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Research Article

The Effect Of Creatine Supplementation On Lipid And Hormone Metabolism In Athletes

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ARTICLE INFO	ABSTRACT
	The aim of this study was to see the effect of creatine supplementation on lipid and hormone metabolism in long-distance athletes. The study included 12 male athletes. In light of the athletic competition season, an eight-week, ninety-minute training program was implemented for the research group four days a week. The program included 5-10 minutes of warm-up time, 55-65 minutes of athletic training and studies to build basic motoric characteristics, and 5 minutes of cool-down activities at the conclusion. The trainings were customized to the study group's fitness level and used throughout the training session. Besides physical training, the research group received 200 mg of creatine daily. Blood samples were taken from the athletes in the research group twice, at the beginning and at the end of the training program. The SPSS package program was utilized to analyze the data. Following the normality study, parametric tests were applied on the data that was judged to have a normal distribution. The significance level was considered as $p<0.05$. When the athletes' thyroid hormone levels were compared before and after training, it was discovered that there was a substantial variation in TSH levels. When the athletes' hormone levels were measured before and after training, it was shown that there was a statistically significant difference in total testosterone, cortisol, and GH pre-post test levels. When the alterations in the athletes' lipid metabolism before and after training were assessed, only total cholesterol showed a significant difference.

Introduction

Scholars discovered the creatine kinase reaction in 1927, research results for phosphorylcreatinine (PCr) first focused on the metabolic involvement of cells and tissues with high energy requirements, as well as the biochemical, physiological and pathological aspects of the CK reaction itself. Although there has not been much interest in Cr metabolism in general, a number of interesting studies have been done recently. As a result of current research, it has been shown that Cr analogs are effective anticancer agents that work together with existing chemotherapeutics. It has been shown that cyclocreatine and PCr, one of the Cr analogs, may have an effect on organ transplantation as well as protecting the tissues in terms of ischemia damage.
Indirect evidence suggests that disturbances in Cr metabolism are related to muscle problems and disorders. In addition, it has been stated that oral CR supplementation has benefits against damage to the organism. Oral intake of Cr has also been shown to improve athletic performance, and it is therefore not surprising that Cr is currently applied as a performance-enhancing supplement by many athletes (Harms, 1995).
Creatine supplementation is an ergogenic aid widely benefited by athletes and physically active individuals to increase aerobic and anaerobic strength, improve performance, and stimulate the protein synthesis process and musculoskeletal hypertrophy (Hall and Trojian, 2013). Creatine use and administration also have antioxidant activities (Sestili et al. 2006). Yet, when combined with its ability to restore intracellular energy levels, creatine administration has also led to its use for therapeutic purposes on cardiovascular, neurological, metabolic, muscle disorders and hormones (Kley et al. 2013; Persky and Brazeau, 2001).
Creatine is a non-essential, naturally occurring derivative of guanidine and is one of the most used supplements among ergogenic supplements. The use of creatine has increased especially after the athletes stated that

creatine supplementation increased sportive performance in the Barcelona Olympics in 1992. It has been stated that creatine monohydrate is the most effective ergogenic support in terms of athletic performance, and it provides recovery as well as preventing muscular problems that occur as a result of training. (Bayram and Öztürkcan, 2020; Gençoğlu et al. 2021).

Some researches indicate that creatine supplementation may increase performance, particularly in phosphocreatine-dependent high-intensity, short-duration workouts, notably in laboratory tests including repeated exercise regimens with minimal recovery time in between (Balsom et al. 1994).

In addition to being physically active, athletes are also interested in diet methods that will increase athletic performance. Creatine (Cr) is placed in a special place in this category because it is one of the most popular and scientifically supported supplements in terms of sports performance. Creatine is known as a naturally occurring, non-protein nitrogen compound synthesized in the liver and kidney from the precursor amino acids "arginine, glycine, and methionine. The majority of Cr in the body (95%) is located in muscle, while two-thirds of it is stored in the form of phosphoryl creatine. and the remaining one third is as free Cr, and less than 5% is found in other tissues, testis and brain (Buford et al. 2007).

Material Method

Research Group

12 male athletes who are licensed in the athletics branch and regularly participate in their training participated in the research group voluntarily. In addition to athletic training, the research group was given 200 mg daily creatine supplementation.

Training Program

In light of the athletic competition season, an eight-week, ninety-minute training program was implemented for the research group four days a week. The program comprised 5-10 minutes of warm-up time, 55-65 minutes of sports training and studies to build basic motoric characteristics, and 5 minutes of cool-down activities at the conclusion. The trainings were tailored to the study group's fitness level and used throughout the training session.

Gathering and Analysis of Samples

Blood samples were taken from the athletes in the research group twice, at the beginning and at the end of the training program. The athletes participating in the study were followed during the training and the athletes with metabolic problems were excluded from the study. In the blood samples taken as a result of the training, the athletes; thyroid hormones (TSH, T3, T4), insulin, total testosterone, cortisol, GH, ACTH, HDL, LDL and total cholesterol levels were determined. The blood samples acquired from the athletes were taken by experts in the private hospital laboratory by means of a fully automatic hemogram named “Coulter Stks”, and the analyzes were made while the athletes were sitting and resting.

Analysis

The data were analyzed in the SPSS package program. After the normality analysis of the data, parametric tests were used for the data determined to have a normal distribution. Paired Samples t-test was used to compare the pre-post test data of the research group. Significance was accepted as $p<0.05$.

Results

Table1. Thyroid Hormone Changes of Athletes before and After Training

Parameters	Pre Test	Post Test	t	P
TSH	1,20±0,39	1,85±0,91	-2,246	0,04*
T3	5,83±0,59	5,36±0,55	1,695	0,11
T4	16,74±1,19	16,86±1,81	-,251	0,80

*: p<0,05

When Table 1 was monitored, it was specified that there was a statistically significant difference between the thyroid hormone metabolism of the research group and the TSH pre-post test values ($p<0.05$), while there was no statistically significant difference between the T3 and T4 values and the pre-post test values (p>0, 0). 05).

Table 2. Hormonal Changes of Athletes before and After Training

Parameters	Pre test	Post test	t	p
Total Testosterone	3,89 ±1,14	4,76 ±1,21	-3,380	0,00*
Insulin	14,11 ±7,95	18,20 ±12,18	-,950	0,36
Cortisol	7,17±2,35	11,63±2,73	-5,114	0,00*
GH	0,53±0,18	2,23±0,90	-2,579	0,02*
ACTH	23,55±5,95	25,51±7,64	-,822	0,42

*p<0,05

When the hormone levels of the athletes at the end of the training were evaluated in Table 2; total testosterone, cortisol and GH pre-posttest levels were found to be statistically significant (p<0.05), while insulin and ACTH pre-post test levels were not statistically significant. difference (p>0.05).

Table3. Hormone Changes in Lipid Metabolism of Athletes before and After Training

Parameters	Pre test	Post test	t	P
HDL	43,95±5,96	42,84±9,69	,390	0,70
LDL	81,79±25,08	73,53±16,92	1,595	0,13
Total Cholesterol	153,50±20,72	139,75±29,02	2,771	0,01*

*: p<0,05

When the Table 3 was scrutinized, it was revealed that there was a statistically significant difference between the lipid metabolism and total cholesterol pre-post-test values of the research group (p<0.05), while there was no statistically significant difference between the pre-post-test values of HDL and LDL values (p>0.05).

Discussion

Literature support on how creatine supplementation can affect metabolism during exercise has been discussed. In conclusion, there is evidence that exercise can increase Cr loading, and very limited data suggest that consuming Cr close to exercise sessions may be more beneficial than taking Cr at other times of the day, at least in terms of muscle Cr loading. However, there is some disagreement as to whether reinforcement time has an effect before, during, or after exercise.

Recent studies have shown that when compared to pre-exercise administration, post-exercise Cr supplementation can enhance muscular mass but not strength. However, given the theoretical factors, processes, and a number of methodological restrictions highlighted by current research on Cr absorption into muscles, interpretation of these data is limited.

In a determinant study by Harris et al. (1992), it was shown for the first time in humans that supplementation of Cr in varying doses of 20-30 g per day, in several separate doses of 5 g throughout the day, can increase total intramuscular Cr content (TCr = PCr + Kr) up to 20%. Multiple subsequent studies have indicated the effectiveness of Cr supplementation in increasing muscle Cr content, including using more gradual loading protocols (Green et al. 1996). An assessment of other research on lipid metabolism and hormone regulation of creatine supplementation in exercise is especially pertinent given the modest Cr dosages employed in these studies. A high daily dose of Cr (eg, 20 g•day-1) appeared to saturate the muscle Cr content within 5-7 days, meaning that with such a high dose the timing of supplementation would likely be unimportant. Nevertheless, as lower daily doses (eg, 5 g•day-1) will only saturate muscle Cr for up to 28 days, it is likely that increased loading due to timing may provide greater utilizations with these lower doses. Results in the early phases of supplementation, for example, the first 1-3 weeks with low doses (eg, 5-7 g day-1) may be most important because measurements (after muscle Cr is already saturated) can barely vary (Solis et al., 2017). Yu and Deng (2000) applied a single dose of creatine (50 mg/kg) to mice, but it was monitored that this did not change urinary methylamine and formaldehyde excretion. As can be realized from the issue; In accordance with the results obtained from this study, it was concluded that creatine supplementation did not have a significant effect in mice. Erdoğan (2020) stated in his study that endurance training causes changes in the thyroid hormone metabolism and some biochemical parameters of the athletes. Akın and Arıkan (2020) found in their study that eight-week endurance training did not affect the irisin hormone levels of healthy young adults, but caused changes in body fat percentage, glucose and lipid metabolism. Pancar (2020) found in his study that six-week core exercises caused changes in the thyroid hormone metabolism of the participants. Akbulut et al. (2019) determined in their study that vitamin E supplementation applied in addition to HIIT training positively affects the thyroid hormone levels of athletes. Selçuk et al. (2018) determined that an acute training program caused changes in some biochemical parameters of the athletes. Margeli et al. (2005) evaluated the biochemical changes before and after the competition and found that there were changes in the lipid metabolism of the athletes. Shirali et al. (2016) determined that the athletes caused changes in lipid metabolism and body weight in their study in which they applied a six-week exercise with carnitine. Kiani et al. (2022) determined that moderate-intensity exercises caused changes in the thyroid hormone levels of the participants.

The researchers concluded that chronic administration of large amounts of creatine could increase formaldehyde production in healthy men, which could potentially cause serious unwanted side effects.

Result and Suggestions

So even though Cr supplementation with exercise appears to increase Cr accumulation in muscles, data supporting the importance of scheduling Cr supplementation around exercise is currently limited to only a few studies; studies suggesting that its use before, after, or during exercise may be more effective are currently restricted to only a few experiments.

In the meantime, customizing Cr timing especially to when training is undertaken is not backed by reliable research and should not be regarded as a significant problem. To verify such claims, more controlled research

determining whether timing of Cr administration during exercise increases intramuscular Cr content and whether this alters its ergogenic benefits may be required.
Creatine is deemed safe for short-term usage and has no noticeable negative effects, although care is suggested due to the scarcity of long-term research. The recommended dose varies, and many various regimens are beneficial. Creatine supplementation has not been researched in children or teenagers. The scientific literature currently favors creatine supplementation for improved performance in short-term, high-intensity resistance training.

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