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Original Research Article

Effect of moderate exercise on Antioxidant and free radical status in Females

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Abstract: Exercise is known to alter antioxidant and free radical status. High intensity exercise is generally known to induce oxidative stress. However the effects of moderate intensity exercise on females is not clearly known. With this background we tried to evaluate the antioxidant and free radical status in healthy females. 40 healthy adult female were divided in two groups, Group I (n=20) this was study group they were allowed to undergo trained moderate intensity isotonic exercise under supervision for 6 weeks and Group II (n=20) acted as controls. Blood samples from both groups were collected prior and post training for comparison. The mean value of Malondialdehyde (MDA) in group I prior to training was 215.67 ± 15.56 nmol% and in Group II it was 212.46 ± 19.03 nmol%. The post training values in Group I was 398.75 ± 25.45 nmol% and group II were 245.98 ± 34 nmol%. Serum uric acid levels were also recorded but no significant changes were observed in their levels before and after exercises. Moderate intensity exercise in females increased the free radical formation but no significant increase in antioxidant status was observed. It is concluded that the free radical formation and oxidative stress in exercise is a necessary factor for muscle adaptation to occur and long term exercise produces beneficial effect by causing better muscle adaptation.
Keywords: Isotonic Exercise, Antioxidant status, free radicals, Female

INTRODUCTION

Exercise is now being considered an important factor for staying healthy. When we exercise our muscles consume oxygen which in turn leads to production of free radicals. Free radicals are essential to many normal biological processes. Free radicals are chemical species that contain one or more unpaired electrons that are capable of independent existence. Most free radicals that occur in vivo are Reactive Oxygen Species (ROS) or reactive nitrogen species. Most free ROS include oxygen based free radicals, e.g. superoxide (0-) hydroxyl (OH'), alkoxyl (RO'), peroxyl (ROO') and hydroperoxyl groups. Free radicals have the potential to react with variety of chemical species, making them ideal for wide range of biological functioning [1]. It has been established that ROS can be both harmful and beneficial in biological systems depending on the environment [2]. Beneficial effects of ROS involve, for example, the physiological roles in cellular responses to noxia such as defence against infectious agents, and in the function of a number of cellular signalling systems. In contrast, at high concentrations, ROS can be mediate damage to cell structures, including lipids and membranes, proteins and nucleic acids; this damage is often referred as "oxidative stress" [3]. Exercise causes an increase in the generation of free radicals by cells, it is found that these radicals cause cellular damage only when exercise is exhaustive. Strenuous exercise causes oxidation of glutathione, the release of cytosolic enzymes and other signs of cell damage [4]. This is prevented by antioxidant administration however, free radicals not only cause damage but they also have a role in cell signalling Moreover, the redox-sensitive transcription factor NF-κB is activated in exercise both in humans. The practical implication is that decreasing RONS effects with antioxidants may hinder beneficial cell adaptations during exercise [5, 6]. However it is important to recognize that free radicals are not the cause any disorder on their own, but the diseased or damaged tissue undergo radical reactions much more readily than the normal tissues exacerbating the primary lesions [7]. Antioxidants are substances that when present in low concentrations compared with those of an oxidisable substrate significantly delays or prevents oxidation of the substrate [7]. Research shows that endurance and strength training places an increased demand on blood antioxidant systems, which are body's first line of defence against free radical damage [8]. A free radical generation in cell damages it to the point

that it must be removed by immune system. If free radical formation and attack are not controlled as in some exercise it could lead to muscle damage. To answer such a question we undertook the present study in which we tried to find the amount of free radical formation in female groups when subject to moderate exercises.

MATERIALS AND METHODS

The present study was conducted at Department of Physiology and Biochemistry, Osmania Medical College Hyderabad. The Biochemical analysis for estimation of Serum Malondialdehyde (MDA, a marker of lipid per oxidation) and Serum Uric acid (Natural antioxidant of the body) levels by calorimetry by using spectrophotometer. A group of 40 female age (20-25) matched volunteers having good health, non-smoking, and non-alcoholic without any significant disorders were selected and randomly assigned into two groups, Group-I n=20 (Isotonic exercise group), Group-II n=20 (Control group). Both the groups are screened for general health and vital data collected. They are also screened for their food habits. Only vegetarians are selected as non-vegetarian food can interfere in the results of the experiment. The subjects selected were not previously trained for Isotonic exercises. Procedures followed in this study were in accordance with the ethical standards laid down by ICMR's Ethical guidelines for biomedical research on human subjects (2006). Informed consent was taken from all the patients participated. Group-I (Isotonic exercise): Group-1 subjects were given programmed training in Isotonic exercise (i.e., bench press; light jogging, Dumbbells and Barbells). They exercise daily for 30 minutes under supervision for 6 weeks in the morning 6:00Am to 6:30Am. Group-II Control group did not receive any training and they were advised not to deviate from their routine work. At the start of the training schedule blood samples were collected from all subjects of both groups for the estimation of MDA and Uric acid levels. Similarly the samples of blood were collected for the estimation of MDA and Uric acid levels at the end of 6 weeks in both the groups.

Biochemical Tests

Aldehydes, especially Malondialdehyde [MDA] a product of fatty acid peroxidation MDA, is an indicator of the extent of peroxidation and has been frequently used as marker of oxidative stress in response to exercise. The most common method used to assess changes in MDA with exercise is Thiobarbituric Acid (TBARS) Assay. This method works well when used on defined membrane systems such as microsomes in vitro [9].

Estimation of Uric Acid

Uric acid is a final enzymatic product in the degradation of purine nucleosides and free bases in humans. Urates appear to play role beyond the end product of purine metabolism. Urate by itself serves as an antioxidant undergoing non-enzymatic conversion to Allantoin. It is now considered as a naturally occurring antioxidant. Estimation of uric acid gives the level of antioxidants in the body [10]. Normal range: female: 3.4 to 7.0 mg%.

RESULTS

The Malondialdehyde [MDA] which is a marker for free radical formation was measured in both the groups, prior to after exercise in both the groups. The values of MDA were not found to be significant before the exercise. The values of MDA shows increase in values in the Group I (test) they underwent isotonic exercise training however the values of Group II controls remains same. When the values of Group I were compared to Group II using't' test the values in group II were found to be significant given in table 1.

Table 1: The mean values of Malondialdehyde [MDA] nmol% in two groups before and after exercise

Groups	MDA (nmol %) Mean	SD	P value
Group I [Before]	215.67 ± 15.56	15.56	
Group II [Before]	212.46 ± 19.03	19.03	> 0.05
Group I [After]	398.75 ± 25.45	25.45	
Group II [After]	245.98 ± 22.86	22.86	<0.05 *

* Significant

The serum uric acid levels, is a natural occurring antioxidant was measured to determine changes in their levels in both groups prior to and after Exercise. The values of uric acid did not show any significant change although a slight increase in their levels were found in the test group I after period of exercise training given in table 2.

Table 2: The mean values of Uric acid mg% in both groups before and after exercise

Groups	Uric Acid mg% Mean	SD	P value
Group I [Before]	5.21	0.89	
Group II [Before]	5.10	0.75	> 0.05
Group I [After]	5.75	0.80	
Group II [After]	5.25	0.79	> 0.05

DISCUSSION

Exercise especially exhaustive exercise is known to generate free radicals. However only few studies have actually measured exercise induced free radicals directly because of lack of sophisticated methodologies to measure this phenomenon, they have instead relied on measurement of lipid peroxidation as the principal indicator of exercise induced free radicals [11]. In the present we have also measured the Malondialdehyde levels as the marker of oxidative stress. In this study it is shown that the MDA levels have increased to significant levels in the Group I which underwent training in exercise whereas the Group II which acted as controls did not show any increase. These observations are in agreement with other similar studies done in this area [12-14]. One of the reasons for oxidative stress during exercise is increased aerobic metabolism. In muscle mitochondria are one of important source of reactive intermediates which include superoxide, hydrogen peroxide and hydroxyl radical [15]. One study by J. Vina *et al.;* have concluded that the xanthine oxidase is responsible for the free radical production and tissue damage during exhaustive exercise. They also suggested that mitochondira play a minor role as source free radicals during exhaustive physical exercise [14]. Sureda *et al.;* found an increased Malondialdehyde due to oxidative stress in lymphocytes after a single bout of intense exercise. [16] Study by Ajmani *et al.;* have shown that exercise produces imbalance between oxidants and antioxidants which is oxidative stress. Physical activity increases generation of free radicals and 2 -5% of oxygen used by mitochondria forms free radicals [17]. As in the present study the MDA levels have been found to increase after one and half month of regular training, similar observations have been made in the past by other studies [18, 19]. A study by McBride JM et al; have shown that the MDA levels significantly from pre exercise levels to post exercise levels indicating high intensity resistance exercise produces free radicals this observation is in agreement with the present study [20]. In the present study there was no significant increase in uric acid levels in Group I and Group II prior to and after exercise such findings are in agreement with study by Alessop *et al.;* [21] they showed that total antioxidant capacity did not increase in response to 30 minute exercise despite increase in MDA levels. Green H et al have observed that the total exercise intensity is an important factor for mediating increase in serum uric acid concentration rather than total work output [22]. Our exercise being moderate intensity could be one of the reasons for the observation. Also one of the important factors that must be considered is that almost all the exercise related studies have been done most commonly on male subjects. Here in the present we have separately done on healthy female subjects which could be one of the reasons for the differences in observations.

CONCLUSION:

Moderate intensity exercise in females increased the free radical formation but no significant increase in antioxidant status was observed. It is concluded that the free radical formation and oxidative stress in exercise is a necessary factor for muscle adaptation to occur and long term exercise produces beneficial effect by causing better muscle adaptation.

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