academicJournals

Vol. 10(17), pp. 2455-2459, 10 September, 2015
DOI: 10.5897/ERR2015.2423
Article Number: 45E7F1748346
ISSN 1990-3839

http://www.academicjournals.org/ERR

Educational Research and Reviews

Full Length Research Paper

The education and evaluation of vitamin consumption effects on stress markers oxidative after exercise

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Received 28 July, 2015; Accepted 21 August, 2015

The purpose of the research was to evaluate the effect of 4-week vitamin C and E supplementation on the markers of oxidative stress after exercise session in students. 30 non-athlete persons (25.21 ± 1.5 years, 173.42 ± 5.62 cm, 75.6±5.75 kg, VO_2 max of 42.26 ± 1.11 ml/kg/min, and waist-hip ratio of 0.91 ±0.02 cm) volunteered for the study and were given vitamin C and E supplementation (1000 mg per day) and control groups (without vitamins receiving). After 4 weeks of supplementation, all the participants in an aerobic exercise session consisting of running on a treadmill at -10° incline and 80% VO_2 max with 2 min rests between sets. Blood samples were taken before and after supplementation and after exercise. Normalized data were analyzed by SPSS software by using of repeated measures ANOVA, Bonferroni test, and independent samples t-test at 5% probability significance level. The results indicated that vitamin C and E supplementation before (P = 0.005) and after exercise (P = 0.004) significantly increased antioxidant capacity. It also prevented post-exercise increase in malondialdehyde (P = 0.001) and creatine kinase levels (P = 0.0001). Four weeks of vitamin C and E supplementation increases serum total antioxidant capacity which prevents exercise-induced oxidative stress and high increase in serum creatine kinase levels in students.

Key words: Creatine kinase, Malondialdehyde, total antioxidant capacity, Vitamin C, Vitamin E.

INTRODUCTION

Physical activity and moderate diet are necessary to quality of life and health. The most considerable biological change during physical activity is enhanced metabolism and oxygen ingestion. Increased oxygen uptake in mitochondria can increase electron transport, generate free radicals, and cause oxidative stress (Chrysostomou et al., 2013; Fisher-Wellman and Bloomer, 2009). The antioxidant system in the body has an important role in defending versus oxidative stress. This system uses antioxidants to disconnect the chain reactions composed by free radicals (Coşkun et al., 2005; Goldfarb et al., 2007). Several researchers believe that the consumption of antioxidants will help to ward off this propagation of free radicals during exercise and convey a beneficial effect (Viitala et al., 2004). The antioxidant system preserves homeostasis and protects the body versus free radical-induced oxidative damage (Fisher-Wellman and Bloomer, 2009). Vitamin C has many functions within the human body. It is a water soluble vitamin basic in carnitine synthesis, Collagen formation, neurotransmitter synthesis, and as an antioxidant (Guthrie and Picciano, 1995). The established functions of

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antioxidant vitamins prepare them for improving physical work capacity. It is a known fact that the concentration of these vitamins enhances after supplements yet more migration to tissues is hindered do to the structure and the accompanying biochemical properties (Thompson et al., 2001; Zoppi et al., 2006). Antioxidant supplementation may provide protection versus the negative health consequences of oxygen free radicals caused by exercise. Vitamin E is probably the most focused on and important non-enzymatic antioxidant substance in the body. Unlike most nutrients, a specific role for vitamin E in a required metabolic function has not been found (Institute of Medicine, 2000). The major function of vitamin E is to work as a chain-breaking antioxidant in a fat soluble environment thus preventing the propagation of free radical reactions (Viitala et al., 2004; Selkow et al., 2011). Two studies involving vitamin E antioxidant supplementation and aerobic exercise have produced positive results (Meydani et al., 1993). Researchers have explored antioxidant vitamins and enzymes that are found in blood plasma, in local tissue and within erythrocytes. Research performed in varying locations has caused conflicting results (Viitala et al., 2004; Zoppi et al., 2006). Kelkar et al. (2008) examined the effect of antioxidant consumption on antioxidant enzymes and they showed that antioxidant consumption significantly decreased malondialdehyde, but the increase in antioxidant enzymes was not significant. Recent researches have shown that intense aerobic exercise has health benefits for non-athletes and even people with certain diseases (Belviranlı and Gökbel, 2006; Ristow et al., 2009). However, these activities may subject sedentary individuals to cell damage due to the release of high levels of free radicals. These individuals have a relatively low antioxidant capacity and require antioxidant supplementation (Peternelj and Coombes, 2011). Studies have shown the antioxidant properties of vitamin C (Nikolaidis et al., 2012). Given a little and equivocal evidence about the effect of vitamin C and E supplementation on oxidative stress, the aim of this research was to study the effect of vitamin C and E supplementation on antioxidant capacity and malondialdehyde, creatine kinase levels after exercise.

MATERIALS AND METHODS

Participants

Sixty male students volunteered for the study of whom thirty qualified ones were selected. The subjects were in good health, were not using medications known to affect body system, and had not consumed vitamin or mineral supplements more than the recommended dietary allowance. The participants mean age was 21.5±1.3 years, mean weight was 70.55±2.9 kg and mean height was 173.42 ± 5.62 cm. All of the students were reading in B.S. of different fields in the university. All participants volunteered to be involved in the study and were informed of the general purpose of the investigation.

Procedure

The researchers were contacted via invited papers on board in the faculties. Participants were assured that the experiments and study did not have any damage for them and the treatments were natural without harmful materials. In this study, we tried to educate participants on vitamins consumption daily but we started with specialized doses until the participants got used to the consumption of vitamins after this test. The purpose of study was explained to the participants and they signed a consent form. Anthropometric indices (height, weight, and body fat percentage) were measured two week prior to the study. There were 3 groups in this study, control (n = 10), with vitamin C consumption (n=10) and with vitamin E consumption (n = 10). The measurements were done under 3 conditions, baseline, pre-exercise and post-exercise. The amounts of vitamin C and E consumption, was 1000 mg daily for both of the vitamins.

Measurements

Fasting blood samples were taken from the right hand antecubital vein 24 hours before supplementation and 12 h after the four-week supplementation period. Then the participants performed the exercise which included a general warm-up followed by 45 min by treadmill running with nine 5-min sets and 2-min rests between sets at -10° incline and at 80% VO_2 max. Final blood samples were taken immediately after the exercise protocol (Sacheck et al., 2003). Blood samples were 5 ml blood samples that were taken of the participants and collected in vials without anticoagulants to measure total antioxidant capacity (TAC) as well as malondialdehyde and creatine kinase levels. TAC was measured by using of Randox kits (MX2333) on auto-analyzer system at 600 nm (Miller et al., 1993) and creatine kinase was measured by using of the MaxDiscovery™ Creatine Kinase (CK) Enzymatic Assay Kit. Serum malondialdehyde level was measured by using spectro-photometry assay at 532 nm based on its reaction with thiobarbituric acid.

Statistical analysis

Normal distribution of the data was analyzed by using of Levene's test and Kolmogorov-Smirnov test. Then, the indices were analyzed by the use of repeated measures ANOVA and Bonferroni correction. All the statistical analysis were done by SPSS 22 and Excel 2013 software at 5% probability level. Also, abbreviation were used in figures as: CK: creatine kinase, MAD: malondialdehyde, TAC: total antioxidant capacity.

RESULTS

The descriptive statistics of the sample (n = 30) were as follows: 25.21 ± 1.5 years, 173.42 ± 5.62 cm, 75.6±5.75 kg, VO_2 max of 42.26 ± 1.11 ml/kg/min, and waist-hip ratio of 0.91 ±0.02 cm. The results of repeated measures ANOVA and Bonferroni correction showed that serum TAC significantly enhanced in the vitamin C and E group after four weeks (P = 0.004), while control group did not change significantly (P = 1.000). Creatine kinase (P = 0.0001) and malondialdehyde levels (P = 0.001) significantly increased after exercise, but a lower increase

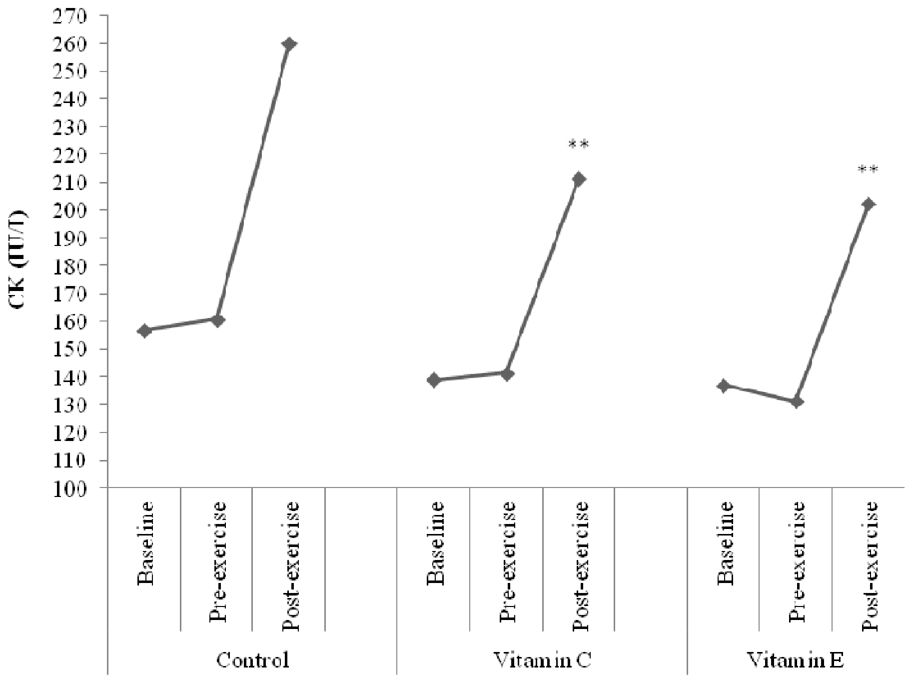

Figure 1. The effect of vitamins on CK under baseline, pre-exercise and post-exercise condition. *Significant at 5% probability level; **Significant at 1% probability level.

was indicated in the control group

There was significant difference between vitamin C and E and vitamin E had more significant effect compared to the vitamin C on the CK under both pre-exercise and post-exercise condition. Also, vitamin E caused to decrease the CK under the pre-exercise condition more than baseline condition (Figure 1).

Both vitamin C and E had significant effects on the MAD decreasing under pre-exercise and post-exercise condition but there was not significant difference between these two vitamins (Figure 2). Both vitamins had significant effects on the CK and MAD at 1% probability level under post-exercise condition (Figures 1 and 2).

Both treatments caused a significant increase in TAC under pre-exercise and post-exercise condition, although there was not significant difference between them. Also, both vitamins had significant effects as decreasing effect on the TAC at 5% probability level under pre-exercise condition (Figure 3).

DISCUSSION

The study results indicated that a four-week vitamin C and vitamin E supplementation program can significantly increase total antioxidant capacity (0.19 mm/l). Moreover, vitamin C supplementation increased antioxidant capacity after exercise (0.48 mm/l). Oberbach et al. (2010) indicated that 1000 mg consumption of vitamin C and 400 IU vitamin E for four weeks increases antioxidant capacity and prevents exercise-induced oxidative stress. The results showed that vitamin C supplementation significantly reduces malondialdehyde levels after exercise. Malondialdehyde is one of the main secondary products of lipid peroxidation (Padayatty et al., 2003). Bloomer et al. (2005) found that 1000 mg/day consumption of vitamin C for 2 weeks did not significantly changed malondialdehyde levels after a 2.5 h cycling session at 60% VO_2 max. Sacheck et al. (2003) showed that 45 min of treadmill running at 75% VO_2 max and -16° incline after vitamin E consumption does not change MDA levels. Kyparos et al (2011) showed that vitamin E consumption does not significantly affect CK levels in rats. Sacheck et al. (2003) illustrated that vitamin E consumption for 12 weeks had no significant effect on CK levels after exercise, but it increased peak CK levels. The results demonstrated that antioxidant vitamin C and E supplementation in soccer players may reduce lipid peroxidation and muscle damage during high intensity efforts (Claudio et al., 2006). The human studies were conducted with reasonable and otherwise practical dosages: 1000 mg/day of vitamin C and/or additionally400 IU of RRR-alpha-tocopherol over three to eight weeks (Gomez-Cabrera et al., 2008; Ristow et al., 2009). It is noteworthy that supplementation with just vitamin C is not comparable to supplementation with a combination of vitamins C and E, even when concentrations of vitamin C are similar. In this respect, added vitamin E might

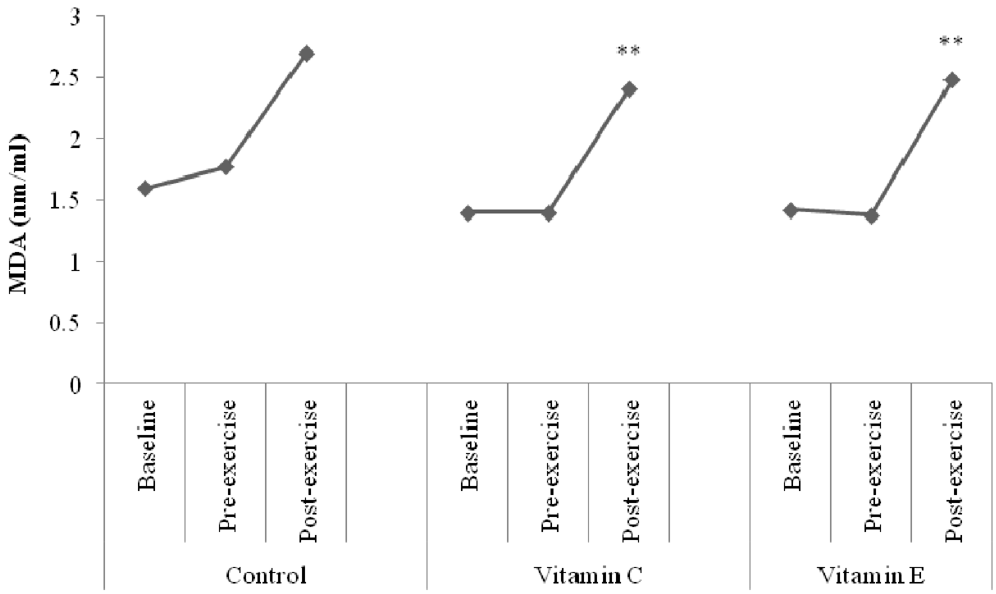

Figure 2. The effect of vitamins on MDA under baseline, pre-exercise and post-exercise condition. *Significant at 5% probability level; **Significant at 1% probability level.

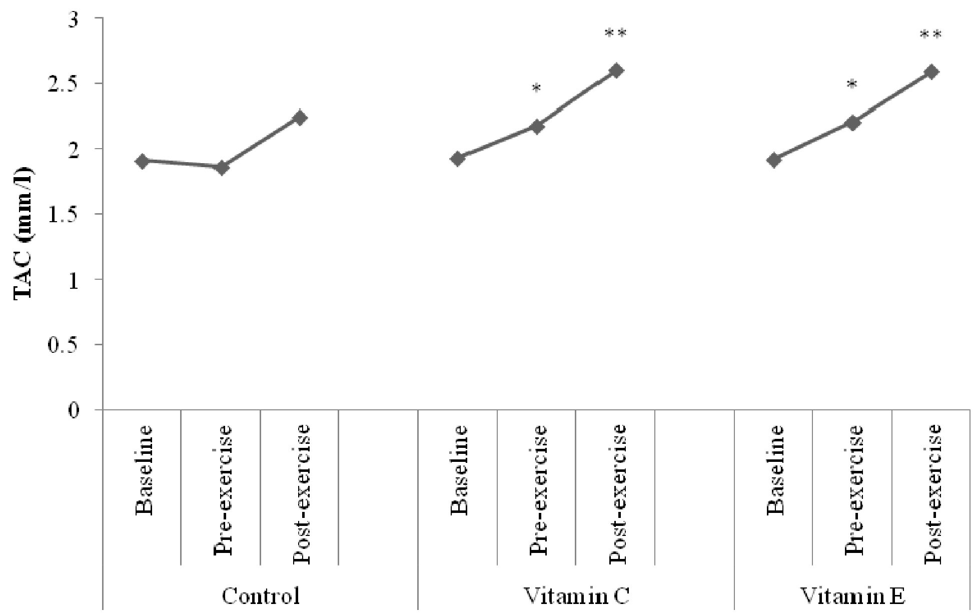

Figure 3. The effect of vitamins on TAC under baseline, pre-exercise and post-exercise condition. *Significant at 5% probability level; **Significant at 1% probability level.

change the impact on redox homeostasis due to its antioxidant and also prooxidant properties (Buettner, 1993).

Conclusion

This study extends previous research by exploring researchers about different treatments about vitamins exercise interaction on the stress markers oxidative. In conclusion, it can be stated, this study results showed that four weeks of vitamin C and E supplementation increase serum total antioxidant capacity and prevent oxidative damage following exercise. Also, it prevents high increasing in malondialdehyde and creatine kinase levels under post-exercise condition. So vitamins consumption especially vitamin E can cause to decrease the stress and its effect after exercise is more in compare to the before exercise. Future research can be focused on other markers of cell inflammation and the different times and doses of the supplements consumption. Also, it can be performed different exercise with different strong on the participations. Female groups can be participate for this test in sufficient time.

Conflict of Interests

The author has not declared any conflicts of interest.

ACKNOWLEDGEMENT

We thank the students and staff for taking part in this study.

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