

Differential effects of L-leucine and whey protein on post-exercise skeletal muscle protein synthesis

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Purpose: It is widely accepted that L-leucine (LEU) or whey protein (WP) consumption following resistance exercise enhances the skeletal muscle protein synthetic (sMPS) response. LEU has been theorized to be the active component in WP that accounts for these additive anabolic effects. Herein, we examined whether LEU or WP (with a similar amount of LEU) elicited differential anabolic effects in skeletal muscle 3 or 6 hours (3h, 6h) post-resistance exercise. **Methods:** Male Wistar rats (~250 g) were fasted overnight and subjected to electrically-stimulated resistance exercise consisting of unilateral plantarflexor contractions (4 sets of 8 repetitions with 2 min between-set rest periods). Immediately following exercise, rats were gavage-fed either water (CTL), 0.054 g of LEU or 0.362 g of WP and euthanized 3h (CTL, n = 10; LEU 3h, n = 8; LEU 6h, n = 9) or 6h (WP 3h, n = 9; WP 6h, n = 10) post-exercise. Gastrocnemius muscles from exercised legs were harvested and analyzed for Akt-mTOR signaling markers as well as sMPS levels via the SUNSET method. **Results:** Compared to the basal condition, 3h exercised CTL muscle presented a 39% increase in sMPS ($p < 0.05$) suggesting that the employed exercise model sufficiently stimulated an acute post-exercise anabolic response. Compared to basal levels of Akt-mTOR signaling, WP and LEU expressed similar markers indicative of increased mTORC1 pathway activity; specifically: a) LEU-fed rats presented a 40% increase in phosphorylated (p)-Akt (Ser473) at 3h ($p < 0.01$), an 80% increase in p-rps6 (Ser235/236) at 3 h ($p < 0.05$) which persisted at 6h (+85%, $p < 0.01$), and a 46% decrease in p-Ampk- (Thr172) at 3h ($p < 0.001$) which persisted at 6h (-34%, $p < 0.001$); b) WP-fed rats presented an 139% increase in p-rps6 (Ser235/236) at 3 h ($p < 0.001$) which persisted at 6h (+69%, $p < 0.05$), and a 58% decrease in p-Ampk- (Thr172) at 3h ($p < 0.001$) which persisted at 6h (-47%, $p < 0.001$). WP and LEU similarly increased post-exercise sMPS levels over basal levels; specifically, LEU 3h rats demonstrated a 49% increase in sMPS ($p < 0.01$) which persisted in LEU 6h rats (49%, $p < 0.05$), whereas WP 3h rats presented a 72% increase in sMPS ($p < 0.01$) though sMPS was non-significantly elevated compared to WP 6h rats (30%, $p = 0.09$). **Conclusion:** Relative to basal levels, WP and LEU feedings elicited similar elevations in intramuscular anabolic indices 3-6 h following a stimulated resistance exercise bout in rodents. *This study was funded in full by MusclePharm Sports Science Institute (Denver, CO, USA).*