Effect of Low Intensity Exercise Training on Total Antioxidant Capacity and Lipid Profile in Sedentary Students: A Pilot Study

Kultida Klarod, Ph.D.[1,*] Niramon Thamawiriyasati, Ph.D.[2], Pranithi Hongsprabhas, M.D.[3], Roongpet Tangrassameeprasert, M.Sc.[4], Sanita singsanan, Ph.D.[2], Patcharee Boonsiri, Ph.D.[4]

[1]Department of Physical Therapy, Burapha University, Chonburi, Thailand

[2]Department of Medical Technology, Burapha University, Chonburi, Thailand

[3]Department of Medicine, Faculty of Medicine, Khon Kaen University, Thailand

[4]Department of Biochemistry, Faculty of Medicine, Khon Kaen University, Thailand

[*]Corresponding author: kultidakku@gmail.com

Abstract

Introduction: Exercise training has been shown to be beneficial in decreasing oxidative stress. The objective of this study was to determine consequences of low intensity exercise training on total antioxidant capacity and lipid profile in the sedentary students.

Methods: Ten sedentary undergraduate students were obtained a low intensity exercise training, at 40% heart rate reserve by cycling (one time/day, three days/weeks), for 8 weeks. Blood samples were collected before and immediately after exercise training.

Results: There were significantly higher in total antioxidant capacity after exercise training compared to before the training ($p = 0.003$). A higher triglyceride level compared to before exercise training ($p = 0.032$) was also reported.

Conclusions: The low intensity exercise training may improve total antioxidant capacity. As a result, this training gives benefit to sedentary students.

Keywords: Total Antioxidant Capacity, Exercise Training, Low Intensity

Introduction/ objective

Exercise, involves with oxygen consumption, results in an increasing of reactive oxygen species (ROS) production (1, 2). However, regular exercise with non-exhaustive intensity has been reported to gain favorable results (3), including preventive effect for various chronic illnesses (4), because a generation of low ROS concentration is able to stimulate the expression of antioxidant enzymes (3). It has been indicated that a low dose of ROS plays role as an inducement for antioxidant system in the body (5). Therefore, low to moderate intensity exercise training may increase total antioxidant capacity.

In addition, exercise also gives benefit to the body by increasing lipid utilization in skeletal muscles, as a result, this causes decreasing in plasma lipid profiles (triglyceride, cholesterol, low density lipoprotein, and high density lipoprotein) (6). However, the exercise training induces a lowering of lipid levels is still controversial (7-9). Kraus et al. recommended that energy expenditure and intensity were influenced factors for decreasing lipid components (10) and O' Donovan et al reported that high intensity training exercise was able to reduce lipid levels (11). On the other hand, moderate intensity exercise leaded to an increasing of high density lipoprotein on atherosclerosis (12). Taken together, we hypothesized that low to moderate exercise training might cause an increasing in total antioxidant capacity but decreasing in lipid levels. Therefore, the objective of this pilot study was to determine effect of low intensity exercise training on total antioxidant capacity and lipid levels in sedentary students.

Materials and Methods

Participants

Ten undergraduate students (male = 3, female = 7) at Burapha University, who were not tobacco smoker/alcohol drinker, were enrolled in this study in the year 2015. They participated in the exercise training for 8 weeks. Before participation, they were abstained from any exercise for at least 3 months, with no antioxidant supplementation or were not at risk under exercise condition. This study was approved by Burapha University Human Ethics Institutional Review Board (2013).

Exercise training protocol

Participants carried out exercise training by cycling for 8 weeks (1 time/day, 3 days/week) at 40% heart rate reserve, determined by Karvonen et al. (13). The blood samples were obtained before and immediately after exercise training.

Total antioxidant capacity

Total antioxidant capacity was measured by Ferric Reducing Antioxidant Power (FRAP) assay (14). The freshly working FRAP reagent contained 300 mM acetate buffer, pH 3.6, 10 mM 2, 4, 6-tri [2pyridyl]-s-trianzine (TPTZ) and 20 mM Ferric chloride hexahydrate (FeCl3.6H2O). The Ferric tripyridyltriazine (Fe3+-TPTZ) complex was reduced to ferrous tripyridyltriazine (Fe2+-TPTZ) which generated blue color at low pH. The absorbance was measured at 593 nm. Ferrous sulfate heptahydrate (FeSO4.7H2O) was used for preparation of a standard curve.

Determination of lipid profile

Cholesterol level, high-density lipoprotein; HDL-C, and triglyceride; TG levels (Olympus automated chemistry analyzer SOP AU 400, within- and between-run coefficient of variation (%CV) was 3% for all analyses) were measured. Low-density lipoprotein; LDL-C was calculated using the Friedwald equation (15).

Statistical analysis

All Data was presented as mean ± SD. Statistical analysis was done by using SPSS program version 17.0 (SPSS Inc., Chicago, IL). The difference between before and after exercise training groups was computed by Paired student's t-test or Willcoxon signed-rank test as appropriate. The significant difference was considered at $p < 0.05$.

Results and Discussion

The baseline characteristics of ten healthy subjects with sedentary lifestyle were shown in Table 1.

Compared to pre-training, there was significantly increased in total antioxidant capacity in post-training exercise ($p = 0.003$), as indicated in Table 2. After exercise training, triglyceride level was significant higher than that of pre-training ($p = 0.032$).

The main findings of this study were the increasing of total antioxidant capacity and triglyceride level after exercise training for 8 weeks. Our results were similar to Liu et al. that there is an increasing of total antioxidant capacity after marathon race (16). In contrast to the present study, Pialoux et al. reported that there was the lower level of total antioxidant capacity for 2 weeks after the end of training, which was from lacking input of antioxidant requirement (17). The exercise training has been reported favorable effect for weakening oxidative stress, as well as developing production of antioxidant enzyme activity (18).

This study demonstrated that triglyceride level after exercise training was higher than pre-exercise. In discrepancy with Kraus et al who revealed that various amount and intensity of exercise showed lowering of triglyceride level (10). However, there was a report observed that plasma triglyceride was constantly maintained in male runner, as opposed with a rising of them in sedentary men (19). Additionally, Mann et al suggested that to reduce low density lipoprotein and triglyceride levels, one has to be increased aerobic exercise intensity (20). The possible explanation for the higher level of triglyceride level in the present study was the higher skeletal lipoprotein lipase activity developed, and then elevated lipolysis in adipose tissue augmented plasma free fatty acid levels. It would be stimulated very low density lipoprotein-triglyceride synthesis in liver. This process developed an increasing of plasma triglyceride level for providing a high amount of hydrolysis from lipoprotein lipase activity in active muscle (21). However, the timing of blood collection was the important factor which it had to be considered.

Table 1. Baseline characteristics

Parameters	Exercise training (n = 10)
Age	20.0 ± 1.3
Weight	58.49 ± 13.51
BMI	21.37 ± 4.73
Gender (male/ female)	3/ 7

Values are as mean ± SD

Table 2. Pre-and Post-training level of total antioxidant capacity and lipid profile of the subjects

Parameters	Exercise training (n = 10)		**p**-value
	Pre-training	Post-training	
Total antioxidant capacity (uM)	829.64±96.66	934.58±108.23	0.003*
Weight (kgs)	58.49 ± 13.51	57.55 ± 13.19	0.081
Cholesterol (mg/ dL)	206±31	201±39	0.623
HDL-C (mg/ dL)	52±5	51±13	0.787
LDL-C (mg/ dL)	141±32	136±39	0.408
Triglyceride (mg/ dL)	63±18	73±20	0.032*

Values are as mean ± SD, *significant difference at $\mathbf{p} < 0.05$, HDL-C = high density lipoprotein-cholesterol, LDL-C = low density lipoprotein-cholesterol

Conclusion

Low intensity exercise training for 8 weeks in this pilot study can improve total antioxidant capacity in the ten sedentary healthy subjects. A higher level of triglyceride after exercise training might be a remarkable character of this exercise training. Further investigation, with a large sample size, is warranted.

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