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THE EFFECT OF SHORT-TERM USE OF COENZYME Q10 SUPPLEMENTATION ON SELECTED PHYSICAL AND PHYSIOLOGICAL CHARACTERISTICS OF YOUNG MALE ELITE WRESTLERS

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ABSTRACT

Aim: The aim of the present study was to determine the effect of short-term use of Coenzyme Q10 supplementation on selected physical and physiological characteristics of young male elite wrestlers. Materials and methods: The present study is a quasi-experimental human model which was performed using 20 elite wrestlers young men with an average age of 1 ± 5.18 years, weight 1 ± 35.83 kg, height 8/0 ± 75.1 cm and BMI2 ± 67.26 , subjects were randomly divided into drug and placebo groups, first measured using RAST test (anaerobic performance indices) and Cooper test (aerobic power test), curl up test (local abdominal muscle endurance), Press up test and Chin up (upper body endurance test), then, after six weeks of training, the above tests were performed. The collected data were analyzed using SPSS 21 software. Normalization of groups was first performed by Kolmogorov-Smirnov test and confirmation of homogeneity of variances by Levon's test. Correlated t-test was used to investigate intra-group changes and independent t-test and significance level (P≤0.05) were used to examine inter-group changes. Findings: The results of dependent group t2 test showed a significant difference (P≤0.05) in increasing the amount of changes in the experimental group Aerobic power (6.51 change rate), Maximum power (2.61 change rate), Average power (2.60), Minimum power (2.76 change rate), Fatigue Index (0.46 change rate), Curl up (7.2% Change rate) And Press up (7.7 change rate) in the post-test compared to the pre-test. But there was no significant difference (P≥0.05) in the amount of variables expressed in the control group before and after the Chin up test. Conclusion: The results of this study show that the Q10 supplement can enhance some of the physiological and physiological characteristics of young elite wrestlers.

Key words: Coenzyme Q10. Physical Indicators. Physiological Indicators. Young Male Elite Wrestlers.

RESUMO

O efeito do uso a curto prazo da suplementação com Coenzima Q10 nas características físicas e fisiológicas selecionadas de jovens lutadores de elite do sexo masculino

Objetivo: O objetivo do presente estudo foi determinar o efeito do uso a curto prazo da suplementação com Coenzima Q10 nas características físicas e fisiológicas selecionadas de jovens lutadores de elite do sexo masculino. Materiais e métodos: O presente estudo é um modelo humano quase experimental, realizado com 20 jovens lutadores de elite, com idade média de 1 ± 5,18 anos, peso 1 ± 35,83 kg, altura 8/0 ± 75,1 cm e IMC 2 ± 67,26. os indivíduos foram divididos aleatoriamente em grupos de drogas e placebo, medidos pela primeira vez usando o teste RAST (índices de desempenho anaeróbico) e o teste de Cooper (teste de potência aeróbica), teste de enrolamento (resistência local do músculo abdominal), teste de pressão e Chin up, depois de seis semanas de treinamento, os testes acima foram realizados. Os resultados do teste do grupo dependente t2 mostraram uma diferença significativa no aumento da quantidade de alterações no grupo experimental Potência aeróbica (taxa de variação de 6,51), Potência máxima (taxa de variação de 2,61), Potência média (2,60), Potência mínima (taxa de variação de 2,76), índice de fadiga (taxa de variação de 0,46), curvatura (taxa de variação de 7,2%) e pressione (taxa de variação de 7,7%) no pós-teste em comparação com o pré-teste. Conclusão: Os resultados deste estudo mostram que o suplemento Q10 pode melhorar algumas das características fisicas e fisiológicas dos jovens lutadores de elite.

Palavras-chave: Coenzima Q10. Indicadores Físicos. Indicadores Fisiológicos. Jovens Lutadores de Elite do Sexo Masculino.

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INTRODUCTION

Wrestle is a sport that is a heavy activity due to specific physical and physiological needs such as anaerobic characteristics (strength, power, speed, lactate tolerance and anaerobic endurance), the wrestler's ability to meet the physical and psychological needs of a wrestling champion will ultimately determine a Champion.

Therefore, strength and preparedness programs should focus on developing physical fitness, weight management programs, and skills needed to overcome the event requirements of the wrestle (Hosseini et al., 2012).

To maximize and maintain the performance and ability of athletes physically and psychologically in competitions is the focus of coaches and their arts, on the other hand, increased aerobic and anaerobic power play an important role in better performance of athletes (Aghaie et al., 2012).

A wrestling match is played in three shifts 2-minute with a 30-second break, these athletes are in dire need of high anaerobic power as well as optimal aerobic capacity and scientific evidence also points to the priority of wrestlers' anaerobic power, optimal nutrition is one of the most important factors related to the acquisition and maintenance of health and is one of the factors affecting sport performance. Many athletes use sports and exercise supplements to improve the quality and quantity of their performances (Mirzaei et al., 2013), athletes are also taking supplements to achieve these goals (increasing energy resources and maintaining health) (Mehri, 2008).

Nutritional supplements are used by athletes all over the world today, and proper and efficient use of nutritional supplements in sports is a major concern of coaches and athletes.

Lack of awareness in this regard as well as the supply of various materials by profit-seeking companies can sometimes lead some athletes to over-use these substances which are not only useless but also endanger their health.

A nutritional supplement is by definition a compound or product that directly improves the performance of athletes directly through its quasi-pharmacological effects (Williams, 2006), one of them can be mentioned as Q10.

The key point is what materials to consume to increase their efficiency and prevent loss of performance.

Coenzyme Q10, also known as Ubiquinone, is a fat-soluble vitamin-like substance and an essential carrier of electrons in mitochondria (Magal et al., 2010).

Coenzyme Q10 is one of the supplements recently made available to athletes and has not been proven to improve its performance (Mehri, 2008).

In the mitochondrial inner membrane, coenzyme Q10 acts as the electron acceptor of compound I (NADH dehydrogenase) and II (succinate dehydrogenase), Q10 present in the respiratory chain.

Although the concentration of this substance in compound II is probably less restrictive, compound I is more dependent on coenzyme Q10.

Laboratory studies have shown that; Insertion of coenzyme Q10 into the mitochondria leads to a sustained increase in NADH cytochrome C Reductase activity (Lenaz et al., 1990).

Therefore, if the coenzyme Q10 concentration in the mitochondria is relatively high, the respiratory chain activity rate will be highly correlated with its concentration (Vargio et al., 2002).

Q10 is an essential carrier for electron transport in the respiratory chain of the inner surface of the mitochondrial membrane for the production of ATP as well as an important antioxidant in the body (Hidaka et al., 2008).

Recent studies have shown that the physiological concentration of Coenzyme Q10 is not saturated and even a slight increase in its concentration in the inner mitochondrial membrane can lead to increased cellular respiration (Litaro and Tiano, 2007).

On the other hand, supplementation of coenzyme with quentin in stressful situations such as heavy exercise (with a decrease in plasma coenzyme) may be associated with increased plasma-cell coenzyme Q10, increases oxidative phosphorus, accelerate electron transfer from flavoproteins to cytochromes (ie aerobic remodeling of intracellular ATP bioenergy stores), Increased access to non-carbohydrate sources, Increased fatty acid metabolism (less dependent on anaerobic glycolysis pathway) and ultimately less lactate accumulation (Aghaie et al., 2012).

Studies show that; the resources required for Q10 in the body come in three

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ways: in vivo synthesis, food intake and oral supplements, or a combination of these factors (Goodarzi et al., 2010).

Essentially, you need to get the nutrition you need for exercise through a balanced diet and proper diet. However, when studying exercise training in terms of energy capacity, awareness of food energy sources and their role in energy release processes in the body is essential.

As age increases, the concentration of Q10 in organs decreases. Coenzyme Q10, however, is also absorbed from foods such as meat, fish, all kinds of nuts, etc. (although it is very low in these foods).

Some nutritionists are currently using Coenzyme Q10 widely to treat a number of diseases (Zheng et al., 2008).

In recent years, the use of Q10 as a nutrition supplement has increased widely, symptoms of deficiency in athletes may be observed in the form of metabolic pressure and increased free radical formation during exercise (Rosenfeldt et al., 2003).

On the other hand, since quantum Q10 plays a key role in the production of aerobic energy, elevated serum Q10 levels are likely to have a significant effect on contracting muscles.

In addition, some researchers have proposed a mechanism related to the effect of endogenous and exogenous coenzyme Q10 on lactate, this combination promotes cellular energy recharge and enhances intracellular calcium reabsorption (calcium pump activity), inhibits allosteric enzymes glycogen phosphorylase, phosphofructokinase (inhibits glycogenolysis and glycolysis), reduces secretion and accumulation of lactate, and lactate accumulation).

In a study followed by 8 weeks of supplementation with coenzyme Q10 (100 mg daily), by performing 5 Wingate tests and taking 2 minutes between exams, there was a significant increase in mean power in the supplement group and only in the fifth phase of the Wingate test, and a tendency (not significant) to decrease the fatigue index in untrained healthy men.

In a study on the effect of short-term supplementation of L-Carnitine and coenzyme Q10 on aerobic and anaerobic performance of inactive men, stated that Short-term and concomitant consumption of L-Carnitine and coenzyme Q10 may improve exercise performance in aerobic and anaerobic activities.

Mohseni and Gaeini (2013), in a study on the effect of six weeks of Coenzyme Q10 supplementation on aerobic endurance, maximal power, minimum power, average power and fatigue index of football players stated that: Coenzyme Q10 supplementation can increase aerobic capacity in subjects, But it was not statistically significant on anaerobic performance index (maximum power, minimum power and fatigue index).

However, the results of research designed and implemented on this hypothesis are contradictory for example; the results of several studies on the use of Q10 supplementation (60 to 100 mg / day for 4 to 8 weeks) suggest improved aerobic power, anaerobic threshold, exercise performance and post-exercise rehabilitation in athletes (Cook et al., 2008).

In contrast, in several other studies after consuming similar amounts (60 to 150 mg daily for 3 to 8 weeks) no ergogenic (overpowering) effects on maximal or sub maximal athletic capacity of individuals trained or untrained have been observed (Brown et al., 1991).

In the research of Gokbel et al., (2010) following eight weeks of supplementation with coenzyme Q10 (100 mg daily) By performing five Wingate tests and taking a two-minute break between tests, a significant increase in mean power in the supplement group was observed and only in the fifth phase of the Wingate test did they report a (non-significant) tendency to decrease fatigue in untrained healthy men Nejatmand et al., (2016).

Comparison of the effect of Coenzyme Q10 supplementation on aerobic power, anaerobic power and muscle fatigue in athletes and non-athletes and concluded that physical fitness levels (comparing athlete or non-athlete) had no effect on coenzyme Q10 supplementation on aerobic power, anaerobic power, and muscle fatigue and both groups used the supplement equally.

On the other hand, given the major role of coenzyme Q10 in the energy production system, there are still no definitive findings regarding the effect of this supplement on athletic performance, especially in the field of aerobic and anaerobic power, in this study, the effect of short-term use of Coenzyme Q10 supplementation on physiological characteristics of elite young male wrestlers was investigated.

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MATERIALS AND METHODS

The present study is a quasi-experimental human model using 20 young male wrestlers with an average age of 18.5 ± 1.09 years, weight 34/1 ± 35/83 kg, height 83/0 ± 75/1, body mass index 84/2 ± 67/26 and 12 ± 9 years old workout history.

They were in good physical condition ready to participate in the research and three days before the pre-test, a briefing was held with the subjects to learn about the type of supplement and its effects.

During the meeting they were provided with brochures and articles on supplementation as well as a personal information questionnaire. We also pointed out the limitations of other effective medication supplements, including other antioxidant supplements such as vitamin E and C, smoking, caffeine use, and other medications Subjects were instructed to adhere strictly to dietary restrictions during the study. 20 wrestlers were randomly divided into experimental and control groups, before taking the supplement, subjects were asked to be present at the test site, first they completed the PAR - Q health log of the ACSM community Their anthropometric characteristics (height, weight, and body mass index) were measured and then after warming up, using the RAST test, a variety of anaerobic power indicators, curl up test, Press up, chin up physical indicators and 48 hours later, Cooper's test was taken to measure maximal aerobic power (Mackenzie, 2005).

Next step, the supplement was given to the experimental and control groups by the instructor (The experimental group was given pure Q10 capsules and the control group received standard wheat flour and edible dyes, which were provided with capsules quite similar to the drug group) and they were asked to take 1 capsule (100 mg) unregulated for six weeks, it was also suggested that in order to be absorbed more, they should consume these capsules with breakfast meal (Mohseni, Gaeini, 2014), after a six-week course of coenzyme Q10 supplementation, subjects were asked to reapply for tests.

Anthropometric characteristics (height, weight and body mass index) were measured first and then after warming up, using RAST test, all kinds of anaerobic power indices, curl up test, Press up, physical indicators chin up and 48 hours later, Cooper's test was performed to measure maximal aerobic power (Mackenzie, 2005) with the following protocols.

Running based Anaerobic Sprint Test - RAST

Subjects ran a distance of 35 m 6 times with 10 seconds rest between repetitions, then, according to the time taken from each 35 m, the power for each repeat was calculated according to fórmula one.

Formula1: $\text{power} = \frac{\text{wieght} \times (\text{distanc})^2}{\text{time}^3}$ MacKenzie (2005).

Assessment: According to the following instructions, maximum power, minimum power, average power and fatigue index were determined.

Formula2: Maximum Power: Maximum power between 6 reps

Formula3: Minimum Power: Minimum power between 6 reps

Formula4: Average Power: Total power of 6 reps divided by 6

Formula5: $\text{Fatigue Index} = \frac{\text{Maximum power} - \text{Minimum power}}{\text{Total time for six stages of running}}$

Cooper Test

According to this test, the subjects ran 12 minutes around the soccer field and then, with the whistleblower standing, record the distance to the end point of movement and the nearest measured location.

The total distance traveled in 12 minutes is the score of the athlete. A distance of 12 minutes can also be considered an athlete's point.

The distance obtained can also be expressed using the fórmula VO_2 max (Cooper, 1968).

Formula6: $\frac{\text{Distance to meters} - 504.9}{44.73} = \text{VO2 max}$

Curl Up Test

To perform this test, subjects bend their knees as they lie on the floor as their feet rest on the floor. In this situation they put their hands on their breasts and do the curl up, the

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subjects' trunk rises 90 degrees and then returns to baseline (Mackenzie, 2005).

Press-ups Test

In this test, the subject is placed in a swimming pool in the Press up position so that the hands are as wide as the shoulders wide and stretched out from the elbows, in this case, the subject lowered the body to 90 degrees elbows, returned to the original position until the arms were stretched, no one holding the legs. Swimming continues without rest (Mackenzie, 2005).

Chin up Test

To perform this test, the subject was hung from the chin up so that the subject's palms were toward his body. By stretching the hands, it lifts the trunk from the baffle rod so that the chin and rod are aligned. When the arms are opened, the trunk is lowered again until the hands are stretched out. The subject should repeat this practice as much as possible (Mackenzie, 2005).

The results were analyzed using spss21 software. The normality of the groups was first determined by Kolmogorov-Smirnov test (Table 1) and confirmation of homogeneity of variances by Levon-table test.

Correlated t-test was used to examine within-group changes and independent t-test was used to examine inter-group changes, other operations such as drawing graphs were performed with Excel software.

Table 1 - Results of the Kolmogorov-Smirnov test for normality of data.

Variable name	Significant level.	Statistics
Aerobic power	0/240	0/904
Maximum power	0/737	0/956
Average power	0/115	0/875
Power at least	0/117	0/774
Fatigue index	0/617	0/946
Chin up	0/808	0/962
Press-ups	0/464	0/932
Chin up	0/229	0/902

The results of the Kolmogorov-Smirnov test in Table (1) show that the distribution of the research variables in the statistical sample is normal ($p<0.05$).

Table 2 - Confirmation of homogeneity of variances through Levon's test.

Variable name	Significant level.	F
Aerobic power	0/482	0/497
Maximum power	0/367	0/82
Average power	0/113	0/384
Power at least	0/452	0/571
Fatigue index	0/347	0/111
Chin up	0/211	0/536
Press-ups	0/32	0/961
Chin up	0/08	0/243

According to Table (2), the significance level of Levon's test for the variance of the research variables is more than 0.05 indicating that their variances are equal.

Findings

In Table (3), the descriptive characteristics of the control and experimental group were measured by age (year), height (cm), weight (kg), body mass index and abdominal circumference (cm), as well as standard deviation of each variable. It has been shown.

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Table 3 - Physical Properties of Young Elite Wrestlers.

Variable group	Age (year)	Height (cm)	Weight (kg)	BMI (kg/m^2)
examination Group	18 ± 1	175 ± 0/8	81 ± 1	26/32 ± 2
control group	18/5 ± 1	176 ± 0/8	28/75 ± 1	27/03 ± 2

Table 4 - Intergroup comparisons of aerobic power (ml-1.kg-1.min-1), peak power (w), average power (w), fatigue index (w.sec-1), chin up, press up and curl up in experimental and control groups.

Variable	group	step	mean	Standard deviation
VO_2 max	the experiment	pre-exam	38/82	1/398
		Post-test	45/33	2/517
	Control	pre-exam	42/67	5/74
		Post-test	45/27	4/958
Maximum Power	the experiment	pre-exam	311/3	65/74
		Post-test	572/80	117/603
	Control	pre-exam	335/6	47/726
		Post-test	449/1	89/459
Average Power	the experiment	pre-exam	254/2	48/089
		Post-test	514/60	1/181
	Control	pre-exam	292/9	28/395
		Post-test	388/7	76/854
Minimum Power	the experiment	pre-exam	195/5	34/875
		Post-test	471/6	113/333
	Control	pre-exam	247/7	22/216
		Post-test	328/2	73/718
Fatigue Index	the experiment	pre-exam	2/68	1/019
		Post-test	3/14	1/246
	Control	pre-exam	2/27	0/99
		Post-test	3/12	1/486
Curl Up Test	the experiment	pre-exam	55/60	5/146
		Post-test	62/80	4/661
	Control	pre-exam	54/20	7/771
		Post-test	57/90	7/030
Press-ups Test	the experiment	pre-exam	59/80	8/651
		Post-test	67	9/439
	Control	pre-exam	60/10	8/887
		Post-test	66/30	8/165
Chin Up Test	the experiment	pre-exam	26/50	2/953
		Post-test	33/80	2/859
	Control	pre-exam	28/90	3/541
		Post-test	33/60	3/373

In table 4 the results of the two dependent groups t-test indicated a significant difference ($p \leq 0.05$) in increasing the values of aerobic power variables (increase of 6.51), Maximum power (2.615 increase rate), Average power (2.60 increase rate), Minimum power (2.76 increase rate), fatigue index (0.46 increase rate), curl up (7.2% increaserate), Press up (7.2% increase rate), Chin up (6.3% increase rate) in experimental group is post-

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test compared to pre-test, but there was no significant difference (p<0.05) in the amount of variables expressed in the control group before and after the test.

Table 5 - Comparison of aerobic power averages (ml-1.kg-1.min-1), maximum power (w), average power (w), fatigue index (w.sec-1), curl up, press up And chin up in the two experimental and control groups.

Variable	group	mean difference	Standard error difference	T Value	P Value
Aerobic power	Control	-2/60	0/496	-5/241	0/154
	the experiment	-6/51	1/815	-11/343	*0/000
Maximum power	Control	-1/13	88/74	-4/044	0/244
	the experiment	-2/615	83/400	-9/915	*0/000
Average power	Control	-9/58	71/78	-4/220	0/407
	the experiment	-2/60	93/138	-8/841	*0/000
Power at least	Control	-9/58	71/78	-4/220	0/362
	the experiment	-2/76	101/37	-8/613	*0/000
Fatigue index	Control	-0/85	1/63	-1/648	0/134
	the experiment	-0/46	1/19	0/975	0/04
Curl up	Control	-3/70	-1/88	-6/195	0/365
	the experiment	-7/20	0/711	-10/115	0/123
Press up	Control	-6/20	-4/26	-4/599	0/238
	the experiment	-7/20	1/87	12/115	*0/000
Chin up	Control	-4/70	2/66	-5/569	0/191
	the experiment	-6/30	1/159	-17/182	0/079

Table 5 compares the mean of the dependent variables in the control and experimental groups.

Comparison of the mean aerobic power of the two experimental and control groups in the post-test showed that the difference of two means in the aerobic power variable was 0.06 in the post-test compared to the control group.

Also compare the average anaerobic power in the maximum power variable of the control and experimental groups in post-test showed that the mean difference in maximum power variable in the experimental group increased by 7.123 compared to the control group.

Comparing the mean of the minimum power of the control and experimental groups after the test showed an increase in the difference of two means in the minimum power variable in the experimental group by 4.243after the test. According to the results, comparing the mean power of the control and experimental groups after the test showed an increase in the mean of two means in the mean power variable by 9.125 compared to the control group after the test.

For fatigue index, comparison of the mean fatigue index of the control group and the experiment after the test showed that the difference of two means in the experimental group was 0.02 compared to the control group after the test.

Also about curl up index Comparison of the mean of the index of curl up the control and post-test groups showed a 9.4 increase in the mean of the two experimental groups compared to the post-test.

In the case of press up, the comparison of the mean press up index

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between the control and test groups showed an increase in the mean of the two means in the experimental group by 7.0 compared to the control group after the test and in the case of chin up, the level of significance was not significantly different in comparison with the mean of the control group and post-test.

Table 6 - Comparison between group aerobic powers (ml-1.kg-1.min-1), maximum power (w), Average power (w), fatigue index (w.sec-1), curl up, press up and chin up in the experimental and control groups in the post-test.

Variable	the level	The mean difference	Value t	Value p
Aerobic power	Post-test	-0/058	-0/033	0/004
Maximum power	Post-test	-123/7	-2/647	0/016
Average power	Post-test	-125/90	-2/824	0/011
Power at least	Post-test	-143/40	-3/354	0/04
Fatigue index	Post-test	-0/081	-0/132	0/006
Curl up	Post-test	-0/7	-0/177	0/000
Press up	Post-test	-0/8	-0/572	0/004
Chin up	Post-test	-4/90	-1/831	0/135

In Table 6 the results of two independent groups'-tests indicated a significant difference ($p \leq 0.05$) in increasing the amount of aerobic power variables (0.058 increase rate), Maximum power (123.7 increase rate), Average power (125/90 increase rate), Minimum power (143/4 increase rate), Fatigue index (0.081 increase rate), Curl up (0.7% increase rate) and press up (0.8% increase rate) in the post-test group compared to the control group post-test but for chin up level of significance, there is no significant difference in post-test between two groups.

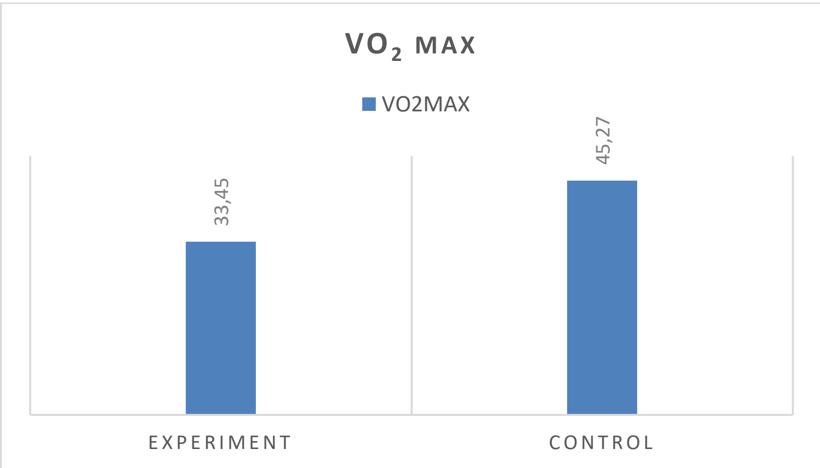

Figure 1 - Comparison of the average aerobic power in the two experimental and control groups in the post-test.

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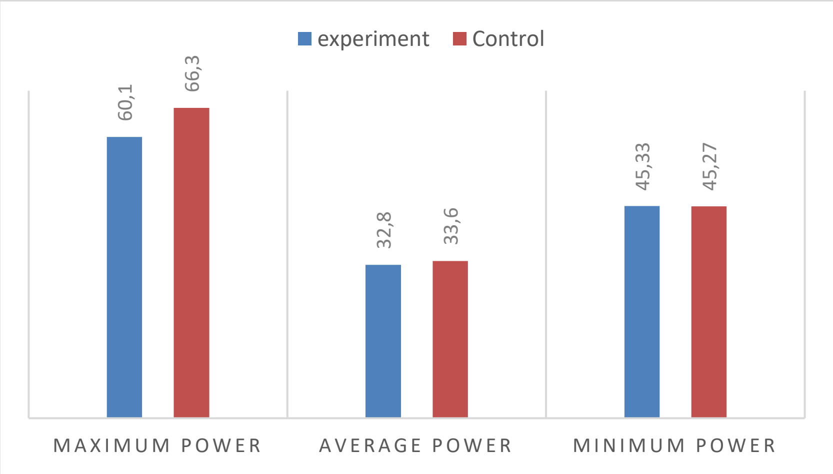

Figure 2 - Comparison of mean minimum power, average power, previous power in the two experimental and control groups in the post-test.

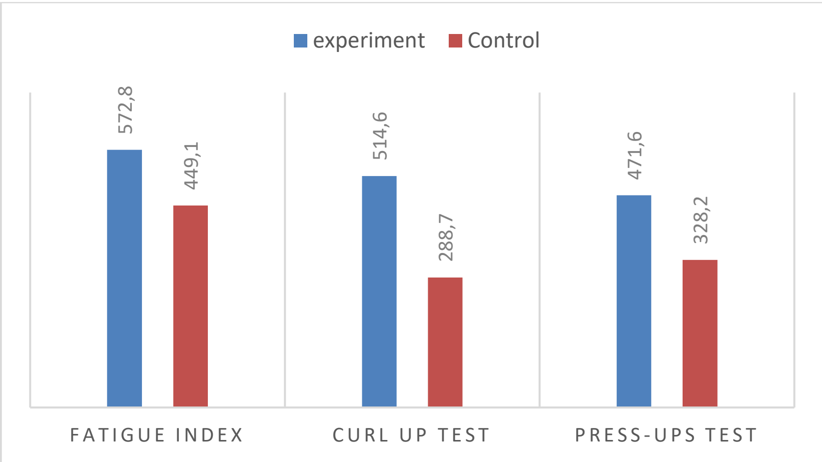

Figure 3 - Comparison of mean press up, curl up and fatigue index in two experimental and control groups in post-test.

DISCUSSION AND CONCLUSION

The purpose of this study was to investigate the effect of short-term use of Coenzyme Q10 supplementation on selected physical and physiological characteristics of young male elite wrestlers.

Factors affecting the outcome of the study were dietary habits, wrestlers' physical activity intensity and training season. Nutrition habits include foods such as Q10-containing foods as well as sources of aerobic and anaerobic power such as caffeine and a variety of antioxidants.

The amount of Q10 consumed by each subject is another methodological factor influencing the results of the study. Therefore, in this study, like the studies of Andrew et al., (2006) and Mohseni and Gaeini (2013), the subjects were told to take the distance between the days before the test and also between our pre and posttest sessions, they do not cause sudden changes in their diet and the intensity of their daily physical activity.

In the present study, each subject received 100 mg of Q10 supplement daily, which is similar to that used by Mehri (2008) and Gaeeni (2009).

Another methodological factor is the duration of supplement use, which was six weeks in the present study, such as the study by Laaksonen et al., (1995).

Another influencing factor on the results of the research is the type of exercise that the subjects in the present study were young elite wrestlers but in other studies, including Mehri (2008), subjects Handball players, Brown et al., (1991) cyclists, Snider et

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al., (1992) triple strand, Mohseni and Gaeini (2013) were young soccer players and Weber et al., (1994) were non-athletes.

The results showed that changes in VO_2 max and muscle endurance were significant after six weeks of daily intake of 100 mg of Q10 supplement in young elite wrestlers ($p<0.05$). This result is consistent with the results of the findings of Mohseni and Gainei (2013), Brown et al., (1991), Zeppili (1991), Amadio et al., (1991), Fiorlla (1991), Mehri (2008) is consistent, but not consistent with the findings of Laaksonen et al., (1995), Malm et al., (1999).

In the case of coenzyme Q10, it has been reported that it increases the levels of 2 and 3 di phosphor glycerides in erythrocytes (Zheng et al., 2008), Because 2 and 3 di phosphor glycerides transfer the Hbo2 decomposition curve to the right, Increases oxygen transfer in a given proportion of oxygen (Pao2) (Bloomer, 2007), Therefore, as a result of the mechanism mentioned above, the oxygen supply to the muscles may be increased, thereby increasing ATP synthesis and reducing lactose production.

So it happens not only in the skeletal muscle but also in the cardiovascular and respiratory muscles, therefore, the increase in oxygen demand was achieved by increasing the capillary diameter by increasing the release of nitric oxide in the capillary endothelial layer as well as by shifting the Hbo2 decomposition curve to the right and possibly increasing VO_2 max. It is believed that better access to Q10 can improve mitochondrial respiratory chain function and oxidized phosphorylation and increase the energy production and utilization of it, this study also confirms the significant increase in VO_2 max in this study.

In addition, tissue function may be better protected due to increased antioxidant capacity and protection of mitochondrial function (clearing acyl groups, preventing mitochondrial leakage, etc.), the logical consequence of this process would be to increase muscle function, which may also affect exercise capacity (Zheng et al., 2008).

About half of the body's quantum Q10 is in the mitochondrial inner membrane, Q10 naturally occurs in the central and hydrophobic part of the membrane, It has therefore been suggested that its concentration may not increase freely and spontaneously due to its physical limitations and its molecular instability and instability due to its bipolar structure.

A number of studies have also confirmed the idea that by supplementation (120 to 130 mg for 4 to 6 weeks) the accumulation of Q10 in tissues other than the liver and plasma is negligible (Zhou et al., 2005; Malm et al., 1999).

One of the factors that may limit the accumulation of Q10 in tissue in response to its consumption is the length of the supplementation period (Cook et al., 2008). In most studies, only the long-term effects of Q10 on muscle concentration have been examined.

In the study of Cook et al., (2008), the concentration of muscle Q10 increased approximately two hours after its acute administration and after two weeks of supplementation, this concentration remained at higher levels than the day before supplementation, but at the end of the supplementation period, it was less than two hours after acute supplementation (Cook et al., 2008).

It is therefore stated that the pharmacological properties of keratin monohydrate are the absorption and accumulation of keratin which, by its complement, exhibits a uniform maximum or in some cases a downward trend in the activity of its transmitters.

This is likely to result in bumps or even a decrease in muscle concentration during the supplementation period.

Such an effect may explain the lack of increase in muscle Q10 concentration after 4 to 6 weeks of supplementation, however, the creation of a uniform maximum or descending trend in the transmission of Q10 to the muscle that occurs after its long-term application is controversial and needs further investigation.

In this study, supplementation in the Q10 group showed a significant change in anaerobic power indices including maximum power, minimum power, average power and fatigue index ($p\geq0.05$).

This result is inconsistent with the findings in the study of Cook et al., (2008), who reported no improvement of anaerobic power after prolonged supplementation of Q10.

Gokbel et al., (2010) following eight weeks of supplementation with Q10 (100 mg daily) with five Wingate tests and two minutes rest between trials, there was a significant increase in mean power in the supplement group and only in the fifth phase of the Wingate test, as well as a (non-significant) tendency to decrease the fatigue index in healthy and untrained men. They suggested, in

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line with the observations above, that Q10 may improve athletic performance during repetitive extracurricular activities (Gokbel et al., 2010).

Shota et al., (2008) also reported a significant increase in output power in the five stages of the 10-second extreme sobriety test following two weeks of 100 mg daily quenching of Q10 in male athletes.

In the inner mitochondrial membrane, Q10 acts as the electron acceptor of compound I (NADH dehydrogenase) and II (Succinate dehydrogenase), Q10 in the respiratory chain although the concentration of this substance in compound Π is probably less restrictive, compound I is more dependent on Q10 (Bloomer et al., 2007).

Laboratory studies showed that the introduction of quanzium Q10 into the mitochondria leads to a sustained increase in NADH activity of the cytochrome C reductase (Lenaz et al., 1990).

Therefore, if the Q10 concentration in the mitochondria is relatively high, the respiratory chain activity rate will be highly correlated with its concentration because the physiological concentration of Q10 varies with the slope of the curve (respiration rate / Q10 concentration), the relatively small changes in its values in the membrane are likely to cause significant changes in respiratory rate.

According to the results of this study, taking 100 mg of Q10 supplement for six weeks can increase the selective physical and physiological characteristics of young elite wrestlers.

Therefore, it is suggested that a similar study with more samples be conducted to obtain more accurate results on the factors mentioned in athletes of different sports in different ages because the present study was conducted on young elite athletes and given that the amount of Q10 in the body decreases with increasing age and some diseases, it is suggested that similar research be carried out on non-athlete, ill, and middle-aged and elderly people.

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