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Effect of creatine supplementation on physiological demands and skill performance of futsal players

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A B S T R A C T

The purpose of this study was to investigate the effect of creatine supplementation (CrS) on physiological demands and skill performance of futsal players. Twenty male futsal players (age: 25.2 ± 4.4 years) participated in a placebo (Plc, n=10)/creatine (Cr, n=10), double-blind study conducted over 7 days period. The Cr group received 20 g (4 × 5 g) creatine monohydrate per day and Plc group received the same dosage of a glucose polymer. Skill performance and physiological demands were measured before and after the CrS. The results showed that CrS had no significant effect on sprint performance, dribbling, agility with and without ball and heart rate however systolic and diastolic blood pressure decreases after a week CrS. In summary, although CrS had no effect on skill performance, it improves physiological demands in futsal players.

Introduction

Futsal is a high intensity, intermittent sport in which accelerations and short sprints (usually with a duration of 1 to 4 seconds) are performed at maximal or almost maximal intensity, interspersed by brief recovery periods (activities of low intensity or pauses), during a relatively long period of time (75-80 minutes) [1,2]. Based on this, we believe that in order to improve their futsal performance, players must arrange specific futsal physiological demands and skill performance, such as sprint, agility and dribbling.

Although futsal is a relatively new sport, there is a large amount of articles analysing and studying the anthropometry of futsal players, the parameters of futsal, its physiological demands and the fitness level of the teams [1-3]. However, to our knowledge, the effect of CrS on motor performance of these athletes have been analysed only in one study. Harmanchi et al. (2013) demonstrated that 20m sprint, squat jump and repetitive vertical jump and muscular power increased after CrS in female futsal players [4]. Cr monohydrate is the most widely used supplements form for improving athletic performance [5], but the effect of this supplementation on physiological demands and skill performance of futsal players is not clear. Lack of studies regarding the effect of CrS on physiological demands and skill performance in futsal players and little attention to the effect of CrS in these parameters led to the current study investigating the effect of CrS on physiological demands and skill performance in futsal players.

Methods

Participants: Twenty male futsal players (age: 25.2 ± 4.4 years) volunteered to participate in this investigation. Subjects were informed about the study objective and signed an informed consent form. Before the data were collected participants were familiarized with test procedures.

Measurement and Procedure: A randomized, double-blind, placebo-controlled study design was carried out. The subjects were randomly divided into two groups: Cr group (n=10) and Plc group (n=10). The Cr group received CrS four times per day (after breakfast, lunch, dinner and before bedtime) for 7 days with a dose of 4 × 5 g for all of the days. Plc group received the same dosage of a glucose polymer. Both supplements had similar taste, texture and appearance and were placed in generic packets to ensure double-blind administration. Participants otherwise followed their normal diet but eliminated caffeine and caffeine-containing foods throughout the experimental period to minimize the possible inhibitory effects of caffeine on the ergogenic effect of Cr. At the end of the study all participants gave verbal assurance that they had complied with these instructions. Performance of the tested subjects was evaluated before and after the supplementation period. Each subject visited the laboratory 4 times. The first visit consisted of sprint test, agility with and without ball and dribbling evaluations. The second visit performed one days later consisted of the Yo-Yo Intermittent Recovery test. After the 7 days of supplementation, the testing procedures were repeated in the same order.

Agility without ball: The Slalom test was performed to evaluate the agility [6]. All the subjects started with both feet behind starting point. Six cones were set up 2 m apart, the first cone 1 m away from the starting line. Every player stood still facing the starting line, with his feet apart and the cone between his legs. He started after the signal and ran from point to point. The player at second point had to be passed on his right-hand side. The player continued to run as fast as possible constantly changing the direction from right to left, until he reached the player standing at last point. After last point, the player made an 180° turn and went on running the slalom to the starting line [6].

Agility with ball: The Slalom test with ball was performed to evaluate the agility with ball. This test is by the structure the same to the Slalom test, but it differs only in that sense that it was performed with the ball [6]. *Sprint:* To measure the speed repetitive sprinting test was used. Thus subjects performed six distances of 15 meters sprint that were interspersed by 30 seconds of recovery. The recovery was active rest (walking slowly) [7].

Dribbling: In the dribble test five cones on a line with a distance 1 m between them was used. Starting point was a 1 meter distance from the first cone. Each subject was standing at the start point while holding the ball under his dominant foot, by hearing the whistle he began the dribble test with maximum speed and in the moment of passing the last cone, he return to the starting point with his maximum speed. Time of performance was recorded by the timer [7].

Physiological demands: VO_{2max} was measured by Yo-Yo Intermittent Recovery test. Heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP) also evaluated before, immediately, two and four min after the Yo-Yo Intermittent Recovery test. Subjects started running back and forth a 20-m course and must touch the 20-m line. The initial speed was 8.5 km/hr. The speed got progressively faster (0.5 km/hr every minute), in accordance with a pace dictated by a sound signal on an audiotape. Several shuttle runs made up each stage. The subjects were instructed to keep pace with the signal for as long as possible. When the subjects could no longer follow the pace, the last stage announced was used to predict the maximal oxygen uptake using the equation of Leger et al. [8]. The equation:

$$Y = -27.4 + 6.0X, \text{ Where } Y = VO_{2\,max} \text{ (ml/kg/min)}$$

$$X = \text{Maximal shuttle run speed (km/hr)}$$

Statistical analysis

Results were expressed as the mean ± SD and distributions of all variables were assessed for normality. Paired t-test was used to compute mean (± SD) changes in the variables in control and concurrent training group pre and after the intervention. Differences among groups were assessed by using and independent t-test. The level of significance in all statistical analyses was set at $P \leq 0.05$. Data analyses were performed using SPSS software for windows (version 17, SPSS, Inc., Chicago, IL).

Results and Discussion

The changes of skill performance and VO_{2max} before and after the CrS in each group are presented in the Table 1. The results demonstrated that CrS had no significant effect on these variables. As the shown in the Table 2, HR, SBP and DBP increased ($P<0.05$) after the Yo-Yo test before and after the supplementation in the both group and decreased ($P<0.05$) after two and four min after the test. For the HR no significant changes were observed before and after the supplementation in the both group, however Cr lead to decrease the SBP and DBP ($P<0.05$).

The results showed that sprint performance and dribbling had not significant changes Cr group. Previous investigations have demonstrated increases in sprint performance after various doses and durations of CrS [9,10,11]. Cox et al. (2002) investigated the effects of acute CrS on repeated 20 m sprint performance of elite female soccer players. After the initial testing session, subjects were assigned to either a Cr (5 g of Cr, 4 times per day for 6 days) or a Plc group. After the experiment, the Cr group had better repeated sprint performance than the Plc group [9]. Skare et al. (2001) examined the effects of 20 gr of Cr and glucose supplementation on 100 m sprint performance of elite male sprinters during 5 days of supplementation. After the 5-day CrS, significant improvement in sprint performance was observed in Cr groups [10].

Table.1 Skill performance and VO_{2max} (mean ± SD) of the subjects before and after the supplementation

	Pre (mean ± SD)	Post (mean ± SD)
Sprint (s)		
Cr (n=10)	3.1 ± 0.1	3.08 ± 0.1
Plc (n=10)	3.2 ± 0.2	3.2 ± 0.2
Agility without ball (s)		
Cr (n=10)	9.8 ± 0.5	9.5 ± 0.2
Plc (n=10)	9.6 ± 0.4	9.6 ± 0.1
Agility with ball (s)		
Cr (n=10)	11.4 ± 0.6	11.2 ± 0.2
Plc (n=10)	11.7 ± 0.3	11.8 ± 0.9
Dribbling (s)		
Cr (n=10)	15.2 ± 1.7	15.6 ± 1.0
Plc (n=10)	16.7 ± 1.2	16.9 ± 1.1
VO_{2max}		
Cr (n=10)	63.0 ± 1.2	63.6 ± 1.4
Plc (n=10)	63.4 ± 1.3	63.0 ± 1.4

Table.2 Changes of cardiovascular variables (mean ± SD) before and after the supplementation

	Baseline			
	Resting SBP (mmHg)	SBP immediately after the Yo-Yo test (mmHg)	SBP; 2 min after the Yo-Yo test (mmHg)	SBP; 4 min after the Yo-Yo test (mmHg)
Cr (n=10)	122.9 ± 10.3	148.1 ± 10.8*	133.3 ± 12.4*†	123.3 ± 11.1*†
Plc (n=10)	126.7 ± 8.0	149.2 ± 11.0*	130.3 ± 13.0*†	121.8 ± 11.5*†
	After the supplementation			
	Resting SBP (mmHg)	SBP immediately after the Yo-Yo test (mmHg)	SBP; 2 min after the Yo-Yo test (mmHg)	SBP; 4 min after the Yo-Yo test (mmHg)
Cr (n=10)	118.0 ± 3.4‡	142.8 ± 15.7*‡	131.7 ± 9.9*†	119.5 ± 10.6*†
Plc (n=10)	124.0 ± 3.9	146.2 ± 7.7*	125.8 ± 10.1*†	121.5 ± 8.2*†
	Baseline			
	Resting DBP (mmHg)	DBP immediately after the Yo-Yo test (mmHg)	DBP; 2 min after the Yo-Yo test (mmHg)	DBP; 4 min after the Yo-Yo test (mmHg)
Cr (n=10)	79.1 ± 4.3	83.0 ± 7.8*	71.9 ± 5.6*†	70.9 ± 3.8*†
Plc (n=10)	76.3 ± 4.9	84.0 ± 18.8*	81.4 ± 18.2*†	71.3 ± 18.2*†
	After the supplementation			
	Resting DBP (mmHg)	DBP immediately after the Yo-Yo test (mmHg)	DBP; 2 min after the Yo-Yo test (mmHg)	DBP; 4 min after the Yo-Yo test (mmHg)
Cr (n=10)	77.1 ± 2.3‡	94.5 ± 22.6*	80.1 ± 12.6*†	76.4 ± 11.1*†‡
Plc (n=10)	81.0 ± 1.6	83.3 ± 8.3*	75.2 ± 7.2*†	72.0 ± 11.7*†
	Baseline			
	Resting HR ($b.min^{-1}$)	HR immediately after the Yo-Yo test ($b.min^{-1}$)	HR; 2 min after the Yo-Yo test ($b.min^{-1}$)	HR; 4 min after the Yo-Yo test ($b.min^{-1}$)
Cr (n=10)	72.1 ± 6.6	136.5 ± 12.7*	120.3 ± 12.3*†	112.7 ± 11.7*†
Plc (n=10)	66.7 ± 7.0	131.2 ± 14.7*	109.4 ± 10.5*†	103.4 ± 10.4*†
	After the supplementation			
	Resting HR ($b.min^{-1}$)	HR immediately after the Yo-Yo test ($b.min^{-1}$)	HR; 2 min after the Yo-Yo test ($b.min^{-1}$)	HR; 4 min after the Yo-Yo test ($b.min^{-1}$)
Cr (n=10)	65.0 ± 4.6	131.6 ± 19.1*	119.5 ± 11.0*†	113.3 ± 11.2*†
Plc (n=10)	67.9 ± 2.8	120.8 ± 19.9*	102.4 ± 14.3*†	92.6 ± 11.1*†

* Significant differences with Before the Yo-Yo test ($P<0.05$)
† Significant differences with immediately after the Yo-Yo test ($P<0.05$)
‡ Significant differences before and after the CrS at the same time ($P<0.05$)

Mohebbi et al. (2012) also indicated that the time of sprint running test and dribbling decreased significantly in the creatine group after a week CrS in young soccer players [12]. The researchers noted that increased speed of the subjects after CrS that might be due to increased muscle phosphocreatine resynthesis in the rest between activities, as H^+ buffer and increase production of ATP [7,12]. These discrepant results may be attributed to differences in timing in blood sampling, variation in the exercise protocols and differences in subject populations.

These results also demonstrated that CrS had no significant effects on agility with or without ball. Previously Cox et al. (2002) showed that agility performance improved after short-term CrS in elite female soccer players [9]. They noted that increased agility of the subjects after CrS that might be due to increased of the speed. As the our result showed, sprint performance had not significant changes after CrS thus it seems that lack of effect of CrS on agility in the present study might be due to the absence of reductions in speed performance.

At the end, the results indicated that although CrS had no significant effect on VO2max and HR, but it could be decrease of SBP and DBP in the futsal players. The finding that CrS did not influence VO_{2max} is in agreement with previous literature [13,14]. Further evidence to suggest that cardiopulmonary function during exercise was unaffected by CrS was provided by the similarity in heart rate and net oxygen uptake responses before and after supplementation. In support of this conclusion, most previous studies that evaluate similar outcomes have failed to identify any effect of CrS on aerobic capacity in healthy [15] and diseased populations [16]. Murphy et al. (2013) noted that blood pressure had not significant changes after a week CrS healthy males [17]. Cr may lead to cardiac hypertrophy, increase of septum, and decrease of sympathetic tone and these mechanisms may play a part in decreasing blood pressure, however additional researches are needed to examine these mechanisms.

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