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LETTER TO THE EDITOR

EFFECT OF ANTIOXIDANT SUPPLEMENTATION AND EXERCISE TRAINING ON SERUM ENZYMES AFTER ACUTE EXHAUSTIVE EXERCISE

Sir,

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An acute bout of exhaustive exercise serves as a very good model for evaluating the effect of oxidative stress on the body. It also contributes to an increase in serum levels of creatine phosphokinase (CPK) and lactate dehydrogenase (LDH) enzymes, as has been demonstrated in several studies (1, 2). Leakage of intracellular CPK or LDH is indicative of local tissue damage induced by oxygen lack or mechanical trauma (3). It has also been noted that trained individuals show a lesser rise in these enzyme levels when exposed to prolonged vigorous exercise (4, 5). The protective effect of antioxidants in diminishing the post exercise rise of serum CPK and LDH in individuals trained for competitive sports has come to light in recent years (6, 7). There is however no report on the effect of antioxidants in preventing the post exercise rises of these enzymes in untrained individuals. Therefore, we planned to carry out this study to investigate the effect of an acute bout of exhaustive exercise in CPK and LDH enzymes in young students undergoing regular exercise training of short duration versus regular antioxidant supplementation.

The study was conducted at the Department of Physiology, GSVM Medical College, Kanpur. Thirty-six healthy, untrained males were randomly selected from a batch of first year MBBS students. Written informed consent was obtained before the start of the experiment. Ethics committee of the institute approved the study.

Duration of the study was twelve weeks. Subjects were divided into three groups of twelve each. The first group received a capsule of antioxidant once daily (E-Carotin, Franco Indian Pharmaceuticals Pvt. Ltd.). Each capsule contained beta carotene - 10 mg, vitamin E - 25 mg, vitamin C - 150 mg, selenium dioxide-75 micro gm and zinc sulphate-61.8 mg. The second group while maintaining their routine activity also underwent high intensity exercise training on friction type bicycle ergometer, six days a week at a frictional force of 0.75 kg and pedal revolution rate between 60–80 per minute for eight minutes. The third group served as a control. It neither received any antioxidant nor underwent any exercise training. The anthropometric data were comparable among the three groups (Table I).

Exercise challenge was an incremental exhaustive exercise starting with effective frictional force of one kg and pedaling rate of sixty per minute for three minutes. After which the frictional force was raised by half

TABLE I: Anthropometric variables.

Groups (Mean±SD)	*Age (years)*	*Height (cm)*	*Weight (kg)*	*Surface area (mt^2)*
AO	21.73±1.54	171.66±6.31	54.66±6.55	1.73±0.10
TR	20.25±1.05	176.07±3.66	65.08±4.12	1.90±0.06
C	21.08±0.99	173.75±5.57	57.66±6.05	1.79±0.10
P value	NS	NS	NS	NS

AO-Antioxidant, TR-Exercise training, C-Control
NS-Non significant

kg every three minutes until the subject was unable to maintain the pedaling rate of sixty per minute due to intolerable dyspnea, sense of fatigue, giddiness and cramps in leg muscles. All subjects were exposed to this exercise challenge twice, once at the beginning (first exercise challenge EX1) and then at the end of three months (second exercise challenge EX2).

Four venous blood samples were drawn from each subject viz. prior to and following first and the second exercise challenge. All samples were transferred to sterile glass vials immediately after collection. The serum was centrifuged, separated and analyzed for CPK and LDH using a semi-autoanalyser (Biotron BTR 420). CPK levels were estimated using CK (Nac act) kit (Crest Biosystems). Serum LDH levels were determined by LDH kit (Merck Limited).

Mean and standard deviations were calculated for serum levels of CPK and LDH before and after first exercise challenge (EX1) and similarly for the second exercise challenge (EX2).

Students t-test was used to analyze the data and $P<0.05$ was considered to be significant.

Comparing the pre-exercise values of serum CPK and LDH before the first (EX1) and second exercise challenge (EX2), it was found that there was a significant decrease ($P<0.05$) in the enzyme levels only in the group that received three months of antioxidant supplementation. No change in enzyme levels was observed in the training and control groups (Tables II, III).

A similar comparison of enzyme levels following the first (EX1) and second exercise challenge (EX2) revealed a significant reduction ($P<0.05$) of CPK and LDH values in the antioxidant group only (Tables II, III).

There are several studies evaluating the effect of exercise 8–10 intensity and/or duration on the enzyme levels (8–10). Most of the studies have shown that exercise of sufficient intensity and/or duration wilt induce an jncrease in serum enzyme levels. It has been observed that there was a greater post-exercise rise in serum enzymes in untrained subjects than in trained athletes (8, 11). Training seems to diminish the release of enzymes into serum after exercise. It has also been suggested by various authors (12, 13) that one of the cellular adaptations to training is synthesis of additional amounts of muscle enzymes

TABLE II: Serum CPK values (units/l).

Groups	*AO*		*TR*		*C*	
	Pre	*Post*	*Pre*	*Post*	*Pre*	*Post*
First Exercise Challenge	116.90±28.50	164.66±39.42	150.83±24.24	201.50±54.48	128.83±36.89	171.0±61.88
Second Exercise Challenge	90.91±21.40	132.66±19.01	153.91±38.99	184.58±46.39	127.33±37.54	176.33±60.14
P value	<0.05	<0.05	>0.05	>0.05	>0.05	>0.05

AO-Antioxidant, TR-Exercise training, C-Control

TABLE III: Serum LDH levels (units/l).

Groups	*AO*		*TR*		*C*	
	Pre	*Post*	*Pre*	*Post*	*Pre*	*Post*
First Exercise Challenge	332.50±101.26	453.41±137.47	282.08±61.79	365.85±122.76	279.83±59.79	351.50±93.33
Second Exercise Challenge	255.08±49.48	314.91±87.09	259.58±59.14	289.83±58.67	271.33±60.14	367.41±84.29
P value	<0.05	<0.05	>0.05	>0.05	>0.05	>0.05

AO-Antioxidant, TR-Exercise training, C-Control

that may be reflected in higher baseline serum enzyme concentration.

This is contrary to the finding in our study in which there was no significant decrease in serum enzyme levels in the subjects undergoing training.

However, all studies mentioned in the literature have been conducted on athletes who had undergone rigorous training. The subjects in our study were previously untrained i.e. non-athletes who underwent a short duration high intensity exercise training for three months only. It is possible that the duration rather than the intensity of exercise may be a more important factor in providing the cellular adaptation to exercise and in preventing the leakage of enzymes (2). This could probably explain why the subjects in the exercise-training group did not have any significant change in the pre- and post-exercise serum enzyme levels.

Various studies insist that the supplementation of vitamin E and/or vitamin C leads to lesser post- exercise rise of serum CPK and LDH levels (7, 14, 15). However, there is no study in which the effect of a combination of antioxidant vitamins and micronutrients has been evaluated. Antioxidant supplementation for three months resulted in decrease of enzyme levels following second challenge when compared with the first exercise challenge. Our findings are in tune with those of Rokitzki et al (7), who also found that antioxidant supplementation (vitamins E and C) in trained athletes reduces blood CPK increase under exercise stress. However we supplemented antioxidants to untrained subjects. Thus, we infer that antioxidant

supplementation, even in non-athletes, can result in limiting a rise of serum CPK and LDH levels following a bout of exhaustive exercise.

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