

## **The effects of coenzyme Q10 Supplementation on futsal competition-induced changes in immune system in male players**

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### **ABSTRACT**

*The aim of this study was to determine the effects of coenzyme Q10 Supplementation on Futsal competition-induced changes in serum neutrophil in male players. Therefore, Twenty four male futsal player of league(age $23/5\pm 1$ year, height $174/75\pm 5.2$ cm,body mass  $71/3\pm 3.5$  kg and BMI  $22/72\pm 1$ ) were selected and randomly assigned in four groups:( coenzyme Q10, competition + coenzyme Q10,competition + placebo and (placebo) . Based on research design, players took coenzyme supplement (100 mg coenzyme Q10) or placebo three times daily .The players accomplished three successive futsal competitions in time period of 4-6 p.m. The blood samples were collected for analysis of serum neutrophil at the rest status before, immediately and 24 hours after the final session of competitions. data were analyzed by repeated measure ANOVA,LSD post hoc test at  $P<0/05$ . Results showed that effect of supplementary consumption of coenzyme Q10 on neutrophil levels during three consecutive matches in competition group with supplement was significantly ( $p=0/0001$ ) different from other groups. Post hoc test revealed that, this difference was significant in the second and third stages. Results of within group comparison in ANOVA analysis showed that the level of neutrophils in competition group with coenzyme Q10 was significant ( $p=0.010$ ) in three stages of measurement. The post hoc test indicated that level of significance were increased ( $p=0.001$ ) in second stage and decreased in third ( $p=0.027$ ).Based on the results consumption of coenzyme Q10 supplement at the time of successive futsal competitions can reduce serum neutrophil of male futsal players, so can have a beneficial effect on players' immune system. It is suggested that, Futsal players use coenzyme Q10 supplement during consecutive matches.*

**Key words:** Coenzyme Q10 Supplement, Immune system, Neutrophil, Futsal

### **INTRODUCTION**

In recent decades has significantly expanded around the world and also in Iran, and many adolescents and young people has engaged in this sport. In recent years, due to compression of sports, futsal players like other athletes in other sports, tried to improve their performance, and to achieve this goal, they have to spend long hours of exercise, or the number of training sessions per day must be increased. Increased training time and reduction of recovery time may inhibit the physiological variables to return to pre-exercise values. It is likely that athletes confront inability of immune response and also it enhances physical and mental stress. Athletes who involved in heavy training and racing are more prone to upper respiratory tract infections, and their immune function may disrupt temporarily following intense exercise. Some athletes may start the next session before returning to initial state. If this process is repeated, it is likely that cause suppression of immune function and increasing risk of infection[1].

The immune system is a critical system which its proper functioning ensures health of individuals. If not functioning properly, it would be impossible to survive, because the human body is constantly exposed to the invasion of

bacteria, viruses, fungi and parasites, which all these factors are exist in natural conditions[2]. White blood cells are involved in all aspects of immune functions[3]. Physical activity may cause a lot of changes in the distribution of white blood cells in the circulation[4]. However in short-term exercise may increase white blood cells and subgroups distribution of cell is transitional[5]. Neutrophils are white blood cells which are phagocytic and have segmented nuclei and numerous intra-cellular granules and make up 60 to 70 percent of white blood cells, and also the most important aspects of human innate immune system and their function can easily influenced by the quality and quantity of physical activity[6].

For the athlete training hard, nutritional supplements are often seen as promoting adaptations to training, allowing more consistent and intensive training by promoting recovery between training sessions, reducing interruptions to training because of illness or injury, and enhancing competitive performance. Surveys show that the prevalence of supplement use is widespread among sportsmen and women, but the use of few of these products is supported by a sound research base and some may even be harmful to the athlete. Special sports foods, including energy bars and sports drinks, have a real role to play, and some protein supplements and meal replacements may also be useful in some circumstances. Where there is a demonstrated deficiency of an essential nutrient, an increased intake from food or from supplementation may help, but many athletes ignore the need for caution in supplement use and take supplements in doses that are not necessary or may even be harmful. Some supplements do offer the prospect of improved performance; these include creatine, caffeine, bicarbonate and, perhaps, a very few others[7].

In fact, there is much debate about the use of antioxidant supplements. A few studies showed that a single session of strenuous aerobic exercise induces oxidative stress in young athletes[8]. Some believed that because of the increased oxidative stress in skeletal muscle and other tissues, use of antioxidant supplements for the prevention of acute and chronic inflammation and oxidative damages is essential. But others believed because of consistency with regular physical activity and performance improvement of protective antioxidant system, antioxidant supplement has not needed. However it is likely that, athletes who are not on a balanced diet and not getting enough antioxidants, or given the high level of training, the amount of dietary antioxidants are insufficient[9]. In fact, a balanced diet has not often enough antioxidant substances to counter the effects of free radicals, especially during periods of high stress or during exercise. In such circumstances, it is possible that supplementary consumption with high antioxidant such as, vitamins A, C, E, beta-carotene and selenium are needed [10]. Coenzyme Q10 or ubiquinone is essential for the transfer of an electron from electron transport chain to produce ATP and its revived form (ubiquinol) acts as an important antioxidant in the body, and due to these functions, supplementary consumption of coenzyme Q10 has beneficial effects for human health[11]. Ochoa's study (2007) shows that supplementary consumption can increase capacity of antioxidant enzymes, and supplements has the ability to prevent the loss of antioxidant capacity which caused by exercise[12]. Although research shows that, moderate exercise is beneficial for the immune system, but intense training programs of elite athletes may harm the immune system, thereby making them more prone to infection[13,14,15]. Research about the effects of exercise on immune function must have a wide range of sporting activities, including, short-term and intense, long-term and endurance activities and regular light exercise. Various factors, such as, physical, psychological and environmental stresses can impair immune function, and nutrition undoubtedly one of the important factors which has critical role in the immune system.

Epidemiological evidence of clinical information indicates that, poor nutrition reduces the ability of the immune system and the risk of infection and infections that are medically safe and has an effect on your physical activity performance[16,17]. The question is whether there are special diets that can eliminate disorders in immune system that caused by exercise? The use of nutritional supplements during or after exercise or competition can reduce the impact of effects resulting from intense physical activity in immune system. Can supplement reduce the risk of infection after intense physical activity in immune system? Certainly, access to balance food can affect all aspects of immune system, because cells of immune system have a very high metabolic rate[18]. The important matter from viewpoint of scientists, trainers, and athletes is that knowing which type of exercise with how much intensity, duration and frequency could increase free radicals and may reduce the ability of immune system, and which type of supplement can modulate the effects of free radicals on immune system. The purpose of this study is to investigate the effects of supplementary consumption of coenzyme Q10 on percentage of neutrophil serum of male players during Football competition.

## MATERIALS AND METHODS

### Research design

The research is quasi-experiment, based on field research and research design is pretest-posttest with repeated measurement.

### Subjects

And statistical population of this research is consist of all the players of Tehran's Futsal premier league, 24 subjects from eligible candidates were selected as samples, after selection, the research topic, purpose and method of implementation and its application as well as risk that involved in process of research were described. Then subjects that volunteered to participate in the study signed a written informed consent. Then through a questionnaire, their health status of last few months was studied. None of the subjects had a history of any disorders related to immune system and also was not under treatment at the time of the research.

### Research protocol

Based on quasi-experimental study, subjects were randomly divided into four groups of six subjects, which include, experimental group1 (Q10 supplement), experimental group 2 (competition plus Q10 supplement), experimental group 3(experimental plus placebo) and control group (placebo). Groups of completion were implemented three consecutive matches in accordance with relevant rules. Three consecutive matches held on Saturday, Sunday and Monday between 4 to 6 p.m. basic data and blood samples before and immediately after the match and 24 hours after last match were collected. Each match consists of two halves of twenty minutes and fifteen minutes break time in between. Supplement was used for three days after every meal and during three matches 100mg of coenzyme Q10 in form of soft gel capsules were given to players. Also placebo group and competition group plus placebo have given the same amount of aspartame. Descriptive characteristics of subjects including, height, body weight, age and body mass were measured before the competition.

### Laboratory methods

In each stage five cc of blood from a vein in the anterior forearm of subjects in sitting position was taken and split in two separate tubes to CBC. And one cc of it transferred to tubes which contain the E.D.T.A powder and four cc to clot tube. Then stirring C.C.B tube and after that freezing the clot tube and C.B.C tube. Then immediately put clot tube in centrifuge at low rpm for about 10 minutes, after that serum was divided to three eppendorf tube of one cc. one of them for an immunological tests, one for biochemical tests and last one was kept in the freezer at -70 degrees. Safety tests and separation of white blood cells were performed in laboratory.

### Measurement of neutrophils

To measure the percentage of neutrophils in blood we were used cell counter machine (EXCELL22) which manufactured in Germany. To determine the percentage of neutrophils we made some blood smear on a slide and paint it with Giemsa. Then a specialist was separated the prepared slide with the aid of binocular microscope.

### Statistical analysis

Normal distribution of data and homogeneity of variances were examined by kolmogorov-smirnov test and Levene's test. In data analysis to determine the mean difference in between group and within group variations, ANOVA analysis and post hoc LSD test at a significance level of ( $p < 0.05$ ) were used.

## RESULTS

Table 1 details characteristics of anthropometry and psychological subject's research shows

**Table 1: Mean  $\pm$  SD Characteristics of subjects in different groups**

Specification group	Age (year)	Weight (kg)	Height (cm)	BMI (Kg/m <sup>2</sup> )
CO-Q <sub>10</sub> group	24/41 $\pm$ 0/52	71/83 $\pm$ 6/11	175/00 $\pm$ 5/21	23/25 $\pm$ 0/41
Q10+Match group	22/74 $\pm$ 0/49	72/83 $\pm$ 3/53	174/33 $\pm$ 5/27	23/78 $\pm$ 0/68
Match group	24/06 $\pm$ 0/03	74/02 $\pm$ 3/86	172/30 $\pm$ 5/75	22/30 $\pm$ 1/05
Control group	23/54 $\pm$ 0/51	68/33 $\pm$ 6/53	178/00 $\pm$ 6/53	21/5 $\pm$ 0/86

Figure 1 shows results from comparison in between group that calculated by ANOVA analysis. Results showed that effect of supplementary consumption of coenzyme Q10 on neutrophil during three consecutive matches in competition group with supplement was significantly ( $p=0/0001$ ) different from other groups. Post hoc test revealed that, this difference was significant in the second and third stages.

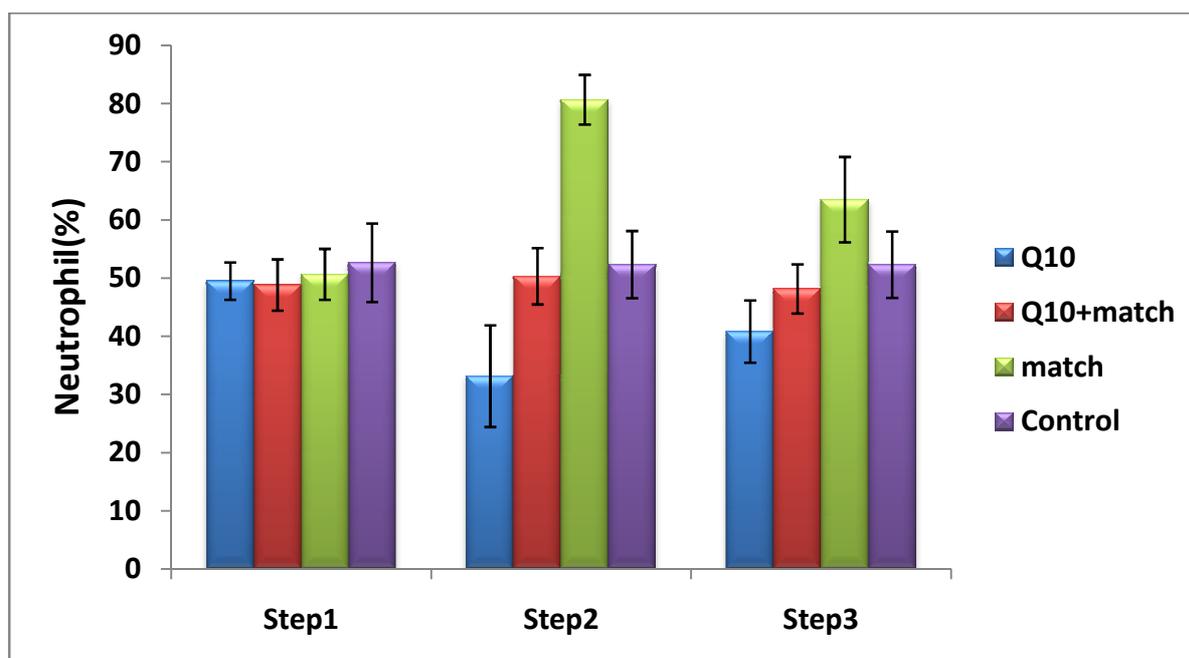


Figure 1: Measurement of neutrophil serum levels from comparison in between group in three steps. \* Significantly different ( $P < 0.05$ ).

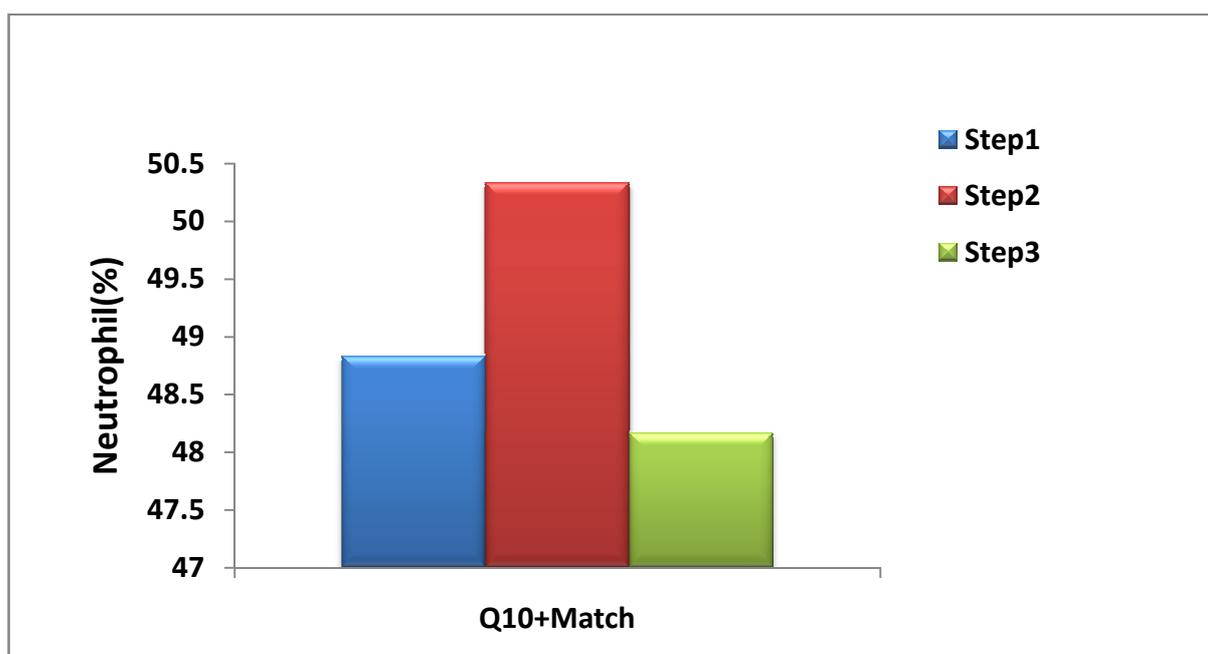


Figure 2: Measurement of neutrophil serum levels of within group comparison in Q10 plus competition group.

Figure 2 shows results of within group comparison in ANOVA analysis showed that the level of neutrophils in competition group with coenzyme Q10 was significant ( $p = 0.010$ ) in three stages of measurement. The post hoc test indicated that level of significance were increased ( $p = 0.001$ ) in second stage and decreased in third ( $p = 0.027$ ).

## DISCUSSION

These findings suggest that supplementary consumption of coenzyme Q10 during footsal tournament in competition group with supplement was significant, and this different was significant in second and third stages. Intense exercise can lead to cardiovascular stress which increases the levels of stress hormone. Simultaneous increase in catecholamine and cortisol is associated with changes in metabolic activity which leads to disorder in membrane of muscle cells and production of free radicals is increased, and this leads to activation of the immune system, such as release of proinflammatory cytokines and chemotaxis[19]. It is believed that proinflammatory cytokines and

chemotaxis substances could cause activation of neutrophils[20]. Researchers believed that the increase in exercise induced muscle damage could increase number of leukocyte. Accordingly, intense exercise damages muscle cells, stimulates the immune system and resulting in the accumulation of white blood cells especially neutrophils[21,22]. So one possible mechanism associated with decreased neutrophils in this study could be less muscle damage. When cell damage is reduced, muscle damage indicators would less trigger and also muscle damage indicators like creatine kinase would less release in the bloodstream. This in turn would cause less stimulation of immune system and resulted in lower exercise-induced leukocytosis [21]. Leukocytes levels display different behaviors as exercises at morning and evening[23]. Some studies showed that ingestion of carbohydrate with high or low glycemic index before endurance exercise had limited effects on circulating leucocytes[24] and may inhibit catabolic hormone (cortisol)[25].

However so far there have not been many studies on effect of supplementary consumption of coenzyme Q10 on percentage of neutrophils during football tournament and only two studies are available on effect of coenzyme Q10 on neutrophil responses.

Tauler et al (2008) were studied the effect of antioxidant supplement containing coenzyme Q10 on plasma and oxidative stress in neutrophils and antioxidant responses after football tournament. Supplementary consumption antioxidant prevents oxidative damage of plasma but has no effect on responses of neutrophils to football match[26]. Kon et al (2008) has evaluated the effect of 300mg of coenzyme Q10 on neutrophil levels during judo practices, results showed that neutrophils increased. Several factors such as duration of supplementary consumption before activity, absorption speed of supplements during activity, diet of subjects before and during study and training status of the participants and combination of these factors can affect antioxidant supplementary consumption in neutrophil serum[27].

Our findings showed significant differences in neutrophil levels of serum in supplementary group with competition more than the other groups. In order to clarify the cellular mechanisms involved in neutrophil responses to exercise researchers has been studied changes in cell membrane receptor expression, production and release of active oxidants and calcium signaling. It seems that differences that seen in the various reports on neutrophil function were due to factors such as use of different protocols with variable and different exercise intensities and different physical and training conditions of athletes, nutritional status and other variables such as genetic and racial differences, mental and psychological techniques which used to measure neutrophil function[28,29].

Inflammatory mediators such as IL-1, IL-6, TNF $\alpha$  and acute phase proteins during and long hours after intense exercises like running became free and constantly increases number of leukocytes and their accumulation in damaged tissues. Leukocyte redistribution during and following exercise might done indirectly through other factors. Some of these factors include, changes in expression of adhesion molecules in the artery wall cells and the release of the cellular constituents of damaged skeletal muscle that might be the property of chemotaxis, stimulation of white blood cells implantation toward the injured tissues and release of inflammatory mediators, in addition extroverted sports also mobilize neutrophils to general flow and infiltration of macrophages and neutrophils into damaged muscles[30,31,32]. However after muscle injury, macrophages appear on site before neutrophils but neutrophil counts are greater than macrophages. Given that oxygen free radicals are involved in the increase of cytokines[33].

It is likely that antioxidant supplements such as coenzyme Q10 reduces oxidative stress and has an influence on cytokines production and also activation of exercise-induced immune and thus will influence the amount of neutrophils. In this regard Shirvani et al was examined the effects of coenzyme Q10 supplementation during intense intermittent exercise on IL-6 serum levels in football players and as a result, coenzyme Q10 supplementation with anti-inflammatory effects could cause significant changes in cytokines[34].

daily use of dietary Tocotrienols and Tocopherol will be efficacious, cost effective, and a good source of vitamin E[35]. Cannon et al were measured the effects of supplemental vitamin E on the levels of cytokines released before, immediately and twelve days after exercise in sedentary adults and demonstrated that increased IL-1 in the group that received vitamin E, in comparison with placebo group declined and this differences remains twelve days after exercise, also production of IL-6 after exercise, in the supplement group was significantly lower than those in placebo group[36].

## CONCLUSION

This study examines the effects of coenzyme Q10 supplementation on percentage of neutrophil serum in male players during Football competition. The results suggest that consecutive matches can cause an increase in

percentage of neutrophils in Foolsal players, and coenzyme Q10 supplements significantly reduced the percentage of neutrophils in players during three consecutive matches, so can have a beneficial effect on players' immune system. It is suggested that, Foolsal players use coenzyme Q10 supplement during consecutive matches.

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