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European Journal of Experimental Biology, 2014, 4(3):176-181

ISSN: 2248 –9215
CODEN (USA): EJEBAU

The effect of short-time supplementation with vitamin E and Q10 coenzyme on maximum strength, flexibility and power in 15-17 years old female Kumite Karateka

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ABSTRACT

The present study investigates the effect of two anti-oxidant supplements including vitamin E and Q10 coenzyme on the maximum strength, flexibility and power of Karateka girls. 36 karate player girls between 15 to 17 years old from the statistical population (N=275) have voluntarily enrolled in the present study and were randomly placed into 3 groups (vitamin E supplement group, Q10 coenzyme supplement and control group). The experimental groups of 12 subjects: experimental group1 consumed vitamin E supplement (400 IU daily) and experimental group 2 consumed Q10 supplement coenzyme (100 mg daily) for 14 consecutive days with dinner while the control group consumed no supplementary or placebo. The tests related to maximum strength, flexibility and power were hold before and after consuming supplement. Data were analyzed by the use of one-way ANOVA for measuring the difference between groups and Tukey follow up test for determining the difference between groups at significant level of $\alpha \leq 0.05$. The findings indicated that no significant difference was seen in maximum strength of muscles of back and lower body, flexibility, peak power and average power in all three groups, but just the maximum strength of lower body muscles significantly increased after consumption in two supplementary group rather than control group ($p \leq 0.05$). It can be concluded that 14 days of consumption vitamin E supplement and Q10 coenzyme can be effective on the maximum strength of lower body muscles in female karateka.

Keywords: Supplement, Anti-oxidant, Maximum Strength, Peak Power, Average Power

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INTRODUCTION

Regular physical activities with balanced diet improve the efficiency of the body systems. Also, the role of vitamins and anti-oxidant supplements seems to be significant. Some research reports show that doing severe physical activities may hurt cellular structure especially muscle tissues [1,2] leading to shape the oxidation pressure [3].The oxidation pressure is caused by increasing free radicals which are reactive oxygen species (ROS) and are produced as a part of metabolic process [4,5].In addition, free radicals lead to the delayed onset muscle soreness (DOMS) process. The muscle soreness and aches are one of widespread and current phenomenon caused by physical activities [6] and also happened in professional athletes. DOMS can disarrange the sports activities of professional athletes and deteriorate their appropriate performances and deprive them from training [5].

One of the methods to deal with undesirable effects of the oxidation pressure caused by severe and heavy physical activities is the consumption of supplements. In recent years, there are a lot of interests to study the effects of food supplements in body protection against damages caused by the oxidation pressures and tiredness between physical activities and after physical activities. Vitamin E is one of the anti-oxidant supplements. Vitamin E or Tochpherol is vital for the health of cell structure, the reduction of aging effects and the protection of some enzyme activities [7].

The shortage of this vitamin has hardly seen in athletes with balanced diets. The surveys show that using the supplement of vitamin E has no effect on implementation [8]. However, this vitamin can play an effective role in reducing muscle lesions and oxidation pressure and also strengthening the immune system [9,10]. Nevertheless, how this vitamin as a supplement can decrease muscle destructive damages and increase strength, power and flexibility is not clearly known.

Q10 coenzyme, known as ubiquinone, is a kind of fat which has both the properties of vitamins and anti-oxidants. Its consumption in the athletes leads to improve their sport performance. It is from necessary compounds of the electron transport chain within mitochondrion which is made in all body cells especially in the heart, the liver, the kidneys and the pancreas from amino acid Tyrosine [11,12]. It can also be considered as an energetic substance among the athletes [13].

Power, strength and flexibility are motor fitness components. If the athletes want to be successful in different sport courses, they should increase their motor fitness components. There are performed surveys about the effects of vitamin E supplement on motor fitness components and the performance and then similar results are obtained. Mastaloudis et al [14] divided 22 trained fartlek runners randomly into control groups and supplement group. The supplement group consumed vitamin E, 300 mg, twice a day and vitamin C, 1000 mg, twice a day during 6 weeks. After the supplementary period, the runners participated in a super marathon race (50Km). In this test, the consumption of vitamin E and C had no positive effect on the muscle power production. The researchers suggested that more vitamin E is probably needed to prevent muscle damages. Warren et al [15] investigated the effect of vitamin E supplement on the strength and Creatine Kinase in mice. The results showed that the consumption of vitamin E supplement after 5 weeks had no effect on the power. Bryant et al [16] stated although consumption of vitamin E supplement can decrease DOMS but it has no effect on the performance.

In different studies, it is investigated the consumption effect of Q10 coenzyme on some motor fitness components. Leelarungrayub et al [17] stated that Q10 coenzyme can decrease oxidation stress and improve physical activities among young swimmers. In this study, the swimmers consumed Q10 coenzyme supplement at a short time (12 days). After the supplement taking period, the subjects practiced on a mechanical treadmill by using of Bruce Protocol. The swimming records were registered for 100 and 800 meters. The fatigue time of treadmill and swimming had no difference in swimming 100 and 800 meters. The maximum time of treadmill, compared to the time before consuming supplement, was increased. On the other hand, the time of swimming 100 meters was improved compared with pre-supplementary period and there was no any difference at swimming 800 meters record. Gokbel et al [13] investigated the effect of Q10 coenzyme consumption on the performance throughout exercises periods in inactive men. Therefore, 15 healthy and inactive men were randomly assigned in two supplement and placebo groups. Then, subjects received the supplement and the placebo during 8-week two periods, daily 100 mg. After these periods, they performed an exercise program including 5 Wingate tests with 2-minute recovery time. Subsequnetly peak power, average power and the fatigue-index were measured. The results showed that after performing 5 Wingate tests, maximum power and mean power decreased in all groups but the fatigue-index increased in all groups. The peak power in first Wingate test and second Wingate test in two groups decreased while the average power in fifth Wingate test increased in supplement group. Also, the fatigue-index in the supplement group decreased but this reduction had negligible difference with placebo group. Due to the results, Q10 coenzyme can improve the performance throughout exercise repetitions as an energetic material. Cooke et al [18] presented similar results. Kon et al [19] performed an investigation titled "the effect of Q10 coenzyme supplement on muscle damages in mice" and achieved opposite results. They stated 4-week consumption of Q10 coenzyme has no effect on aerobic power of mice.

Most studies are performed regarding the effect of these two supplements on motor fitness components such as power and strength but there was no single research to investigate the effect of these supplements on the flexibility. One reason may be due to anti- oxidant supplements and their physiological mechanism, because vitamin E supplement can decline unsuitable effects of delayed onset muscle soreness [9]. On the other hand, Q10 coenzyme supplement has an important role in transport chain within mitochondrion [11,12]. It can also be considered as an energetic substance among the athletes [13]; therefore, there is a need for more studies to investigate the level of direct and indirect effects of these two supplements on motor fitness components such as power, strength and flexibility. Considering the effect of these two supplements on motor fitness components power, strength and flexibility, there are various studies but they show contradictory results. Since the anti-oxidant supplements have similar mechanism due to the decrease of the destructive effect of free radicals and with regard to this matter that in sport of Karate some factors such as power, strength and flexibility are main indices to determine the victory or the defeat among Karateka. Due to the energetic effect of some anti- oxidants such as Q10 coenzyme and its role as a catalyst in ATP synthesis in the body and based on some research sources [13], performing more surveys in this field are necessary. Therefore, the aim of this research is to study the effect of vitamin E and Q10 coenzyme in the

sport Karate. in order to achieve that we will focus on short time effect of vitamin E and Q10 coenzyme on maximum strength of back and lower body muscles, maximum power, average power and the flexibility?

MATERIALS AND METHODS

Research Design: the research methodology applied is semi experimental method and the research design is the factorial with three experimental groups 1, 2 and the control group and pre-test and post-test.

Samples: the statistical population of this survey consist of female kumite Karateka players from Alborz province and its suburbs (N=275) with age range 15-17. From this statistical population, 36 healthy subjects without any special diet or taking any supplement and without a history of a disease were purposefully selected. After signing the consent form, they were randomly divided into three groups and in each group there were 12 subjects.

Data collection methods: after measuring subjects' heights and weights, early tests of maximum strength, power and flexibility were performed. Then, first experimental group received vitamin E supplement and second experimental group received Q10 coenzyme. The subjects consumed the supplements just day after pre-test for 14 days. The control group received no supplement. After finishing supplement taking period, second phase tests, in order to observe the differences in measurement indices, were performed.

Measurement Methods of Research Variables: The variables in this survey were maximum strength of muscles of back and lower body muscles, peak power, average power and the flexibility of muscles of back and lower body. Each variable was measured by related tests.

The measurement method for the flexibility of muscles of back and lower body: to measure the flexibility of muscles of back and lower body, the flexible box was used (made by Satrap Co.).

The measurement method for the strength of muscles of back and lower body: to measure the strength of muscles of back and lower body, the multi-work dynamometer was used (Dead Lift, made by Satrap Co.). Written number on the monitor of the device was taken.

The measurement method for the strength of lower body muscles: to measure the maximum strength of lower body muscles, the leg press device (model selection, TechnoJim co) was used. The maximum weights which a subject could repeat were also recorded (1RM).

The measurement method for the peak power and average power: each subject stood up on the Monarchs bicycle (Model 894 e a). The characteristics of each subject, related to his weight and height, were given to the device.Then numbers and figures related to the peak power and average powers were measured by the device. Recorded numbers from 0 to 5 seconds were related to the peak power and the numbers from 5 to 30 seconds were related to the average power. Total activity was 30 seconds.

Supplementary protocol: the supplementary program for vitamin E and Q10 coenzyme was performed during 14 days. first experimental group (12 subjects) received vitamin E supplement, at the form of 14 pills, 1 pill daily (400 IU daily, made by International Agencies of USA) and second experimental group (12 subjects) received Q10 coenzyme, at the form of 14 pills (100 mg daily, made by Euro OTC Pharmacy of Germany) and 12 subjects that were randomly assigned in control group received no supplement or no pill or no placebo. The subjects that were in supplement taking groups were asked to consume every pill while eating dinner (based on the recipe available on the boxes of supplements).

Statistical Methods: basically in this study the mean and the standard deviation were used to explain data. In order to determine the effects of anti- oxidant supplements on the strength, power and the flexibility and with regard to this matter that Co- variance test conditions were not instituted; first of all, the means of differences between pre- test and post- test were calculated and then they were evaluated by using one-way ANOVA. In addition, in every hypothesis that one-way ANOVA test was significant, Tukey follow up test was used for more investigations. All calculations were performed by software SPSS, version 20, at significance level of $\alpha \leq 0.05$.

RESULTS AND DISCUSSION

The descriptive statistics related to subjects' properties are shown in table 1. Also, the descriptive statistics related to variables strength, power and flexibility of pre-test and post-test in three groups are shown in table 2. The results of Tukey follow up tests of studied variables are shown in table 3. The results of one-way ANOVA tests, for the

comparison between changes of maximum strength of muscles of back and lower body, did not show significant difference between changes of the strength in three groups: vitamin E group, Q10 coenzyme group and control group (Sig=0.137, F2.33=2.109). One-way ANOVA test, comparing changes of maximum strength of lower body muscles, showed significant diffrence between three groups; vitamin E group, Q10 coenzyme group and control group (sig=0.000, F 2.33=12.490).Tukey follow up tests showed the strength level in lower body muscles after consuming vitamin E (sig=0.000) and Q10 coenzyme (sig=0.000) increased significantly. This increase was statistically significant in the control group but it was not significant in vitamin E group and Q10 coenzyme group (sig=0.230).

One-way ANOVA test, assessing changes of flexibility, showed no significant difference in known of these 3 groups (sig=752, F2.33=0.287). One-way ANOVA test,showed no significant difference between the peak power changes in three groups (sig=607, F2.33=0.506). likewhy changes of the average power in the above mentions groups showed no significant difference (sig=315, F2.33=1.197).

Table1: Detailed characteristics of anthropometry and psychological subject's research shows

Variable	Vitamin E group	Q10 coenzyme group	Control group
Height(cm)	159.75±4.51	160.75±5.62	162.67±7.07
Weight(kg)	44.91±9.21	53.41±5.68	49.91±9.08
Age(year)	15.83±0.84	15.84±0.72	15.75±0.75

Table 2: pre-test and post-test Strength, power and flexibility in three studied groups

Variable	Test	Vitamin E group	Q10 coenzyme group	Control group
The strength of back muscles (kg/BW)	Pre	1.21±0.27	1.20±0.13	1.15±0.26
	Post	1.36±0.33	1.24±0.29	1.14±0.23
The strength of lower body (kg/BW)	Pre	2.63±1.29	1.91±0.66	2.76±1.09
	Post	4.13±0.96	3.87±0.79	3.39±1.08
Flexibility (cm)	Pre	30.58±7.82	36.50±5.00	34.41±7.10
	Post	32.00±6.13	37.58±6.05	35.08±6.98
Peak power (W/kg)	Pre	9.75±1.52	10.52±1.99	9.28±2.28
	Post	9.64±1.48	10.89±2.05	9.37±2.24
Average power (W/kg)	Pre	5.44±0.91	5.44±0.91	5.31±1.12
	Post	5.35±0.52	5.76±0.86	5.28±1.03

Table 3: Turkey follow up tests for indices with significant effects

Studied indices	P vitamin E with control group	P Q10 coenzyme with control group	P vitamin E with Q10 coenzyme
Maximum strength of lower body muscles	0.007*	0.000*	0.230

*The sign * show significant differences ($p \leq 0.05$) between groups throughout different phases.*

According to our findings there was no significant difference in maximum strength of muscles of back and lower body, flexibility, peak power and average power in all three groups; just the maximum strength of lower body muscles significantly increased in supplement taking groups comparing to the control group ($p \leq 0.05$).

Due to theoretical bases and performed studies, anti-oxidant supplements such as vitamin E and Q10 coenzyme have a kind of conservative role towards free radicals and can annihilate the destructive effect of free radicals increased by physical activities. But in none of available sources and surveys, vitamin E is not introduced as an energetic material. Some findings stated that there is a need for higher doses of vitamin E to affect on motor components such as the strength. Due to these statements, Mastaloudis et al [14] performed a research. In this research, despite high consumed dose of vitamin E (twice a day), it had no effect on the muscle strength. Warren et al [15] investigated the effects of vitamin E on the mice strength. They stated that the consumption of this supplement after 5 weeks had no effect on mice strength. On the other hand, some sources stated that Q10 coenzyme is an energetic material [13] but how much this supplement can have the energetic effect is not obvious and more investigations are needed to be performed. Due to results of this study, the little increase the strength of back and lower body muscles measured by multi-work dynamometer and remarkable increase of the strength of lower body muscles measured by the leg press device after supplementary protocol may be due to some other factors such as the type and severity of exercises during the supplement taking period. Also, because the subjects have eaten supplements knowledgeably, it is necessary to pay attention the empathy effect. There found no survey to investigate the effect of the consumption of Q10 coenzyme on the strength directly. It may be related to the nature of this supplement and its effect on body cells because Q10 coenzyme is a vitamin-shaped soluble in fat caused releasing the biological energy in different tissues in the body (especially in skeleton muscles) by accelerating mitochondrial metabolism. Therefore, it cannot probably affect on some factors such as the strength. But other studies are performed with regard to the effect of

Q10 coenzyme supplement on the performance and the speed. Leelarungrayub et al [17] stated that Q10 coenzyme can decrease oxidation stress and improve physical activities among young swimmers. In this study, the swimmers consumed Q10 coenzyme supplement at a short time (12 days, each day 300 mlg). The results showed that the time of swimming 100 meters was improved compared with before supplement taking period and there was no any difference at swimming 800 meters record.

The results obtained in relation with the effect of these supplements on the flexibility is logical because, as told before, anti- oxidant supplements can improve anti- oxidant defensive system of the body against the increase of free radicals caused by physical activities and the probably have no effect on the increase of the range of movement in the joints. But, on the other hand, vitamin E can decrease muscle damage factors. Perhaps, consuming higher doses of this supplement can effect on the flexibility. As a result, there is a need for more investigations. On the other hand, there was not found a survey regarding the effect of anti- oxidant supplements on some factors such as the flexibility to compare its results with the current study.

The well controlled studies showed that the consumption of vitamin E supplement had no effect on the performance, yet this vitamin has a role in reducing the muscle damages, the oxidation pressure and the reinforcement of the immune system. Q10 coenzyme also has a role in performing mitochondrial activities [11,12].Thus, these two supplements cannot probably affect on the power which embrace the speed and strength. On the other hand, some findings stated that the anti-oxidant supplements such as Q10 coenzyme leads to improve the physical activities and is known as an energetic material [13]. Therefore, it is not certainly obvious that how much mentioned supplements can affect on factors such as the power. Due to the findings of Mastaloudis et al [14], they stated despite high consumed dose of vitamin E (twice a day), it had no effect on the power factors such as the muscle strength. Also, Gokbel et al [13] investigated the effect of Q10 coenzyme consumption on the performance throughout exercises periods in inactive men. Therefore, 15 healthy and inactive men were randomly assigned in two supplement and placebo groups. Then, subjects received the supplement and the placebo during 8-week, two sessions a week, daily 100 mg. after these periods, there was performed an exercise program including fifth Wingate tests with 2-minute recovery time. So, peak power, average power and the fatigue-index were measured. The results showed after performing fifth Wingate tests, maximum power and mean power decreased in all groups but the fatigue-index increased in all groups. The peak power in first Wingate test and second Wingate test in two groups decreased while the average power in fifth Wingate test in supplement group increased. Also, the fatigue -index in the supplement group decreased but this reduction had negligible difference with placebo group. Due to these results, Q10 coenzyme can improve the performance throughout exercise repetitions as an energetic material. Cooke et al [18] presented similar results. Kon et al [19] performed a study titled the effect of Q10 coenzyme supplement on muscle damages in mice and achieved opposite results. They stated 4-week consumption of Q10 coenzyme has no effect on aerobic power of mice. Also, in the survey of the current researcher, by consuming Q10 coenzyme supplement, the average level of the power was slightly increased but this increase was not significant. Therefore, there is a need to perform more investigations on this field.

As a whole, the results showed that the consumption of the anti-oxidant supplements such as Q10 coenzyme (during a 14-day period, daily 100 mlg) can improve maximum strength of lower body muscles. Also, higher doses of this supplement can probably affect on the power. On the other hand vitamin E supplement had no effect significantly and except the changes in the maximum strength of lower body muscles, no significant changes in other indices were observed. Therefore, it is recommended to athletes of the endurance sports to consume Q10 coenzyme.

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