Influence of whey protein dose on muscle protein synthesis following leg resistance exercise

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Purpose: Protein ingestion following resistance exercise enhances the muscle protein synthetic response to a greater extent than exercise alone. However, there appears to be a limit to the rate of muscle protein synthesis (MPS) that can be attained. Amino acids not used to synthesize new proteins are simply oxidised. The optimal amount of whey protein to ingest following exercise to maximally stimulate MPS has not been determined. Moreover, the response of MPS to differing doses of whey protein following exercise in the fed state is unknown. Therefore the purpose of this study was to determine the response of MPS to differing amounts of whey protein ingested after resistance exercise performed in the post–prandial state.

Method: Thirty resistance–trained males performed a bout of unilateral leg resistance exercise in a parallel designed study. Exercise consisted of 8 x 10 repetitions at 80% one repetition maximum on both leg press and leg extension machines. Each subject consumed a beverage containing either 20g (20WP) or 40g (40WP) of whey protein or a placebo (PLA) ~20 min post exercise. Exercise was performed 3h following consumption of a high protein (~30% energy) breakfast. Myofibrillar protein synthesis was measured over the 4h recovery period by a primed constant infusion of L-[ring 13C6]phenylalanine and muscle biopsies immediately after and 4h post resistance exercise. Arterialized blood samples were collected throughout the trial. Diet was controlled for two days prior to the infusion trial to match habitual energy intake and dietary composition.

Results: Plasma amino acid concentrations did not change for PLA, but increased following protein ingestion (40WP>20WP>PLA; p<0.05). Peak amino acid concentrations were observed between 0.25 and 0.5h post drink in 20WP and 0.75 to 1h post drink in 40WP. Amino acid levels remained elevated for 4h post drink ingestion in both 40WP and 20WP. FSR was significantly higher in 40WP (0.079±0.003%/h) by 51% and 20WP (0.074±0.005%/h) by 41% than PLA (0.053±0.005%/h), however there were no differences between 40WP and 20WP over the 4h recovery period. Area under the curve of urea production post-drink ingestion was significantly higher in 40WP (5±1 μmol/min/kg*4h) and 20WP (4±3 μmol/min/kg*4h) than PLA (−5±2 μmol/min/kg *4h). Insulin concentrations were significantly higher in 40WP than PLA at 0.5 and 1h post drink ingestion. Glucose concentrations were not different between conditions.

Conclusion: Our results are the first to show that when exercise is performed 3h following food intake there is a limit to the rate of post–exercise MPS following protein ingestion. Whey protein ingestion above 20g does not provide any additional benefit to MPS.

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