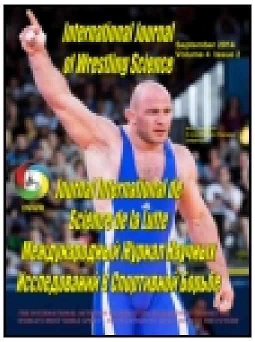

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THE EFFECTS OF TWO DIFFERENT DOSAGES OF BCAA SUPPLEMENTATION ON A SERUM INDICATORS OF MUSCLE DAMAGE IN WRESTLERS

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ABSTRACT

Background and Aim: Few studies have been done to examine the effect of different dosages of branched-chain amino acid (BCAA) supplementation on muscle damage indices in wrestlers. The purpose of this research was to compare the effects of two dosages of BCAA on muscle damage indices after heavy resistance exercise in wrestlers. **Methods:** 29 young wrestlers were randomly selected and divided into three groups. All subjects participated in heavy weight resistance exercise (3 sets, 10 repetitions, 80% 1RM). The BCAA was given at doses of 210 and 450 mg·kg $^{-1}$ body weight for supplemental groups 1 and 2 respectively, 30 minutes before and after the exercise test and dextrin was given at a dose of 210 mg.kg $^{-1}$ body weight for the placebo group. To identify enzyme activity (IU/L), venous blood samples were obtained 30 min prior to exercise and at 24 and 48 hrs post exercise. Data were statistically analyzed using ANOVA with repeated measures and the Bonfferoni test ($P \leq 0.05$). **Results:** Based on this study results, creatine kinase (CK), lactate dehydrogenase (LDH), creatine kinase isoenzyme MB (CK_{MB}) activity were significantly increased ($p<0.05$) in all groups. CK, LDH, CK_{MB} indices having the highest activity in the placebo group, but there were no significant differences between all groups. **Conclusion:** These results provide evidence that the use of two different dosages of BCAA did not decrease the muscle damage associated with heavy resistance exercise.

KEY WORDS: BCAA, muscle damage, heavy resistance exercise, CK,CK_{MB}, LDH.

INTRODUCTION

Nutritional supplements frequently contain compounds of mainly carbohydrate, protein (essential and non-essential amino acids), vitamins, minerals and another (1,6,15). Use of dietary supplements is very extensive in sport and few athletes can be found who have never used them while involved in the quest for top performance (12,16,22).

Branched-chain amino acids (BCAA), including leucine, valine and isoleucine are classified as essential amino acids. The human body cannot synthesize these amino acids and must be included in the diet (13,26,29). There is some evidence showing that the consumption of branched amino acids has an anticatabolic effect during and after exercise (2,3,4,27,28). The theory has been proposed that branched amino acid supplementation can increase the healing rate from muscle damage after exercise (8,10,14,18).

One of the consequences of resistance training is injury, pain and delayed onset muscle soreness (DOMS). Muscle damage occurs when the muscle cell structures breakdown (11,13,21). Symptoms of muscle damage are the presence of muscle proteins in the blood, long-term decline in muscle function, including reduction in strength and power, flexibility and muscle dynamic speed (20). Researches measure a serum index of muscle damage, such as creatine kinase (CK), creatine kinase iso enzymes (CK_{MB}) and lactate dehydrogenize (LDH) (18). Creatine kinase enzymes are involved in the phosphate system that is important for energy metabolism in most body cells, especially muscle cells and the brain. The LDH enzyme is found in abundant quantities in the cytoplasm of all tissues and in different concentrations in the conversion of pyruvate to lactate (4,25).

Greer and colleagues (2007) did not see any significant difference between consumption of BCAA and a similar caloric placebo (14). Zebblin et al (2007) in a double blind study found that consuming eight grams of BCAA before light resistance activityhad no effect on the 24 and 48 hour post exercise serumic creatine kinase index (31). A review of research shows that the majority of studies with BCAA supplementation used training programs with endurance exercises. The results obtained from a review are not consistent. Our research question is, can taking two different doses of BCAA supplementation before and after a session of heavy resistance exercises effect the serumic index of muscle damage (CK-CKMB-LDH) in wrestlers?

METHODS

The study design was semi-experimental. The subjects were trained wrestlers from Mahabad City that volunteered and were assigned according to the criteria and indicators to fitness and had similar groups based on maximum aerobic power, anaerobic power, and one repetition maximum (1RM) in the desired movements. 29 wrestlers were then randomly assigned to one of three groups 1- low dose supplement group, 2- high dose group and 3- a placebo group. The subjects did not practice any sports activity a week before the test and were not using any drugs or supplements and were also healthy according to the medical questionnaires all subjects completed. After completing the consent form, the subjects was forbidden taking from any medication, supplements, or performing any heavy physical activity during the research protocol execution. The caliper was used for measuring the skin fat thickness of subjects.

Method of BCAA Supplementation The BCAA supplement (50 percent leucine, 25 percent iso leucine and 25 percent valine) was prepared to the required amount. Using digital scales (Sartovious models: GM312), the amounts for ingestion of 68 mg/kg for six days before the exercise test and two days after the exercise test, were prepared and were placed in a special plastic. The placebo for this study was Dextrin. Before taking supplements, it use explained to the subjects by the researcher, that they were required to ingest their assigned supplement for six days, three meals daily (before meals). On the performance day, the supplement group with the lower dose consumes 210mg/kg, and the supplement group with a high dose consumes 450 mg/kg and placebo group consumes 210mg/kg supplements, 30 minutes before and after the exercise test.

Heavy Resistance Exercise Protocol To create the muscular stress, a heavy resistance exercise program was used. Multi-joint movements and then single-joint movements were used. Resistance training activities at the 80 percent of 1RM was chosen; in case the subject's have ability to do more than one repetition, the Cochrane formula was used (4). 7 exercises were performed with the three sets of ten repetitions. The rest interval between sets was three minutes; rest between exercises was one minute. The exercises were: leg presses, chest presses, lat pull downs, leg extensions, arm curls, leg curls and abdominal crunches.

Blood Sample Blood sampling was collected at three points- prior to exercise performance, 24 h and 48 h after exercise protocol. The subjects entered the laboratory and sat for five minutes. The laboratory technicians collected 5 ml blood from the anticubital vein. These blood samples were placed for 30 minutes at a laboratory temperature until clotted, then separating by centrifuge (Hettich, Germany) and then the amount of enzymes (CK, CKMB and LDH) were measured via auto analyzer device (COBAS-Mira Plus, Switzerland).

Statistical Analysis Kolmogrov Smirnov test was used for data normality testing. for statistical Analysis, one way analysis of variance with repeated measure ANOVA with between group factor and post hoc Bonferroni tests was used ($p < .05$).

RESULTS

Subject's physiological profiles to separate the three groups are listed in table 1.

Table1. Profile of subjects in three study groups

Variables	Low-dosage BCAA supplement group (N=10)	High-dosage BCAA supplement group (N=10)	Placebo group (N=9)
Age (years)	22.4	22.6	22.6
Weight (kg)	73.4	71.9	74.4
Height (cm)	173.8	174.4	172.2
Fat percent	17.2	17.5	17.2
Vo_2max(ml/kg/min)	42.4	43.05	44.3
Sargent jump (cm)	52.2	51.5	50.8
BMI (kh/m^2)	24.2	23.7	24.5

Research findings show a significant increases in the mean values for group cellular damage serum indexes (CK-LDH-CKMB) within both supplementation groups with low dose, high dose supplements and placebo 24 and 48 hours after the test (table2).

Table 2. Mean and SD measured (international units per liter) in three sampling periods.

Group	Pre activity	24 h after activity	48 h after activity
Supplement 1-CK	172 ±29.1	343 ±78.6	400 ±183.5
Supplement 2-CK	168 ±23.9	634 ±214	468 ±220.2
Placebo-CK	177 ±13.4	762 ±331	582 ±264
Supplement 1-CK_{MB}	19 ±8.2	33 ±8.5	27 ±6.1
Supplement 2-CK_{MB}	5 ±2.2	30 ±5.7	25 ±3.5
Placebo-CK_{MB}	19 ±2.3	38 ±10.1	29 ±8.8
Supplement 1-LDH	250 ±29.6	394 ±60.1	312 ±33.5
Supplement 2-LDH	260 ±37.9	398 ±72.6	354 ±53.8
Placebo-LDH	264 ±36.9	419 ±61.1	345 ±59.8

Results of analysis of variance with repeated measurements within groups showed that time effect in both time periods (24 and 48 hours after the activity) on (CK-LDH-CKMB) values is significant (p=0/001). According to statistical test results, cellular damage indexes in the three groups in LDH (Sig= 0.734), CK (Sig= 0.312) and CKMB (Sig= 0.181) was obtained, which is not significant.

DISCUSSION

Comparison of results between groups in mean and amplitude changes of serum indexes of cell damage (CK-LDH-CKMB), 24 and 48 hours after the exercise performance showed no significant difference between the 3 groups. In other words, different amounts of BCAA did not significantly affect the serum cell injury indexes (CK-LDH-CKMB), 24 and 48 hours after the heavy resistance activity.

Data analysis from this study suggest that taking two different values of BCAA does have an significant effect on LDH enzyme activity compared with similar calories placebo. After studying changes in LDH enzyme activity 24 and 48 hours after exercise protocol, a significant increase in activity of LDH was observed in all three groups.
It seems that serum LDH enzyme concentration increases after muscle cell damage in sports activities. When the muscle cell membrane permeability increases or complete tears occur in muscle cells, enzymes are imported into the blood or lymphatic system (14). LDH enzyme widely distributed in tissues and its high concentration is found in the liver, myocardial, kidney, skeletal muscle, red blood cells and other tissues. Activity of serum LDH and CK enzymes, like other muscle damage goes up after a period of time, and its concentration remains high for a long time(14,30). Ferri and colleagues (2006) after running ten sets of ten repetitive plantar flexion motion (to gastrocnemius and soleus muscle) with 70 percent of 1RM intensity reported significant increased in LDH enzyme rates (10).

The results of these research is consistent with the results from Greer (14), whereas it is inconsistent with Coombes et al (2000) and Koba et al (2007) result (7,18). For justifying factors affecting the activity of serum enzymes we can refer to fitness levels, muscular type, muscle mass, race and age (4,5,17,23). Activity of serum enzymes also depends on gender differences. The estrogen hormone has a protective effect on the muscle cell membrane therefore the increase in serum enzymes is less in women than in men. The research has shown that in resting conditions, CK activity in athletes is higher than non-athletes. So after exercise, a smaller increase is seen in athletes serum CK levels (4,5). Sasaki and colleagues showed resistance exercise significantly increased serum CK for an hour to seven days after the exercise test execution.

The present findings are inconsistent with the findings of Coombes and Koba et all studies (7,18,19). Koba and colleagues showed that taking 10 grams of BCAA supplementation compared with a placebo reduced serum CK and LDH activities (24). This inconsistency probably was due to the type of subjects. Also, in this study used a heavy resistance activity for muscle cell damage. Activities with high and low intensity resistance increased serum CK activity (15). Reasons for why the present findings contradict the previous research, could be the difference in anabolic hormone response to BCAA intake in endurance and resistance activities.

Results related to CKMB isoenzyme activity levels before, and 24 and 48 hours after heavy resistance activity indicates that adding a BCAA supplement to diet and either two dosage does not affect activity of CKMB isoenzymes. Increases in CKMB 24 and 48 hours after heavy resistance activity in both groups of BCAA supplementation was lower than the placebo group but, these differences were not statistically significant. The range of CKMB changes after 24 h using a t-test showed that BCAA supplementation with high dosage and placebo groups were close to significance. It may be that with increasing amounts of BCAA supplementation we could see significant changes. Vigorous physical activities can be potentially damaging to cardiac function. The relative risk for heart cell damage during intense physical activity can increase after an hour. Cardiac dysfunction caused by exercise, if there is no cardiovascular disease, shows the category of symptoms that is called heart fatigue.

Atashak (2006) concluded that creatine consumption weekly significantly increased the level of CKMB isoenzymes (1). Also Faramarzi and colleagues (9) reported that three sessions of intense periodic soccer activity is associated with significantly increased CKMB isoenzymes, and carbohydrate supplementation significantly reduced CKMB isoenzymes activity compared with a placebo group (9). Muscle cell damage has been studied in human and animal models. Most signs of muscle cell damage were delayed onset muscle soreness (DOMS), which is very dependent on the type and intensity of sporting activity. DOMS is usually emerges eight to 24 hours after cells damage, and usually reaches a peak 24 to 48 hours after exercise. On the other hand, creatine kinase secretion takes 24 hours to reach peak values. Some studies have mentioned that in resistance activities, creatine kinase secretion reaches a maximum after 48 hours.

Generally, from the results of this study we can infer that the effect of consuming a BCAA supplement, particularly with higher doses, have a very poor effect in the prevention of muscle damage as evidenced by increased CK, CK_{MB}, and LDH activity. But much research is needed to actually determine the effect of different dosage of BCAA intake on cellular damage serum indices.

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