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The Effect of BCAA Supplementation on Mental Performance Following Exercise



EXERCISE SCIENCE
SACRED HEART UNIVERSITY

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ABSTRACT

The effect of branched chain amino acid (BCAA) supplementation on physical performance has been documented extensively, but mental performance post-exercise remains understudied. Therefore, the present study sought to determine the efficacy of BCAA supplementation on cognitive performance after exhaustive exercise. In a double-blind manner, 14 male collegiate soccer players performed three cognitive performance tests prior to and after a conditioning-heavy, 80 minute soccer practice. Before and during practice, subjects ingested either a water-based solution containing BCAAs (SUPP) or a calorically equivalent amount of maltodextrin (PLAC) at fixed time intervals. Paired t-tests were used to assess within-group differences. Session rating of perceived exertion (RPE) was assessed 30 minutes post-exercise, and were compared between-groups via a Mann-Whitney U test. Participants in the SUPP group had significantly ($p < 0.05$) improved performance on the Encephalapp Stroop Color and Word Test following exercise (11.1 ± 1.5 s) as compared to before exercise (13.4 ± 3.6 s). Participants in the PLAC group had a significantly ($p < 0.05$) improved performance on Part A of the Trail Making Test following exercise (14.5 ± 4.7 s) as compared to before exercise (22.0 ± 9.5 s). There were no differences within or between groups for the remaining cognitive tests or RPE ($p > 0.05$). The evidence suggests that BCAA supplementation before and during exercise may improve certain aspects of cognitive performance. Familiarization of the Trail Making Test may have induced a type I error in finding significance in the PLAC group's performance.

Can BCAA supplementation improve cognitive performance?

There is a linear relationship between both the intensity and duration of exercise and free fatty acid concentration in the blood.¹³ This induces an increase in free tryptophan levels, a known modulator of attention, mood, and fatigue in the central nervous system once entering the brain.¹⁴⁻¹⁸ An increased concentration of BCAAs in the bloodstream may block tryptophan from entering the brain, diminishing the possible cognitively fatiguing result of exercise.¹⁹ Therefore, BCAA supplementation may be an appropriate method to enhance cognitive performance following exercise.

Purpose

There is scant research on the cognitive effects of BCAA supplementation following exercise. The purpose of this experiment is to determine if there are any cognitive performance-enhancing effects of BCAA supplementation following exercise.

PARTICIPANTS

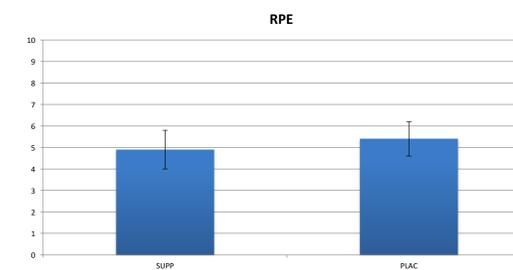
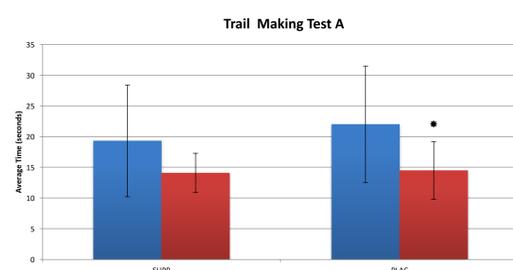
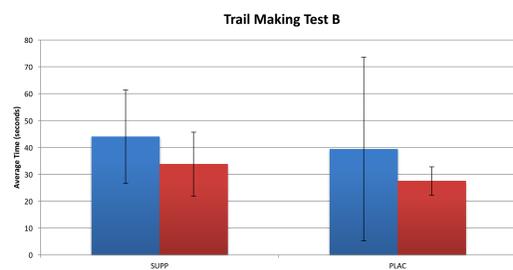
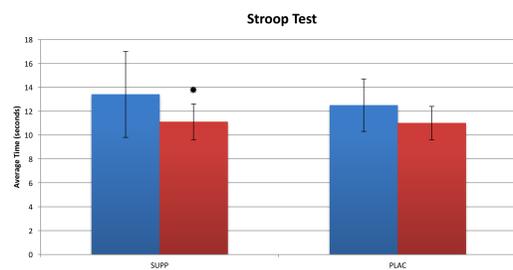
Fourteen male NCAA Division I soccer athletes participated in this study after providing informed consent. All methods were approved by the Sacred Heart University Institutional Review Board. All subjects underwent the same daily exercise regimen for 3 months prior to the study. The mean age and BMI of the subjects were 20 ± 1 years and 23.6 ± 1.9 , respectively, with a mean height and weight of 70.4 ± 2.3 inches and 166.2 ± 20.6 pounds, respectively.

METHODS

The subjects took part in a standardized workout consisting of a dynamic warm-up, reaction-training drills, agility drills, relay races, and sprinting exercises. The workout was approximately 80 minutes in duration and largely consisted of sport-specific exercises. The night prior to testing, each subject consumed a minimum of 0.5 Liters of water. Three hours prior to testing, each subject consumed at least 0.5 Liters of water along with a standardized 520 Calorie meal of wheat-based crackers (8g protein; 96g carbohydrates; 12g fat). The subjects were randomly assigned to two groups, each receiving solutions to drink prior to and during the exercise bout containing either BCAAs (SUPP) ($n = 7$) or an equal caloric amount of maltodextrin (PLAC) ($n = 7$). PLAC consumed 32 ounces of a zero-calorie mixture of water and artificial sweetener (Crystal Light, Northfield, IL). The BCAA subjects consumed 32 ounces of water, with unflavored BCAA powder dissolved in it in addition to the artificial sweetener, containing 18 grams of BCAA (powder form) with ratio of leucine to iso-leucine to valine of 3:1:1. The ratio and dosages are comparable to recent investigation in which administration of BCAAs were involved¹⁻⁶. The subjects consumed their respective beverages in eight-ounce portions incremented every twenty minutes with the first consumption being five minutes prior to the beginning of the workout. Ten minutes prior to the exercise, the subjects' visual scanning, motor speed, and selective attention ability was measured using the Trail Making Test (Parts A and B) and the Stroop Color and Word Test⁷⁻¹². Immediately following the exercise, the subjects were tested again using the same tools. Both of these tests are valid and reliable tests to measure brain function/dysfunction^{8,11,9}. A measure of each subject's rating of perceived exertion (RPE) was obtained thirty minutes following the exercise. This method of collecting a session RPE has been validated and shown to be a reliable subjective tool.¹¹

RESULTS

Fourteen subjects completed all testing procedures and were thus included in the final statistical analyses.



SUPP = supplement group; PLAC = placebo group; * = significantly different than Pre ($p < 0.05$)

DISCUSSION

The present data suggests that there may be a cognitively enhancing effect post-exercise from supplementing with BCAAs. However, this suggestion must be considered cautiously as the supplementation was seen to be just as effective as the placebo according to the metrics used. While there was no significant performance-enhancing effect observed during either of the Trail Making Tests (supposedly assessing speed of cognition and executive functioning), this may have actually been a reflection of the subject's ability to memorize the test as an element of familiarization was present. Due to high subject dropout rate, the sample size was relatively small. This study would benefit from a second trial such that the SUPP group would receive a placebo and the PLAC group would receive BCAAs.

TAKE HOME MESSAGES

- BCAA supplementation may enhance cognitive performance following exercise, though caution should be taken as a placebo also enhanced cognitive performance
- The Trail-Making Tests may be an invalid metric for a Pre-Post measurement

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