Scholar Publishing Group
International Journal of Sports Technology
https://doi.org/10.38007/IJST.2022.030203
ISSN 2789-7141 Vol. 3, Issue 2: 26-38

Oral Branched Chain Amino Acids on Strength Antagonism Athletes

Charith Pereran[*]

University of Bologna, Italy

[*]*corresponding author*

Keywords: Branched Chain Amino Acids, Strength Antagonistic Events, Exercise-Induced Central Fatigue, Skeletal Muscle

Abstract: In recent years, research on exercise adjuvants to enhance exercise capacity and fatigue recovery is very active. Supplementation of auxiliary chain amino acids can inhibit the production of 5-HT during exercise and has the effect of preventing fatigue. Therefore, this article mainly studies the effects of branched-chain amino acids taken by contestants in the strength competition. In this experiment, 36 football players were selected and randomly divided into an experimental group (n=18) and a control group (n=18). The total duration of the experiment is 6 weeks, with 5 days training per week. Each training time is 90 minutes to ensure that the training intensity of the two groups matches. After training every day, the experimental group drank a glass of water containing BCAA, and the control group drank mineral water. At the beginning of the test, saliva and venous blood samples will be collected when waking up in the morning, and the thigh speed will be measured in the afternoon. Repeat the above index test at the end of the test. Using YEAGER gas analysis and cardiac function analysis system, physiological parameters during exercise can be collected. The experimental data showed that before the start of the experiment, the INS levels of the control group and the 20mg group were significantly different (P>0.05), and the 20mg group was 36.57% and 25.31% higher than the control and 40mg groups, respectively. It turns out that supplementing branched-chain amino acids does not significantly affect the body's normal metabolism. After supplementing BCAA, endurance athletes can speed up lactate clearance after exhaustive exercise, stabilize blood glucose level during long-term sub polar exercise, and increase serum enzyme GOT and GPT after long-term sub polar exercise, which can reduce and delay the occurrence of fatigue in exercise.

1. Introduction

Confrontation is the basic feature of all sports competitions. In competitions, the competitiveness gained through training is exerted through various confrontations and strives to achieve the goal of victory. The existence of opposition is very common, but the characteristics, intensity and form of opposition in different sports groups are obviously different. In recent years, research on the use of sports aids to improve athletic ability and eliminate fatigue has been very active, and exercise aids have a certain effect on improving athletic ability and eliminating fatigue. The supply of branched-chain amino acids inhibits the mass production of 5-HT during exercise and has a certain anti-fatigue effect.

In this article, the branched amino acids are taken orally to athletes to enhance the body's antioxidant capacity after exercise and reduce the damage caused by exercise oxidative stress. It regulates hormone levels, especially insulin levels, stimulates insulin secretion, increases the effect of insulin on muscle cells, and promotes muscle cells to absorb nutrients. At the same time, it enhances the metabolism of energy substances. In particular, it promotes the oxidative function of muscle acid and glucose, and provides sufficient energy for human exercise. It also reduces or eliminates the amount of metabolites, thereby reducing fatigue and accelerating physical recovery after exercise.

Branched-chain amino acids are closely related to the metabolic function of the human body. Lerin believes that in obesity and type 2 diabetes (T2D), plasma branched chain amino acids (BCAA) levels continue to rise, and T2D can also be predicted. However, the role of BCAA in the pathogenesis of insulin resistance and T2D is unclear. In order to determine the pathways related to insulin resistance, he conducted a comprehensive gene expression and metabolomics analysis of insulin sensitivity in the skeletal muscles of 41 people with normal glucose tolerance and 11 people with T2D (SI, 0.49 to 14.28) . He studied heterozygous cultured cells and mouse BCAAs methylmalonyl-CoA mutase (Mut), and evaluated the effect of changes in BCAA flux on lipid and glucose homeostasis. His research process lacked a control group, and the experiment was not rigorous [1].

Mahendran believes that branched-chain amino acids (BCAA) in fasting plasma are related to insulin resistance, but it is not clear whether there is a causal relationship between the two. He conducted a Mendelian randomized study to eliminate causality by using genetic variants related to circulating BCAA levels and insulin resistance as instrumental variables. He measured the circulating BCAA levels in the plasma of 1,321 individuals in the ADDITION-PRO cohort by NMR spectroscopy. He used the genetic risk score (GRS) and calculated it using ten established fasting serum insulin-related variants as an instrumental variable for insulin resistance. The GRS of the three variants that increase circulating BCAA levels were used as instrumental variables for circulating BCAA levels. The sample size of genetic risk score in his study is not enough [2].

Juan believes that heart failure (HF) is a complex syndrome that may include physiological, neurohormonal and metabolic complications, called "cardiac cachexia" (CC). In the development of CC, the release of catabolic cytokines (tumor necrosis factor-α, interleukins 1 and 6) leads to a decrease in fat-free mass and fat mass. He believes that the therapeutic combination of resistance exercise and branched-chain amino acid supplements (BCAA) can reverse these changes in body composition. To evaluate the changes in body composition of BCAA after the resistance exercise program and supplementation of HF patients. In a randomized clinical trial with a 3-month follow-up, he evaluated body composition analysis and stress testing at the beginning and end of the study. He divided the patients into two groups. The experimental group received resistance exercise training and supplemented with 10g BCAA every day, and the control group only received resistance exercise training. Both groups provided personalized diet and conventional treatment. The experimental group has insufficient data and has no reference significance [3].

This paper focuses on the positive behavioral expression of branched chain amino acids, plasma biomarkers and the effects on the neural transmission and gene expression of tryptophan in the brain stem of athletes in power competition events, and further studies the mechanism of influencing mental fatigue, so as to provide the basis for considering measures to reduce mental fatigue. At the same time, the effective supplemental dose of BCAA was compared, which provided experimental basis for the study of the molecular mechanism of exercise center fatigue and the development and use of BCAA as a sports nutrient.

2. Strength Resistance Exercise and Branched Chain Amino Acids

2.1. Strength Antagonistic Sports

Strength is the ability to resist the body's resistance and is the basis of the human body's strength elements, such as the human body's movement speed, endurance, body agility and flexibility. Resistance training is one of the most effective ways to increase human strength. It uses training strength to overcome the body's load and the resistance of external loads. It is the main means of strengthening muscle strength and endurance. The purpose of resistance training is to train the body's muscle strength, body agility, body balance and harmony. Long-term resistance training can help the body's skeletal muscle to adapt to physiology and change its shape and function. Different resistance training intensity will change the body, so the training intensity should be set according to the physical condition, training purpose and fitness needs [4].

The contraction of skeletal muscle generates power. Skeletal muscle accounts for about 40% of body weight and 50-75% of the total protein mass of the body. In addition to innate factors, many factors also affect the balance of skeletal muscles. These factors include testosterone (T), cortisol (C), growth factor (GH), growth factor 1 (IGF-1), etc. Under normal healthy and quiet conditions, skeletal muscle has 1-2% conversion every day, and energy consumption is about 15-25% of the entire body.

The role of strength against sports:

(1) Correct body shape and improve posture. With the development of society, people's life and working methods are also undergoing tremendous changes. People study and work in front of the computer for a long time, which will cause the formation of body shapes such as round shoulders. Anti-resistance training can well improve bone deformation caused by bad movements and has a body shaping effect.

(2) If you insist on strength training from adolescence, you can reduce the risk of osteoporosis. If muscle strength decreases, action will slow down, pace will decrease, and stride length will decrease. Strength training can effectively reduce the rate of decline of muscle strength and achieve the purpose of slowing down aging [5].

(3) Consume calories and reduce fat. Obese people generally have low metabolism, lack of exercise and unreasonable diet are the reasons for obesity. Resistance training can increase muscle mass well, and the increase in muscle mass can improve the body's basic metabolism and reduce fat.

(4) Reduce injury and pain, and protect joints. Resistance training can also effectively increase the muscle strength of some joints of the body and reduce sports injuries [6].

Protein synthesis and degradation regulate protein balance in the body, and various molecular structures control protein synthesis and degradation, including the initiation of various transcription factors, translation initiation and proteolysis. This system is used to start the hydrolysis system and hydrolysis system of whole protein. The rate of protein synthesis exceeds the rate of hydrolysis, and the human body shows anabolic metabolism or growth. Normally, healthy adult skeletal muscle absorbs and releases amino acids and proteins, and amino acid metabolism is always in a balanced state. Physiological or pathological factors can affect this balance, such as exercise, hormones, age, food intake, diet and disease. Sports exercise, especially in the form of resistance exercise, will cause an increase in total protein balance, and many factors will affect the protein accumulation of resistance exercise, including early training status, exercise intensity and nutritional supplement [7].

The competitive power structure and the state formed before the competition constitute the competitive power and state of the player (team). In actual games, the importance of the game, the stage of the game process, opponents, judgment, environment and other factors will more or less affect the state of mind and will before and during the game. It can be seen that positive expectations can help to play a high level in the game, overcome the disadvantages in the game, and the ability to sustain a favorable state reflects the subjective strength of the athlete. Athletes are the main body of physical exercise activities and are a direct manifestation of the competitiveness of sports activities. However, it cannot be denied that the overall ability of the participants is the comprehensive strength displayed by coaches and athletes as an organic whole. Especially in opposing events, it is also very advantageous to adjust the player's state and things to change through the form of temporary coaching, alternation, off-court guidance, etc., and to open up the player's game environment for the purpose of comprehensive team competitive ability [8].

2.2. Branched Chain Amino Acids

BCAA is the general term for Leucine (Len), Isoleucine (Ilu) and Valine (Val). They are called BCAA because they are similar in structure, have branched carbon chains, are antagonistic and synergistic in the metabolic process, and are essential amino acids. BCAA is an important essential amino acid in the human body and is mainly oxidized by muscles. BCAA participates in the production of sugar and ketone in the cycle of tricarboxylic acid, and realizes the mutual conversion of the three main nutrients (protein, fat and sugar) in the organism. In skeletal muscle and cardiomyocytes, BCAA has protein synthesis and anti-proteolytic effects. Len has the effect of stimulating muscle protein synthesis, while improving muscle strength and promoting the improvement of muscle type sports ability. BCAA is a kind of crude sugar ketoamic acid, which promotes the utilization of biological amino acids in the process of sugar metabolism, and generates glucose (or glycogen) through the sugar metabolism of amino acids. The use of glycogen in skeletal muscle can promote energy conversion in the liver. Supplementing BCAA can accelerate the recovery of blood sugar after exercise, inhibit the excessive production of blood lactic acid, reduce the accumulation of lactic acid in skeletal muscle, and delay the production of fatigue. Supplementing BCAA can also improve the intracellular environment. Strenuous exercise can lead to increased intracellular calcium release, increased cardiac calcium ion concentration, calcium overload, and damage to biological mitochondrial membranes. It inhibits the oxidative phosphorylation energy in the mitochondria, reduces the production of ATP, and affects exercise capacity. BCAA supplements can reduce the content of calcium ions in the myocardium, maintain a stable state of calcium ions, reduce calcium ion overload, and meet energy requirements [9].

All the chemical reactions that nutrients experience in the body are collectively called metabolism, and these reactions are continuous chemical reactions catalyzed by enzymes. In the metabolic process, the catalytic product of the former enzyme is also the substrate of the latter enzyme, so that the continuously changing enzyme products are called metabolic intermediates. Biological metabolism has two main areas: assimilation and alienation of substances. Biology uses small molecules to generate its own macromolecules for assimilation. Biology converts its own macromolecules or macromolecules obtained from the outside into simple small molecules to carry out alienation. Branched chain amino acids enter the body from the outside and are hydrolyzed by protein molecules in the body. The metabolism of branched-chain amino acids in the body mainly refers to their degradation metabolism, which is broken down into smaller molecular units through a series of enzyme-stimulated reactions to produce metabolic intermediates, which are then used or excreted by the body [10].

The precursor for the synthesis of 5-HT in the brain is tryptophan. With the increase of exercise time, bones can supply blood through the use of fat and branched chain amino acids (BCAA), the concentration of BCAA in the blood decreases, and the concentration of free fatty acids increases. As the concentration of free tryptophan in plasma increases, the ratio of [f-Trp]/[BAA] increases with competition for protein binding sites. BCAA and f-Trp enter the human brain through the blood-brain barrier. Since f-Trp is a precursor for the synthesis of 5-HT in the brain, the metabolism of 5-HT is also increased.

2.3. Exercise Fatigue

Sports fatigue is a normal phenomenon during sports training. Sports fatigue evaluates whether the exercise training load is sufficient to stimulate the body's adaptive changes, which can be said to be a perceptual index to reach a new level of adaptation. However, if sports fatigue cannot be eliminated quickly, it will affect the next sports training and may lead to excessive training. If sports fatigue is a normal phenomenon in sports training, then overtraining is due to the long-term accumulation of sports fatigue, which makes it difficult for athletes to recover. It seriously damages the physical and mental health of athletes, affects athletes' performance, and weakens athletes' interest and confidence in sports. Sports fatigue includes central fatigue and terminal fatigue. Central fatigue is a phenomenon in which the excitability of the motor nerve is reduced due to the imbalance of the motor nerve center. Peripheral fatigue is mainly muscle fatigue, which means muscle loss of strength [11].

The mechanism of sports fatigue is related to the type of exercise. From the perspective of sports training, the main direct cause of fatigue is overtraining. The specific performance is that it is out of the principle of training, improper load arrangement, too fast or very strong load intensity, too much load increase, improper training method, monotonous repetition of content arrangement, and too short recovery time after load. When improper recovery methods and continuous accumulation of fatigue have not been eliminated, continuing to apply a larger exercise load is very easy to make athletes feel fatigued.

The number of neurotransmitters in nerve endings is relatively fixed, mainly through strict regulation of the formation of neurotransmitters, and has nothing to do with nerve activity. This type of regulation varies from neuron to neuron, but the link of regulation is only the changes in the activity of some enzymes related to the synthesis and decomposition of the uptake of precursor substances and neurotransmitters. Stimulation or blocking of postsynaptic receptors can also reduce or increase the synthesis of presynaptic neurotransmitters [12].

3. Effect Experiment of Athletes' Internal Intake of Branched Chain Amino Acids

3.1. Subjects and Groups

A total of 36 players were selected, including 20 level 1 players, 8 level 2 players, and 8 level 3 players. The test subjects received 1 week of nutrition education before the start of the experiment. During the experiment, all test subjects had closed training in the club, and they were not allowed to go out during the training. Eat collectively in the club restaurant to maintain the nutritional balance of the players. The basic information of the test object is shown in Table 1. The test subjects were randomly divided into two groups, one was the experimental group and the other was the comparison group.

Table 1. Basic information of experimental subjects

Sport level	Gender	Age	Height	Weight	Training years
Level 1	Male	23±2.3	175±6.7	68±2.9	2±1.6
	Female	21±3.1	168±2.3	55±3.4	2.4±0.9
Level 2	Male	24±2.8	172±3.9	62±4.1	4±2.5
	Female	24±3.2	165±4.8	52±3.5	2.9±3.1
Level 3	Male	26±2.9	180±4.2	63±3.2	5±3.7
	Female	25±3.0	167±4.8	51±2.9	4.8±2.9

3.2. Test Items

(1) Maximum aerobic capacity test: On the day of the experiment, the subjects ate breakfast with the same ingredients and arrived at the laboratory one hour before. In a sitting position, measure the resting heart rate, collect blood at the same time, and measure the resting blood lactate. The subjects used the YEAGER ER900 power cycle to complete the incremental load exercise, and started the incremental load 2 minutes after preparing for the exercise. The initial load was 80 watts, with an increase of 10 watts every 15 seconds. Using the YEAGER gas analysis and cardiac function analysis system, the physiological parameters of the subject during exercise are collected every second, and parameters such as heart rate, VOZ and respiratory exchange rate (RER) are obtained. Continue to exercise until the subject is no longer able to exercise (ie reach the limit). Record the completed series and the corresponding load value. After completing the maximum exercise, changes in blood lactic acid were observed and the recovery of heart rate was recorded.

(2) Fixed-load sub-load exercise test: After the testee arrives in the laboratory, he sits still for 5 minutes before taking blood. Then, exercise the extreme bike for 45 minutes. The intensity is 60% VOZmax. During the 45-minute continuous exercise, the subjects did not supplement other sports drinks except mineral water. Blood samples and blood lactic acid were measured by collecting ear blood at 0, 15, 30, 45 and 6 minutes after exercise. At the same time, the heart rate changes were measured at 0, 15, 30, 45 and 3 minutes after exercise. After six minutes of exercise, venous blood was drawn, the serum was separated, and the urea and Tanihei rotaminases in the blood were measured.

3.3. Experimental Process

The total duration of the experiment is 6 weeks, with 5 days training per week. Each training time is 90 minutes to ensure that the training intensity of the two groups matches. After training every day, the experimental group drank a glass of water containing BAA. The control group drank mineral water.

At the beginning of the experiment, saliva and venous blood samples were collected every morning. Repeat the test of the above indicators at the end. During exercise, the components of breathing are continuously measured and analyzed by the highermed exercise cardiopulmonary function test and analysis instrument. The intensity of exercise initially generated by the maximum oxygen uptake is the maximum oxygen uptake intensity. According to the above test, the anaerobic threshold driving speed (Trid Mir speed) was obtained and converted into the anaerobic threshold driving speed on the field. This is the benchmark for test subjects to perform anaerobic threshold driving speed training during the maximum-intensity physical training phase.

3.4. Statistical Processing

In statistical processing and related T verification, the experimental data was processed with Excel software. The experimental results are expressed as average ± standard deviation. The correlation test adopts double-T test. The correlation standard is $P<0.005$, and the very appropriateness is $P<0.01$. The surface method uses SPSS1.00 statistical software, and the regression equation uses the linear cubic regression method[13-14].

4. Analysis of the Effect of Branched Chain Amino Acids on Athletes

4.1. Analysis of Experimental Results

The weight changes of the athletes in the experimental group and the control group are shown in Table 2 and Figure 1. The weight difference between the experimental group and the control group before the experiment was small, $P>0.05$; after the experiment, it was found that the weight change of the contestants was still not obvious. Body weight reflects the overall development of the body, including bone width, muscle development and obesity indicators (fat content). The weight check reflects the amount of exercise and the functional status of the human body. At the same time, observe whether BCAA will adversely affect players. Lactic acid is the final product of the energy supply system for the fermentation and decomposition of sugar, and is an important oxidation substrate for the oxygen metabolism energy supply system. In addition, it can also be converted into glucose through the path of liver sugar, which plays an important role in the energy supply system. The blood lactic acid level after exercise is closely related to exercise intensity and can be used to assess aerobic work capacity. The body's blood and lactic acid levels can reflect the body's exercise capacity and anti-fatigue ability: the blood and lactic acid levels can reflect the body's aerobic exercise capacity. The higher the blood lactic acid, the main body's glycolysis function, the lower the blood lactic acid, the main body's oxygen supply function. The same intensity, low blood and lactic acid, proves that the administration of anaerobic yeast is delayed, indicating a high oxygen supply capacity. On the other hand, the level of blood lactic acid reflects the speed of the body's elimination of lactic acid. The faster the elimination of lactic acid, the slower the body's fatigue and the stronger the exercise capacity. The heart rate recovered after strength exercise, and there was no significant difference in each group compared with before supplementation[15]. However, on average, the maximum heart rate will drop to varying degrees. Through this stage of training, cardiopulmonary function can improve the maximum working pressure capacity of oxygen to varying degrees.

Table 2. Weight changes of the experimental group and the control group athletes

Group	Before the experiment	After the experiment	Weight change
C	67	65	2
T	68	64	4
TB1	66	63	3
TB2	65	64	1

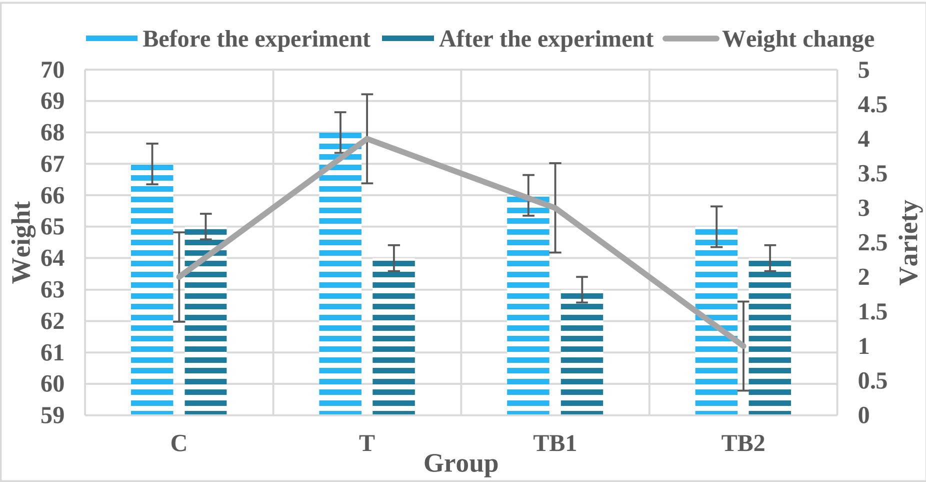

Figure 1. The weight change of the experimental group and the control group athletes

4.2. Effects of BCAA Supplementation on Blood Lipids of Athletes

The changes of blood lipid of athletes are shown in Table 3 and Figure 2.Compared with the pre-experiment, athletes in the 20mg group had reduced serum low-density phospholipids (LDL) levels, and the difference was significant (P<0.05). The difference ratio of high-density phospholipid (HDL) and high-density phospholipid protein (HDD/LDL) increased, and the content of total cholesterol (TC) and tritol (TG) did not change significantly. Compared with the control group, there was a significant difference in the reduction of low-density phospholipid (LDL) in the serum of the 20mg group players (P<0.05). Compared with high-density phospholipid protein (HDL), the ratio of protein (HDD/LDL) increased significantly (P<0.05). On the other hand, the content of cholesterol (TC) and glycerol (TG) has changed, but there is no obvious difference. The level of low-density phospholipid protein (LDL) in the serum of athletes in the 40 mg group was lower than before the experiment. The ratio of high-density phospholipid protein (HDL) to high-density phospholipid protein (HDD/LDL) increased, but there was no significant difference. On the other hand, the content of cholesterol (TC) and glycerol (TG) has changed, but there is no obvious difference. Compared with the control group, the content of total cholesterol (TC), triplet (TG) and low-density lipoprotein (LDL) was reduced. High-density lipoprotein (HDL), high-density lipoprotein and low-density lipoprotein (HDD/LDL)) Although there is an increase, the difference is not significant.

After 6 weeks of oral BCAA, the athlete's test system and cortisol test results are shown in Figure 3. Compared with the control group, the serum cortisol content of athletes in the 20mg group was reduced, the difference was very obvious (P<0.01), the blood testosterone level was significantly increased, the difference was very obvious (P<0.01), the blood testosterone and cortisol were tested The proportion of serotonin increased, and the difference was significant (P<0.05); after 3 weeks of experiment, the cortisol concentration of 20mg group players was significantly lower than that of 40mg group players, and there was a significant difference (P<0.05). The 40mg group athletes had significantly higher serum testosterone and testosterone/cortisol ratios than the control group. The change of testosterone content was very different (P<0.01), and the change of T/C value was significantly different (P<0.05). Compared with the control group, there was no significant difference in the content of cortisol. The level of testosterone in the blood and the ratio of testosterone to cortisol in the blood decreased a little among the athletes in the comparison group, but the level of cortisol increased slightly, but there was no significant difference. BCAA has a very active dissimilation effect in muscle. Compared with most other amino acids, BCAA is converted and completely oxidized in a relatively fast time, providing amino acid bases for alanine and glutamic acid. The decomposition products of BCAA, acetyl-CA, and squalene-CA enter the trisulfonic acid cycle and release a lot of energy. The oxidation efficiency of BCAA is higher than that of other amino acids. The changes of plasma BCAA vary greatly according to exercise time. This indicates that the dissimilation effect of BCAA increases during prolonged exercise. This is related to the increase in the ratio of decomposition and energy supply.

Table 3. Changes in blood lipids of athletes

Group	Test items	Test group		Control group
		20mg group	40mg group	
Before the experiment	TC	4.05	4.22	4.08
	TG	1.48	1.37	1.31
	HDL	1.59	1.53	1.28
	LDL	3.77	3.18	2.84
	HDL/LDL	0.95	0.91	0.48
Third week of experiment	TC	3.68	3.97	4.16
	TG	1.55	1.34	1.51
	HDL	2.01	1.64	1.13
	LDL	3.51	2.09	2.48
	HDL/LDL	1.01	0.88	0.61
Sixth week of experiment	TC	3.22	4.11	3.91
	TG	1.39	1.25	1.52
	HDL	1.62	1.72	1.26
	LDL	3.58	2.36	2.77
	HDL/LDL	2.09	1.01	0.48

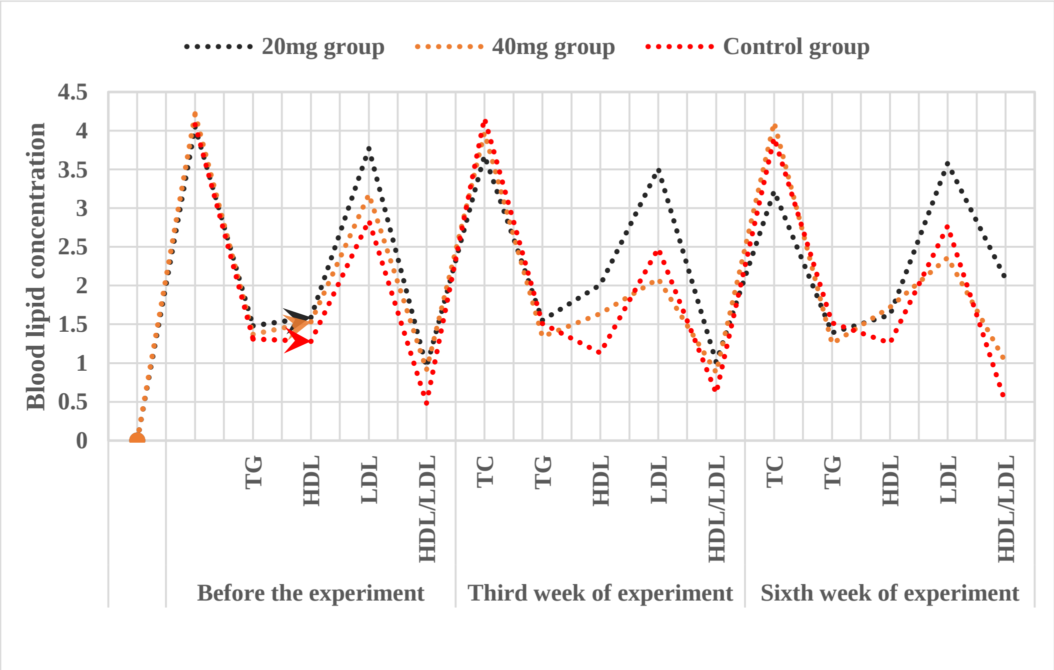

Figure 2. Changes in blood lipids of athletes

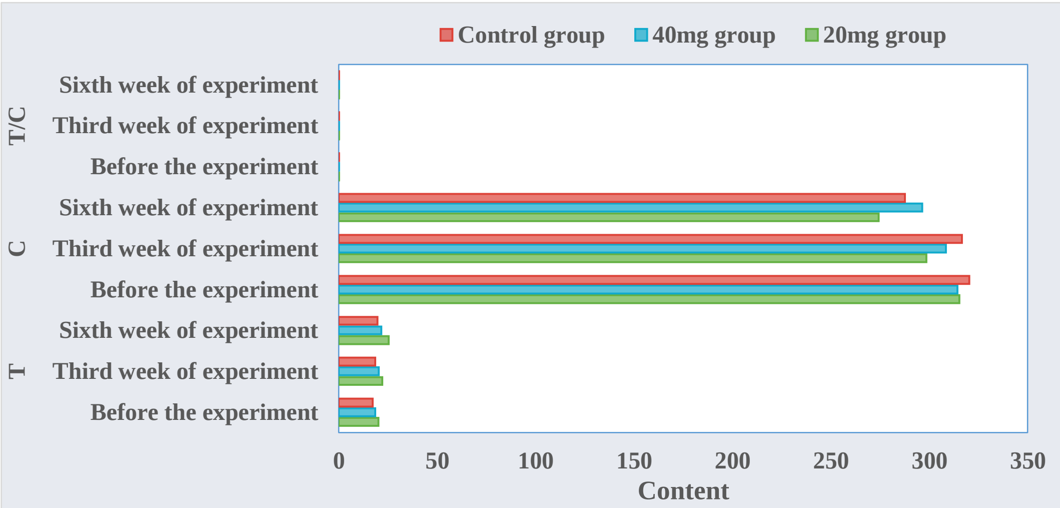

Figure 3. Test results of testosterone and cortisol for athletes

4.3. Effect of Oral BCAA on Plasma Hormone Level of Athletes

After 6 weeks of exercise, the plasma hormone levels of the experimental group and the control group are shown in Figure 4. In terms of INS levels, before the start of the experiment, the difference between the control group and the 20 mg group was significant (P>0.05). The 20 mg group was 36.57% and 25.31% higher than the control group and the 40 mg group, respectively. At the beginning of the experiment, the INS content in the 20 mg group and the 40 mg group decreased, which has a certain relationship with the oral branched chain amino acid. The control group and the 40 mg group were significantly different (P>0.05). In the third week of the experiment, the INS content of the 20mg and 40mg groups increased, but the difference between the experimental groups was not significant (P>0.05). In the 6th week of the experiment, the INS content of each experimental group did not change much, and the difference between the experimental groups was not significant (P>0.05). The experimental results showed that after 3 weeks of oral administration of BCAA, plasma in the body was at a normal metabolic level, and INS did not change significantly. However, the supplementary feeding of the BCAA group had a more obvious stimulation effect on the secretion of INS. Regarding the GC level, the difference between the experimental groups was not significant (P>0.05). At the beginning of the experiment, the GC content of each experimental group did not change much, and the difference between the experimental groups was not significant (P>0.05), maintaining a normal physiological level. In the third week of the experiment, the GC content of each experimental group increased, but the difference between the experimental groups was not significant (P>0.05). In the 6th week of the experiment, the GC content of each experimental group did not change much, the difference was not significant (P>0.05), and the content of the control group was higher. Regarding COR content, before the start of the experiment, the difference between the test groups was not significant (P>0.05), maintaining the physiological level. At the beginning of the experiment, there were significant differences between the 20mg group, 40mg group and the control group (P>0.05), increasing by 30.21% and 37.63%, respectively. In the third week of the experiment, the COR content of each test group was at the normal physiological level, and the difference between the test groups was not significant (P>0.05). In the 6th week of the experiment, the COR content of each experimental group was maintained at the normal physiological level, and there was no significant difference between the groups (P>0.05). During long-term exercise, fat is mobilized in a large amount, and the FFA concentration in the blood increases. FFA must bind to albumin, the main carrier in plasma, and Trp competes with FFA for binding to albumin, thereby increasing f-Trp. In long-term exercise, on the one hand, the supply of BCAA oxidation energy will reduce the mobilization of fat, thereby reducing the increase of f-Trp; on the other hand, it will increase the content of BCAA in the blood, making f-Trp/BCAA and f-Trp relative cut back.

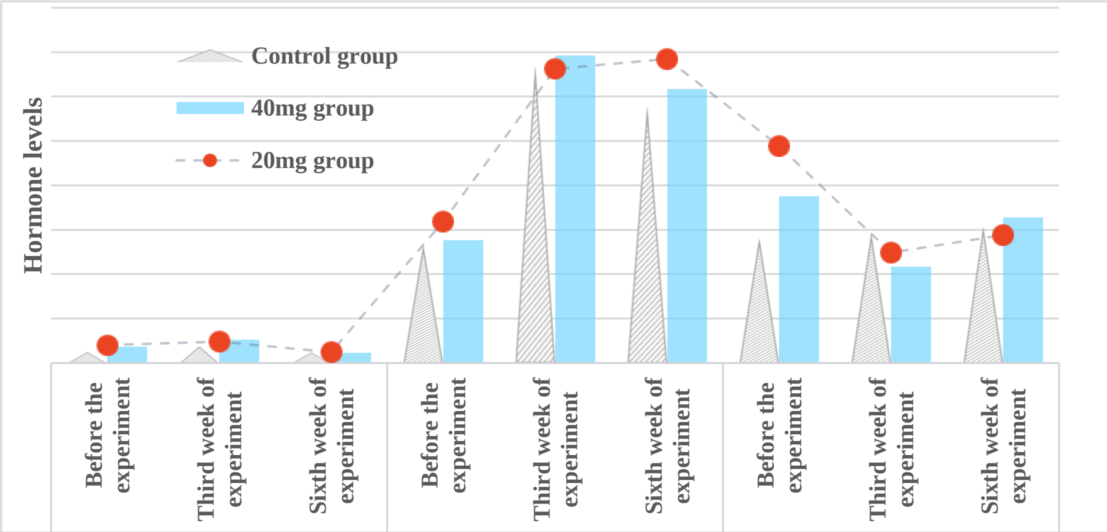

Figure 4. Changes in plasma hormone levels between the experimental group and the control group

5. Conclusion

This article mainly studies the effects of internal administration of chain amino acids by athletes in muscle resistance events. Experimental results show that oral administration of chain amino acids significantly reduces biological LDL levels, increases HDL levels and HDD/LDL ratio, and the effect of a small amount of group is more obvious. The oral administration of branched-chain amino acids can improve the level of lipid metabolism in the blood and has a significant effect on improving the athletic ability of athletes. Branched-chain amino acids can increase the concentration of athletes' blood test system, increase the T/C ratio, significantly reduce the concentration of serum cortisol and blood leptin, regulate bio-energy metabolism, delay the occurrence of sports fatigue, and enhance athletic ability.

After the maximum exercise, the ammonia concentration in the blood of athletes is significantly higher than that at rest, and the ammonia concentration in the blood increases with the increase in supplementation after BCAA supplementation. The brain 5-HIAA content of the BCAA supplement group is high, which indicates that BCAA promotes the increase of 5-HIAA, that is, BCA effectively accelerates the decomposition of 5-HT and reduces the accumulation of 5-HT, which can not only delay the occurrence of fatigue, but also improve Eliminate fatigue quickly. A certain intensity of exercise training produces biological fatigue, which occurs in all links from the central nervous system to the peripheral muscle contraction. One of the important findings is the impact on the neuroendocrine system. The central inhibition of fatigue is directly related to the decrease in the secretion of testosterone (testosterone) in the hypothalamus-pituitary-gonadal axis. In many cases, changes in testosterone levels precede the ability of organisms to exercise. Therefore, observing changes in testosterone levels is The monitoring of sports training and nutritional recovery is of great significance.

BCAA is mainly metabolized by muscle. This is because the BCAA metabolism restriction enzyme (BC complex) activity in the muscle is strong, and the muscle's ability to use BCAA is improved. After long-term high-intensity exercise, muscles and internal organs will break down a lot of protein to produce energy. This may reach 10% of all energy. In addition, the redistribution of blood leads to an increase in the blood flow of skeletal muscle. The selective absorption of BCAA in plasma reduces the content of BCAA in blood plasma. The blood flow of the liver is less than before exercise, so the Trp in plasma cannot be effectively decomposed. Absorption, the Trp content in plasma increases, and the BCAA/Trp decreases.

Funding

This article is not supported by any foundation.

Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

References

[1]Lerin, C. , Goldfine, A. B. , Boes, T. , Liu, M. , & Patti, M. E. . (2016). "Defects in Muscle Branched-Chain Amino Acid Oxidation Contribute to Impaired Lipid Metabolism", Molecular Metabolism, 5(10), pp.926-936. https://doi.org/10.1016/j.molmet.2016.08.001

[2]Mahendran, Y. , Jonsson, A. , Have, C. T. , Allin, K. H. , Witte, D. R. , & J?Rgensen, M. E. , et al. (2017). "Genetic Evidence of a Causal Effect of Insulin Resistance on Branched-Chain Amino Acid Levels", Diabetologia,60(5), pp.1-6. https://doi.org/10.1007/s00125-017-4222-6

[3]Juan Antonio Pineda-Juárez, Néstor Alonso Sánchez-Ortiz, Lilia Castillo-Martínez, Orea-Tejeda, A. , & Alberto Ronquillo-Martínez. (2016). "Changes in Body Composition in Heart Failure Patients after Aresistance Exercise Program and Branched Chain Amino Acid Supplementation", Clinical nutrition (Edinburgh, Scotland), 35(1), pp.41-47. https://doi.org/10.1016/j.clnu.2015.02.004

[4]Ikeda, T. , Jinno, T. , Masuda, T. , Aizawa, J. , Ninomiya, K. , & Suzuki, K. , et al. (2018). "Effect of Exercise Therapy Combined with Branched-Chain Amino Acid Supplementation on Muscle Strengthening in Persons with Osteoarthritis", Hong Kong Physiotherapy Journal, 38(01), pp.23-31. https://doi.org/10.1142/S1013702518500038

[5]Wessels, A. G. , Kluge, H. , Hirche, F. , Kiowski, A. , & Stangl, G. I. . (2016). "High Leucine Diets Stimulate Cerebral Branched-Chain Amino Acid Degradation and Modify Serotonin and Ketone Body Concentrations in a Pig Model", Plos One, 11(3), pp.e0150376. https://doi.org/10.1371/journal.pone.0150376

[6]Hiraoka, A. , Michitaka, K. , Kiguchi, D. , Izumoto, H. , & Hiasa, Y. . (2017). "Efficacy of Branched-Chain Amino Acid Supplementation and Walking Exercise for Preventing Sarcopenia in Patients with Liver Cirrhosis", European Journal of Gastroenterology & Hepatology, 29(12), pp.1. https://doi.org/10.1097/MEG.0000000000000986

[7]Boyko, K. M. , Stekhanova, T. N. , Nikolaeva, A. Y. , Mardanov, A. V. , Rakitin, A. L. , & Ravin, N. V. , et al. (2016). "First Structure of Archaeal Branched-Chain Amino Acid Aminotransferase from Thermoproteus Uzoniensis Specific for l-Amino Acids and r-Amines", Extremophiles, 20(2), pp.215-225. https://doi.org/10.1007/s00792-016-0816-z

[8]Kaiser, J. C. , King, A. N. , Grigg, J. C. , Sheldon, J. R. , Edgell, D. R. , & Murphy, M. E. P. , et

al. (2018). "Repression of Branched-Chain Amino Acid Synthesis in Staphylococcus Aureus is Mediated by Isoleucine via Cody, and by a Leucine-Rich Attenuator Peptide", Plos Genetics, 14(1), pp.e1007159. https://doi.org/10.1371/journal.pgen.1007159

[9]Ikeda, T. , Aizawa, J. , Nagasawa, H. , Gomi, I. , Kugota, H. , & Nanjo, K. , et al. (2016). "Effects and Feasibility of Exercise Therapy Combined with Branched-Chain Amino Acid Supplementation on Muscle Strengthening in Frail and Pre-Frail Elderly People Requiring Long-Term Care: a Crossover Trial", Applied Physiology Nutrition & Metabolism, 41(4), pp.1-8. https://doi.org/10.1139/apnm-2015-0436

[10]Shiozawa, S. , Usui, T. , Kuhara, K. , Tsuchiya, A. , Miyauchi, T. , & Kono, T. , et al. (2016). "Impact of Branched-Chain Amino Acid-Enriched Nutrient on Liver Cirrhosis with Hepatocellular Carcinoma Undergoing Transcatheter Arterial Chemoembolization in Barcelona Clinic Liver Cancer Stage b: a Prospective Study", Journal of Nippon Medical School = Nippon Ika Daigaku zasshi, 83(6), pp.248. https://doi.org/10.1272/jnms.83.248

[11]Yang, Z. , Huang, S. , Zou, D. , Dong, D. , He, X. , & Liu., N. , et al. (2016). "Metabolic Shifts and Structural Changes in the Gut Microbiota upon Branched-Chain Amino Acid Supplementation in Middle-Aged Mice", Amino Acids, 48(12), pp.1-15. https://doi.org/10.1007/s00726-016-2308-y

[12]Li, Y. , Wei, H. , Li, F. , Duan, Y. , Guo, Q. , & Yin, Y. . (2017). "Effects of Low-Protein Diets Supplemented with Branched-Chain Amino Acid on Lipid Metabolism in White Adipose Tissue of Piglets", Journal of Agricultural and Food Chemistry, 65(13), pp.2839. https://doi.org/10.1021/acs.jafc.7b00488

[13]A. A. Hamad, A. S. Al-Obeidi, E. H. Al-Taiy, O. I. Khalaf and D. Le, "Synchronization phenomena investigation of a new nonlinear dynamical system 4d by gardano's and lyapunov's methods," Computers, Materials & Continua, vol. 66, no.3, pp. 3311–3327, 2021. https://doi.org/10.32604/cmc.2021.013395

[14]Khan, N.A.; Khalaf, O.I.; Romero, C.A.T.; Sulaiman, M.; Bakar, M.A. Application of Euler Neural Networks with Soft Computing Paradigm to Solve Nonlinear Problems Arising in Heat Transfer. Entropy 2021, 23, 1053. https://doi.org/10.3390/e23081053

[15]Choi, G. H. , Ko, H. , Pedrycz, W. , Singh, A. K. , & Pan, S. B. . (2020). Recognition system using fusion normalization based on morphological features of post-exercise ecg for intelligent biometrics. Sensors, 20(24), 7130. https://doi.org/10.3390/s20247130