

## Effect of Creatine Supplementation on Sprint and Skill Performance in Young Soccer Players

Mohebbi, H;<sup>1</sup> Rahnama, N;<sup>2</sup> Moghadassi, M;<sup>3</sup> Ranjbar, K<sup>1</sup>

1 Department of Exercise Physiology, Guilan University, Guilan, Ira

2 Department of Physical Education, Esfahan University, Esfahan, Iran

3 Department of Exercise Physiology Shiraz Branch, Islamic Azad University, Shiraz, Iran

### Abstract

The aim of this study was to determine the effect of creatine supplementation on sprint and skill performance in young soccer players. Seventeen young soccer players (mean age:  $17.18 \pm 1.37$  y, mean high:  $169.6 \pm 6.17$  cm and mean weight:  $61.67 \pm 1.37$  kg) participated in this study. Subjects were assigned to either a creatine (5 g of Cr, 4 times per day for 7 days) or a placebo group (same dosage of a glucose polymer) using a double-blind research design. Subjects performed a repeated sprint test, a dribble and an accuracy of shooting to a target zone tests, before and after supplementation. Results showed that the weight and lean body mass increased significantly in the creatine group ( $P < 0.05$ ), but, means difference between two groups were not significant. On the other hand, results showed that the time of sprint running test and dribbling decreased significantly in the creatine group ( $P < 0.05$ ), that mean differences between two groups, also, were significant ( $P < 0.05$ ). For accuracy of shooting, no significant difference was observed ( $P > 0.05$ ). In conclusion, creatine supplementation improved performance of repeated sprint and dribble in young soccer

players.

**Key Words:** Young Soccer Players, Creatine Supplementation, Skill

### Introduction

According to the reports about 95 percent of body creatine is stored in the muscles with about 60 to 70 percent phosphocreatine. Creatine consumption causes an increase of the muscle creatine resulting in increase in phosphocreatine and creatine free in skeletal muscles (Volek et al., 2001). Creatine plays an important role in energy metabolism (phosphocreatine) and product energy for short duration exercise (Skare et al., 2001). Studies have shown that after consumption of creatine for 2 to 7 days in a dose of 20 g daily causes a significant increase (by approximately 10 to 20 percent) of the total creatine pool and increase (by approximately 20 to 40 percent) of the phosphocreatine concentration (Burke et al., 1996; Hultman et al., 1996). It has been reported that, among professional players, high-intensity running accounts for about 8-18% of the total playing time during a soccer match and players also perform 10-19 tackles and 9-13 headings, most of which involve jumping for aerial possession of the ball (Mujika et al., 2000). In addition there is a shortage of scientific data concerning the possible

Ranjbar, K (✉)

kazem.ranjbar@gmail.com

effects of oral creatine-monohydrate supplementation on specific performance in sport such as soccer (Ostojic., 2004). Therefore, it is possible that creatine supplement use in improving performance of soccer players be effective.

Performance improve of speed and skill in different fields of sports such as wrestling, sprinting and volleyball and after complementary use of creatine have been experimented (Volek et al., 2001; Delecluse et al., 2003; Koçak & Karli., 2003; Mohamed Ebrahim 2010). For example Preen and his colleagues (Preen et al., 2001) reported that consumption of 20 g creatine per day for 5 days improves the performance of repetitive of short-duration and rapid cycling. Also Gaeni and his colleagues (Gaeni et al., 2009) reported that short term use of creatine supplement has a significant effect on short term running (20 and 40 meters), long term running (60 and 100 meters), interval speed endurance running (30 fast running in 5 seconds with 10 seconds of rest between each running) and muscle strength (1-RM in knee extension) of wrestlers. The effect of this supplementation on performance of speed and skill of soccer players is not clear. Some studies have reported the soccer speed improvement after taking a course of creatine (Mujika et al., 2000) while in other research taking creatine on performance speed and precision ball kicking of football players was ineffective (Cox et al., 2002). Lack of studies regarding the effect of creatine supplementation on performance in soccer skill and little attention to the effect of creatine supplementation in speed and performance skills of young soccer players and the importance of these variables in soccer led to the current study investigating the effect of creatine supplementation on sprint and skill performance in young soccer players.

## Methods

### Subjects

In this experiment 17 young soccer players from the squad of first batch were selected and they were organized (in terms of endurance and speed performance, body mass index and playing position) in two groups of creatine (n=8) and placebo (n=9).

### Research design

A double-blind research design was followed to administer the creatine and placebo treatments. The creatine group ingested four capsules content (5 g doses of creatine) per day and placebo group ingested the same dosage of glucose polymer. They were recommended to use the content of each capsule solved in 250 ml of lukewarm water or juice and consume with breakfast, lunch, dinner and the last meal before sleeping. During the supplementation, the subjects were asked to avoid consuming lots of red meat and white and avoid materials containing caffeine and any intensive activities. During the supplementation, the participants practiced only soccer training (three sessions per week). Repeated sprinting test and the skill test of dribble and accuracy of shooting were performed before and after the supplementation.

### Measurements

Subjects' height and weight were recorded by height – measurement and standard digital scale respectively. Fat percentage was measured by method of seven-point skin fold thickness (Jackson & Pollock., 1985) and Lafayette caliper made in America and millimeter accuracy were used to assess the maximum oxygen consumption used in 12 minute (Cooper test) (Neiman., 1990). 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). Accuracy of shooting was measured, by kick a role ball

into a  $0.8 \times 2.3$  meters target constructed in the center of goal. Strike zone was constructed with dimensions of  $1 \times 1$  meter then this zone 7.0 meters away from the target. Subjects with a 5 / 5 meters away from this area were located. Four balls were rolled from the player right-hand side, and followed by four balls from the players' left-hands side. Balls were rolled at 6 seconds intervals. Players were instructed to kick the ball with their dominant kicking foot when it reached to strike zone. Between each ball strike, player returned to a baseline position 5.5 meters behind the strike zone before approaching the next ball. Subject repeated this procedure until striking the ball eight. For every ball into the target, one score for subjects was recorded. In the dribble test five cones on a line with a distance 1 m between them were 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. Creatinine levels of subjects were measured before performing the pretest and post test.

For comparison in each group the dependent t test was used and for comparison between groups independent t-test was used at significant level of 0.05.

### Results

Profiles of subjects were presented in table 1. As can be seen there aren't significant differences (Where P in table 1) in aerobic fitness and body mass index between creatine and placebo groups. Therefore, the subjects were divided into two homogeneous groups.

Table 1. Profiles of individual subjects (mean  $\pm$  SD)

	Creatine	Placebo
Age (yr)	17.38 $\pm$ 1.18	17 $\pm$ 1.5
Height (cm)	170.37 $\pm$ 6.23	169.01 $\pm$ 6.42
Weight (kg)	61.95 $\pm$ 6.65	60.46 $\pm$ 4.88
BMI (kg/m <sup>2</sup> )	21.30 $\pm$ 2.01	21.18 $\pm$ 1.76
Vo <sub>2max</sub> (ml/kg/min)	45.17 $\pm$ 3.24	46.85 $\pm$ 2.13

Result of in-group differences were presented in table 2. The results showed that urinary creatinine in the creatine group had significantly increased ( $P < 0.05$ ) while in the placebo group the amount of creatinine did not change. Therefore, the results showed that creatine loading is performed in the experimental group. Body & fat weight and lean body mass in the creatine group and fat weight &

percentage in the placebo group increased significantly ( $P < 0.05$ ). In addition, the results indicated significant improvement both for speed of repeated sprint and dribble in the creatine group. Despite improvements in the accuracy of shooting (14.82 percent) but using creatine didn't affect significantly the accuracy of shooting ( $P > 0.05$ ).

Table 2: Comparison of pre-test and post test one week after taking creatine (mean  $\pm$  SD)

	Creatine				placebo			
	Pre-test	Post-test	t	p	Pre-test	Post-test	t	p
Weight (kg)	61.95 $\pm$ 6.6	63.63 $\pm$ 6.7	16.52	0.01*	60.46 $\pm$ 4.8	60.58 $\pm$ 4.8	-0.94	0.37
Fat percentage	7.99 $\pm$ 2.1	7.98 $\pm$ 2.1	0.3	0.77	8.1 $\pm$ 2.9	8.26 $\pm$ 2.8	-20.07	0.01*
Fat weight (kg)	5.017 $\pm$ 1.7	5.148 $\pm$ 1.7	-6.58	0.01*	5.004 $\pm$ 2.1	5.09 $\pm$ 2.2	8.14	0.01*
Lean body mass (kg)	56.94 $\pm$ 5.5	58.50 $\pm$ 5.70	-16.75	0.01*	55.46 $\pm$ 3.1	55.48 $\pm$ 3.2	-1.84	0.86
Repeated sprint test (s)	18.89 $\pm$ 0.7	17.79 $\pm$ 0.5	5.68	0.001*	18.77 $\pm$ 0.6	18.31 $\pm$ 0.4	2.26	0.053
Accuracy of shooting	3.62 $\pm$ 1.4	4.25 $\pm$ 1.2	-0.88	0.4	4.55 $\pm$ 2.2	5.22 $\pm$ 1.3	0.943	0.373
Dribble (s)	7.37 $\pm$ 1.09	6.75 $\pm$ 0.5	2.38	0.049*	7.06 $\pm$ 0.8	7.38 $\pm$ 0.4	-0.833	0.439
Creatinine (mg/dl)	1.47 $\pm$ 0.44	2.12 $\pm$ 0.51	-3.28	0.013*	1.57 $\pm$ 0.34	1.54 $\pm$ 0.44	0.26	0.8

\*Significant difference ( $P < 0.05$ ) between pre-test and post-test

According to charts 1 and 2, it was clear that there were significant differences in both speed of repeat sprint and time of dribble between the two groups ( $P < 0.05$ ).

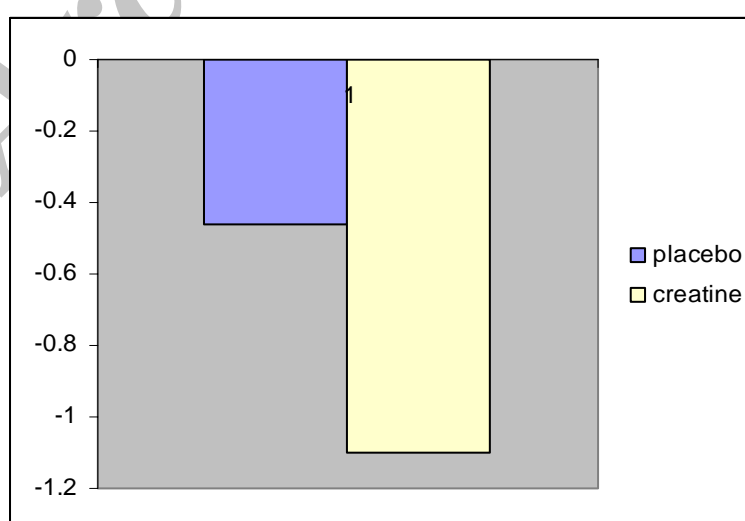


Chart 1: Comparing the difference of repeat sprint running between creatine and placebo groups (second)

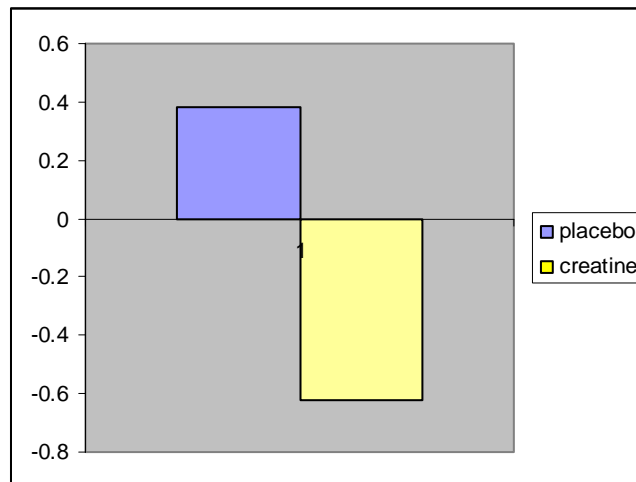


Chart 1: Comparing the difference of dribble between creatine and placebo groups (second)

### Discussion

The aim of this study was to determine the effect of creatine supplementation on sprint and skill performance in young soccer player. The results showed that the creatine group significantly gained weight (2.71 percent). Various investigations has observed that body weight after creatine supplementation is increased about 0.5 to 3 kg (Mujika et al., 2000; Cox et al., 2002) although this topic has not been confirmed by some studies (Kambis & Pizzedaz., 2003; Mckenna et al., 1999]. Lean body mass increased significantly in the creatine group. Researchers announced that cause of increasing weight and lean body mass with the use of creatine is increase of total body water (water retention) possibly resulting from simple osmotic effects, sell swelling, and consequent increase in protein synthesis. While some studies have also reported that muscle protein anabolism after creatine supplementation over the short term is due to decrease of catabolism (Branch., 2003; Kilduff et al., 2004). Either reduction loss or increase synthesis of protein muscle myofibril cause of increased lean body mass after creatine is supplementation (Preen et al., 2003). On the other hand, weight gain created in the placebo group may be related to their body fluids is increased (Preen et al., 2003; Falah Mohammadi et al., 2007), because the subjects had been

recommended taking a lot of fluids during their research since the creatine storage needs water.

Other results of this study showed that percent of body fat did not change significantly between groups. Much of researches have shown that fat percent doesn't change much after creatine supplementation (Cox et al., 2002; Branch et al., 2003; Leenders et al., 1999; Sub Lim., 2003). As was observed despite fat gain in both groups, there was no significant difference between the two groups. Fat weight increase in this study might be due to reduced volume and intensity of exercise, started after the competitive season (in the rest period).

The results showed that speed of dribble increased significantly in creatine group. In the creatine group, cause of improve in the speed of dribble probably was due to increased speed of the subjects that might be due to increased muscle phosphocreatine and increase production of ATP (Mckenna et al., 1999). In confirming this, Ostojic (Ostojic., 2004) also observed that speed of dribble has improved in the creatine group after a week (speed of 13 seconds to 10.2 seconds decreased). This study showed that the speed of performance improved following creatine intake, earlier researches are in line with this result (Gaeni et al., 2009; Mckenna et al., 1999; Falah Mohammadi

et al., 2007; Burke et al., 2001). Improve in the speed performance may be due to phosphocreatine re synthesis in the rest between activities (Mujika et al., 2000) as well as improve performance of phosphocreatine, as  $H^+$  buffer [20]. In contradiction with the results of this study, speed performance is not improved in other sports [Mckenna et al., 1999, Leenders et al., 1999]. For example Leenders *et al.* (Leenders et al., 1999) observed that two weeks creatine supplementation does not affect swimming speed of 10×25 yards women and men and as well as 6×50 meters with 30 seconds in the rest between activities. The gender differences and age differences in the samples as well as dose of creatine supplementation may be the cause of contradiction to the researchers. Mckenna *et al.* (Mckenna et al., 1999) also observed that the speed in five 10 s maximal cycle ergo meter sprint with rest intervals of 180, 50, 20, and 20 s after 4 weeks of creatine supplementation compared to control group remains without change. Finally, study results showed that the accuracy of shooting in creatine group (17.4 percent) and placebo (14.72 percent) has increased but this increase was not statistically significant and also significant differences between the two groups was not observed. The small increase in accuracy of shooting in the groups was probably due to learning in the post test. The present results confirm with Cox *et al.* (Cox et al., 2002) who observed that using creative supplement for a week does not affect accuracy of shoot in women's soccer. Thus the necessity of research on creatine supplementation on longer period is recommended. In this study, urinary creatinine as a marker of muscle creatine was used. Studies have shown that creatinine excretion takes place only in conditions when amount of creatine is stored in the body (Wilder et al., 2004). The results indicated significant increases in urinary creatinine in creatine group, thus it's clear that creative supplementation (20

g a day for 6 days) increased creatine levels in the body, and despite the increased body weight, these supplements could cause performance improvement in speed and skill of young soccer players. Results from this study can concluded that short-term consumption of creatine supplementation is effective in improvement of performance, speed and skill of young soccer player.

## References

- Branch, D. (2003). Effect of creatine supplementation on body composition and performance: A meta-analysis. *Int J Sport Nutr Exerc Metab.* 13(2): 198-228.
- Burke DG, Chilibeck PD, Davidson KS, Candow DG, Farthing J, Smith-Palmer T. (2001). The effect of whey protein supplementation with and without creatine monohydrate combined with resistance training on lean tissue mass and muscle strength. *Int J Sport Nutr Exerc Metab.* 11(3): 349-64.
- Burke LM, Pyne DB, & Telford RD. (1996). Effect of oral creatine supplementation on single effort sprint performance in elite swimmer. *Int J Sport Nutr.* 6(3): 222-33.
- Cox G, Mujika I, Tumilty D, & Burke L. (2002). Acute creatine supplementation and performance during a field test simulating match play in elite female soccer players. *Int J Sport Nutr Exerc Metab.* 12(1): 33-46.
- Delecluse C, Diels R, & Goris M. (2003). Effect of creatine supplementation on intermittent sprint running performance in highly trained athletes. *J Strength Cond Res.* 17(3): 446-54.
- Falah Mohammadi, Z., V.A. Dabidi Roushan & Soltani, H. (2007). The effect of creatine supplementation on blood lactate after an intermittent exercise protocol in trained taekwondo players. *Olympic.* 15: 45-53.
- Gaeni, A.A., E. Alidosteghahfarokhi, A. Ahmadi & Aabolhasani, M. (2009).

- The effects of short term creatine supplementation in sprint performance and muscular strength in wrestlers. *Journal of Sport Biosciences*. 1(3): 77-92.
- Hultman E, Söderlund K, Timmons JA, Cederblad G, & Greenhaff PL. (1996). Muscle creatine loading in man. *J Appl Physiol*. 81(1): 232-7.
- Jackson, A.S. & M.L. Pollock. (1985). Practical assessment of body composition. *Physician Sports med*, 13:76-90.
- Kambis, K.W. & Pizzedaz, S.K. (2003). Short-term creatine supplementation improve maximum quadriceps contraction in women. *Int J Sport Nutr Exerc Metab*. 13(1): 87-96.
- Kilduff LP, Georgiades E, James N, Minnion RH, Mitchell M, Kingsmore D, & et al. (2004). The effect of creatine supplementation on cardiovascular metabolic, and thermoregulatory responses during exercise in the heat if endurance-trained humans. *Int J Sport Nutr Exerc Metab*. 14(4): 443-60.
- Koçak S, & Karli U. (2003). Effects of high dose oral creatine supplementation on anaerobic capacity of elite wrestlers. *J Sports Med Phys Fitness*. 43(4): 488-93.
- Leenders NM, Lamb DR, & Nelson TE. (1999). Creatine supplementation and swimming performance. *Int J Sport Nutr*. 9(3): 251-62.
- Mckenna, M.J., J. Morton, S.E. Selig & Snow, R.J. (1999). Creatine supplementation increases muscle total creatine but not maximal intermittent exercise performance. *J Appl Physiol*. 87(6): 2244-52.
- Mohamed Ebrahim, A.E. (2010). Impact of Load Muscle with Creatine Monohydrate on Some Biological and Physical Variables and the Level Digital for Racers 100 Meter Running. *WJSS*. 3: 640-54.
- Mujika I, Padilla S, Ibañez J, Izquierdo M, & Gorostiaga E. (2000). Creatine supplementation and sprint performance in soccer players. *Med Sci Sports Exerc*. 32(2): 518-25.
- Neiman, D.C. (1990). *Fitness and sports medicine. An introduction*. Publishers: Bull Publishing Company, pp: 70-76.
- Ostojic, S.M. (2004). Creatine supplementation in young soccer players. *Int J Sport Nutr Exerc Metab*. 14(1): 95-103.
- Preen D, Dawson B, Goodman C, Beilby J, Ching S. (2003). Creatine supplementation: A comparison of loading and maintenance protocols on creatine uptake By Human Skeletal Muscle. *Int J Sport Nutr Exerc Metab*. 13(1): 97-111.
- Preen D, Dawson B, Goodman C, Lawrence S, Beilby J, & Ching S. (2001). Effects of creatine loading of long-term sprint exercise performance and metabolism. *Med Sci Sports Exerc*. 33(5): 814-21.
- Skare OC, Skadberg, & Wisnes AR. (2001). Creatine supplementation improves sprint performance in male sprints. *Scand J Med Sci Sports*. 11(2): 96-102.
- Sub Lim, J.Y., 2003. The effect of creatine supplementation on body composition, muscular strength and power. *The Sport Journal*, 6: 1-7.
- Volek JS, Mazzetti SA, Farquhar WB, Barnes BR, Gómez AL, & Kraemer WJ. (2001). Physiological response to short term exercise in the heat after creatine loading. *Med Sci Sports Exerc*. 33(7): 1101-8.
- Wilder N, Deivert RG, Hagerman F, Gilders R. (2004). The effect of low - dose creatine supplementation versus creatine loading in collegiate football players. *J Athl Train*. 36(2): 124-29.