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Effect of Whole body vibration Training and Creatine Supplementation on Some of Fitness Factors in healthy male

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ABSTRACT

The purpose of this study was to investigate the effect of whole body vibration training (WBVT) with creatine supplementation on some fitness factors in healthy male. 60 healthy male students were selected randomly and were assigned in four groups: 1: WBVT with creatine supplementation 2: WBVT with placebo consumption, 3: WBVT without supplementation consumption And 4: Control. The leg press test, the Sargent Jump Test, and the 60-meter sprint were used for measuring the maximum strength of lower extremity, the muscular power in lower extremity, and speed respectively. After getting the subjects' records in the pre-test stage, the subjects of the three experimental groups did the WBVT with a similar plan, for ten days. With this difference that the first group subjects received creatine supplementation, the second group were given placebo, the third group subjects did not receive any supplementation and the fourth group subjects continued their daily activities. In order to analyze the data, the descriptive statistics and one-way ANOVA with Tukey's Post Hoc Test were used ($\alpha \leq 0.05$). The results showed that there is a significant difference between the data related to lower extremity muscular power and strength of the four groups' subjects in the post-test period, which illustrates the improvement of the measured factors after the exercise and creatine supplementation consumption. The time for 60 meter sprint showed reduction only in WBVT with creatine supplementation group. Considering the research's findings, it is suggested that in designing the exercise plans for athletic fields which need speed performance similar to 60-meter sprint, the WBVT and creatine supplementation feeding be used.

Keywords: Whole body vibration training, Creatine supplementation, Fitness, Muscular Power.

INTRODUCTION

Creatine (Methyl guanidine acetic acid) is found in skeletal muscles in two forms of Free (Fcr) and Phosphocreatine (Pcr). Theoretically, the energizing effects of creatine is related to the creatine and Pcr's roles in the muscle's energy reconstruction. Although the creatine supplementation may have energizing effect on intense and short-term sports performance which are dependent to phosphagen system (ATP-Pcr), it may also be helpful for long-term activities with low intensity [1]. The maximum decomposition speed of Pcr inside the body is near to the maximum speed of ATP hydrolysis by the contractive proteins. So the Pcr availability may be a limiting factor in potential activities, even before the complete evacuation of muscle's phosphocreatine [2]. This can explain why the running speed decreases at the end of 100-meter sprint although the Pcr is not completely evacuated. Theoretically, creatine supplementation can increase the total creatine (Tcr) of the muscle and probably it can facilitate the Pcr production inside the muscle, especially in the fast twitch muscle fibers, which increases the performance capacity with high intensity [3]. Some of the researches have shown that the creatine supplementation, expedites the reconstruction of ATP from ADP up to 30% or more in intense activities [4]. Recent studies show that in different conditions, muscular fatigue is related to the increase of adenine nucleotide catabolism to inosine monophosphate (IMP) and ammonia and they support the hypothesis that the fatigue is due to the imbalance between the production and consumption of ATP [5].

Gravity causes most of the mechanical stimuli that is responsible for development in muscle structures in everyday life; on the other hand the strength and power training are along with changes in magnitude and speed of gravity, that this leads to greater stimulation of gravity to improve physical fitness [6-8]. Gravitational conditions can change by mechanical stimuli such as whole body vibration platform (WBVP) [6-8], that means subjects with help of WBVT can suffer more stimuli than daily activities [6-8]. Vibration as a factor for powerful mechanical stimuli in neuromuscular system, skeletal and muscular tissue has been studied widely in medicine, ergonomic and animal studies [9] and the use of WBVT has been considered as a new method in neuromuscular training [9, 10]. In WBVT subjects stand and take different physical conditions on WBVP that produce Sinusoidal vibrations and they maintain this position until the end the practice. The WBVT device is adjustable in different frequency and severity [9, 10].

Recent increases of different audiences and fans in different areas to WBVT have caused researchers to consider the short and long-term effects of this practice more than before. The different effects of WBVT that have been published in numerous journal articles can be mentioned as the shorter of training time, increase in muscle strength, flexibility enhancement, neuromuscular enhancement, and increase in skeletal density [11-13]. The studies have shown that sport performance, fitness, health level can be accelerating by WBVT [6, 14]. Although the physiological effects of WBVT are anonymous, researchers have expressed somatosensory activation theory, vibration tonic reflex, decrease in electromechanical delay, increase in motor unit recruitment, muscle activation and neuromuscular coordination [8, 11, 15-17].

Considering the importance of athletes' performance enhancement in competitive sports and records' proximity in national and international competitions, consuming the permitted athletic supplementation has become an important part of athletes' preparation for participating in the competition [18]. From the viewpoint of competition holders, managers, trainers and many athletes, two points in supplementation are of importance: 1. using the permitted supplementation 2. using the substance with maximum efficiency and least side effects [19]. Considering the mentioned points, using the monohydrate creatine supplementation as a permitted athletic supplementation is included in the plans of many athletes in different levels of professionals, semi-amateurs and amateurs. Hence, along with the increase of creatine supplementation use, the researchers' attention is attracted to it, and many studies have been done in this field. For example, Burke et al (2003) in a study investigated the effect of creatine supplementation and power training on vegetarians' muscle creatine and performance in 8 weeks. Creatine was given according to fat-free mass amount (0.25 grams of creatine per kilogram of fat-free mass for 7 days and in addition 0.0625 grams of creatine per kilogram of fat-free mass) for 46 days. The results showed that in the pretest the total muscle creatine (Tcr) in the vegetarian group was meaningfully lower than the non-vegetarian group (117 m mol/kg to 130m mol/kg). For those who received the creatine supplementation, the maximum increase was in Pcr, Tcr, chest press power, isokinetic work, second type of fabric cross section, fat-free mass compared to the placebo group. Also those vegetarians who were given creatine had more growth in Tcr, Pcr, fat-free mass and done work compared to the other non-vegetarian group who had taken creatine. The changes in Tcr, was obviously homologous with the first amount of muscle creatine, fat-free mass changes and athletic performance. These findings showed that creatine supplementation have energizing effects during the power trainings and those subjects with low level of creatine (vegetarians), respond more to these supplementation [4]. Yeansub (2003) did a research on the effect of creatine supplementation on the physical formation, the muscular power and vertical jump of the female academic volleyball players in a 10-week period. In this study, 36 athletes (from 19 to 26 years old) were randomly divided into two group of creatine (18 athletes) and placebo (18 athletes). The creatine groups were given 20 grams of creatine per day (loading stage) for five days, and afterwards they consumed 5 grams of creatine per day until the end of the study. The placebo group instead of creatine was given glucose, in a similar procedure. All the subjects participated in a power and plyometric plan and the following results were achieved. Both groups were improved in chest press power and vertical jump. But the creatine group showed a better growth compared to the placebo group. Also the creatine group had a meaningful improvement in the fat-free body mass and the fat mass was unchanged [20]. Castell et al (2010) investigated the effect of creatine supplementation and power training on the power enhancement of middle-aged and old people. The results of this study showed that the creatine loading along with power training in both age groups, has caused the muscular power enhancement [21]. Hichner et al (2010) in their study," the effect of 28-day consumption of creatine on the road cyclists' muscle performance and metabolism", reported the performance improvement after taking the creatine. Also the results of their study showed that the muscle metabolism after the creatine loading causes less lactate aggregation [22].

Despite the positive effects of creatine supplementation on body mass increasing, after studying the previous studies it was observed that some of the uses of this supplementation does not improve the athletes' performance. Considering the importance of improving the performance without increasing the muscular mass or with low increase of the mass, and also considering the importance of WBVT, especially in potential sports, the purpose of this study was to investigate the effect of WSBVT along with creatine supplementation on some of the fitness factors of healthy male.

MATERIALS AND METHODS

In order to operate the research, 60 college male student athletes, from those who had participated at least once in the national student competitions, were randomly selected and were classified in four groups as follows: 1. WBVT with creatine supplementation, 2. WBVT with placebo consumption, 3. WBVT without supplementation consumption, 4. Control (n = 15 per groups). The leg press test, the Sargent Jump Test, and the 60-meter sprint were used for measuring the maximum strength of lower extremity, the muscular power in lower extremity, and speed respectively. After getting the subjects' records in the pre-test stage, the subjects of the three experimental groups did the WBVT with a similar plan, for 10 days. With this difference that the first group subjects received creatine supplementation, the second group was given placebo; the third group subjects did not receive any supplementation. This training protocol contain the standing on the WBVP with 20-35 Hz of frequency and the amplitude of 5-10 mm. subjects did training in 6 position: standing with semi locked knee, 120 degree squat, 90 degree squat on right leg, 90 degree squat on left leg, and slowly ascending and descending on WBVP. Training and relaxation time had set up with the overload principle. The fourth group subjects continued their daily activities.

The first group subjects were given 20 grams of supplementation per day at the beginning of the exercises for five days and afterwards until the end of the trainings, consumed 10 grams of creatine (5 grams before the training and 5 grams after the training) every day. The placebo group in a similar plan used the glucose instead of creatine and the control group only did the WBVT without taking creatine and placebo. The control group continued their daily activities. After the end of the training period, the subjects were assessed similar to the pretest period. To describe the subjects' individual characteristics the descriptive statistics and for investigating the difference among the four groups' data in pretest and post-test periods the statistical test of one-way ANOVA with Tukey's Post Hoc Test in SPSS version 16 environment were used ($\alpha \leq 0.05$).

RESULTS

By using the ANOVA test, it became clear that there is no significant difference among the individual characteristics of the four groups' subjects, which shows the homogeneousness of the groups in the pretest period (table 1).

Also, using the ANOVA test did not show any significant difference among the data of the lower extremity maximum power, lower extremity muscular potency and 60-meter sprint speed among the four groups' subjects in the pretest period (table 2).

After including the training period, ANOVA test showed a significant difference among the four groups' data. By using the Tukey's Post-hoc test it became clear that there is a significant difference among the lower extremity maximum power of the control group's subjects and other three groups that are supplementation group ($F=9.45$, $P=0.001$), placebo group ($F=6.23$, $P=0.002$) and the training not-supplemented group ($F=3.76$, $P=0.012$). The difference between the data related to the three groups of training was not significant ($P>0.05$).

Table 1: The average and the standard deviation of individual characteristics of the four groups' subjects and the results of their comparison by using the one-way ANOVA

Variable	Group	Number	Average	Standard Deviation		F	P
Age	Supplement	15	24.07	1.14		0.576	0.354
	Placebo	15	22.80	2.32			
	No Supplement	15	24.84	1.32			
	Control	15	25.87	1.17			
Height (cm)	Supplement	15	175.2	2.57		0.478	0.472
	Placebo	15	173.53	2.85			
	No Supplement	15	174.63	3.75			
	Control	15	173.73	3.68			
Mass (Kg)	Supplement	15	73.67	2.31		0.556	0.189
	Placebo	15	74.53	3.56			
	No Supplement	15	72.87	3.68			
	Control	15	73.75	2.94			

Table 2: The average and the standard deviation of maximum power, muscular power and 60-meter sprint time of four groups' in pretest period

Variable	Group	Average	Standard Deviation		F	P
Maximum Power (kg)	Supplement	87.12	4.97		0.346	0.291
	Placebo	82.54	3.65			
	Training	81.25	5.38			
	Control	80.80	4.76			
Muscular Power (cm)	Supplement	54.4	2.48		0.293	0.214
	Placebo	52.6	3.81			
	Training	50.4	4.36			
	Control	49.03	4.29			
60-meter Sprint time (second)	Supplement	7.36	1.48		0.393	0.214
	Placebo	7.59	1.81			
	Training	7.48	1.76			
	Control	7.51	1.26			

Table 3: The average and the standard deviation of maximum power, muscular power and 60-meter sprint time of four groups' in post-test period

Variable	Group	Average	Standard Deviation		F	P
Maximum Power (kg)	Supplement	109.02	4.26		0.746	0.591
	Placebo	106.20	3.94			
	Training	105.17	4.75			
	Control	91.82	4.40			
Muscular Power (cm)	Supplement	69.4	2.38		0.893	0.614
	Placebo	68.6	3.01			
	Training	65.53	3.32			
	Control	50.03	2.29			
60-meter Sprint time (second)	Supplement	6.2	1.08		0.893	0.614
	Placebo	7.65	1.81			
	Training	7.34	1.32			
	Control	7.68	0.89			

In case of the muscular potency of lower extremity, a significant difference was observed among the jump level of control group and the other three groups that are supplementation group

(F=9.35, P=0.011), placebo group (F=8.72, P=0.001) and not-supplemented training group (F=6.88, P=0.001). In case of the mentioned factor, no significant differences were observed among the three training groups (P>0.05).

The post-hoc test for 60-meter sprint time showed that among the data of the supplementation group and the other three group which are control group (F=5.72, P=0.012) , placebo group (F=7.64, P=0.003) and the training group without supplementation(F=9.53, P=0.002) , a significant difference exists. Among the data related to placebo group, training group without supplementation and the control group, no significant differences were observed.

All three measured factors for the supplementation group's subjects, showed improvement in post-test period compared to the pretest condition. In case of placebo group and training group without supplementation, the observed difference for the muscular potency and lower extremity's power was meaningful. For the control group's subjects none of the measured factors in post-test and pretest showed any difference.

DISCUSSION

The purpose of this study was to investigate the effect of WBVT along with creatine supplementation on some fitness factors of healthy male. The results of this research, in accordance with the previous studies' findings which reported performance improvement after creatine supplementation, showed the performance enhancement of subjects after the supplementation period [4, 20-22]. Creatine is an active osmotic substance, so increasing the density of intracellular total creatine (Tcr), free creatine (Fcr) and phosphocreatine, stimulates the water stream to get into the cell. The increase in body water causes the increase in body mass. Also the intracellular water increase may be a sign of cellular anabolic development. We can conclude that the intracellular water increase done by creatine supplementation, may increase the synthesis of protein and decrease its analysis. Hence, the body mass and the fat-free mass increase [20]. Some of the researchers have observed the decrease in urination during the supplementation period, which helps to prove the aforementioned hypothesis [21]. However, the creatine-caused increase in intramuscular osmolality cannot be the probable cause of this amount of water. In a study, it is suggested that the simultaneous consumption of creatine and carbohydrates leads to increase in insulin level of blood, which can increase the glycogen production and consequently it can increase the muscle's water [21]. Also in some studies it is recommended that increasing Pcr in muscular cell can stimulate the protein, like the sport's or insulin's stimulation [22].

Several mechanisms which can cause the creatine supplementation act as energizer for intense activities are suggested, as follows:

I. Increasing the muscle's Pcr amount in relaxation state which can be as urgent transporter of phosphate for reconstructing ATP during the activity
II. Increasing the muscle's free creatine (Fcr) in relaxation state can increase the Pcr reconstruction during and after the activity and also can facilitate the energy transportation from mitochondria to places ATP is consumed.
III. Increasing the buffering state for hydrogen ion which can prevent from muscular cells' acidity.

IV. The training increaser: increasing the creatine or Pcr in athletes can cause reaching to higher training load, can decrease the training fatigue and it makes possible that the muscle's hypertrophy accelerate which can improve the performance.

V. Body mass increase: the increase in fat-free mass or muscular mass in sports which need high potentiality for overcoming a resistance or an external thing, can be helpful [4, 18-22].

Also, the results of this study in case of performance improvement after doing plyometric exercises was in agreement with the previous studies' findings [15, 23, 24]. The effect of WBVT in improving the performance can be summarized as follows: Considering the sensory receptors' activation by the WBVT, it is obvious that these exercises can directly affect the brain's activity. This issue, expresses the kinetic neurons' preparation in a group of muscles and joints for doing a motion and its compatibility to environmental background and also increasing the harmony and integrity of kinetic units, the cooperative muscles' twitch, the reverse muscles' resistance increase which can finally cause the improvement of neuromuscular responses, leading to the athletic performance improvement [7, 25].

CONCLUSION

Considering the findings of this study, it is suggested that in designing the training plans for power sport, whose best performance depends on the proper jump, the WBVT be used. Also it can be said that for athletic training whose purpose is to increase the muscular power, doing exercises without creatine supplementation is also effective. So it is suggested that in these trainings, the creatine supplementation not be used. However, for training courses which aim to increase the speed, the creatine supplementation can be used.

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