Editorial

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One size doesn't fit all: postexercise protein requirements for the endurance athlete

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Dietary protein is a fundamental component of any nutritional strategy aimed at enhancing postexercise recovery. This is due to its ability to provide the requisite amino acid building blocks to support enhanced rates of body and muscle protein synthesis, which serves to offset any fasted-state losses in protein content arising from elevations in proteolysis and repair or remodeling of intracellular components (e.g., myofibrillar and mitochondrial proteins) to optimize muscle mass and quality in healthy humans. Research to date has primarily focused on the impact of dietary protein amount, type, and timing on rates of muscle protein synthesis (especially of the contractile myofibrillar fraction) after resistance exercise with relatively little attention paid to the endurance athlete. Nevertheless, postexercise dietary protein recommendations for endurance athletes have generally been based on the observation that ∼20 g or the equivalent of ∼0.25–0.3 g/kg of high-quality (i.e., essential amino acid– and leucine-enriched) protein being optimal to maximize myofibrillar protein synthesis (1, 2). However, in contrast to resistance exercise, which is inherently anabolic, endurance exercise represents a more systemic stimulus that can include the degradation of body proteins into their constituent amino acids, which conservatively may contribute ∼5% to metabolic fuel use and, in the case of the nutritionally essential amino acids, must subsequently be replaced by the diet. Therefore, the recent work by Churchward-Venne and colleagues (3) represents an overdue and important contribution to the sports nutrition landscape.

Using a group design in well-trained athletes, Churchward-Venne et al. (3) demonstrated that myofibrillar protein synthesis after an acute bout of endurance exercise was enhanced in a relative dose–response fashion up to a plateau at 30 g of ingested milk protein, which is consistent with the nutrient sensitivity of this protein fraction after resistance exercise (2). In contrast, there was no apparent augmentation of mitochondrial protein synthesis, which further adds to the evidence that the remodeling of this essential organelle after exercise is dissociated from the stimulatory effect of amino acids (4, 5). However, the application of novel, intrinsically labeled proteins demonstrated that dietary phenylalanine was incorporated into new proteins in both muscle protein fractions in proportion to its total intake. Therefore, while mitochondrial remodeling does not appear to be dependent on the intracellular amino acid concentration, the authors clearly demonstrate that dietary amino acids represent important precursors for the de novo synthesis of all skeletal muscle proteins, further highlighting the importance of dietary protein to enhance recovery from all modalities of exercise.

Normalizing protein intakes to body mass, which will aid in individualized athlete recommendations, revealed that the requirement for protein ingestion to maximize myofibrillar remodeling after endurance exercise is ∼60% greater than after resistance exercise (i.e., ∼0.49 vs. ∼0.31 g protein/kg) (1). Rates of myofibrillar protein synthesis were broadly similar to those reported previously after resistance exercise by this research group (6), suggesting the rightward shift in the dose–response curve was not related to an increased synthetic capacity (i.e., greater ceiling) after endurance exercise. It is equally unlikely that this increased requirement is related to a blunted response as the authors report a rapid increase in dietary phenylalanine availability (i.e., ≤60 min) and early (≤120 min) myofibrillar fractional synthetic rates that are broadly similar to previous studies after resistance exercise (6) and consistent with enhanced mechanistic target of rapamycin complex 1 activity early in recovery after endurance exercise with protein/carbohydrate feeding (5). It is worth noting, however, that the efflux of amino acids from skeletal muscle during endurance exercise in the fasted state is due to the degradation of muscle proteins (7), which may preferentially represent myofilament elements (8). The fate of these amino acids liberated by proteolysis may equate to ∼10 g of endogenous protein oxidation in ∼1 h of moderate-intensity metabolic work (9). Therefore, the general rightward shift in the relative protein intake after 90 min of fasted endurance exercise (3) may represent a requirement to replenish exercise-induced myofilament proteolysis. While it is likely that dietary protein consumed outside of this early recovery window could still serve this purpose, the present research suggests that a strategy aimed at facilitating the rapid recovery from endurance exercise should also feature the intake of a high-quality protein that is in excess of what is generally recommended after resistance exercise. Additional longer-term research would help elucidate the benefits of this enhanced myofibrillar remodeling from a performance perspective.

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The authors also characterized changes in whole-body protein metabolism, which is arguably more relevant for endurance athletes than those engaging in more "muscle-centric" resistance exercise, given the whole-body stimulus of aerobic exercise. Unlike myofibrillar protein synthesis, there was no apparent plateau in whole-body net protein balance, which is consistent with a greater capacity to assimilate dietary proteins at the whole-body level and the apparent prioritization of skeletal muscle anabolism after exercise (10). While whole-body net protein balance is a nonspecific physiological outcome and could be overestimated if exercise-induced catabolism is not accounted for (9), potential positive implications for maximizing this response for the endurance athlete may include other nutritionally regulated processes such as the replenishment of labile protein oxidative losses, enhanced plasma volume expansion secondary to plasma albumin synthesis (11), increased nonmyofibrillar skeletal muscle protein synthesis (e.g., metabolic enzymes) (12), and/or increased structural protein remodeling (e.g., bone collagen synthesis) (13). Therefore, elucidating nutritional strategies that optimize both muscle and nonmuscle proteostasis would best serve an athlete's goal to optimize his or her postexercise recovery and training adaptation.

There are undoubtedly additional questions still to be resolved with respect to the postexercise protein requirements for endurance athletes. These could include the impact of the sex hormone estrogen, training intensity or duration, and/or carbohydrate availability, all of which can influence amino acid oxidative losses during exercise. Additional research would also be warranted to determine whether requirements may be modified by protein type, micro-/macronutrient co-ingestion, and/or food matrix, all of which are emerging as important considerations to optimize the anabolic potential of an ingested protein and would feature in athletes' whole-food–based diets (14). However, these questions may reveal to be merely incremental modifications to the postexercise nutritional advice for endurance athletes. The findings of Churchward-Venne et al. (3) on acute protein requirements, which were generated in endurance athletes, for endurance athletes represent the new comparator and will arguably form the cornerstone for sports nutrition recommendations in the future.

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