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The Effect of BCAAS on Mental Performance after Exercıse

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Abstract: The aim of this study was to examine the effect of Branched Amino Acids (BCAAs), which was taken orally before exercise, on mental performance after exercise. Participants (n = 9) all consisted of male volunteers with a mean age of 21.78 ± 1.20 / year), a height of 176.56 ± 4.40 (cm), body weight 68,47 ± 7,49 (kg), BMI 21,90 ± 1,71. Participants were randomly assigned to 4 different trial groups and our study was done with Cross over design. Trial Making Test (A-B) was performed to determine their mental performance. The tests were carried out in the same room, in a quiet room so as not to distract the participants. During each trial period, pre-test was performed and supplementary food (Placebo, 2,10,20 g BCAA) was provided. According to body weight 2,0g for BCAA 0,029g, Body weight, 0,142g for 10g BCAA, Body weight, 0,285g for 20g BCAA, Body weight calculations were made. The BCAA measurements were made with the WL 303L digital precision scale with a sensitivity of 0.001 g. After 30 minutes (with 5 min intervals) participants were given the opportunity to start exercising. Immediately after exercise, post-test was performed. Participants were given nutritional advice before work and were asked to follow their nutritional programs during the trial periods. According to the analysis results, there was no difference in total calorie and protein intake rates compared to the experimental periods ($p>0,05$). In the analysis of the data, two way ANOVA was performed using SPSS 23.0 program and significance level was determined as $p<0,05$. In the comparison between the groups, no significant difference was found in trial, time and trial-time interactions in mental performance (A and B) tests ($p>0,05$). As a result, it was determined that acute BCAA, which was taken orally at different quantity prior to exercise, had no effect on mental performance after exercise ($p>0,05$).
Keywords: Branched Amino Acid, Mental Performance, Trail Making Test.

INTRODUCTION

Physical fatigue is defined as the inability to maintain p factors as possible causes of fatigue are represented; increased components during physical activity; protons, K^+, ions, etc. protons, ions etc., decrease in the blood glucose level used by neurons involved in motor activities in some parts of the brain and increase of tryptophan (Trp) concentration and so 5-hydroxytryptamine (5-HT) CNS in neurons involved in motor activity control is the cause of fatigue [2-5]. Although the distinction between central and peripheral fatigue is very frequent in the literature, it is very difficult to distinguish between them. Both mechanisms of fatigue affect each other [6].

There are 20 essential and non-essential amino acids in the human body [7] Branche- chain amino acid (BCAAs; valine, leucine, and isoleucine) are abundant and catabolized in the skeletal muscle, help to prevent protein breakdown, and elevate protein synthesis [8] BCAAs from these are rapidly digested (30 min) after orally [9]. BCAAs are not synthesized by the human body, so it is compulsory to take diets [7]. It is proved ral. It has be that BCAAs reduced perceived fatigue [10] and increased physical performance [11]. In addition, after BCAAs are introduced into the body, the density of BCAAs in the plasma increases and the increase of Trp is balanced and may block tryptophan from entering the brain, delaying central fatigue [10, 4], reduce mental fatigue and improve cognitive performance result of exercise [3, 12, 13, 14, 15, 16]. When the previous studies were examined, it was observed that there are a limited number of studies on the effect of BCAAs on mental performance after exercise and different methods have been used in these studies [3, 15, 12, 9]. However, the study that examined the effect of pre-acute exercise BCAAs ingestion on mental performance could not be determined. As it is seen, more studies should be done to reveal the effect of BCAAs on mental performance. Therefore, the aim of this study was to investigate the effects of BCAAs on post-exercise mental performance.

MATERIALS AND METHODS

Selection of Subjects

The study was started with 12 participants and 3 of them were excluded from the study due to injury during the measurements or exercise protocol and because of this our study was completed with 9 participant. The mean age of the participants (n = 9) was 21.78 ± 1.20 years, body weight was 68.47 ± 7.49 kg., BMI was 21.90 ± 1.171 kg/m2 and height was 176.56 ± 4.40 m. In addition, as a result of analysis of nutrient follow-up, total calorie and protein intake ratio averages first week 1904,75 ± 357,88 kcal, 76,40 ± 13,40 g protein, second week 2031,74 ± 435,12 kcal, 79,36 ± 14,20 g protein, third week 2022,07 ± 443,53 kcal, 78,39 ± 14,91 g protein, fourt week 4 2069,19 ± 553,18 kcal, 78,58 ± 13,54 g protein has been found.

Experimental Desing

In our study, a total of 4 trials of cross-over design was performed and after each trial, 7 days was given for regeneration in order to get rid of the effect of exercise. All participants were randomly divided into 4 (placebo, 2g, 10g and 20g BCAAs) trial groups and each trial group was consisted of 3 participants (Figure 1). All procedures were performed during the same time of the day for 4 trial to eliminate the effect of circadian rhythm.

Participants were given 10 minutes of general warming [9] and then they were allowed to perform Trial Making Test (TMT). Then, BCAAs (g/kg) intake was obtained and no information was given about the amount of BCAAs which they received. After 30 minutes, they were allowed to warm up and exercise again. TMT tests were performed immediately after the exercise protocol. Participants were informed about the absence of any physical activity or exercise and no food consumption and no smoking among the tests between trials. They should wear sportswear in the measurements and eat at least 2 hours before meals and sleep at least 10 hours [17].

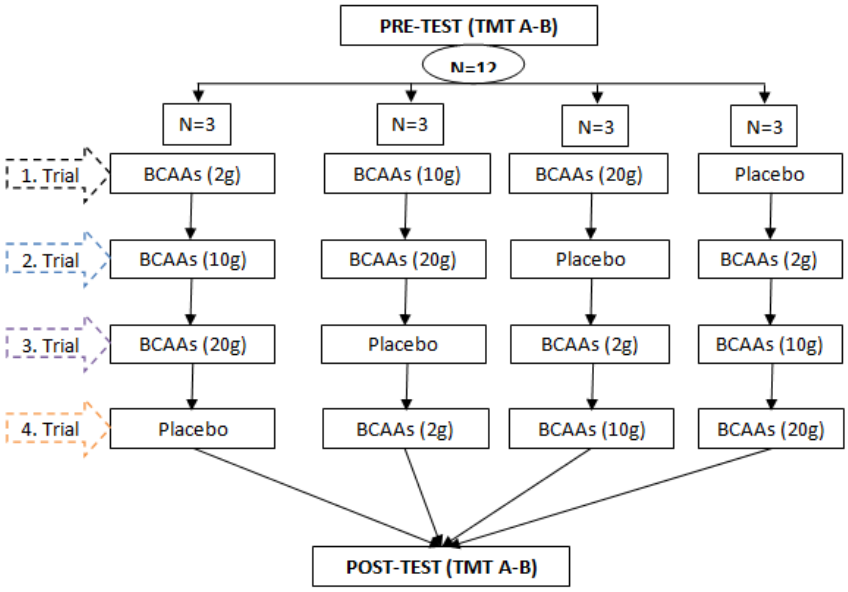

Fig-1: Experimental Dizayn

Procedure

Exercise: An acute exercise protocol was applied to the participants to create delayed muscle pain, which is frequently preferred in the studies. This protocol consists of a total of 100 drop-jumps. Participants were asked to leave from a height of 60 cm and jump upwards with maximum power at the time of contact with floor. Protocol were performed with 5 * 20 jumps for 10 seconds between each jump and 2 minutes for rest between sets [18].

Warm-up: Warm up prptocol consists of jogging with low intensity for 10 minutes and static stretching for lower extremity muscles. Static stretching applications were carried out slowly (active stretching), at a sensitivity point (on the pain threshold), for 2 times 10 seconds, and for 10 seconds between repeats. Static stretching applications for the determined muscle groups alter (calf, quadriceps, adductor, hamstring and hip rotator) were performed according to the method reported by [19].

Nutrition: One week before the study, 1-week diet follow-up (nutrient intake time and amount) was asked to do. Participants were informed about consuming the same foods in the first week or at similar values and sizes for other weeks. One day before the

measurement days, they were informed that they should not take caffeine and consume alcohol.

Quantity of BCAAs: Previous studies with BCAAs showed that body weights were not taken into account when calculating the quantity of BCAAs [11, 20, 11, 21]. Since the average weight of men in the 20-25 age range is 70 kg [22], it was calculated 0.029g BCAAs *Body weight for 2g, 0.142g BCAAs *Body weight for 10g, 0.285g BCAAs*Body weight for 20g. The quantitiy of BCAAs were measured with WL 303L digital precision scale with accuracy of 0.001 g. In this study, BCAAs without aroma and which containe Leucine, Isoleucine and Valine (ratio of 4:1:1) was used. Aspartam was added in 250 ml water for placebo.

Body Analysises: The height measurements of the participants were measured by Digital and 0.01 m. precision tool [23, 24]. Body analysises were done with Tanita BC 418 (Japan). The participants were asked to place the hand grip holder standing separately with both hands after placing the feet on the metal part with the bare settings. They have been informed that they should remain stationary until the measurement results.

Trial Making Test

In part A of the test, a page containing 1 to 25 numbered and irregularly placed 25 circles is given to the participant (1-2-3). The participant is asked to combine these circles without removing the item. In section B, both numbers and letters are mixed together on the same page. The participant is asked to combine the circles with one another (1-a-2-b-3-c, respectively) without removing the pen. Completion times of the sections A and B of the test are recorded [25, 4, 26]. Although different interpretations have been used since the day TMT was developed, assessement the performance according to the completion time of A and B parts which was proposed by Reitan [27] have been used very friquently. In our study, TMT with foreign character was used. In the previous study, it has been proved that Turkish characters for person who is under 40 age can be used [26]. The tests were carried out in a silent environment by the same person. The participant was asked to start when he was ready for testing. The time between the start and end of the test was followed by a stopwatch and recorded in seconds.

STATİSTİCAL ANALYSIS

Statistical evaluation of the data was accomplished by using a two-way analysis of variance with repeated-measures design by using SPSS 23.0 program. The two factors were supplement condition (2g,10g, 20g BCAAs and placebo) and repeated measures (pre-and post exercise). The level of significance for this investigation was set at p <0,05.

RESULTS

Participants were given nutritional advice before work and were asked to follow their nutritional programs during the trial periods. Quantities of energy and nutrients taken with daily consumed foods were calculated by using nutrition information system (BEBIS) program [28]. According to the analysis results, there was no difference in total calorie and protein intake rates compared to the experimental periods for each person (Two-factor ANOVA, p>0,05).

Trial Making Test-A

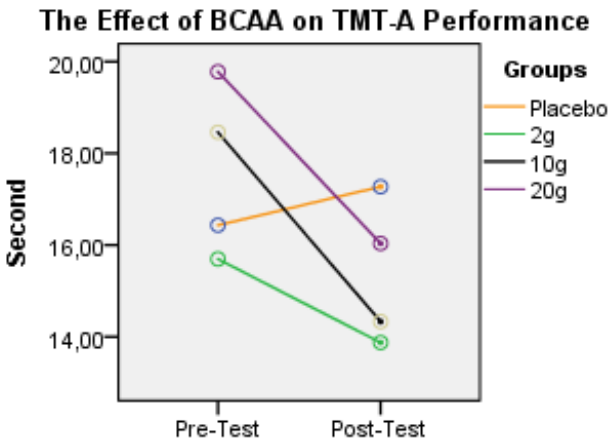

Fig-1: Comparision of TMT-A performance between groups (Placebo, 2g, 10g and 20g)

The baseline of TMT-A performances did not differ significantly between 4 trials (Two-factor ANOVA, p>0.05). As compared result of TMT-A to trials (Placebo, 2, 10, 20 g BCAAs) according to Two-way ANOVA, a main effect of trial (0,77), a main effect of time (0,02), a main effect of trial and time interaction (0,22) were found.

Trial Making Test-B

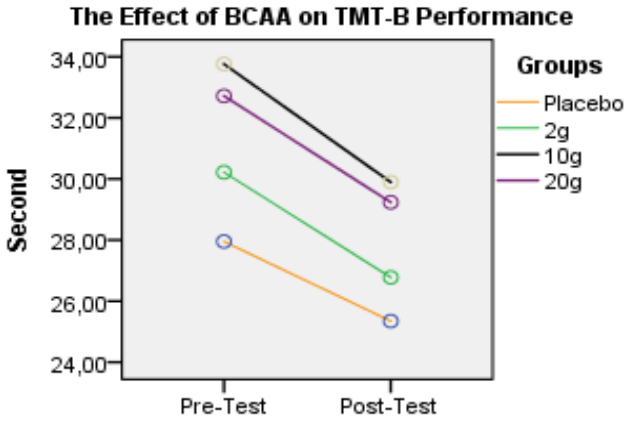

Fig-2: Comparision of TMT-B performance between groups (Placebo, 2g, 10g and 20g)

The baseline ofTMT-B performances did not differ significantly between 4 trials (Two-factor ANOVA, p>0,05). As compared result of TMT-B to trials (Placebo, 2, 10, 20 g BCAAs) according to Two-way ANOVA, a main effect of trial (0,64), a main effect of time (0,00), a main effect of trial and time interaction (0,95) were detected.

CONCLUSION AND DISCUSSION

In our study, it was determined that BCAAs which was taken orally before exercise and in different amounts did not have an effect on TMT (A and B) after exercise, which are used to measure mental performance (p >0,05).

When previous studies have been examined, we concluded that the studies were designed differently and so they have different result. Manzo [12] evaluated the effect of BCAAs on post-exercise mental performance (Stroop Color and Word Test). Placebo and BCAAs (3:1:1/18 g) group found significant improvement, but no significant difference between groups (p>0.05). On the contrary, Blomstrand *et al*. [10] subjects (cylists) were given a total amount of 6–8g of BCAAs or 90 mg/kg body weight. The subjects prformed 60 min of standardised ergometer cycle exercise at 70% of the maximal oxygen uptake, followed by another 20 min at their maximum. The results showed that the subjects' ratings of mental fatigue on two different Borgscales were lower during the exercise when they consumed the solution containing BCAAs during exercise as compared to placebo. Chang *et al*. [15] studied the effect of combined supplementation of BCAAs and arginine on intermittent sprint performance in simulated handball games on 2 consecutive days. This study concluded that BCAAS and arginine supplementation could improve performance in intermittent sprints on the second consecutive day of simulated handball games in well-trained athletes by potentially alleviating central fatigue. Hassmen *et al*. [13] examined the effcet of either a mixture of BCAAs in a carbohydrate solution or a placebo drink on a 30-km cross-country race. This study showed that BCAAs supplementation seemed to have an effect on the more complex tasks, While no effect could be detected on the less demanding ones. However, an intake of BCAAs during exercise modified only slightly the exercise-induced changes in mood. Mikulski *et al*. [2] investigated the effectiveness of oral BCAAs+ L-ornithine L-aspartate supplementation to reduce plasma ammonia concentration and enhance psychomotor performance during exhaustive exercise in healthy men. They found that supplementation with BCAAs and L-ornithine L-aspartate is a useful way to improve multiple choice reaction time during high-intensity exercise. Similarly, Wiśnik *et al*. [4] examined the effect of BCAAs ingestion on psychomotor performance during the effort. Ten male soccer players were submitted to BCAAs and placebo trials at 1-week intervals in a randomized order. BCAAs (7 g) or placebo were given 1 h before exercise in a double blind manner. They founded that BCAAs could prevented deterioration of multiple choice reaction time, which reflects improved psychomotor performance. In addition, Yang *et al*. [3] studied was to investigate the supplementation of branched-chain amino acids (BCAAs), arginine, and citrulline on performance after a simulated match. Nine male tennis players consumed 0.17 g/kg BCAAs, 0,05 g/kg arginine, and 0.05 g/kg citrulline, or placebo. This study suggested that the supplementation could prevent the decline in perceptualmotor performance through alleviation of central fatigue by only BCAAs but prevention of excess hyperammonemia by arginine and citrulline. In other study, Mittleman *et al*. [29] investigated the effect of warm environment on central component of fatigue by using BCAAs. Significant improvement in physical performance was found: the average exercise time to

exhaustion during ergometer cycle exercise at 40% of the maximal oxygen uptake when the subjects received BCAAs as compared with the placebo.

In this study, it was determined that BCAAs, which was taken by orally in different amounts (Placebo, 2,10,20g BCAAs) before exercise, had no effect on mental performance after exercise. While there was no significant performance-enhancing effect observed during of TMT (supposedly assessing speed of cognition function), this may have actually been a reflection of the subject's ability to memorize the test as an element of familiarization was present. However, in some previous studies, BCAAs has been shown to reduce and delayed central nervous system fatigue and so it has positive effects on mental performance. Further studies are needed on the effects of BCAAs on the central nervous system, its optimum amount and when it should be taken.

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