Journal of Sports Physiology and Athletic Conditioning (J.S.P.A.C) 2021; 1 (1): 1-10

Research Article

The Effects of Coenzyme Q10 Supplementation with Two Consecutive Soccer Games on Stress Oxidative and Muscle Injury Markers in Male Collegiate Soccer Players

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Received: 29 June 2021
Revised: 3 July 2021
Accepted: 18 July 2021

Abstract

Background: This study aimed to investigate the effect of coenzyme Q10 consumption for fourteen days on the response of some indicators of oxidative stress and muscle damage following two consecutive football matches in college players

Materials and Methods: for this purpose, 24 football players (with an average age of 20.08±12.1 years, a weight of 63.28±65.1 kg and a maximum oxygen consumption of 53.12± 0.98 ml /per /kg of body weight) The three groups were studied over a fourteen-day period. The control group did not receive these supplements and exercise activities, but the experimental groups included the placebo group (300 mg aspartame) and the coenzyme Q10 group (300 mg ubiquinone supplement) during the course in addition to receiving a placebo or supplement the two 90-minute football matches were less than 48 hours apart. Then, according to the research plan, blood samples were collected from the subjects in two stages 24 hours before and after the period and MDA, LDH, CK and AST indices were measured. Dependent t-test, one-way analysis of variance and Tukey's post hoc test were also used.

Results: The results showed a significant difference between serum coenzyme Q 10 supplementation with serum MDA (P = 0.000) and AST (P = 0.006) concentrations from two consecutive football matches, while LDH levels (P = 0.970) and serum CK (P = 0.911) did not change significantly.

Conclusion: Overall, the results show that supplementing coenzyme Q10 before and during a two-week match can have anti-oxidant benefits, so it can be recommended to college soccer players.

Keywords:
Coenzyme Q10, Muscle, Oxidative Stress, Soccer Games

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1. Introduction

Multi-speed sports such as soccer are distinguished by periods of intense activity (sprinting, running, shooting, jumping and tackling) among low-intensity activities (jogging and walking) and active and inactive recovery (1). During a soccer match, players reach an average and peak heart rate of 85 to 98% of their maximum values, and their blood lactate levels range from 2 to 14 m/mol (2), which indicates a high rate of anaerobic energy recovery and average capacity. Aerobics is about 75% of the maximum oxygen consumption (VO2max) (3). The total distance traveled is about 9 to 12 kilometers, which is approximately equivalent to 1350 runs, of which 220 high-speed runs are performed in 4 to 6 seconds in one game. Soccer requires the major production of eccentric forces, which is often associated with muscle injury and is clinically manifested as increased muscle pain (4). Muscle damage is occurring mainly due to mechanical stress and impaired calcium homeostasis (5) and is experienced by the athlete as a feeling of muscle irritation and pain. The severity of this irritation increases in the first 24 hours after exercise and peaks at 24 to 72 hours, then subsides and finally disappears 5 to 7 days after exercise (6). This phenomenon is known as delayed onset muscle soreness (DOMS). Exercise-induced muscle injury is associated with an acute-phase inflammatory response characterized by intramuscular phagocytic filtration, free radical production, and an increase in cytokines and other inflammatory molecules (7). All of this production can also induce ROS. Regular soccer practice improves the "lymphocyte strategy" in clearing the ROS and increasing protection against oxidative stress (8).

Showed that a friendly soccer match could trigger lymphocytic activity in ROS and oxidative damage, but that stimulation was not sufficient to elicit a defensive response, thus creating a "post-exercise oxidative stress crisis." Becomes. It is found that the density of official matches with low recovery (for example, three official matches in a week) can cause ROS production and oxidative stress, exposing soccer players to muscle damage and suppression of the immune system, and finally It causes their performance to decline.

Coenzyme Q10 (CoQ) is an exogenous cofactor of enzyme produced in all living human cells and acts as a catalyst for proton / electron transport in mitochondria and lysosomes (9) and from mitochondria to decrease radical damage. CoQ10 is mainly transported by lipoproteins in the blood and can have an antioxidant function (10). Recent evidence has shown that CoQ10 can regenerate alpha tocopherol and ascorbate. Circulates or regenerates and can block the peroxidant effects of alpha tocopherol (11) and ultimately provide lipoproteins that are highly resistant to oxidation (12). Potential benefits of CoQ10 supplementation in cardiovascular disease and nerve damage has been identified (13).

Therefore, the aim of this study was to evaluate the effect of CoQ10 supplementing for 14 days with two consecutive soccer matches on oxidative stress indices and muscle tissue damage in college soccer players.

2. Materials and Methods

Subjects

The present study is semi-experimental and applied and will be conducted on 24 college male soccer players. These subjects are the selected players of the eight Islamic Azad University region who will be selected by available (targeted) sampling from among the selected fourteen regions of the Islamic Azad University. After selecting the subjects, first the subject of the research, the purpose and method of its implementation, as well as the possible applications and risks that will follow for them will be informed. Subjects then voluntarily sign a written consent to participate in the research process. After that, their health status and history in the last few months will be examined through a questionnaire. In the absence of patients with effective immune systems, infections, and muscle injuries, "eligibility of the subject" will be established. Then the subjects are randomly divided into three groups according to the quasi-experimental method and research objectives. The criterion for classification will be supplementation or placebo. The first group is the group that receives coenzyme 10Q supplement before and during the competition week and is called coenzyme 10Q supplement group (8 people). The second group is the group that receives an equal amount of placebo before and during the week of the competition and is called the placebo group (8 people), the third group is the group that does not receive any supplement, does not participate in the competition and during the research period, they only follow their normal activities and the control group (8 people) is called. The anthropometric characteristics measured were: height, weight and maximum oxygen consumption (hoff and helgerud test), which are measured two weeks before the start of the course.

To measure the subjects' VO2max, the Hoff and Helgerud tests (on the soccer field) are used. In this test, some soccer -like actions are performed for 8 minutes and the maximum oxygen consumption is calculated according standards.

Protocol

Co Q10 supplement

In this study, supplementation will be done in a 14-day period with two consecutive soccer matches. In the Co Q10 supplement group, test subjects will consume 300 mg of Co Q10 daily in the form of 3, 100 mg oral capsules with their main meals. In the placebo group, subjects will receive equal capsules containing aspartame sugar per day, and in the control group, no supplement will be received by subjects. During this 14-day period, subjects in the experimental groups receive their supplements and placebo every day after breakfast, lunch, and dinner, and then perform their supplementation schedule at 6-18 pm on the twelfth- and fourteenth-days' soccer competition will pay off. In addition, all groups completed the McArdell Food Reminder Questionnaire during the course.

Two consecutive races in less than 48 hours

Players are asked to play two competitive matches in the final three days in the form of two homogenized teams A and B (for example, on Saturdays and Mondays at 4-16 pm) so that some of them are crossed out and the main characters are identified. Obviously, this will increase the motivation of the players and their level of competition.

Sampling

To collect basic information, subjects are referred to the laboratory 24 hours before the start of the course and a blood sample of 5 cc of resting anterior vein is taken in a sitting position. The anthropometric characteristics to be measured are: their height, weight and maximum oxygen consumption (Huff and Hilgord test) which is performed in the first session and after the initial blood sampling. Also, blood samples similar to the initial state are collected 24 hours before the start of the period and 24 hours after the period.

Biochemistry measurement

(TBARS chemical colorimetric method, Cayman MI, USA, Intra assay CV%: 5.9 Sensitivity: 0.08 μM) Measurement of serum malondialdehyde perform using a valid American kit (TBARS kit, Cayman Chemical Co., MI, USA). The basis of this kit was chemical colorimetry and the basis of measurement was the reaction between malondialdehyde with thiobarbituric acid and the formation of a color complex. The sensitivity of the method used was 0.08 and the coefficient of variation within the test was 5.9%.

Creatine kinase was measured by photometric method (Pars Azmoun, Iran, Intra assay CV%: 1.6, sensivity: 1 U / L). Aspartate aminotransferase was quantitatively measured by IFCC enzymatic method. Lactate dehydrogenase was measured by Pars Azmoun photometric method, Iran, Intra assay CV%: 2.1, sensivity: 5 U / L.

Statistical analysis

The obtained information is classified and described based on the mean and standard deviation. To compare the means in each group, paired t-test is used and to compare the means between the three groups, one-way analysis of variance (ANOVA) is used separately for the stages before and after the period. The Tukey post hoc test is used to determine which two means are significantly different.

3. Results

The table 1 shows the anthropometric and physiological characteristics of the subjects separately for each group.

MDA

As Figure 1 shows, 24 hours after the supplementation period and two consecutive soccer matches, the serum MDA concentrations in the placebo (PG) group were significantly different from before the period. Thus, the dependent t-test showed that the serum MDA increased in the PG group after 24 hours (P = 0.001). Tukey post hoc test showed that the serum concentration of MDA was significantly different in the control and placebo groups (P = 0.000) and in the placebo and supplement group Q10 (P = 0.000). In other words, in the placebo and Q10 supplement groups, the serum MDA concentration was significantly different in response to coenzyme Q10 supplementation and two consecutive soccer matches during it (Fig 1).

Table 1: The Anthropometric and physiological characteristics of the subjects

Groups	Control (CG)	Placebo (PG)	Q_{10} (QG)
Age (Year)	19.04 ± 1.01	19.44 ± 0.72	20.06 ± 0.05
Weight (Kg)	66.33 ± 5.53	65.83 ± 6.11	67.00 ± 3.86
Hight (cm)	178.00 ± 6.53	175.00 ± 5.21	172.30 ± 5.57
BMI (kg/m2)	19.96 ± 0.30	20.10 ± 0.48	20.70 ± 0.55
Vo_2max (ml/kg.min-1)	54.20 ± 2.51	56.20 ± 3.01	55.08 ± 2.11

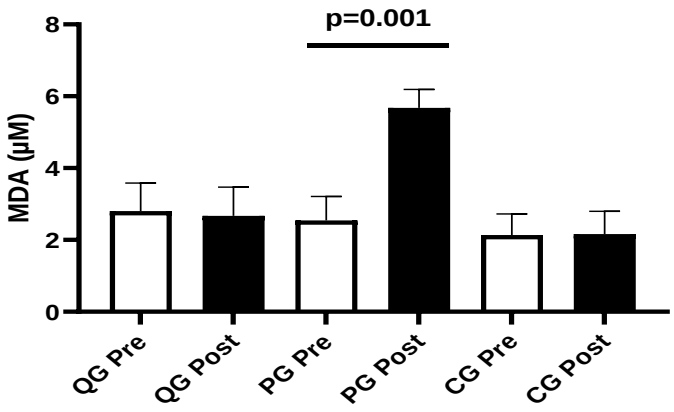

Figure 1. Mean ± standard deviation of serum MDA values of soccer players in different stages.

LDH

24 hours after the supplementation period and two consecutive soccer matches, serum LDH levels in different groups were not significantly different from 24 hours before the start of the period (Fig 2).

Also, the F and P values calculated from the one-way analysis of variance test did not show a significant difference between coenzyme 10 Q supplementation and serum LDH concentration due to two consecutive soccer matches.

CK

As Figure 3 shows, 24 hours after the supplementation period and two consecutive soccer matches, the serum CK concentrations in the placebo (PG) group were significantly different from before the period. Thus, the dependent t-test showed that the amount of serum CK enzyme increased in the PG group after 24 hours after the period (P = 0.001). The F and P values calculated from the one-way analysis of variance test did not show a significant difference between coenzyme Q10 supplementation and serum CK concentration due to two consecutive soccer matches.

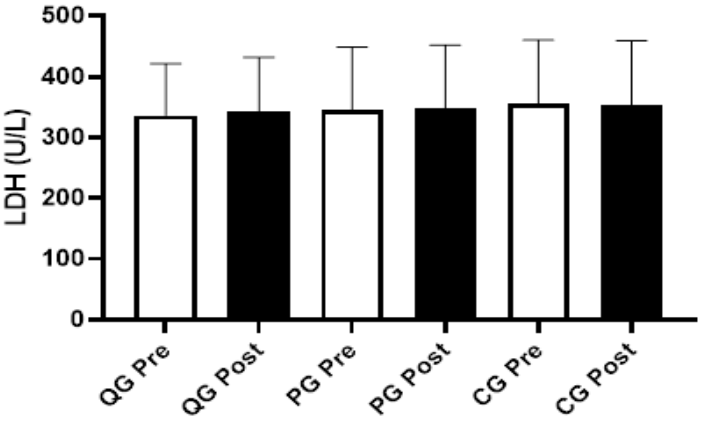

Figure 2. Mean ± standard deviation of serum LDH values of soccer players in different stages. Abbreviation: QG: Q10 group, PG: Placebo group, CG: Control group

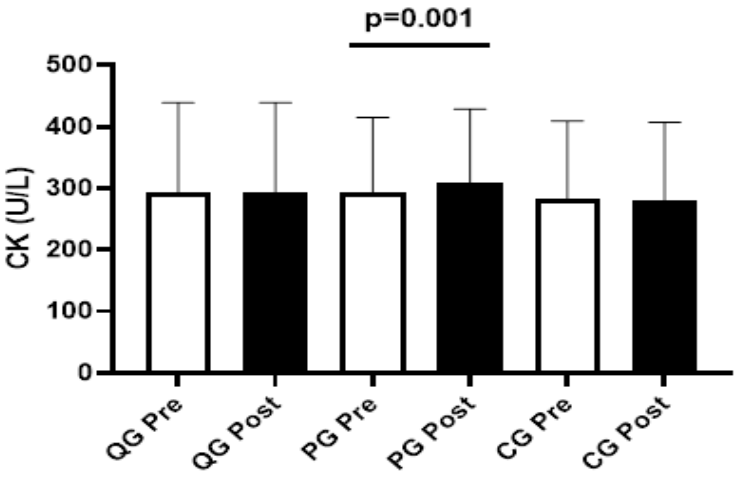

Figure 3. Mean ± standard deviation of serum CK values of soccer players in different stages. Abbreviation: QG: Q10 group, PG: Placebo group, CG: Control group

AST

As Figure 4 shows, 24 hours after the supplementation period and two consecutive soccer matches, the serum AST enzyme concentrations in the placebo (PG) group were significantly different from before the period. Thus, the dependent t-test showed that the serum AST level increased in the PG group after 24 hours after the period (P = 0.004). Tukey post hoc test showed that the serum AST concentration was significantly different in the control and placebo groups (P = 0.008) and in the placebo and supplement group Q10 (P = 0.023). In other words, in placebo and Q10 supplement groups, serum AST concentration was significantly different in response to coenzyme Q10 supplementation and two consecutive soccer matches during it.

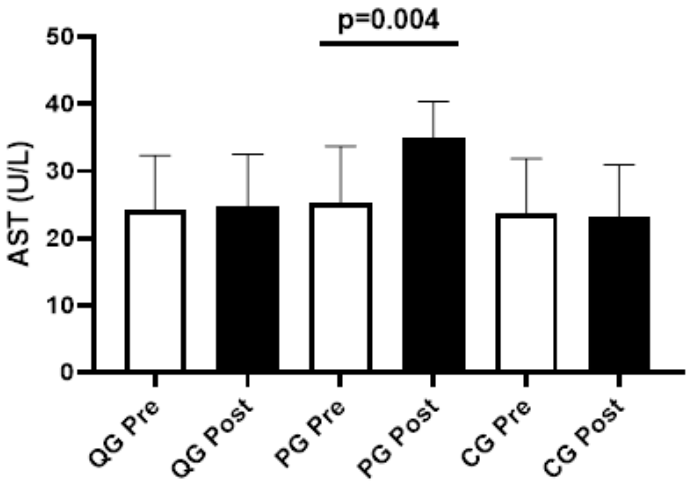

Figure 4. Mean ± standard deviation of serum AST values of soccer players in different stages. Abbreviation: QG: Q10 group, PG: Placebo group, CG: Control group.

4. Discussion

The high intensity of soccer matches sometimes provides favorable conditions for the pressure on the oxidation system and the production of free radicals and eventually lipid peroxidation. In recent years, various strategies have been adopted to supplement antioxidants, all of which seek to reduce exercise-induced injury (14). This study evaluates the effect of CoQ10 supplementing for 14 days with two consecutive soccer matches on oxidative stress indices and muscle tissue damage in college soccer players.

Asensau et al. (2008) in their study of the effect of a formal soccer match on plasma levels of oxidative stress indicators found that MDA increased throughout the period and suggested that intense soccer match could increase levels of oxidative stress and muscle damage up to 72 hours after It will increase (14). Dacosta et al. (2011) also observed a significant increase in MDA and CK enzyme levels during the LIST test (especially for soccer) in young Brazilian players (15). Coenzyme Q in mitochondria and lysosomes smoothes redox cycles as protons cross the membrane in the form of proton gradients. High concentration of quinol in all membranes; Provides the basis for antioxidant action by direct reaction with radicals or by reduction of tocopherol and ascorbate (2). Studies in the redox control of cellular signaling and gene expression have shown that coenzyme Q10 stimulates cell growth, inhibits programmed cell death, and controls the thiol group, hydrogen peroxide formation, and membrane channels (16). It has been show that coenzyme A Q10 supplementation (intravenous injection) reduced the increase in muscle injury indices in rats following downhill running. COQ10 protects cultured cells against electrical stimulation induced by the release of lactate dehydrogenase. It is possible that exercise-induced muscle damage does not decrease because the intake of COQ10 required to increase the concentration of COQ10 in muscle tissue has been low in previous human studies. For example, Kaikan et al. Attributed the ineffectiveness of COQ10 to its low dose. COQ10 stabilizes the phospholipid structure of cell membranes and protects cultured muscle cells against electrical damage caused by electrical stimulation (17). Bilo et al. Reported that coenzyme 10Q supplementation significantly increased COQ10 levels in cell membranes. Therefore, COQ10 supplementation may improve muscle damage by increasing the concentration of COQ10 in cell membranes and, consequently, stabilizing cell membranes. However, in addition to ROS-induced cell damage, endogenous antioxidant defense has been shown to be activated (18). Because in this study the baseline levels of MDA in both groups increased after three months of supplementation, it can be assumed that in line with the increase in MDA levels as a result of regular exercise. DT-diaphorase activity has also shown an increase (19). However, more research is needed to determine the effect of Q supplementation on DT-diaphorase activity. An increase in plasma MDA levels after exercise has been reported in many studies. It seems that the increase in MDA values after exercise in men athletes is probably due to the intensity of exercise activity that develops in soccer players according to their playing position (20). Preservation of carbonyl protein derivatives after a soccer match is consistent with the findings of Miyazaki et al. (2001).

A strong association between serum and urinary carbonyl protein derivatives has been reported in previous research (21) And it is suggested that carbonyl protein filtration prevents its accumulation in plasma. Therefore, the results of this study show that the effect of antioxidant levels due to carbonylated protein derivatives in the supplement group is less compared to the placebo group. In fact, antioxidant supplementation has affected not only carbonyl derivatives but also plasma MDA levels. Overall, it is suggested that even with low levels of oxidative stress indices, mild antioxidant supplementation can have beneficial effects, as in the supplement group, after exercise, levels of MDA and plasma carbonyl protein are reduced.

5. Conclusion

Overall, the results show that coenzyme Q10 supplementation before and during a two-week race can have antioxidant benefits and prevent muscle tissue damage. Therefore, it can be recommended for university soccer players to use it in high-intensity training and competition courses.

Acknowledgements

The authors would like to thanks all the participants who participated in this research.

Funding

None

Compliance with ethical standards

Conflict of interest: The authors declare that they have no conflict of interest.

Ethical approval: The research was conducted with regard to the ethical principles.

Informed consent: Informed consent was obtained from all participants.

Author contributions

Conceptualization: H.SH., E.A.; Methodology: H.SH., E.A.; Software: H.SH., E.A.; Validation: H.SH., E.A.; Formal analysis: H.SH., E.A.; Investigation: H.SH., E.A.; Resources: H.SH.; Data curation: H.SH.; Writing - original draft: H.SH.; Writing - review & editing: H.SH., E.A.; Visualization: H.SH.; Supervision: H.SH.; Project administration: H.SH.; Funding acquisition: H.SH., E.A.

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