

This edition of Nutrition Research Update highlights recent research in the area of dietary protein, including findings related to protein quality and timing of intake as well as satiety. We hope that, as a health professional, you find this topic interesting and applicable to your day-to-day work. If you have any questions about the studies or concepts presented, don't hesitate to contact us at info@eggnutrition.org.

Regards,



Mitchell Kanter, PhD
Executive Director, The Egg Nutrition Center

SPECIAL FEATURE

Leucine and the Importance of Protein Quality at Individual Meals

By: Don Layman, PhD, ENC Research Director

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PROTEIN

Effects of Varying Protein Diets on Weight Loss and Cardiometabolic Risk

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SPECIAL FEATURE

Leucine and the Importance of Protein Quality at Individual Meals

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Functional mobility and metabolic health of muscles are recognized as central for healthy aging. New research highlights the importance of protein quantity and quality at individual meals for protecting muscle mass and function¹. Evidence is accumulating that protein intake above the current RDA of 0.8 g/kg of body weight is beneficial for long-term muscle health. Attempts to define optimal protein needs for adults are beginning to focus on specific amounts and types of proteins required at each individual meal.

A recent study by Norton et al. published in the journal *Nutrition & Metabolism* provides a breakthrough in understanding a fundamental mechanism that may help define the amount of protein necessary to protect muscles². These investigators reported that the amount of the essential amino acid leucine contained in individual proteins ultimately determined the amount of protein required at a meal.

Leucine is an essential amino acid that serves as a dietary signal to inform skeletal muscle that adequate dietary protein is available to begin protein synthesis. Protein synthesis is a cycling process that increases after a meal and decreases between meals. The balance of these increases and decreases determines the size and health of muscle. If the meal has less than 2.5 grams of leucine, the protein in the meal will not stimulate muscle protein synthesis and the protein becomes calories. Depending on the leucine content of the particular protein, 2.5 grams of leucine corresponds to about 25-40 grams of total protein.

Norton et al. compared four different proteins, wheat gluten, soy, egg white, and whey protein that represent a range in leucine content (6.8%, 8.0%, 8.8%, and 10.9%, respectively) in breakfast meals. The breakfast meals were fed to adult rats trained to eat three meals per day. The breakfast meals were designed to mimic American adult eating patterns and provided 20% of daily calories and contained 16% protein, 54% carbohydrates, and 30% fat.

The study demonstrated that in small breakfast meals, the leucine content of the protein determines its potential to stimulate protein synthesis in muscle. These results demonstrate that high quality dairy and egg proteins are more effective in stimulating muscle protein synthesis and can be used in lower amounts to achieve optimal muscle health with the least calories. This new research further demonstrates that protein needs should be defined as protein amount and quality at individual meals and not simply a total amount of protein per day.

Sources:

¹Paddon-Jones D, Rasmussen BB. Dietary protein recommendations and the prevention of sarcopenia. *Curr Opin Clin Nutr Metab Care* 2009;12:86-90.

²Norton LE, Wilson GJ, Layman DK, Moulton CJ, Garlick PJ. Leucine content of dietary proteins is a determinant of postprandial skeletal muscle protein synthesis in adult rats. *Nutrition & Metabolism* 2012; 9:67-76.

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In the analysis, study diets were classified as either standard protein (SP), ranging from 12-18% of energy or high protein (HP), or 25-35% of energy; all diets were low-fat, with less than 30% of calories from fat. On average, participants followed the diets for about 12 weeks. The researchers looked at the effects of these diets on weight loss, body composition, resting energy expenditure (REE), satiety and cardiometabolic risk factors.

Through statistical analysis, the researchers discovered that compared with an energy-restricted, SP diet, an isocaloric HP diet resulted in greater weight loss and reduction in fat mass. Furthermore, the HP diet was shown to help mitigate the loss of fat-free mass (FFM) and a decrease in REE that typically occurs with weight reduction. While changes in fasting plasma glucose, fasting insulin, blood pressure and blood cholesterol levels did not vary significantly between the dietary treatments, the HP diet was also shown to produce greater reductions in plasma triglycerides. Participants in the HP group also reported greater feelings of satiety in several of the studies. The researchers concluded that a HP diet provides modest benefits for weight loss, particularly in protecting FFM and REE, but that long-term effects require further investigation.

KEY MESSAGES

- Study participants consuming 25-35% of calories as protein as part of a low-fat, weight loss diet experienced greater reductions in weight loss, fat mass and plasma triglycerides compared with individuals following standard protein, higher carbohydrate diets.
- Analysis showed that the high protein diets helped to mitigate the reductions in fat-free mass and resting energy expenditure typically observed in weight loss.

Source:

¹Wycherley TP, Moran LJ, Clifton PM, Noakes M, Brinkworth GD. Effects of energy-restricted high-protein, low fat compared with standard-protein, low-fat diets: a meta-analysis of randomized controlled trials. *Am J Clin Nutr*. 2012 October [Epub ahead of print]

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Fifteen healthy young women were randomly assigned to consume a 160-calorie yogurt snack containing low (LP), moderate (MP) or high (HP) protein (5g, 14 g or 24 g, respectively), or no snack (NS) for three days. On day four, participants ate a standardized lunch followed three hours later by the yogurt snack. Perceived sensations were then measured every 30 minutes until the participant voluntarily requested dinner, which was then provided ad libitum.

As compared to the NS group, those who consumed an afternoon snack, regardless of protein content, reported reduced hunger and increased fullness for up to 120 minutes after eating the snack. Eating a HP snack, compared with a LP snack, resulted in significantly higher perceived fullness and lower feelings of hunger. While all snacks delayed dinner request and eating initiation, HP snack led to significantly later request times than both LP and MP groups.

Snacking also resulted in lower energy intake at dinner; however, the 160-calorie snacks were not fully compensated for in the meal. Given the beneficial effects of a high-protein snack on improving satiety and delaying eating initiation demonstrated in this study, protein-rich snacks that are also lower in calories, like a hard-boiled egg, may be a useful strategy for weight management.

KEY MESSAGES

- Snacking, regardless of protein level, led to lower levels of perceived hunger and increased feelings of fullness; the high-protein snack provided the greatest hunger and satiety benefits as well as longest delays in eating initiation.
- Just as a protein-rich breakfast has been shown to help people feel more satisfied and reduce calorie intake throughout the day, an afternoon snack high in protein may have similar effects with regard to evening intake, a problem area for many looking to manage their weight.

Sources:

¹Leidy HJ, Bossingham MJ, Mattes RD, Campbell WW. Increased dietary protein consumed at breakfast leads to an initial and sustained feeling of fullness during energy restriction compared to other meal times. *BJN* 2009; 101(6):798-803.

²Vander Wal JS, Marth JM, Khosla P, Jen KL, Dhurandhar NV. Short-term effect of eggs on satiety in overweight and obese subjects. *JACN* 2005; 24(6): 510-515.

³Douglas SM, Ortinau LC, Hoertel HA, Leidy HJ. Low, moderate, or high protein yogurt snacks on appetite control and subsequent eating in healthy women. *Appetite*. 2012 September [Epub ahead of print]



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