Dietary Protein for Muscle Hypertrophy

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Skeletal muscle hypertrophy is a beneficial adaptation for many individuals. The hypertrophic response to resistance exercise is enhanced by nutrition, in particular provision of protein. Study of the interaction of nutrition and exercise offers valuable information that may be used to enhance muscle hypertrophy and alter body composition during training.

The metabolic basis for muscle hypertrophy is the balance between the rates of muscle protein synthesis (MPS) and muscle protein breakdown (MPB), i.e. net muscle protein balance (NMPB = MPS – MPB). Periods of positive NMPB must be of larger duration and magnitude than negative periods over any given time for muscle growth to occur.

Ingestion of a protein source in temporal proximity to resistance exercise increases MPS resulting in positive NMPB. At this juncture, it is difficult to unequivocally state that one source is ideal. Dairy proteins seem to offer some advantage for muscle anabolism over other protein sources. Moreover, the response of MPS to whey protein ingestion following resistance exercise was superior to that of either casein or soy protein [1].

It seems clear that it is the essential amino acids (EAA) in the protein that are the key to muscle anabolism, i.e. provision of nonessential amino acids are unnecessary for stimulation of MPS [2]. Exercise potentiates the protein synthetic response in muscle allowing it to better respond to provision of EAA. This response leads to muscle hypertrophy with repeated bouts of resistance exercise.

The differences in the anabolic response to whey protein ingestion and the ingestion of other proteins likely are due to a combination of its high leucine and EAA content and the rapidity of digestion of the protein resulting in rapid hyperaminoacidemia. Whey protein provides all of the EAA, including leucine, in greater amounts than is present in human muscle protein, but soy and casein do not. In fact, recently, a 'leucine trigger' has been suggested to be a key factor for muscle anabolism. Rapid appearance of amino acids into the blood seems to be important for an optimal response of MPS [3]. Greater and more rapid aminoacidemia of EAA likely contributes to the superior anabolic response noted for whey protein over casein. Taken together, the data suggest that the superiority of whey protein for stimulation of MPS following exercise results from rapid increase in EAA, in particular leucine, availability. However, we know nothing about mixed meal consumption and the effect of protein in a matrix of fat and carbohydrate.

The optimal amount of protein to maximally stimulate MPS has yet to be firmly established. Studies suggest determined that ~20–25g of protein is sufficient to optimally stimulate MPS following exercise, at least in young, resistance-trained males. Ingestion of >20g simply results in oxidation of the excess amino acids [4]. However, it seems that 40 g of protein is necessary for the optimal stimulation of MPS in older adults.

The precise timing of the ingestion in relation to the exercise may impact the response. Immediate post-exercise ingestion of an amino acid source obviously is a sound method of enhancing muscle anabolism. More recent work suggests that this 'window of opportunity' may be even more extensive than just a few hours around the exercise bout. The synergistic response of muscle to exercise and nutrition lasts for at least 24 h. Thus, whereas the optimal response may occur when protein is ingested soon after exercise, a normal post-exercise feeding pattern will, in fact, support muscle anabolism. Recent work has confirmed that ingestion of carbohydrate with sufficient amounts of protein does not further increase MPS following exercise [5].

References

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