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ORIGINAL ARTICLE

The Effects of Different Doses of Caffeine on Young Futsal Players

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ABSTRACT
Interest in the use of caffeine as an ergogenic aid has increased since the International Olympic Committee lifted the partial ban on its use. Caffeine has beneficial effects on various aspects of athletic performance, but its effects on training have been neglected. The purpose of this study was to investigate the acute effect of caffeine on testosterone and cortisole in young futsal players.
Keywords; *Anabolic, Catabolic, Performance, Testosterone Cortisol Ratio, RAST Test*

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INTRODUCTION

Many studies analysed the effects of caffeine as an effective element on delaying muscles tiredness and increasing the heart and skeletal muscles contraction power [1,2]. Several mental and physiological mechanisms are suggested in which caffeine applies its ergogenic effects. Caffeine promotes sympathetic system activities and reduces pain feeling by inhibiting adenosine receptors. Increasing sympathetic system activities affects energy consuming (e.g. lipolysis and glycogen increase) and muscle contraction process (e.g. increasing intercellular calcium and improving sodium- potassium pomp act) [3]. Former studies have shown that taking caffeine before exercising can enhance inflammatory responses and as a result, increases the muscle injury index. Strong mechanisms are available by which caffeine can affect the number and efficiency of immune cells [4, 5]. Caffeine as an antagonist for adenosine can inhibit A2 adenosine receptors, this is defined on neutrophils. In addition, adenosine inhibition reduces pain feeling during the practice course and allowed for more work. This indirectly leads to a greater immune response and more disorders in homeostasis [6].

Furthermore, caffeine enhances the level of circulating catecholamine that is leukocyte enhancer after exercising. Bassini *et.al* proposes that pain feeling delay induced by caffeine can lead to sever muscle injuries during exercises. Caffeine has been widely used by athletes as a supplement, however its effects on immune system during the exercise remains unclear. The effects of taking different amounts of caffeine have not been studies precisely, as well. In present paper, we study caffeine effects on muscle injury indices (CK, LDH, IL-6) in futsal players during activity.

MATERIAL AND METHODS

A) Sampling

Young futsal players of selected Shahin Shahr (a city in Esfahan province, Iran) team are sampled (24 people of 18.3±1.9 year- old). All players are members of youth team playing in Esfahan counties league. Having at least 5 years of experience, 2 practices and 1 match per week and lacking any limitation in the past 6 months are the most important requirements for sampling the players. Next, the study topic, its method, its uses, as ell possible risks are explained to the players. They signed a consent letter to take part in the study. Their health history in the past months is studied through a questionnaire; also

following the exercise protocols is approved by physical education department of Shahrekord University. Considering the method and the objectives of the study, the samples are put in three groups of 200 mg, 800 mg, and placebo, based on their body readiness and after measuring their maximum consuming oxygen. The activity is short term and alternating in three phases of RAST test with 10 minutes rest between phases. Anthropometrical features including, height, weight, and maximum oxygen taking were measured by Cooper test (table 1).

Table 1. Samples' physiological and anthropometrical features (mean ± standard deviation)

Group / Variable	0 mg	200 mg	800 mg
Age	17.9 ± 2.1	18.5 ± 0.9	18.2 ± 1.8
Weight (kg)	66.33±5.00	65.36±4.9	54.79 ± 5.7
Height (cm)	166.39±5.98	174.65±5.81	178.53±4.98
BMI (kg/m)	22.63±1.37	21.91±0.90	21.85±1.43
Maximum oxygen take (mkg/min)	61.38±3.89	59.89±5.18	61.79±4.67

B) Measuring blood variables

One hour before the activity (as soon as caffeine taking) and right after alternative short term activity, a 7 ml vein blood sample of each person's left hand is taken and then the clot is sent to the laboratory to separate the serum. The serum are kept in -80º c to measure keratin kinas, lactate dehydrogenize and interleukin-6. To do so, the ELISA method is applied and specialized biotechnical kits (made in Brazil), Ruche (made in Germany), and Booster (made in China) are used. Body mass, fat percentage and BMI of the samples are measured by body composition analyser model In Body 3 (made in Korea). Caffeine drinks are made by Puripharma co, China.

C) Alternating short term activity protocols for football one session before the test is started, maximum oxygen intake of the samples is measured using Cooper test. After a period of 8 to 12 hours of hunger, samples are at the salon at 7:00 AM and have a light standard breakfast (23grams carbohydrate, 4grams fat, 3grams protein); they are classified in 3 groups and take 0 mg, 200 mg and 800 mg caffeine, respectively. Vein blood samples are taken and the levels of keratin kinase, lactate dehydrogenase and interleukin-6 are calculated. Anaerobic power and fatigue index are measured through running anaerobic speed test (RAST) that includes 6 course of running fast and a very short 10-second break between the courses. Before the test, a warm-up of 10 minutes length is done and then the test is repeated three times and there is a 10-minute rest between each phase. During the week when the study is taken place, the samples were asked not to drink any kind of caffeine drinks.

Alternative short term anaerobic activities protocols and the supplementing method

1- Having a light breakfast 15 minutes before caffeine taking
2- First sampling
3- Caffeine taking
4- 50- min rest and then 10-min warm-up
5- RAST test
6- 10-min rest
7- RAST test
8- 10-min rest
9- RAST test
10. Second sampling

D) Statistical methods

The data is categorized and analysed using mean and standard deviation. One way variance analysis (ANOVA) is also used to compare the measured variables mean in each level, and to find meaningful differences between the 3 groups of samples. To test the theories a post- hoc LSD test is applied and the meaningful level is considered 5 percent ($p< 0.05$); Kolmogorov- Smirnov test is applied to ensure the samples distribution, as well. Parametric statistic and SPSS.17 software program are used to do the calculations.

RESULTS

Table-2 shows Cretin kinas, lactates dehydrogenize and Interleukin-6 levels in the blood before and after taking caffeine supplement, and after alternative short term activity by mean ±standard deviation. The

results of one way variance analysis test and the post-hoc test show meaningful differences in muscle inflammatory index and interleukin-6 of 800 mg group with the other two groups ($p \leq 0.05$), while no meaningful differences are observed between the 0 and 200 mg groups ($p>0.05$).

Table 2- a. Muscle injury index in the rest and right after alternative short term activity

Group	variable	Rest	The end of first RAST
0 mg	Ck	404/4±20/3	409/3±16/1
200 mg		413/8±28/6	419/8±16/4
800 mg*		434/6±13/4	471/6±98/2
O mg	LDH	374/7±11/6	409/6±15/2
200 mg		379/7±8/9	419/±16/4
800 mg*		364/3±21/1	471/6±98/2
0 mg	IL-6	2/7±0/5	2/6±0/5
200 mg		2/2±0/5	2/4±0/5
800 mg*		2/6±0/4	2/9±0/1

* Shows statistical meaningfulness

DISCUSSION AND CONCLUSION

Former studies show an increase in immune index like leukocytes level after exercising [7]. It seems increasing the level of epinephrine circulating and nor-epinephrine during exercises is the most important increase in immune indices. The immune system plays a vital role in reconstructing the skeletal muscles. In TIDBAL, Survey [8], the contributing mechanisms in increasing the inflammatory responses in exercising are studied. For instance leukocytes can directly or indirectly (cytokine release), contribute in muscle tissue renovation or hypertrophy.

In this study taking 800 mg of caffeine causes a meaningful increase in keratin kinas, lactate dehydrogenase, and interleukin -6, however in lower doses this increase is not observed. These findings do not support those of Walker et.al [9]. That suggest inflammatory responses do not increase after taking 6 mg caffeine and then cycling for 120 minutes with 65% intensity. But it supports Bishop, et.al [10]. Findings that show the inflammatory responses increase after taking 6 mg of caffeine for each kilogram of body weight and then exercising for 90 minutes with 70% intensity. These differences can be due to different doses of caffeine or different degrees of caffeine tolerance in samples. Increasing the mentioned indices supports this theory that practicing protocols used in this study can cause minor muscle injuries. Draining keratin kinas, lactate dehydrogenase and interleukin-6 can happen after an increase in membrane permeability of muscle cells. Increasing keratin kinas levels after exercising is proved in former studies. Also, taking 200 mg keratin kinas supplement has no meaningful effects on inflammatory indices, but other studies, has shown the increase even with lower doses. This can be because of the difference in the type of exercises or the samples. Our study shows that caffeine in doses more than 400 mg can increase positive effects of exercise by enhancing inteleukin-6. We can conclude that IL-6 level changes depend on the intensity and duration of exercise, age, sex, samples' body readiness, and epinephrine and CORTISOL levels. After one session of RAST test, our finding of: IL-6 increase show that, this manikins a pre-inflammatory exercise sensitive cytokine. Running and common bumps with minor injuries in tissues can increase IL-6 in long term that, in turn, increases hypertrophy. Also, any short term or long term exercise that boost energy consuming can increase circulating pre-inflammatory cytokines. IL-6 rising is possibly because of high intensity of this test that leads to a decrease in glycogen reserve. The objective of the study is to see the short term effects of different doses of caffeine on KK, LDH and IL-6. Several studies show the effects of caffeine on performance of athletes, the result of taking higher doses of caffeine (more than 400 mg) is still unknown, though. Even though the study suggests that taking caffeine supplements increases the positive effects of inflammatory indices, the possibility of absolute

muscle injuries is not clear (because of unknown mechanisms of muscle injury after caffeine taking and the limited number of studies on this subject). Anyway, having a clear conclusion that definitely suggests the positive or negative effects of caffeine is depending on more research on this field, so it is recommended that taking caffeine should be done with more caution.

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