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Effect of physical exercise using α-lipoic acid (ALA) and eicosapentaenoic acid (EPA) on physical fitness, recovery, and performance in young weightlifters

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ABSTRACT

The purpose of this study was to determine the effect of physical exercise using α-lipoic acid (ALA) and eicosapentaenoic acid (EPA) on physical fitness, recovery, and performance in young weightlifters. The design of the study was experimental. A total of 30 volunteer weightlifters took part in the study, which employed the random partition method. After taking their pre-measurements (height and weight), exercises were created to develop the components of physical fitness, and supplementation was provided for a duration of ten weeks to examine its impact on the other research variables, and the outcomes of the pre arithmetic means were compared. The two methods of homogeneity and equivalence were applied for the data of the research samples. Eicosapentaenoic acid (EPA), which lessens pain and helps the body restore its normal state, was favored by the second experimental group, where the values of the studied variables were better than in the other groups. Finally, α-lipoic acid (ALA) was crucial for recovery by 20% compared to conventional approaches.

KEYWORDS

α-lipoic acid; Eicosapentaenoic acid; Physical fitness; Weightlifting

1. INTRODUCTION

In the sport of weightlifting, it takes a long time to return athletes to their natural state and physical fitness, and this is one of the most important goals that coaches aim to develop, and it derives its importance from being one of the components of comprehensive fitness, which in turn qualifies the individual to live in a balanced way, and this requires that the individual is physically, psychologically and mentally qualified. Researchers and coaches are always finding ways to make exercise and performance better (Abd, 2022; Martínez-Sánchez et al, 2017).

The importance of physical fitness comes through its association with the requirements of training work on the one hand and achievement on the other hand, and for this reason the interest in physical fitness has increased, and given that man is an integrated biological unit whose parts cannot

be separated from each other, the dialectical link between physical and motor growth emerges. The difference in the structural composition of the body "plays an important role in athletic performance and contributes to reducing fatigue" (Ochi & Tsuchiya, 2018). It has been demonstrated in earlier studies that dietary supplements have a positive impact on strength performance. Several studies as well found that longer supplementation periods (over 8 weeks) are required to produce the beneficial effect of EPA and DHA intake on strength performance (Ochi & Tsuchiya, 2018).

A number of researchers have dealt with the study of physical fitness and anthropometric measurements from many directions, such as identifying the factors of physical growth, or studying the development of its tolerance with other variables to increase it or to relieve pain, and return to the normal state of athletes as soon as possible, and the reality indicates the role that physical construction plays in physical fitness, especially the percentage of damage and endurance in the sport of weightlifting (Tsuchiya et al, 2016; Ochi, Tsuchiya, & Yanagimoto, 2017; Phillips et al, 2003).

Lipoic acid is the subject of research for many recent studies, as alpha lipoic acid (ALA), also known as lipoic acid for short (LA) is an organosulfur compound derived from caprylic acid. It contains two sulfur atoms (at C6 and C8) connected by a chain of disulfide (dithiolane) bonds. Alpha-lipoic acid serves as the primary catalyst for the breakdown of aggregates in many compounds (Harris & Holly, 1987). EPA is a component of fish oil, which is used as a dietary supplement. It is, along with the rest of the omega-3 acids, one of the substances that are of vital importance for the body (Ochi & Tsuchiya, 2018). It is also an essential catalyst in enzymatic reactions related to glucose metabolism. Alpha-lipoic acid's cofactor, which is made up of four mitochondrial enzymes, is crucial. Aerobic metabolism requires alpha-lipoic acid to be produced and developed normally. Additionally, it can be found in dietary supplements that do not require a prescription. One of the most important functions of alpha lipoic acid is to stop the action of free radicals damaging the mitochondria and thus preserve the only source of energy for the cell. It is the least known antioxidant, but it is the most effective one because it is active in the aqueous and fatty media, which makes it effective in all tissues and cells of the body, especially in preserving brain tissues from the destructive action of free radicals, while the rest of the antioxidants are active in only one of the two media.

It is very important maintaining antioxidant systems in the body and restoring their activity after depleting them and using them again. Understanding how lipoic acid (ALA) and eicosapentaenoic acid (EPA) affect many measures of young weightlifters' physical fitness and performance gives this research its significance. It was noticed that the athletes after the effort suffer from great weakness and a decline in restoring the normal state of the body after the effort. After

studying the effects of amino acids such as lipoleic acid and eicosapentaenoic acid (EPA), the researcher suggested knowing their effect on the athletes in some indicators of physical fitness, as well as the achievement and recovery after the effort in training. From here, it was asked whether lipoleic acid and eicosapentaenoic acid (EPA) given to weightlifters have an effect on physical fitness, achievement and recovery. The researcher made the assumption that there would be statistically significant changes between the first and second experimental and control research groups' pre and post assessments of certain aspects of physical fitness, achievement, and recovery, in favor of the post test.

2. METHODS

2.1. Participants and design

The study sample was deliberately selected and invited from the volunteer weightlifting athletes in the clubs Al-Kut, Al-ettifaq and Al-Iskan in Iraq. The number of weightlifters who participated in the study was 30, after excluding the elderly and unhealthy ones and those suffering from health problems from all weight groups. They were all selected with an examination of the research variables (height, weight, percentage of lipoic acid and eicosapentaenoic acid (EPA) concentrations in the blood before and after the effort, the pulse before and after the effort, and the relative achievement of the snatch and lunge). After simple random division into three groups using lots, the homogenization and equivalence processes were carried out on them.

The groups were assigned in the following way: 1) The control group, which consisted of ten weightlifters that simply received physical exercise. 2) The first experimental group, which consisted of ten weightlifters that had physical exercise combined with the administration of lipoic acid. 3) The second experimental group, which consisted of ten weightlifters that had physical exercise combined with the administration of lipoic acid and eicosapentaenoic acid.

2.2. Instruments

The tools and devices used in this research were a standard tape of 1 meter of length, an electronic scale to measure body mass to the nearest 100 grams and height, and a device for taking and preserving blood samples. Also, for this study it was necessary a weightlifting hall and an auxiliary work team.

2.3. Procedures

2.3.1. Pre-test

After an exploratory experiment, the members of the two study groups in the field participated in a pre-test with the assistance of the work team to determine the most essential criteria for the main experiment, which was scheduled for Monday, October 1, 2022, at 5:00 pm. Squatting for the legs and indicators were taken (height, weight, the percentage of concentrations of lipoleic acid and eicosapentaenoic acid in the blood before and after the effort, the pulse before and after the effort, and the relative achievement of the snatch and lunge lifts).

The author utilized pharmacology- and drug-specific sources and references and gathered the opinions of numerous experts and specialists in the fields of sports training and pharmacophysiology regarding the method of administering acid during and after training for a duration of 10 weeks and within the following determinants:

1. The program lasted for ten weeks and was implemented in enclosed areas with some degree of competition. One training unit lasted around 60 and 90 minutes, and there were four of these units each week. The author's goal was to provide supplements of lipoic acid (100 mg/training day) and eicosapentaenoic acid (EPA) (220 mg/training day) 15 minutes after exertion in the oral form of syrup and tablets, respectively. From Monday, October 1, 2022, through Thursday, April 4, 2022, the training program was put into practice. The first week of the curriculum, which covers the first and second units, included a presentation on how to carry out the training units in practice in addition to how to use the daily supplement dosages. The author's duties were restricted to monitoring the instruction phases and supervising the program for the control and experimental groups. The training was done in stages, with the first stage consisting of 4 training units over a period of 2 weeks at a dosage of 100 mg per day. In the second step, training was done to boost the amount of giving acid produced prior to, during, and after exercising by raising the exercise's volume by four units over the course of three weeks. Furthermore, in a dosage of 150 mg. In the third stage, the training was conducted at the highest competitive intensity and the tests performed for weighlifters' achievement in the frequent lifts (jerk and snatch), at a rate of 3 units for a duration of 3 weeks, and in a quantity of 200 mg, which is the highest limit for ingesting in the training course and for supplements.
2. The gradualness principle was embraced, beginning with simple exercises on the floor and devices, and using exercises such as leaping and jumping from stabilization, and then progressing

to more challenging exercises and then to competition, as the challenge of the exercises is increased by raising the accomplishment load.

3. The recovery period following exercises was 2-5 minutes for each group. Heart rates were used to calculate training intensity and resting time.
4. The volume of the training was estimated related to the highest heart rate (220 - age x ratio), and the training unit was completed with cooling off activities. The control group was not educated using the same course for supplement administration, but rather with the coach's typical technique and in a different room.

2.3.2. Post-test

On Sunday, April 14, 2022, the researchers performed the post-test under identical settings as the pre-test for the first and second experimental groups and the control group after finishing the implementation of the training curriculum's terminology. The researcher collected the test results, which included bench press test, deadlift test, calves test, squatting for the legs, height, weight, percentage of concentrations of lipoic acid and eicosapentaenoic acid (EPA) before and after the effort, pulse before and after the effort, and the relative achievement of the snatch and lunge lifts.

2.4. Statistical analyses

The statistical analyses were carried out with the Statistical Package for the Social Sciences, SPSS, version 25. The statistical analyses conducted by the researcher included means, standard deviations and t tests.

3. RESULTS

Table 1 shows the findings of the mathematical means, standard deviations, T value, and significance of the differences for the bench press test, the dead lift test, the squatting test for the legs, height and weight, as well as the ratio of lipoleic acid and eicosapentaenoic acid (EPA) concentration levels before and after the exercise. Table 1 also shows the results of the heart rate during and following the exercise, as well as the relative success of snatch and lunge lifts for the experimental and control groups' baseline and follow-up assessments.

Table 1. Results of the pre and post tests

Groups	Variables	Pretest		Post-test		T Value	Significance of differences
		Mean	SD	Mean	SD		
Control	ALA/mg before effort	154.71	5.76	154.42	6.52	1.564	Non-significant 11% change
	ALA/mg post-workout	70.45	3.29	70.21	3.88	2.009	
	Deadlift/kg	3.527	1.62	74.72	1.63	2.018	
	Squat/kg	102.62	3.62	102.63	3.63	1.435	
	Bench press/kg	67.64	4.638	68.78	4.93	2.083	
	Height/cm	155	1.27	156	1.67	2.001	
	Weight/kg	78.77	2.07	78,73	2,04	1.063	
	Achievement clean and jerk	1.50	1.01	1.22	1.09	1.331	
	Snatch achievement	1.22	1.08	1.18	1.19	1.14	
	Pulse before exertion	84	2.43	81	2.11	1.52	
	Pulse after exertion	97	2.63	99	2.20	1.28	
Experimental 1	ALA/mg before effort	154.68	5.40	176.08	6.65	2.562	Significant 17% change
	ALA/mg post-workout	68.97	3.44	78.43	3.54	4.729	
	Deadlift/kg	3.587	3.54	84.88	3.22	2.518	
	Squat/kg	101.42	3,82	110.68	3.03	3.524	
	Bench press/kg	64.88	4.03	72.72	4.32	3.823	
	Height/cm	154	1.06	155	1.67	2.271	
	Weight/kg	57.78	2.15	76.02	2,07	2.073	
	Achievement clean and jerk	1.52	1.04	1.22	1.05	2.507	
	Snatch achievement	1.24	1.09	1.40	1.12	3.143	
	Pulse before exertion	82	2.27	78	2.11	2.410	
	Pulse after exertion	95	2.73	94	2.32	-3.28	
Experimental 2	EPA/ALA/mg before effort	155.33	5.20	180.31	5.60	.2884	Significant 20% change
	EPA/ALA/mg post-workout	68.90	2.77	80.90	4.65	.6654	
	Deadlift/kg	1.507	3.88	87.90	4.21	2.728	
	Squat/kg	102.05	3,77	112.64	3.70	3.112	
	Bench press/kg	61.75	4.33	78.80	4.44	3.927	
	Height/cm	154	1.06	155	1.67	2.931	
	Weight/kg	57.78	2.15	76,02	2,07	2.863	
	Achievement clean and jerk	1.51	1.04	44.1	1.12	5.543	
	Snatch achievement	1.22	1.03	1.48	1.11	3.180	
	Pulse before exertion	85	2.32	77	2.17	7.329	
	Pulse after exertion	98	2.77	92	2.21	-4.77	

4. DISCUSSION

Only the first and second experimental study groups showed significant variations between the pre and post-tests, and these differences were in benefit of the post tests. Regarding the control group, there were no significant variations. The training program, which was favorably represented in the development of such variables for the research sample, is what the author attributes for this positive change. The experts' viewpoints concur that the training program fosters accomplishment since it was developed on a rational foundation in arranging and programming the procedure,

utilizing suitable and incremental intensity, perceiving the required individual differences, while using the best possible repeats and an efficient inter-rest timeframe, under the guidance of highly specialized trainers. Ochi & Tsuchiya (2018) indicate that the performance of aerobic exercises of high intensity (within the limits of aerobic action) leads to a change (increase) in the lipoic acid level in the blood plasma.

As for the research variables, all the results were also of significant importance for the first and second experimental groups, with preference for the second experimental group. In addition, the improvement of heart function as a result of these approaches also helped in reducing the heart rate, which in turn worked on increasing the fitness components (Wiecek, 1990; Ochi & Tsuchiya, 2018; Phillips et al, 2003).

The improvement of the circulation and breathing systems means an increase in the ability of working muscles to benefit from most of the amount of oxygen and antioxidants carried by the blood, which causes an increase in the efficiency of muscle work and an improvement in the condition of the patient. As for the weight variable, all the results were significant, and for the experimental group, the lipoic acid supplement is of great importance in controlling weight when practicing these approaches, which are characterized by a relatively long performance period, which contributed to the reduction of the amount of fat in a relative way, which showed significant differences. It was also observed that the regularity in practicing physical programs continuously and moderately leads to a decrease in the level of blood pressure accompanied by a decrease in the amount of fat at the same time (Harris & Holly, 1987; Al-Selmi et al, 2019).

The supplement has the ability to raise the fitness levels of the weighlifters, which is reflected in the results of the achievement. Alpha Lipoic Acid (ALA) is synthesized enzymatically in the mitochondria from octanoic acid and plays a very important role in mitochondrial energy metabolism. Weight is also an important factor, albeit in a small amount (Gasso, Bogdanov, & Domingo, 2008; Al-Selmi, Al-Shawi, & Mohammed, 2019). It has been found that supplementing EPA has an advantage after exercise to increase muscle recovery (Tinsley et al, 2017) in conjunction with other supplements to increase its nutritional effectiveness (Lee & Clarkson, 2003).

5. CONCLUSIONS

This study demonstrated the importance of dietary supplement (lipoic acid ALA) with physical exercise for a period before and after effort to increase physical fitness indicators and reduce recovery time in weighlifters. The results showed the superiority of the second experimental group in the indications of giving the dietary supplement lipoic acid and eicosapentaenoic acid, which

enhanced performance and achievement. Lipoic acid and eicosapentaenoic acid are very important for recovery by 20% compared to traditional methods. There was no improvement in the control group that did not take nutritional supplements.

The author recommends to generalize the results of this study on sports teams to benefit from giving nutritional supplements. Future research should conduct studies on other sports and other age groups.

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All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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