Keywords: Myocardium; Oxidative stress; Physical exercise

Introduction

Worldwide, cardiovascular diseases are the main cause of death in the occidental lifestyle [1]. In the countries of America, 75% of deaths are associated with heart diseases [2].

The risk of developing heart diseases can be explained by side-reactions of the metabolism, which has been shown to promote oxidative stress through the elevated reactive oxygen species (ROS) production and/or reduced antioxidant defense that provokes the decrease of health and well-being of biological systems and their functions [3-6].

According to biochemical theories, lipotoxicity may be an important target for the deleterious action of free radicals and trigger oxidative stress in the cardiac tissue [7,8], due to the imbalance between lipid entry in cardiac tissue and its ability to oxidize them [9].

In addition, it was possible to evidence that, in young people,

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[protocol no. 421] by the Ethical Committee for Conduction of Animal Studies at the Institute of Biosciences of Botucatu, Universidade Estadual Paulista [UNESP], in accordance with guidelines of the Canadian Council on Animal Care as outlined in *"Guide to the Care and Use of Experimental Animals"*. The animals were randomly divided into two groups [n=8]: sedentary control [C] and group submitted to swimming sessions, considered trained [TR]. Food and water intake was daily measured [9:00-10:00 a.m.] and body weight was weekly measured.

T a c

The rats were submitted to swim in a rectangular polyethylene tank with dimensions 80 cm deep, 80 cm wide and 100 cm length, containing water at 31 ± 1°C. The adaptation period was initiated at a depth of 10 cm of water for 10 minutes, which gradually increased 10 cm/day and 10 min/day, for six consecutive days. After this period, the animals initiated swimming training sessions at 60 cm deep for 60 min daily [always between 18:00 and 19:00 p.m.], five times per week during eight weeks [experimental period]. The exercise intensity was obtained by placing small weights in the thoracic region of the animal, corresponding 5% of body weight. This load was previously established by determining the anaerobic threshold into progressive test swimming [21], ensuring therefore the physical exercise of moderate intensity.

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The parameters calorimetrics were obtained in rats, fasted overnight (for 12-12 h) confined in metabolic cages (air flow=1.01/min) coupled to calorimetric (CWE, Inc, St. Paul, USA), after experimental period of 56 days. Oxygen consumption (VO_2) and carbon dioxide production (VCO_2) were registered by respiratory-based software program (MMX, CWE, Inc., USA) every 5 min for 20 min. The resting metabolic rate (RMR), respiratory quotient (RQ) and oxidation of carbohydrates were calculated from VO_2 and VCO_2, according to Strohl et al. [22].

M ca a a

After obtaining the calorimetric measurements, the animals were anaesthetized (0.1 mL/100 g body mass of 2:1 solution of 10% ketamine chloride and 2% xylazine) for measurement body length, which was used to determine Lee index (LI) [g/cm]=cube root of body weight/length. Total energy intake (EI, kcal/day=mean food consumption per day [g] × metabolizable energy of the ration [kcal/g]) and feed efficiency (FE, g/kcal=weight gain [g]/EI) were calculated according to Kawahara et al. [23] and Santos et al. [24].

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After corporal measurements, animals were anaesthetized with 10% of cetamin and 2% xilazin and euthanized by decapitation. Firstly, total blood was collected and centrifuged (1,400 g/10 min) to obtain the serum, which determined glycemia, concentration of total cholesterol, triacylglycerol and its lipoproteic fractions low-density lipoprotein (LDL-C cholesterol) and high-density lipoprotein (HDL-C cholesterol) by enzymatic colorimetric method (test LaborLab®, Brazil). Secondly, the cardiac tissue (Sample of 200 mg) was removed and washed in saline solution (9%).

E a a a

Lipid hydroperoxide (HP) was estimated through the oxidation of ferrous ion, which in the presence of xylenol orange led to the formation of a Fe^{-3} – xylenol orange complex, then measured at 560 nm [25]. Superoxide dismutase [SOD, EC 1.15,1.1] activity was assayed as described elsewhere [26], through the inhibition of the reduction of nitro blue tetrazolium [NBT] in the presence of reduced nicotinamide adenine dinucleotide (NADH) and phenazine. The amount of enzyme that gave 50% inhibition of NBT reduction/mg protein was taken as one unit of enzyme activity. Glutathione peroxidase (GSH-Px, EC 1.11,1.9) activity was indirectly determined by measuring the consumption of NADPH during the reduction of oxidized glutathione (GSSG) in a reaction catalyzed by glutathione reductase, one unit of enzyme was defined as the amount required to oxidize 1 μmole GSH/min, which corresponded to 0.5 μmol NADPH oxidized/min [27].

S a ca a a

Data normality was confirmed using the Shapiro-Wilk test. Results are presented as the mean ± standard deviation. Comparisons between groups were performed by analysis of variance (t-student test). For all the analyses, the level of significance was set at $p<0.05$ (Sigma Plot 12.0;USA).

R

According to Table 1, the trained group (TR) gained less weight than the control group [C], but it is not enough to evidence a statistically significant value ($p>0.05$). The TR group showed for the Lee index, feed intake, energy intake and energy efficiency of this study higher absolute values when compared with the C group, but it is not effectively and statistically different ($p>0.05$). Changes in calorimetric parameters are illustrated in Figure 1. Firstly, the TR group showed extremely increase in the parameters VO_2 and RQ, which evidenced statistically difference between TR and C groups ($p<0.01$). Secondly, the C group showed lower values for the parameters VCO_2, RMR and oxidation of carbohydrates, which resulted in statistical significance ($p<0.05$) and thirdly the parameter oxidation of lipids showed homogeneity between TR and C groups, which means that there is not a statistical significance ($p>0.05$).

On the blood, this study analyzed Glucose, Total Cholesterol, LDL-C, VLDL-C, TG and HDL-C, as shown in Table 2. The TR group have shown statistical significance to the Glucose when compared with C group ($p<0.05$). Total Cholesterol and LDL-C statistically differed C group ($p<0.01$) from TR group. Serum levels of VLDL-C and TG showed statistical significance between the groups of this study ($p<0.05$). TR group increased the plasmatic level of HDL-C ($p<0.001$) when compared with C group. The trained group (TR), lipids hidroperoxide (HP) and glutathione peroxidase (GSH-Px) activity decreased significantly when compared with control group (C), while the activity of superoxide dismutase (SOD) and catalase (CAT) were not effect to promote a statistical significance ($p>0.05$) when comparing C and TR groups (Table 3).

D c

In fact, the benefits of physical exercise are already well known in the literature regarding the prevention and control of risk factors. They need, however, a more comprehensive view and a specific detail of their relation with the pathophysiology of diseases. Thus, it is essential

	Wt g	LI g/cm	FI g/day	EI kcal/day	EE g/kcal

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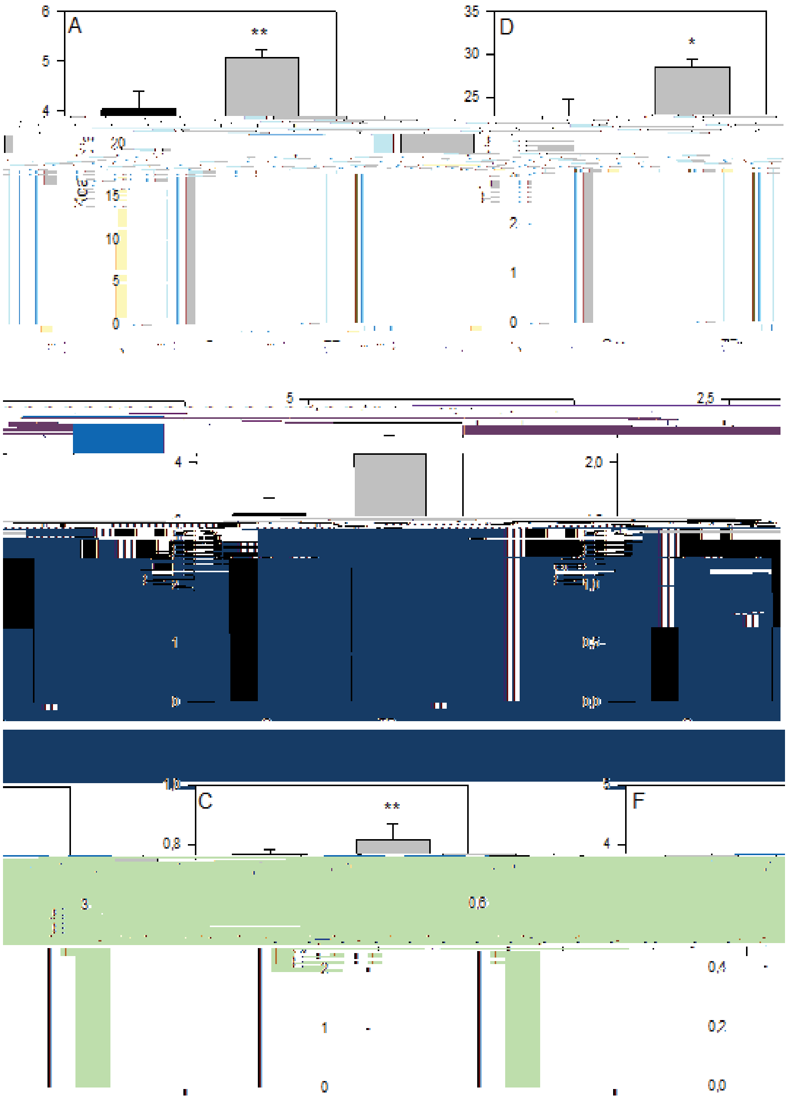

Signifcant difference between control (C) and trained group (TR)

Figure 1:
(C) Metabolic rate basal (TMB) (D) Oxidation of carbohydrates (E) Oxidation of lipids (F) Observed between different experimental groups.

	Glucose mg/dL	Total cholesterol mg/dL	LDL-C mg/dL	VLDL-C mg/dL	TG mg/dL	HDL-C mg/dL

to identify the factors and to know the effects of physical exercise on modulating cardiovascular risks, with the predominant purpose of medical conduct and the treatment of cardiopathy individuals [5,15,16].

Physical exercise can cause deviation in the homeostasis of an organism leading to reorganization of responses in different organ systems [21,28,29]. Intensity, duration and frequency of exercise have a key role in determining the metabolic responses to the effort, and may increase it or reduce it. It is recommended the intensity of physical exercise between mild to moderate, regularly performed, for the prevention of cardiovascular diseases [24,30]. Studies by Delmondes et al. [31] and Figueira et al. [32] also did not perform direct measurement of lactate and considered intense exercise as used when an overload of 5% of body weight, considering as reference the study by Gobatto et al. [21] and sorting the intense term as intense aerobic, in other words, corresponding to maximum steady state of blood lactate, which is the upper limit of heavy exercise domain.

Understanding factors related to morphometry is essential in the prevention of cardiovascular diseases because it allows better knowledge of the complications associated with overweight and diets [33]. The body weight has homogeneity between C and TR groups. Given this, it may be suggested that the influence of exercise on body weight loss is dependent on the feeding behavior, as exercised animals fed *ad libitum* diet showed no decrease in body weight. These results are consistent with McArdle et al. [34]. It is possible to observe that the Lee index also showed statistical difference between the groups. th in some way at low levels of LDL-cholesterol. The training protocol used in this study was able to reduce the level of total cholesterol and LDL-cholesterol in serum, regardless of feeding behavior, to less than those obtained for the control group. These findings are confirmed by the study of Ishikawa et al [55] who observed decrease in the concentration of both total cholesterol and LDL-cholesterol during aerobic exercise. In addition, the literature reports that exercise decreases the likelihood of present values for these parameters considered normal according to what was previously mentioned [56].

The concentration of triglycerides and VLDL-cholesterol in C group showed a significant change compared with TR group, suggesting that hepatic synthesis of triacylglycerols and consequently of VLDL-cholesterol lipoprotein, has been changed due to regular practice of physical exercise the TR animals were submitted. Kraus and Slentz reported that the triglyceride level was lower in individuals subjected to the intensity of exercise.

Nounou HA, Deif MM, Shalaby MA (2012) Effect of faxseed supplementation and exercise training on lipid profle, oxidative stress and infammation in rats with myocardial ischemia. Lipids Health Dis 11: 129-136.

Dolinsky VW, Jones KE, Sidhu RS, Haykowsky M, Czubryt MP, et al. (2012)

by resveratrol during exercise training contribute to enhanced exercise