THE EFFECTS OF LEUCINE-ENRICHED BRANCHED-CHAIN AMINO ACID SUPPLEMENTATION ON EXERCISE-INDUCED SKELETAL MUSCLE DAMAGE

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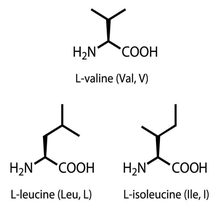
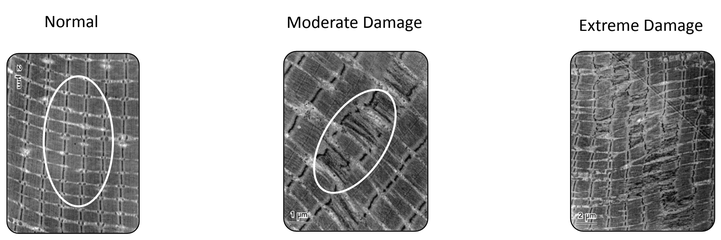
ABSTRACT

Branched-chain amino acids, or BCAA's, are amino acids that increase synthesis of the cellular machinery responsible for carrying out the process of protein synthesis. Moreover, practice of supplementation with BCAA's accelerates the recovery process following a bout of damaging exercise. Previous research validates this because results demonstrated that there were significant increases in alleviating symptoms associated with exercise-induced muscle damage (EIMD) resulting from a bout of damaging exercise. Of the three BCAA's, which include leucine, isoleucine, and valine, leucine (LEU) contributes most to the anabolic and anti-catabolic properties in skeletal muscle. The supposition that supplementary LEU alone would alleviate the symptoms of EIMD is within scientific reason. There is, nonetheless, a limited amount of evidence demonstrating that supplementary LEU is not significantly efficient in alleviating EIMD. However, due to confounding factors, this evidence, although current, is both inconclusive and limited. However, there is uncertainty whether leucine-enriched BCAA or free-form leucine (LEU) supplement further decreases EIMD when compared to a conventional BCAA supplement.



INTRODUCTION

When resistance exercise (RE), is performed frequently over a prolonged period of time, it is known as resistance training. Resistance training provides a potent stimulus for neuromuscular adaptations. The continuous neuromuscular stress from overloaded contractions of this training and muscle damage it induces allows for an adaptive response conducive to increased muscular force capacity and myofiber hypertrophy. Although exercise-induced muscle damage (EIMD) has shown to contribute towards this adaptive response, it may also limit subsequent performance for up to 72 hours by provoking acute inflammation and muscle soreness, thereby inhibiting muscular force production and range of motion. However, previous research indicates that BCAA interventions facilitated a greater rate of recovery of neuromuscular function during resistance training. Moreover, of the three BCAA's leucine (LEU) is evidently most contributory to these anabolic and anti-catabolic properties in skeletal muscle. Consequently, there is speculation that supplementary LEU alone would likewise alleviate the symptoms of EIMD. However, some research demonstrates that supplementary LEU has only a minor degree of efficacy in alleviating EIMD. For this reason, enrichment of an essential amino acid mixture with LEU has shown to be a more effective countermeasure than isolated LEU, suggesting that other BCAA may be necessary to elicit any significant effect.



OBJECTIVE

The objective of this study is to examine the effects of LEU-enriched BCAA and free-form LEU supplementation on select markers of EIMD elicited by a bout of damaging exercise.

HYPOTHESIS

The magnitude of EIMD would be lower with BCAA supplementation compared to a placebo control

METHODS

Participants: Twenty-two (N=22) recreationally-trained male (n=19) and female (n=3) individuals aged 18 to 30 years were a part of this study. They all participated in resistance exercise at least 3 days per week for 6 months prior to the start of the study and were not competitive athletes in any sanctioned collegiate or professional sport.

Design: A randomized, counter-balanced, double-blind experimental design was implemented for the proposed study. The research was conducted in an approximate 11-day testing period. Participants underwent an initial muscular strength assessment through testing of one-repetition maximum (1RM) on the leg press exercise.

VISIT 1 (*DAY 1*)	VISIT 2 (*DAY 8*)	VISITS 3-5 (*DAYS 9-11*)
Informed Consent EHHQ Anthropometric Measures 1RM Leg Press Assign Supplement	Pre-ECRE Testing Biomarkers Soreness Pain Threshold/Tolerance Flexibility and ROM Performance (Power)	Post-ECRE Testing Biomarkers Soreness Pain Threshold/Tolerance Flexibility and ROM Performance (Power)
Begin 7-Day "Loading" Phase (BCAA, LEU, or LBCAA)	*Damaging Eccentric-Based Resistance Exercise*	

Participants were randomly allocated to one of the following treatment groups: (1) conventional branched-chain amino acid supplementation (BCAA) (n=8; 7 males and 1 female), (2) standalone leucine supplementation (LEU) (n=7; 6 males and 1 female), or (3) leucine-enriched BCAA supplementation (LBCAA) (n=7; 6 males and 1 female).

Participants first consumed two servings of their assigned supplement approximately 30 minutes prior to the eccentric-based resistance exercise (ECRE) protocol. Participants then underwent testing to establish baseline values for serum muscle damage biomarkers, perceived muscle soreness (DOMS), localized pain threshold (THR), lower body flexibility and range of motion (FLEX), and muscle function and performance (MAP and MPP), in the listed order. Participants then performed ECRE, which consisted of a series of eccentric-based lower body resistance exercises: vertical depth jumps and leg press. Immediately following ECRE, participants consumed an additional two servings of their assigned supplement.

RESULTS

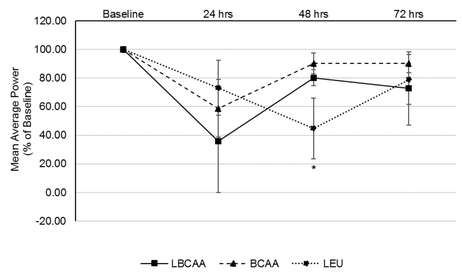


Figure 1. Mean average power before and up to 72 hours after the bout of damaging exercise.

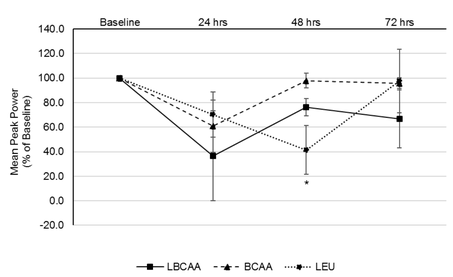


Figure 2. Mean peak power before and up to 72 hours after the bout of damaging exercise.

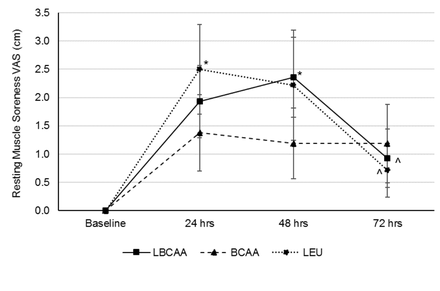


Figure 3. Rating of resting muscle soreness before and up to 72 hours after the bout of damaging exercise.

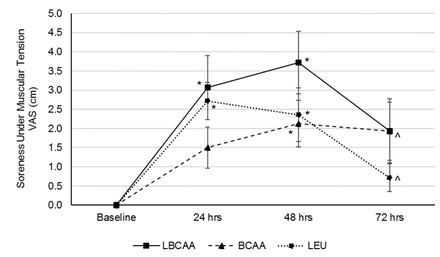


Figure 4. Rating of soreness under muscle tension before and up to 72 hours after the bout of damaging exercise.

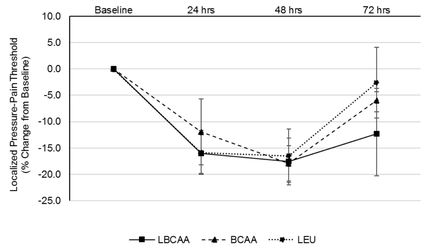


Figure 5. Localized pressure-pain threshold up to 72 hours after the bout of damaging exercise.

ANALYSIS

The results suggest that standard BCAA supplements are effective at relieving the symptoms associated with EIMD. This is due to the fact that exercise performance and muscle soreness were least affected in those supplementing with BCAA. Moreover, results from the study suggest that free-form LUE supplements may not be an ideal countermeasure to EIMD. However, due to the overall lack of group by time interactions (between group differences), it cannot be said that BCAA outweighs LBCAA or LEU benefits. Furthermore, the biochemical markers of EIMD have yet to be analyzed. Consequently, this data may provide insight towards mechanisms of muscle damage and repair. Overall, BCAA remain to be an effective ergogenic aid for EIMD. In corroboration with prior investigations, BCAA may help maintain power generating capabilities following damaging exercise and may help relieve the perception of muscle soreness.

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