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The Effect of Simple Pyramid Resistance Training Session with Branched-Chain Amino Acid Supplementation on Insulin-Like Growth Hormone-1 Levels in Postmenopausal Women

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***Abstract*— the aim of the current research was the effect of a simple pyramid resistance training session with BCAA supplementation on IGF-1 levels during different periods of time in postmenopausal women. The current research was semi-experimental and applied. A total of 19 inactive postmenopausal women were selected. At first, the subjects were given the necessary information about the objectives and method of conducting the research, and each subject completed the consent form, physical activity and medical-sports readiness questionnaire. Then the subjects were randomly divided into two groups of simple + supplement pyramid resistance training (10 people) (age 52.20 ± 5.70 years, height 1.57 ± 0.01 cm and weight 88.76 ± 14.81 kg), Simple pyramid resistance training group + placebo (9 people) (age 50.89±4.25 years, height 1.60±0.01 cm and average weight 88.76±7.41 kg) were divided. The resistance training program was a pyramid with an intensity of 70-80% of one repetition maximum. The simple pyramid resistance training group + supplement consumed 0.1 gram per kilogram of body weight of BCAA powder in solution. Serum IGF-1 levels were measured before, 30 and 120 minutes after exercise. Two-way repeated measures statistical test was used to analyze the data. The findings showed that a simple pyramid resistance training session with BCAA supplementation has no effect on IGF-1 serum levels at different training times of postmenopausal women. Also, the difference between the groups in the level of IGF-1 after exercise was not significant. Probably, a simple pyramid resistance training session with and without BCAA**

supplementation at the rate of 0.1 gram per kilogram of body weight before and after training has no effect on the initial increase of IGF-1.
***Keywords*— Simple pyramid resistance training, branched chain amino acid supplementation, insulin-like growth factor-1, postmenopausal women**

Introduction

Menopause is a period of women's life that occurs on average after the age of 50 and is associated with a decrease in the secretion and production of estrogen. This period with increased immobility; Bone density, aerobic fitness, muscle strength and decreased balance are associated (1). In addition, menopause is associated with aging, followed by metabolic syndrome, obesity, high blood pressure, cardiovascular diseases, sarcopenia, and osteopenia. The phenomenon of sarcopenia is always associated with a decrease in muscle mass, the quality and function of skeletal muscles, which can lead to a decrease in the function of physical activity and sports activity in this society (2). During this period, the reduction in the ratio of anabolic to catabolic hormones plays an important role in reducing physical strength, muscle mass and aerobic capacity. With age, the amount of testosterone (the most important androgenic hormone) decreases after the age of 40, and the level of cortisol in the blood increases. to find Also, the amount of estrogen hormone decreases, which accelerates the loss of muscle mass and bone density in women. Insulin-like growth factor-1 (IGF-1) (polypeptide with a sequence of 77 amino acids) from the family of insulin-like growth factors; Together with its protein receptors, it is effective in regulating the mechanisms of production, differentiation and growth. Growth hormone acts as an inducer of the synthesis and release of IGF-1 from the liver, hence it is effective in controlling the growth and differentiation of most body tissues (3). IGF-1 is an important mediator for the growth of skeletal muscle and bone tissue, which is originally synthesized by the liver. Meanwhile, IGF-1 is also produced in several other extrahepatic tissues; and has local paracrine and autocrine effects (4). Normally, tissue reactivity to IGF-1 changes with age. The aging process is related to the reduction of its receptor content and IGF1R phosphorylation in muscle.

Physical activity and sports can help menopausal women to experience less physiological changes during this period. The results of studies show that performing regular sports activities leads to a reduction in the speed of physiological, anatomical, hormonal and metabolic changes and also leads to an improvement in the quality of life of postmenopausal women in society (5). The results of several studies have reported that a session or a period of resistance training with different intensities of a maximum repetition was associated with significant changes in IGF-1 levels in postmenopausal women. In general, the results of this research show that significant changes in the level of IGF-1 immediately after training and the following hours are influenced by several factors, including training program, food consumption, growth hormone changes and blood lactate levels (5-7). In addition to performing resistance exercises, athletes use supplements to maximize the effective factors of growth factors. Food supplements mainly include carbohydrate compounds, proteins, vitamins, minerals, etc. Branched-chain amino acid supplement contains leucine, isoleucine, and valine amino acid compounds, all of which are involved in the processes of the membrane transport system, transfer enzymes, growth hormone secretion and oxidative carboxylation (8). BCAA contains 35-40% of the essential amino acids of body protein and 14-18% of the total amino acids of skeletal muscle protein. Considering that 40% of the body weight is made up of skeletal muscle mass, therefore the muscle protein pool represents a significant reserve of BCAA in the body (0.6 to 1.2 mmol per kilogram of body weight). Most studies have shown that leucine plays an important role in protein metabolism and increases protein synthesis and inhibits protein degradation through the mTOR mechanism. BCAAs are involved in the oxidation process of skeletal muscle, although this process takes place directly in the liver. The body is not able to synthesize amino acids and must be included in the diet, and it is known that BCAAs play an important role in muscle oxidation during sports activities (9). On the other hand, leucine is a water-soluble amino acid that increases the amount of plasma insulin after eating, which plays an important role in increasing the activation of anabolic pathways leading to mTOR (7).

IGF-1 is a liver factor in muscle protein synthesis, and its production and release rate is different under the influence of resistance training programs. However, there are controversial results regarding the effect of resistance training program on IGF-1 levels during a training period. Also, there are limited studies on the effects of single-session simple pyramid resistance training programs on IGF-1 levels in AES women. The aim of the current research was the effect of a simple pyramid resistance training session with BCAA supplementation on IGF-1 levels during different periods of time in postmenopausal women.

Materials and methods

The current research was applied and semi-experimental, which was conducted as a pre-test-post-test with two groups. The statistical population of the research was made up of postmenopausal women of Mashhad city, based on the criteria for entering the research (one year has passed since the last menstrual period, no use of hormone therapy, having a body mass index between 25 and 30 kg/m2, no history of cardiovascular disease, liver, kidney, lung and diabetes and no regular sports activity in the last 6 months) and after initial screening by the researcher, 19 people were selected to participate in this study. Subjects were randomly divided into two groups: simple pyramid resistance training + branched amino acid supplement (10 people) and simple pyramid resistance training + placebo group (9 people).

In order to comply with the ethical charter, before taking samples, all people were familiarized orally with the nature and manner of doing the work and its possible risks, and they were reminded of important and necessary points about nutrition, physical activity, illness and drug consumption in order to comply with it. Exercise the necessary care then all the people completed the written consent form to cooperate in the research work and declared their readiness to participate in the research. It should be mentioned that all the people were free to withdraw from the research work at any time without any conditions. First, the standing height was measured in centimeters using a caliper (Seca; Germany), then the body mass index and fat percentage were measured using a body composition analyzer model 720 made in South Korea in two stages: pre-test and post-test.

In order to prepare blood samples, in coordination with the medical diagnosis center, an experienced expert in experimental sciences was asked to take blood from the subjects. Blood samples were taken in three stages before, 30 minutes and 120 minutes after training. The amount of blood taken was 5 cc from the antecubital vein of the arm, which was then poured into anti-coagulant glasses and transferred to the laboratory for analysis after the end of blood collection. The values of IGF-1 were reported by the ELISA method and its kit with Mediagonest brand, made in Germany, with a sensitivity of 0.09ng/ml and a variability of less than 6.8 and 6.7%.

The simple pyramid resistance training program (light to heavy) was as follows, the first set is 70% of one repetition of sitting with 12 repetitions, the second set is 75% of one repetition of maximum with 10 repetitions and the third set is 80% of one repetition of maximum with 8 repetitions, rest There was 1 to 2 minutes between each set and 2 to 3 minutes rest between each movement. (To estimate the maximum muscle strength, the subject first warmed up by choosing light weights for 5 minutes, and after a two-minute rest, according to the subject's estimation, they chose weights that they could lift at least once and at most 10 times completely. and do it correctly. By placing the amount of weight and the number of repetitions in the following formula, the maximum strength of the subjects in the movements of the simple pyramid resistance training program was calculated. To measure the maximum strength, the formula of Berzyski (1999) was used (repetitions * 2.78 - 78/102) / load* 100 = one maximum repetition). The exercises included Chest Press, Horizontal Leg Press, Seated Row, Seated Calf Raise, Triceps Pushdown, Leg Curl, Knee Extension and Preacher Curl (23).

The groups were randomly divided into two groups: supplement + simple pyramid resistance training and placebo + simple pyramid resistance training. For the supplement group, the branched-chain amino acid supplement made by the Universal company of America with the brand BCAA Stack was used, and the amount of 0.1 gram per kilogram of body weight of BCAA powder was mixed in 400 ml of solution, and the subjects took 200 ml before training and after They used the remaining 200 ml of exercise (9). For the placebo group, a supplement with the minimum amount of energy made in the country and with the brand

Slim last 1 was used. The placebo group, like the supplement group, consumed 200 ml before and after training. It should be noted that the solutions were used in a blinded manner.
To analyze the data, descriptive statistical tests (mean and standard deviation), Shapiro-Wilk statistical tests used to determine the normality of the data, and Levene's test was used to determine the homogeneity of variances. Two-way analysis of variance with repeated measures used to examine the changes in the research variables. All statistical calculations were done using SPSS statistical program. Also, a significance level of $p<0.05$ was considered.

Results

Based on research, the average age, weight and body mass index of the subjects were respectively in the resistance training group with supplement (52.20±5.70), (76.88±14.81), (29.80±5.72) and in resistance training and placebo group were (53.89±2.25), (69.30±7.41), (27.00±2.52). All variables had a normal distribution. According to the results obtained from this research (Table 1) in both exercise groups with supplements and exercise, there is no significant difference in the amount of IGF-1 between the time periods before, 30 and 120 minutes after exercise (650/ $F=0.2$; $p>0.098$), ($F=0.766$; $p=0.481$). Also, the results of the two-way ANOVA statistical test with repeated measurements showed that there is no significant difference in IGF-1 levels between the time periods before, 30 and 120 minutes after exercise ($F=0.904$; $p<0.414$). (Table2). In other words, there was no significant difference between the groups before, immediately and 120 minutes after training. On the other hand, the results of the interaction effect of time repetitions of IGF-1 of the groups showed that there is no significant difference ($F = 2.431$; $p = 0.103$) (Table3).

Table1. Information on changes in IGF-1 before, 30 and 120 minutes after exercise in the subjects of exercise + supplement, exercise (19 people)

groups	Before exercise	30 minutes after exercise	120 minutes after exercise
exercise + supplement	70.40 ± 25.13	74.40 ± 35.73	93 ± 46.40
exercise	63.77 ± 22.40	51.33 ± 26.69	53 ± 10.34

Table2. The results of the analysis of variance statistical test with repeated measurements between the exercise + supplement group and the exercise group

groups	df	F	P
exercise + supplement	2	2.650	0.098
exercise	2	0.766	0.481

Table3. The results of the statistical test of two-way analysis of variance with repeated measurements between the levels and the exercise + supplement and exercise group

groups	Df	F	P
Levels of measurement	2	0.904	0.414
Interactive effect	2	2.431	0.103

Discussion

The present findings showed that a simple pyramid resistance training session and BCAA supplement consumption have no effect on IGF-1 serum levels before, 30 minutes and 120 minutes after exercise in postmenopausal women. One of the main objectives of the present study was to determine the effects of BCAA consumption along with a simple pyramid resistance training session on changes in serum IGF-1 levels. In general, the results of the present study showed that performing a simple pyramid resistance training session with BCAA supplementation before and after training has no effect on IGF-1. So far, no study has been conducted on postmenopausal women with BCAA supplementation with resistance training. However, several other studies have investigated the effect of resistance training and BCAA supplementation on physiological variables. In line with the results of the current research, Spillane et al. (2013) reported that eight weeks of heavy resistance training and BCAA supplementation had no effect

on body composition and skeletal muscle performance (10). These researchers attributed the lack of effect of BCAA supplementation to the low sample size, lack of direct monitoring of supplement consumption and resistance training by the researcher, lack of diet control and low dose of BCAA supplementation (9 grams). Also, Foster et al. (2011) investigated the effect of eight weeks of heavy resistance training and BCAA + carbohydrate supplementation on physical performance and body composition. The results of this study showed that the consumption of BCAA supplements along with carbohydrates during resistance training is required (12). kerksick et al. (2006) also investigated the effect of ten weeks of resistance training and protein and amino acid supplementation on skeletal muscle performance and muscle metabolism index. The results indicated an increase in total body mass, lean mass, muscle strength and serum IGF-1, mRNA expression of IGF-1, MHCI-II and myofibrillar protein (13). IGF-1 is an anabolic hormone that increases in response to mechanical activity. It is thought that IGF-1 participates in skeletal muscle cell hypertrophy processes by activating satellite cells. It has been found that IGF-1 levels in skeletal muscle tissue exert their myogenic effects up to 72 hours after exercise (14, 15). It has been reported that a session of resistance training leads to the positive regulation of mRNA expression of growth factors, including IGF-1, and continues for several hours after exercise (16). In relation to food consumption and resistance training, studies have shown that taking amino acid supplements immediately after resistance training leads to the activation of anabolic factors for several hours after training. Showed consumption of 10 grams of BCAA is effective in increasing some skeletal muscle anabolic factors up to three hours after consumption. Reported carrying out a resistance training session with BCAA and carbohydrate consumption has an effect on IGF-1. Researchers attributed their possible causes to the amount of leucine in BCAA, which leads to an increase in IGF-1, which was confirmed by Church et al. (2016). It seems that the dose of BCAA supplement (120 mg per kilogram of body weight) and resistance training were effective in increasing IGF-1. In the present study, there was no change in the amount of IGF-1. The possible causes can be due to the dosage that was 0.1 gram per kilogram of body weight (17). Willoughby et al. (2006) subjects consumed 20 grams of amino acid before and after training, it was more than the amount prescribed in the present study (18).

The results of this research showed that simple pyramid resistance training had no effect on IGF-1 profile. It seems that it was caused by the lack of increase in growth hormone after training. Of course, it can be said that the amount of blood lactate has not increased significantly. It has been reported that lactate and blood acidity play an important role in growth hormone secretion (19). However; Growth hormone and blood lactate changes were not measured in the present study; Therefore, caution should be used in interpreting the results. Another aim of the current research was to investigate the effect of simple pyramid resistance training on IGF-1 changes in postmenopausal women. The obtained results showed that resistance training has no effect on blood serum IGF-1 levels. As we mentioned earlier, limited studies have investigated the acute effect of resistance training on postmenopausal women. However; in the study by Ribeiro et al. (2016), the effect of simple versus traditional pyramid resistance training on IGF-1 responses in elderly women was investigated. The results of this study showed that hormonal responses increased in both groups during the first 12 hours. These researchers attributed this increase to the characteristics of simple pyramid resistance training and the increase of hormone receptors (20). The results of the present study did not confirm that high intensity can affect IGF-1 changes. Probably, this lack of alignment can be attributed to the sample size, the type of training protocol. Other studies conducted in line with the present study show that resistance training has no effect on IGF-1 levels. In this regard, Razmjoo et al. (2009) examined the acute and chronic effects of resistance training on IGF-1 changes in non-athlete girls. These researchers reported that there was no significant change in the amount of IGF-1, but an increase in muscle strength was achieved. They attributed the lack of increase in the amount of IGF-1 to the increase in the half-life of IGFBP-3, the increase of inflammatory factors (21). This was while the researcher was not able to measure these influential variables. Therefore caution should be used in interpreting the results. Sadeghi et al. (2008) attributed the increase in IGF-1 in connection with resistance training to the amount of rest between each set and pointed out that short-term rest leads to a greater increase in anabolic hormones. These researchers stated possible reasons for changes in acidity caused by muscle activity, increased growth hormone secretion, sympathetic nervous

system activity (noradrenaline) and low rest between sets (22). Also, Hoshyar et al. (2015) reported that strength training with two fertility patterns has a positive effect on some physiological and hormonal factors, especially IGF-1, in active young women. They reported that the increase in the amount of IGF-1 is related to the increase in growth hormone and lactic changes (23).

Conclusion

The purpose of this study was the effect of a simple pyramid resistance training session with and without BCAA supplementation on postmenopausal women. The results of this present study showed that a simple pyramid resistance training session with BCAA supplementation at the rate of 0.1 gram per kilogram of body weight before and after training has no effect on the initial increase of IGF-1. Also, other results showed that a simple pyramid resistance training session without BCAA supplementation has no effect on IGF-1.

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