See corresponding article on page 332.

Determining the protein needs of "older" persons one meal at a time

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The determination of protein requirements (need) and "optimal" protein intakes (greater than need but beneficial to health) is complex and currently, insofar as older persons are concerned, without consensus. Protein requirements determined through the "black box" nitrogen balance methodology (1) set the current US and Canadian Recommended Dietary Allowance (RDA) at 0.80 g protein $\cdot$ kg^{-1} $\cdot$ d^{-1} (2). There has been, however, considerable dissention over this amount of protein intake for older persons who, due to sarcopenic loss of muscle, may benefit from protein intakes at amounts greater than the RDA (3, 4). Observational studies have shown associations between higher protein intakes and preservation of lean mass as well as muscle function (5). Moreover, there is evidence that shows that protein needs are actually substantially higher than the RDA for older persons (6, 7). Nonetheless, the nitrogen balance methodology remains the mainstay of the RDA, and no separate recommendations for protein requirements for older persons are currently given (2).

In this issue of the Journal, Gorissen et al. (8) take a "deeper dive" into the question of how dietary protein regulates muscle mass in older persons. By using elegant methodology, these researchers have unlocked a small part of the black box and have shown how habitual protein intakes may modulate muscle protein turnover in older persons. There are some important considerations in this work (8) that are worth highlighting. First, the mean age of the men in the study was only 62 y, which is a relevant "older" population because they will be in the earlier stages of sarcopenic muscle loss. It appears to be much easier to attempt to attenuate muscle loss via protein intake earlier in life rather than to try and reclaim what has been lost at the latter stages of life, which appears to be a far more difficult proposition. Thus, examining protein intakes and muscle responses in this age group bears great relevance for the aging population. Second, the protein source provided to the study participants, whey protein isolate, is one of the highest quality proteins with a high leucine content (9) and so the results likely represent an absolute best-case finding from a muscle protein synthetic perspective. Finally, the study took place over a period of "only" 2 wk. This last point in no way undermines the importance of the work, but highlights that the results are short-term observations and also brings to the fore the fact that longer-term studies of dietary protein metabolism and requirements, including relevant protein turnover measures, are urgently required in older persons. This point is paramount for skeletal muscle, which is the engine of mobility and which would be among the most relevant clinical measures for older persons. For example, if sarcopenic muscle loss proceeds at $\sim$1% annually, then a 90-kg man or a 70-kg woman would lose $\sim$400 or $\sim$250 g of muscle annually, respectively. The number of subjects required, and/or the duration of intervention needed, to show an attenuation of such a change in muscle mass and, further, to show a functional outcome requires a large investment. This is highlighted by the findings of a recent protein-supplementation intervention (10), which included $>$180 subjects/study arm.

The critical takeaway findings from the study by Gorissen et al. (8) relate to the observation that first-pass splanchnic extraction of amino acids, which were determined in their study from the use of intrinsically labeled whey proteins, was significantly reduced by $\sim$5% in the men with the lower protein (0.7 g protein $\cdot$ kg^{-1} $\cdot$ d^{-1}) intake compared with those with the higher protein (1.5 g protein $\cdot$ kg^{-1} $\cdot$ d^{-1}) intake. This splanchnic "adaptability" resulted in a better availability of amino acids from the 25 g of ingested whey protein (an intake that would have represented $\sim$42% of the low protein–consuming and $\sim$20% of the high protein–consuming groups' daily protein intakes, respectively) for muscle protein synthesis (MPS) in the men who consumed the lower-protein diet. The result was that postprandial MPS was equivalent in the lower and higher protein–consuming groups. Interestingly, the postabsorptive rates of MPS also were not different between the lower and higher protein–consuming groups after 2 wk with their respective diets. The authors speculated that the improved "efficiency" of protein use in the lower protein–consuming group might translate into an additional 20–500 g protein being made annually. This is a critical observation that has important implications for recommendations for protein needs in older persons. Clearly, longer-term studies involving the ingestion of proteins of mixed quality are required to substantiate such speculation. Importantly, the issue of protein dose also needs to be considered. Would the MPS response be the same if the dose of protein were lower or higher? Similar to most studies of this nature, as many questions are raised as are answered, but the answers provided by Gorissen et al. (8) are weighty in their implications. Our knowledge of the protein requirements for older persons, even from a nitrogen balance perspective (1), is remarkably underdeveloped

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(14 of 235 data points in an analysis that showed a median requirement for protein of 104 mg $N \cdot kg^{-1} \cdot d^{-1}$ in younger compared with 131 mg $N \cdot kg^{-1} \cdot d^{-1}$ in older persons). Given the potential burden of sarcopenia and its effects on muscle function and loss of mobility, our global aging population would be well served by new research that addresses how age-appropriate dietary recommendations may help mitigate this problem. Answers to this question will come in many forms, and in the case of the findings from Gorissen et al. (8), they are arriving one meal at a time.

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REFERENCES

1. Rand WM, Pellett PL, Young VR. Meta-analysis of nitrogen balance studies for estimating protein requirements in healthy adults. Am J Clin Nutr 2003;77:109–27.
2. Institute of Medicine. Dietary Reference Intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids. Washington (DC): National Academies Press; 2005.
3. Bauer J, Biolo G, Cederholm T, Cesari M, Cruz-Jentoft AJ, Morley JE, Phillips S, Sieber C, Stehle P, Teta D, et al. Evidence-based recommendations for optimal dietary protein intake in older people: a position paper from the PROT-AGE Study Group. J Am Med Dir Assoc 2013; 14:542–59.
4. Deutz NE, Bauer JM, Barazzoni R, Biolo G, Boirie Y, Bosy-Westphal A, Cederholm T, Cruz-Jentoft A, Krznaric Z, Nair KS, et al. Protein intake and exercise for optimal muscle function with aging: recommendations from the ESPEN Expert Group. Clin Nutr 2014;33:929–36.
5. Loenneke JP, Loprinzi PD, Murphy CH, Phillips SM. Per meal dose and frequency of protein consumption is associated with lean mass and muscle performance. Clin Nutr 2016;35:1506–11.
6. Rafii M, Chapman K, Owens J, Elango R, Campbell WW, Ball RO, Pencharz PB, Courtney-Martin G. Dietary protein requirement of female adults >65 years determined by the indicator amino acid oxidation technique is higher than current recommendations. J Nutr 2015;145: 18–24.
7. Tang M, McCabe GP, Elango R, Pencharz PB, Ball RO, Campbell WW. Assessment of protein requirement in octogenarian women with use of the indicator amino acid oxidation technique. Am J Clin Nutr 2014;99: 891–8.
8. Gorissen SHM, Horstman AMH, Franssen R, Kouw IWK, Wall BT, Burd NA, de Groot LCPGM, van Loon LJC. Habituation to low or high protein intake does not modulate basal or postprandial muscle protein synthesis rates: a randomized trial. Am J Clin Nutr 2017;105: 332–42.
9. Rutherfurd SM, Fanning AC, Miller BJ, Moughan PJ. Protein digestibility-corrected amino acid scores and digestible indispensable amino acid scores differentially describe protein quality in growing male rats. J Nutr 2015;145:372–9.
10. Bauer JM, Verlaan S, Bautmans I, Brandt K, Donini LM, Maggio M, McMurdo ME, Mets T, Seal C, Wijers SL, et al. Effects of a vitamin D and leucine-enriched whey protein nutritional supplement on measures of sarcopenia in older adults, the PROVIDE study: a randomized, double-blind, placebo-controlled trial. J Am Med Dir Assoc 2015;16: 740–7.