



# The Effect of Supplement on the Performing Special Skill Test

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**Abstract:** *Introduction: it is important for athletes to use sports drinks to help them reach their maximum capability in performing an important issue. The aim of this research was to evaluate the effect of the combination of caffeine and sodium bicarbonate on performing special skill tests, blood lactate and heart rate indices in elite Karate athletes of Iran. Methodology: This quasi-experimental study was carried out on 8 elite karate athletes in Iran (with a mean age of  $21.5 \pm 0.5$  years). The subjects were divided randomly into three groups with a double-blinded model in three separate days. One group received neither supplement nor placebo on the first day, another group received sodium bicarbonate supplement and caffeine on the second day, and the other group received placebo on the third day. SPSS 21 software was used to analyze the data. Results: The results of this research revealed that after drinking caffeine and sodium bicarbonate, there was a significant increase in performing special skill test in karate ( $p = 0.001$ ). The results also showed that the values of lactate, blood pressure and heart rate increased significantly in each stage of the pretest, immediately after the test and in the period of returning to the initial state ( $p < 0.05$ ). Blood pressure and heart rate values were significantly lower in returning to the initial state in the supplement group (drinking caffeine and sodium bicarbonate), compared to other groups. Conclusion: The results of this study revealed that sports drinks cannot only improve blood pressure and heart rate in Iranian elite karate athletes, but can also be useful in enhancing sports performance.*

**Keywords:** *Sports Drinks, Blood Pressure, Heart Rate, Iranian Elite Karate Athletes*

## INTRODUCTION

The use of various sports sciences, including the application of scientific principles of nutrition and dietary supplements is nowadays one of the necessities of modern sports. Karate is not an exception in this regard and karate athletes, as other athletes, are looking for ways to maximize their capabilities. Therefore, most researchers have focused on using sports supplements and energy drinks such as vitamins, protein supplements, carbohydrates, sodium bicarbonate and caffeine to improve the performance of athletes (Khorsandi and Nikoo Kheslat, 2011). One of the supplements used by athletes is sodium bicarbonate and caffeine. As the International Olympic Committee has excluded the caffeine and sodium bicarbonate from the list of unauthorized substances, many athletes have shown the tendency to use these supplements (Bijan and Ramezani, 2014). Caffeine is a natural stimulant and drinking it during exercising and competitions can result in improved performance and technical progress of athletes (Bijan and Ramezani, 2014; Aylanhamnew

and Jay Steele, 2016). Another supplement studied in this study is sodium bicarbonate. This substance, commonly known as baking soda, is a strong tampon of lactic acid. It is one of the supplements used commonly by athletes, especially in the fields the pressure is applied on the acid-base device, in order to maintain muscle contraction, reduce lactate production, delay fatigue and reduce the time to return to the initial state (Esfarjani and Tathian, 2012).

In addition to measuring lactate, measuring blood pressure and heart rate is considered as one of the most common clinical tests. Athletes pay special attention to blood pressure and heart rate. All physiological actions, especially each cell of body, are dependent on the cardiovascular system. In very intense exercises in which active muscles require more blood, the demand from the left ventricle to deliver blood to active muscles increases. It will cause hypertrophy in the left ventricle. Thus, after the exercise, a positive adjustment caused by physical activity is seen (Esfarjani and Tathian, 2012). To maintain blood circulation continuity, the heart should create enough pressure to circulate blood in the closed loop of the continuous blood vessel network. The performance of heart as the core of the cardiovascular system plays an important role in sports activities. Under the influence of continuous and non-continuous sports activities, the heart is affected by significant quantitative and qualitative changes that result in optimum adaptation in the heart (Amir Sasan and Sani, 2012). Therefore, it is very important to evaluate the heart rate and blood pressure among athletes. Several studies have been conducted on the effects of supplements and energy drinks such as sodium bicarbonate and caffeine, and their different doses and the level of their effects on various indices on martial arts athletes and most of them have proven the effect of exercises and supplements on heart indices. However, researchers have not paid attention to the special skill of karate and the way of improving the level of its performing. Therefore, this study was conducted with the aim of evaluating the effect of the combined drink of caffeine and sodium bicarbonate on the special skill test, lactate and heart rate indices in the elite karate athletes of Iran.

## Methodology

This quasi-experimental study was conducted on 8 elite karate athletes (with a mean age of  $21.5 \pm 0.5$  years) among the 15 elite athletes in Youth Karate League of Iran. All subjects had a healthy physical condition at the 70-90% level of physical fitness and they were voluntarily selected as a sample. They stated that they did not use any drug supplement. The mean weight of participants in this study was  $76.02 \pm 1.31$  kg and body mass index was  $22.74 \pm 0.61$ . The subjects were divided randomly into three groups with double-blinded model in three separate days. One group received neither supplement nor placebo in the first day, another group received sodium bicarbonate supplement and caffeine in the second day, and one another group received placebo in the third day. At each turn, the results of heart rate, blood pressure and base lactate were examined immediately after exercise and at rest time.

A special skill test for karate was performed by two testers and two referees to determine the strength and accuracy of the considered techniques in the sports club on Tatami and measurements of heart rate and lactate were performed by two nurses in the early hours of the morning. Moreover, to perform the test, a half-meter distance to a sandy bag and a one-meter distance of sandy bag from the ground were considered according to new karate field aerobic test. The test consisted of successive blows resulting from contact of hands and feet with sandy bag, which began and stopped every time after hearing the audio signal, while recovery without foot dance and displacement was not allowed. It should be also noted that test should be performed with the possible maximum force at each time. The validity of this test was reported ... in 2014. Before the performing the test, the baseline blood pressure and baseline heart rate were measured daily.

The implementation of the test other than the day when there was no need to use a supplement and placebo was one hour before the onset of the test along with the use of a supplement and placebo. Each person consumed his supplement based on his own weight. Caffeine 5 mg / kg body weight and bicarbonate 3 mg/kg body weight of the subjects were considered. The first subject performed his test one hour after using the

supplement, while during the supplement loading of the previous person, each subject used his supplement and waited for the effect of the supplement for one hour before performing his time, and one hour in the anticipation of the complementary effect before the test was performed. As the mean time of tests was 12.87 for each person, the performing of the test lasted more than one hour due to the effect of the supplement. Then, the special skill test ended by recognizing the effect of reduced power on the performance of the subjects by two referees, and two nurses performed the required measurements. The nurse immediately measured the heart rate, blood pressure and lactate of each subject. After 5 minutes of recovery, the heart rate and blood pressure and blood lactate were re-measured and recorded.

Finally, data were analyzed by descriptive and inferential statistics. In the inferential statistics section, to implement the repeated measures of variance analysis test, the sphericity presumption was examined by Mauchly's test. In the case of observing deviation from sphericity presumption, Greenhouse-Geisser was used for analysis of the variance results. Bonferroni post hoc test was used to determine the significance level between the different states of sampling before, after, and immediately and the period of returning to the initial state after the exercise. In addition, one-way ANOVA test was used to compare the non-supplement and non-placebo groups with sodium bicarbonate supplement and caffeine and placebo groups. Data were analyzed by using SPSS 21 software and the charts were plotted in Excel software. The significance level of the tests was considered  $P \leq 0.05$  in this study.

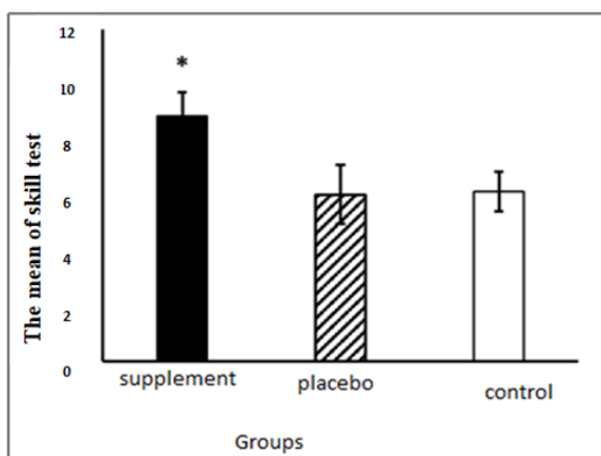
## Results

In this study, the Kolmogorov-Smirnov test was used to determine the normal distribution of data. Based on this test, if the p-value is more than the critical number at the level of 0.05, the data distribution will be normal. P-value obtained from this test for all data was above 0.05 in this study, indicating that the obtained data has a normal distribution and it is possible to use parametric tests to test the hypotheses.

### Testing hypotheses

Hypothesis 1: The combination of caffeine and sodium bicarbonate has a significant effect on performing special skill tests in elite karate athletes.

The results presented in Chart 1 show that there is a significant difference among different groups in the skill performance test. The results of the Tukey post hoc test showed that the lowest skill performance test was seen in the placebo group and the highest was seen in the group receiving the combination of caffeine and sodium bicarbonate. The results also showed that the mean skill performance in the group receiving a combination of caffeine and sodium bicarbonate was significantly higher than that of others ( $P < 0.001$ ), while there was no significant difference between the control and placebo groups ( $P < 0.960$ ).



**Chart 1-** Tukey post-test results for comparing the skill performance test record among the groups

(\*) There was a significant difference between the supplement group and placebo group and control group

Hypothesis 2: The combination of caffeine and sodium bicarbonate has a significant effect on blood lactate in elite karate athletes immediately after the skill test and in return to the initial state.

The results of repeated measures of variance analysis for blood lactate variations showed that blood lactate values in the supplement group, placebo group, and control group were statistically significant ( $p < 0.05$ ). Moreover, in order to compare blood lactate variations at different times, Bonferroni post hoc test was used. The results showed that there is a significant difference between blood lactate measurement times of pre-test and immediately after test ( $P = 0.001$ ) ( $P = 0.001$ ) and return to the initial state ( $P = 0.001$ ) and immediately after the test and return to the initial state ( $P = 0.001$ ) (Table 1).

**Table 1-** Bonferroni test results to compare the variations of blood lactate at different times among the groups

turns	Measurement times	Pretest	Immediately after test	Immediately after test
Supplement	Pretest	-	001*.0	001*.0
	Immediately after test	001*.0	-	001*.0
	Return to initial state	001*.0	001*.0	-
placebo	Pretest	-	001*.0	001*.0
	Immediately after test	001*.0	-	001*.0
	Return to initial state	001*.0	001*.0	-
control	Pretest	-	001*.0	001*.0
	Immediately after test	001*.0	-	001*.0
	Return to initial state	001*.0	001*.0	-

\*significant difference at  $p < 0.05$  level

Hypothesis 3: The combination of caffeine and sodium bicarbonate has a significant effect on systolic blood pressure in elite karate athletes immediately after the skill test and in return to the initial state. The results of repeated measures of variance analysis for systolic blood pressure variations showed that its values are significant in the supplement, placebo, and control groups at the  $p < 0.05$  level. Moreover, in order to compare systolic blood pressure variations at different times, Bonferroni post hoc test was used. The results showed that there is a significant difference between systolic blood pressure measurement times of pre-test and immediately after test and between immediately after the pretest and return to the initial state. However, a significant difference was not seen between pretest and return to initial state in all three groups (Table 2).

**Table 2-** Bonferroni test results to compare the variations of systolic blood pressure at different times among the groups

turns	Measurement times	pretest	Immediately after test	Return to initial state
Supplement	Pretest	-	001*.0	158.0
	Immediately after test	001*.0	-	001*.0
	Return to initial state	158.0	001*.0	-
placebo	Pretest	-	001*.0	089.0
	Immediately after test	001*.0	-	001*.0
	Return to initial state	089.0	001*.0	-
control	Pretest	-	001*.0	050.0
	Immediately after test	001*.0	-	001*.0
	Return to initial state	050.0	001*.0	-

\*significant difference at  $p < 0.05$  level

Hypothesis 4: The combination of caffeine and sodium bicarbonate has a significant effect on diastolic blood pressure in elite karate athletes immediately after the skill test and in return to the initial state.

The results of repeated measures of variance analysis for diastolic blood pressure variations showed that its values are significant in the supplement, placebo, and control groups at the  $p < 0.05$  level. Moreover, in order to compare the diastolic blood pressure variations at different times, Bonferroni post hoc test was used, which its results are shown in Table 3. The results of repeated measures of variance analysis showed that there is a significant difference between diastolic blood pressure measurement times of pre-test and immediately after the test and between immediately after the pretest and return to the initial state in all three groups. However, a significant difference was not seen between pretest and return to the initial state in all three groups (Table 3).

**Table 3-** Bonferroni test results to compare the variations of diastolic blood pressure at different times among the groups

turns	Measurement times	pretest	Immediately after test	Return to initial state
Supplement	Pretest	-	003*.0	095.0
	Immediately after test	003*.0	-	002*.0
	Return to initial state	095.0	002*.0	-
placebo	Pretest	-	002*.0	050.0
	Immediately after test	002*.0	-	049*.0
	Return to initial state	050.0	049*.0	-
control	Pretest	-	002*.0	014.0
	Immediately after test	002*.0	-	003*.0
	Return to initial state	014.0	003*.0	-

\*significant difference at  $p < 0.05$  level

Hypothesis 5: The combination of caffeine and sodium bicarbonate has a significant effect on heart rate in elite karate athletes immediately after the skill test and in return to the initial state.

The results of repeated measures of variance analysis for heart rate variations showed that its values are significant in the supplement, placebo, and control groups at the  $p < 0.05$  level. Moreover, in order to compare heart rate variations at different times, Bonferroni post hoc test was used, which its results are shown in Table 4. The results of repeated measures of variance analysis showed that there is a significant difference between heart rate measurement times of pre-test and immediately after test, immediately after the pretest and return to the initial state, immediately after test and return to initial state, and pretest and return to initial state in all three groups (Table 4).

**Table 4-** Bonferroni test results to compare the variations of heart rate at different times among the groups

turns	Measurement times	pretest	Immediately after test	Return to initial state
Supplement	Pretest	-	001*.0	001*.0
	Immediately after test	001*.0	-	001*.0
	Return to initial state	001*.0	001*.0	-
placebo	Pretest	-	001*.0	001*.0
	Immediately after test	001*.0	-	001*.0
	Return to initial state	001*.0	001*.0	-
control	Pretest	-	001*.0	001*.0
	Immediately after test	001*.0	-	001*.0

	Return to initial state	001*.0	001*.0	-
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\*significant difference at  $p < 0.05$  level

## Discussion and Conclusion

The results of this study showed that the combination of caffeine and sodium bicarbonate had a significant effect on the performance of special skill test in elite karate athletes. The lowest skill performance test was seen in the placebo group and the highest was seen in the group receiving the combination of caffeine and sodium bicarbonate. The results of this study are in line with the results of the study conducted by Artioli et al. (2007), Christiansen et al. (2014) and Callahan et al. (2017) who reported that the combination of caffeine and sodium bicarbonate supplement increases the athlete's performance.

Also, the results of the present study showed that there was no significant difference between the combination group of caffeine and sodium bicarbonate with the placebo and control group compared to the mean of blood lactate. Moreover, the results of this study showed that there is no significant difference between placebo and control group in terms of mean blood lactate levels. However, the mean of blood lactate in the group receiving a combination of caffeine and sodium bicarbonate was lower than that of other groups in returning to the initial state, but it was not statistically significant. The results of the present study are in line with the results of studies conducted by Christiansen et al. (2014), Felipe et al. (2016), while they are inconsistent with the results of the studies conducted by Higgins et al. (2016), Callahan et al (2017) and Pruscino et al (2008) Generally, based on the results of this study, it can be concluded that the combination of caffeine and sodium bicarbonate increases the performance significantly, decreases the mean heart rate and systolic and diastolic blood pressure significantly in athletes. However, the rate of reduction and variations in blood lactate level was not significant in karate athletes. At high levels of sports competitions, the difference among the teams is negligible and low, even a small influential factor might determine the outcome of a sports competition. Based on the results, it is suggested that further research to be conducted on the supplement of caffeine and bicarbonate in athletes of other team sports fields and similar studies are recommended to be conducted in female athletes in order to obtain more useful and complementary information.

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