern for healthy people.

Find us on Facebook for more comprehensive and up-to-date scientific nutrition information on the role of milk products in a healthy diet.

Nutrition file

The team of Dairy Farmers of Canada registered dietitians in Alberta is:

Lee Finell, MHSA, RD
Lindsay Buchanan, MEd, RD
Cindy Thorvaldson, MSc, RD

NutriNews®
Every month, articles of interest are featured in our NutriNews Bulletin.

Sign up today to stay up to date on the latest scientific evidence and research.