

Effects of two different dosage of bcaa supplementation on serum indices of muscle damage and soreness in soccer players

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Annotation:

The purpose of this study was to investigation of the effects of two different dose of BCAA supplementation on serum indices of muscle damage and soreness in soccer players. 30 male soccer players (age: 20.2±0.6 yr) participated as subjects in this study. Subjects were randomly divided into three groups (double-blind design). All subjects performed lower-body resistance exercise (6 sets, 10 repetitions, 70% 1RM). The BCAA was given at doses of 200 and 450 mg.kg⁻¹ BW for supplemental groups 1 and 2, respectively, 30 minutes before and after to exercise tests and carbohydrate was given at dose of 200 mg.kg⁻¹ BW for placebo group. To identify enzymes activity (IU/L), venous blood samples were collected 30 min prior to exercise and at 24 and 48 hrs post exercise. Data were statistically analyzed using repeated measures ANOVA and Bonferroni test. Baseline CK, CK-MB and muscle soreness were determined 30 minutes before the exercise test. Baseline serum values for CK, CK-MB and baseline muscle soreness were not different between groups in the 30 minutes before the exercise test (p>0/05). However, there were significant increases between the pre-exercise and post-exercise values for CK, CK-MB and muscle soreness from 24 hrs to 48 hrs post-test (p<0/05), but there were no significant differences between two groups (p< 0.05). These results suggested that two different dosages of BCAA supplementation did not affect muscle damage and muscle soreness during resistance exercise bout in soccer players.

Пайям Мохамад-Панахи, Соран Аміні-агхдам, Навід Лотфі, Хаїдан Хатамі. Вплив двох різних дозувань добавок ВСАА на сироваткові індекси пошкодження м'язів і болючість у футболістів. Метою даного дослідження було дослідження впливу двох різних доз добавок ВСАА на сироваткові показники пошкодження м'язів і чутливість у футболістів. 30 чоловіків футболістів (вік 20,2 ± 0,6 років) брало участь в даному дослідженні. Піддослідні були випадковим чином розділені на три групи (подвійний сліпий метод). Всі випробовувані виконували вправи з опором нижньою частиною тіла (6 комплексів, 10 повторень, 70% +1 RM). ВСАА вводили в дозах 200 і 450 mg.kg⁻¹ BW для додаткових груп 1 і 2 відповідно, за 30 хвилин до і після того, як здійснювати тести, вуглеводів вводили в дозі 200 mg.kg⁻¹ BW у групі плацебо. Щоб визначити активність ферментів (МО / л), зразки венозної крові були зібрані за 30 хвилин до тренування і через 24 і 48 годин після вправ. Дані аналізувалися статистично з використанням повторних вимірювань ANOVA і тесту Вонфероні. Базові СК, СК-МВ і м'язові болі були визначені за 30 хвилин до здійснення тесту. Вихідний рівень сироваткового значення для СК, СК-МВ і чутливість м'язів не відрізнялися між групами за 30 хвилин до навантажувальних тестів (p> 0/05). Тим не менш, відбулося значне збільшення між попередніми вправами і після тренування значення для СК, СК-МВ і болючість м'язів з 24 годин до 48 годин після тестування (p<0/05), ніяких істотних відмінностей між двома групами (p< 0, 05) не було. Ці результати показали, що дві різні дозування добавок ВСАА не впливають на пошкодження м'язів під час вправ з опором у футболістів.

Пайям Мохамад-Панахи, Соран Аміні-агхдам, Навід Лотфі, Хаїдан Хатамі. Воздействие двух различных дозировок добавок ВСАА на сывороточные индексы повреждения мышц и болезненность у футболистов. Целью данного исследования было исследование влияния двух различных доз добавок ВСАА на сывороточные показатели повреждения мышц и чувствительность у футболистов. 30 мужчин футболистов (возраст 20,2 ± 0,6 лет) принимало участие в данном исследовании. Испытуемые были случайным образом разделены на три группы (двойной слепой метод). Все испытуемые выполняли упражнения с сопротивлением нижней частью тела (6 комплексов, 10 повторений, 70% 1 RM). ВСАА вводили в дозах 200 и 450 mg.kg⁻¹ BW для дополнительных групп 1 и 2 соответственно, за 30 минут до и после того, как осуществляют тесты, углеводов вводили в дозе 200 mg.kg⁻¹ BW в группе плацебо. Чтобы определить активность ферментов (МЕ / л), образцы венозной крови были собраны за 30 минут до тренировки и через 24 и 48 часов после упражнений. Данные анализировались статистически с использованием повторных измерений ANOVA и теста Bonferroni. Базовые СК, СК-МВ и мышечные боли были определены за 30 минут до осуществления теста. Исходный уровень сывороточного значения для СК, СК-МВ и чувствительность мышц не отличались между группами за 30 минут до нагрузочных тестов (p> 0/05). Тем не менее, произошло значительное увеличение между предварительным упражнением и после тренировки значения для СК, СК-МВ и болезненность мышц с 24 часов до 48 часов после тестирования (p<0/05), никаких существенных различий между двумя группами (p<0,05) не было. Эти результаты показали, что две различные дозировки добавок ВСАА не влияют на повреждения мышц во время упражнений с сопротивлением у футболистов.

Key words:

branch-chain amino acid, soccer, muscle damage, muscle soreness.

BCAA, футбол, пошкодження м'язів, чутливість м'язів.

BCAA, футбол, повреждение мышц, чувствительность мышц.

Introduction

Exercise-induced muscle damage has been reported to result in a number of local and systematic changes including disruptions to the sarcolemma, myofibrils and excitation-contraction coupling processes, swollen mitochondria and an elevation of muscle proteins in the blood and muscle soreness [3-13]. Studies have shown that intense repetitive exercise especially when it involves a large eccentric component is typically associated with damage to connective or contractile tissue of skeletal muscle [19-10].

Leucine, isoleucine, and valine possess a similar structure with a branched-chain residue and therefore are referred to as BCAAs. All are essential amino acids for animals and share a common membrane transport system

and enzymes for their transamination and oxidative decarboxylation [24]. Recent studies have demonstrated that free BCAAs, especially leucine, play a very important role in protein metabolism [24]. Therefore, BCAAs may play an important role in injury prevention and faster recovery. Recently branched-chain amino acid has been considered by researchers in decrease this exercise-induced muscle damage [9, 14, 17,18]. Recent studies have demonstrated that BCAA supplementation administration before and during endurance exercise may attenuate the clinical signs of fatigue and muscle damage [11]. In contrast, Zebblin (2007) showed that BCAA supplementation administration before mild resistance exercise had no effect on serum CK activity.

Factors in reducing muscle damage have been investigated in many studies and conflicting results have

been reported. But to date there are no published studies to support the effects of BCAA damage on indicators of muscle damage after resistance training. Therefore, the purpose of this research was to determine the effects of two different dosage of BCAA supplementation on Serum Indices of Muscle Damage and Soreness in Soccer Players

Methods

Subjects

Thirty young soccer (age (yr): 20.2 ± 0.6 , weight (kg): 74.2 ± 2.4 , height (cm): 177.36 ± 1.13 and body fat (%): 16.2 ± 0.8) participated as subjects in this study. All subjects in a randomized and double-blind design were divided into three groups: supplemental 1 and supplemental 2 and placebo groups. They have 3 training session per week. Subjects were instructed to refrain from unaccustomed exercise during the course of the study starting 48 h before the exercise session.

Nutritional supplements design

The supplemental group consumed the BCAA supplementation (50% leucine, 25% isoleucine, 25% valine (Pooyan Nutrition Company)) for 9 days. In addition to this amount, 200 and 450 mg.kg⁻¹ of drug were consumed 30 minutes before and after the exercise test by the supplement groups 1 and 2, respectively .

The placebo group consumed 68 mg.kg⁻¹ dextrin three times a day, instead of BCAA, with an additional 200 mg.kg⁻¹ given directly 30 minutes before and after the exercise test.

Exercise protocol

Subjects were requested to avoid exercise the day of the test session. The training sessions consisted of 3-different resistance exercises (leg press, knee extension and knee flexion). Subjects performed 6- sets \times 10 reps at 70% 1RM for each resistance exercise (One-minute rest intervals between each sets and three-minute rest intervals between exercises).

Experimental design

Body composition was estimated using the sum of three skinfolds (chest, abdomen, and thigh) following the procedures outlined by Jackson and Pollock. Subjects were given up to 4 maximal attempts to achieve 1RM. Rest periods of 3 to 5 minutes were given between trials.

Subjects were instructed to perform a 10 minute warm-up on a cycle ergometer. Baseline muscle damage was evaluated using the measurements of serum CK, CK-MB levels and muscle soreness. Baseline muscle soreness was evaluated using the visual analogue scale (VAS) which has been utilized as a valid indicator of pain in several studies (24, 25) has correlated with other indices of muscle damage including MVC, and CK (24), and has obtained reported reliability scores as high as $r = 0.97$ for assessing soreness (26).

Statistical Analyses

The Kolmogorov-Smirnov test was used for testing normality. All descriptive data are expressed as means \pm SD. Data were analyzed using two-way repeated-measure ANNOVA. Statistical significance was set at $P < 0.05$. Statistical analysis was conducted using SPSS 18.0 for Windows.

Results

Subjects' data are presented in Table 1. There were no differences among groups for age, bodyweight, height, percent body fat and lean mass (Table 1).

9-day die analysis revealed no differences in the energy, protein, fat and carbohydrate intake between groups throughout the study (table 2). Subjects were instructed to maintain their normal eating habits during the study.

Serum Creatine kinase activity

Mean serum CK level before and 24 and 48 hrs after the exercise is presented in Fig1. CK level reached its peak activity 24 hours after exercise (659.8 ± 154.8 U/l for the placebo-supplemented group, 607.5 ± 155.4 U/l for the high dose BCAA supplement group and 625.4 ± 153.4 U/l (mean \pm SE) for the low dose BCAA supplement group). In all groups, CK was significantly elevated at the 24 and 48 hrs.

Serum CK-MB activity

Mean serum CK levels before and 24 and 48 hrs after the lower-body resistance exercise is presented in Fig1. Serum CK-MB activity was elevated in three groups 24 and 48 hrs after resistance exercise. Approximately 24 hrs after resistance exercise, CK-MB activity reached peak (659.8 ± 154.8 U/l for the placebo-supplement group,

Table1. Subject Characteristics (n = 30)

Characteristics	Supplementation1	Supplementation2	Placebo	P
Age (yr)	20.2 ± 0.9	20.1 ± 0.7	20.3 ± 0.6	0.63
Height (cm)	177.3 ± 1.1	178.5 ± 1.2	176.2 ± 1.0	0.81
Weight (kg)	74.1 ± 2.3	75.3 ± 2.9	74.9 ± 2.6	0.3
Body Fat (%)	16.1 ± 0.9	16.3 ± 0.8	16.2 ± 0.7	0.7
Leg press (kg)	227.1 ± 12	231.4 ± 11.1	235.6 ± 11.7	0.69
Knee extension (kg)	52.7 ± 4.1	52.1 ± 3.1	53.9 ± 3.9	0.74
Knee flexion (kg)	86.1 ± 5.3	84.3 ± 3.7	83.4 ± 5.1	0.51

Table 2. Die Analyses

Characteristics	Placebo (n=10)	Supplementation 1 (n=10)	Supplementation 2 (n=10)	P
Energy Intake (kcal/kg/day)	$2464.2 + 292.1$	$2460.1 + 303.81$	$2505.38 + 271$	0.51
Protein Intake (g/kg/day)	$68.9 + 9.7$	$67.4 + 9.6$	$68.5 + 11.3$	0.91
Fat Intake (g)	$71.9 + 9.7$	$70.1 + 11.3$	$74.5 + 10.5$	0.54
Carbohydrate Intake (g)	$362.7 + 74.1$	$365.3 + 72$	$366.44 + 73.6$	0.9

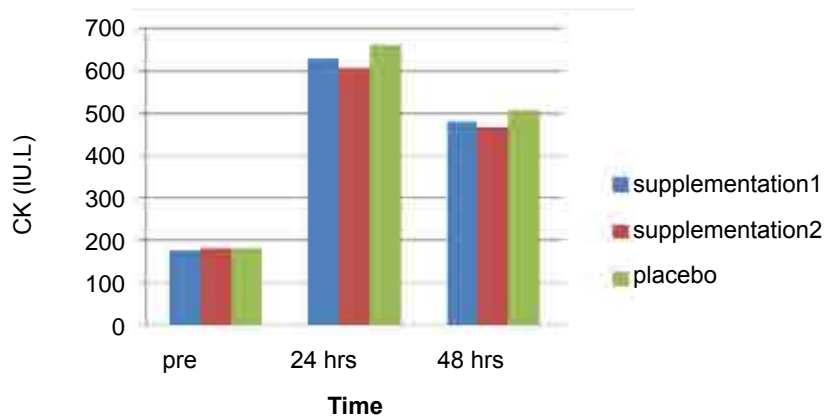


Fig 1. Serum creatine kinase concentration during 48 hours

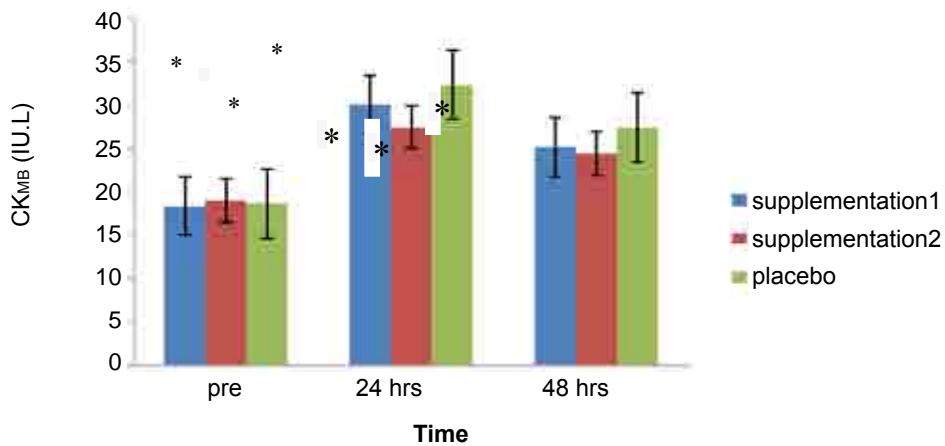


Fig 2. Serum creatine kinase (CK-MB) concentration during 48 hours

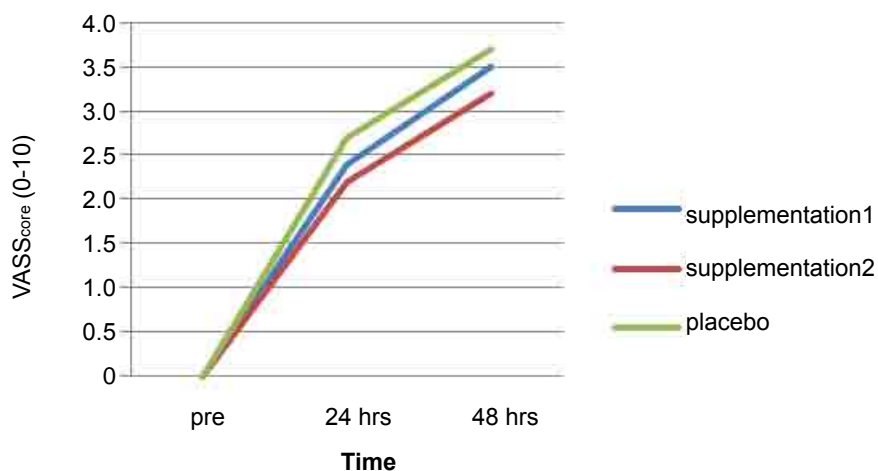


Fig 3. Visual Analogue Scales (VAS) during 48 hrs

607.5 ± 155.4 U/l for the high dose BCAA supplement group and 625.4 ± 153.4 U/l for the low dose BCAA supplement group). CK-MB was significantly elevated in all groups at 24 and 48 hrs.

Muscle soreness

Pre exercise values were not different among groups for muscle soreness. Muscle soreness significantly increased above baseline in all groups at all time points ($p < 0.05$; Fig 3). Peak soreness occurred in all groups at 48 hrs after exercise. Also, the two different dose of BCAA supplementation had no effect on soreness scores.

Discussion

The results of our study showed no differences between groups in the serum CK, CK-MB activity and muscle soreness. Creatine kinase increased at all time among three groups. However, no significant differences were found between groups at any point in time. These data are not in agreement with Coombes et al (2000) and Koba et al (2005, 2007) [11, 20]. They reported that BCAA intake before and during endurance exercise reduces indirect

markers of muscle damage [11, 20]. Possible explanations for differences between our findings and other published data could include age of subjects, exercise protocol and intensity of exercise.

Serum creatine kinase (CK) and lactate dehydrogenase (LDH) are indication of the degree of metabolic adaptation to physical training of skeletal muscles [6, 7]. These enzymes are involved in muscle metabolism, and their serum concentration is normally very low. They increase considerably after intensive exercise. Changes in serum activity of muscle enzymes have been reported in normal subjects and athletes after strenuous exercise. The amount of enzyme efflux from muscle tissue to serum can be influenced by physical exercise. [6, 7].

These results showed that the use of two different dose of BCAA do not reduce serum CK-MB activity 24 and 48 hrs after heavy resistance exercise. Serum CK-MB activity was elevated in all groups after exercise and was highest in the placebo group.

References

- Ahmadi S., Sinclair P.J., Foroughi N., Davis G.M. Electromyographic activity of the biceps brachii after exercise-induced muscle damage. *Journal of Sports Science and Medicine*. 2007, vol.6, pp. 461-470.
- Baty J.J., Hwang H., Ding Z., Bernard J.R., Wang B., Kwon B., Ivy J.L. The effect of a carbohydrate and protein supplement on resistance exercise performance, hormonal response, and muscle damage. *The Journal of Strength & Conditioning Research*. 2007, vol.21(2), pp. 321-329.
- Behm D.G., Baker K.M., Kelland R., Lomond J. The effect of muscle damage on strength and fatigue deficits. *The Journal of Strength & Conditioning Research*. 2001, vol.15(2), pp. 255-263.
- Belcastro A., Shewchuk L., Raj D. Exercise-induced muscle injury, pp. a calpain hypothesis. *Molecular and Cellular Biochemistry*. 1998, vol.179, pp. 135-145.
- Bijur P.E., Silver W., Gallagher E.J. Reliability of the visual analog scale for measurement of acute pain. *Academic Emergency Medicine*. 2001, vol.8(12), pp. 1153-7.
- Brancaccio P., Limongelli F.M., Maffulli N. Monitoring of serum enzymes in sport. *British Journal of Sports Medicine*. 2006, vol.40(2), pp. 96-97.
- Brancaccio P., Maffulli N., and Limongelli F.M. Creatine kinase monitoring in sport medicine. *British Medical Bulletin*. 2007, vol.81(1), pp. 209-230.
- Chapman D., Newton M., Sacco P., Nosaka K. Greater muscle damage induced by fast versus slow velocity eccentric exercise. *International Journal of Sports Medicine*. 2006, vol.27(8), pp. 591-598.
- Connolly D.A.J., Sayers S.P., Mchugh M.P. Treatment and prevention of delayed onset muscle soreness. *The Journal of Strength & Conditioning Research*. 2003, vol.17, pp. 197-208.
- Cooke M.B., Rybalka E., Williams A.D., Cribb P.J., Hayes A. Creatine supplementation enhances muscle force recovery after eccentrically-induced muscle damage in healthy individuals. *Journal of the International Society of Sports Nutrition*. 2009, vol.6, p. 13.
- Coombes J.S., McNaughton L.R. Effects of branched-chain amino acid supplementation on serum creatine kinase and lactate dehydrogenase after prolonged exercise. *The Journal of Sports Medicine and Physical Fitness*. 2000, vol.40, pp. 240-246.
- Dreyer H.C., Drummond M.J., Pennings B., Fujita S., Glynn E.L., Chinkes D.L., Dhanani S., Volpi E., and Rasmussen B.B. Leucine-enriched essential amino acid and carbohydrate ingestion following resistance exercise enhances mTOR signaling and protein synthesis in human muscle. *American Journal of Physiology*, pp. *Endocrinology & Metabolism*. 2008, vol.294, pp. 392-400.
- Fridén J., Seger J., Sjöström M., Ekblom B. Adaptive response in human skeletal muscle subjected to prolonged eccentric training. *International Journal of Sports Medicine*. 1983, vol.4(3), pp. 177-183.
- Gauri Shankar., Sinha A.G., Sandhu J.S. Pulsed Ultrasound does not affect recovery from Delayed Onset Muscle Soreness. *The Online Journal of Health and Allied Sciences*. 2006, vol.17, pp. 1-5.
- Greer, B.K., Woodard J.L.; White J.P., Arguello E.M., Haymes E.M. Branched-chain amino acid supplementation and indicators of muscle damage after endurance exercise. *International Journal of Sport Nutrition and Exercise Metabolism*. 2007, vol.17(6), pp. 595-607.
- Guzel N.A., Hazar S., Erbas D. Effects of different resistance exercise protocols on nitric oxide, lipid peroxidation and creatine kinase activity in sedentary males. *International Journal of Sports Medicine*. 2007, vol.6, pp. 417- 417.
- Howatson G., Gaze D., van Someren K.A. The efficacy of ice massage in the treatment of exercise-induced muscle damage. *Scandinavian Journal of Medicine & Science in Sports*. 2005, vol.15(6), pp. 416-422.
- Jackman S.R., Witard O.C., Jeukendrup A.E., Tipton K.D. Branched-chain amino acid ingestion can ameliorate soreness from eccentric exercise. *Medicine & Science in Sports & Exercise*. 2010, vol.42(5), pp. 962-970.
- Knitter A.E., Panton L., Rathmacher J.A., Petersen A., Sharp R. Effects of β -hydroxy- β -methylbutyrate on muscle damage after a prolonged run. *Journal of Applied Physiology*. 2000, vol. 89, pp. 1340-1344.
- Koba T., Hamada K., Sakurai M., Matsumoto K., Hayase H., Imaizumi K., Tsujimoto H., Mitsuzono R. Branched-chain amino acids supplementation attenuates the accumulation of blood lactate dehydrogenase during distance running. *The Journal of Sports Medicine and Physical Fitness*. 2007, vol.47(3), pp. 316-22.
- Kuipers H. Exercise-induced muscle damage. *International Journal of Sports Medicine*. 1994, vol.15(3), pp. 132-135.
- Matthews D.E. Observations of branched-chain amino acid administration in humans. *Journal of Nutrition*. 2005, vol.135, pp. 1580-1584.
- Nigam P.K. Biochemical markers of myocardial injury. *Indian Journal of Clinical Biochemistry*. 2007, vol.22, pp. 10-17.

24. Shimomura Y., Inaguma A., Watanabe S., Yamamoto Y., Muramatsu Y., Bajotto G., Sato J., Shimomura N., Kobayashi H., Mawatari K. Branched-chain amino acid supplementation before squat exercise and delayed-onset muscle soreness. *International Journal of Sport Nutrition and Exercise Metabolism*. 2010, vol.20(3), pp. 236-244.
25. Tipton K.D., Elliott T.A., Cree M.G., Aarsland A.A., Sanford A.P., Wolfe R.R. Stimulation of net muscle protein synthesis by whey protein ingestion before and after exercise. *American Journal of Physiology – Endocrinology and Metabolism*. 2007, vol.292, pp. 71-76.
26. Yoshida M., Nijima T., Yokoyama T., Miyachi M., Tabata I., Fujii Y. Effects of BCAA supplementation on makers of muscle damage and inflammation during low-intensity prolonged exercise. *Medicine & Science in Sports & Exercise*. 2007, vol.39, pp. 364.

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