63 - METABOLIC ALTERATIONS ASSOCIATED TO PHYSICAL EXERCISE OF SWIMMING AND THE INCREASE OF THE SIMPLE CARBOHYDRATE IN THE DIET OF FEMALE RATS

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1- INTRODUCTION

The modernity had brought us a series of technologies that related to the life style, together with the age and the hereditary succession, are called factors of risk to the sprouting of illnesses, the existence and the association of these had unchains significant difficulties. However, the presence of the factors individually also represents an important risk (HOFFMAN et al., 1996).

It was already demonstrated that the dietary habits directly interfere with the control and prevention of the called chronic-degenerative illnesses, such as obesity, some types of cancer, type II diabetes, arterial hypertension, osteoporosis, among others. Despite the efforts of the health services in the occidental countries, there was in the end of century XX, a significant increase in the incidence of these illnesses in the population. About 90 million of North American people suffer with its effect, spending something around 700 billion dollars to try to brighten up its effect and to pay for the damages of the loss of productivity in 1990 (HOFFMAN et al., 1996). According to BOOTH et al. (2000), the current cost must exceed the cipher of 1 trillion of dollars/year in the beginning of the XXI century. In Brazil there is not statistical referring to these expenses yet.

The effect of the ingestion of carbohydrates, fats and proteins before, during and after exercises have been studied for physiologists of the whole world for almost 70 years, amongst them ROMBALDI (1996). The importance of these nutrients is based on the hypothesis that they are the main substrate to provide energy for intense activities of long duration and the reserves of carbohydrate in the body are relatively small.

The human body stores much more fat that carbohydrate, according to BJÖRNTORP (1992). In contrast with limited stored amount of carbohydrate, the lipids supplies, are limitless. According to HARGREAVES (1994), the problem with the use of the lipids during exercises is not the physical availability of the fat as power plant, but to bring it to be used in the oxidative process of supply energy.

The use of aerobic exercise in programs directed to the reduction weight widely is spread out, especially due to capacity of the same ones in promoting great mobilization of free fatty acids (FFA) as energy substrate, what it constitutes basic factor for reduction of the corporal deposits of fat (ROMIJIN et al., 1993). On the other hand, the anaerobic exercises can also promote high mobilization of FFA and consequence control on the stores of fat, what can intervene on the basal metabolism (CEDDIA, 1998).

Based on that, this work had for objective to study the metabolic alterations in the lipidic profile associated to the increase in the simple carbohydrate in the diet of Wistar rats, submitted to the continuous physical exercise of swimming, as well as determining the profile through the serum levels of triglycerides (TG), total cholesterol and fractions (HDL and LDL).

2 MATERIALS and METHODS

It was used 32 female Wistar rats (divided in 4 groups), weighing in the beginning of the experiment between 200 and 300 g, adults (60 days in the beginning of the experiment), being 20 animals for the experimental group that was exercised (being 10 rats in the group with normal diet and 10 rats in the group with carbohydrate rich diet) and 12 animals for the group control that was kept sedentary (being 6 rats in the group with normal diet and 6 rats in the group with carbohydrate rich diet). The experiment was carried through in the Laboratory of Biochemistry and Physiology of the Exercise of the ESEF-UFPel. The animals were kept in collective river steamers (maximum of 4 animals for river steamer) and fed with proper ration for rodents and "ad libitum" water, and kept in room with a 12 hours/12 hours cycle of light/dark of, initiating to the 6 a.m.. The swimming procedure happened between 4 p.m. and 8 p.m.

The animals, before been submitted to the swimming procedure, were adapted and trained in the aquatic exercise, in way that they could support the time of 60 minutes of continuous exercise in a way to present, when sacrificed, biochemists and physiological chronicles adaptations in consequence of the physical training of continuous standard and moderate intensity, similar to what happens with human beings submitted when exposed to the same protocol of physical exercise (ÅSTRAND & RODAHL, 1977; GREEN et al., 1978; WITHERS et al., 1982; JACKSON et al., 1995). In this direction, the intensity used in this study was moderate e, in way, it was used a lead overweight of 5% of the corporal weight of the imprisoned animals to the trunk of each one through an rubber band (KOKUBUN, 1990).

The swimming collective system used in this work was developed in rectangular tanks of 60 cm of width, 80 cm of length and 100 cm of height, linked through a central office of bombardment and water heating (VIEIRA et al., 1988). The water kept in depth of 80 cm was recirculated through the central system adjusted to keep the temperature 32° C.

The necessary period so that the training produces the necessary adaptations was 10 weeks. The animals of the experimental group exercised 5 times a week, during 1 hour a day. The animals were weighed weekly, on Wednesdays, so that the load always varies if there is any alteration in the in the animal weight.

To investigate the effect of the carbohydrate rich diet, 5% of simple carbohydrate (sucrose) was added in water consumed during the corresponding period to the active cycle of the rats (nocturnal), after the swimming program. In the period of the morning, between 7 and 8 hours, the water was measured for control of the consumption. After to this pure water was placed for consumption, rats' not active period, preceding to the swimming program. The water was given “ad libitum”. The rats without carbohydrate rich diet received pure water, not being measured its consumption.

The chow used for group the carbohydrate rich diet as for the group without diet presented the same composition. The used chow possess around 47% of carbohydrate, 22% of proteins, 20% of lipids, 10% of mineral salts (SUPPRA LAB), and it was weight once a day for the group with diet, to control the consumption of ingested ration, and for determination of the amount of carbohydrate ingested. It was weighed during the entire swimming program. The averages of the consumption of ration and water for each box and rat were calculated.

After to be submitted the 12 hours without eating, the animals were sacrificed by decapitation, using guillotine, collecting their blood in glass pipes without anticoagulant. The blood was centrifuge in 3000 rpm per 3 minutes, being separate the serum for free fatty acid and glucose determination, total cholesterol and fractions (HDL and LDL) and triglycerides. The total cholesterol and fractions (HDL and LDL) were determined through kits for blood analyses (LABTEST).

Was used the analysis of factorial variance for the comparison between the averages (2 x 2). When the F was significant, to locate the differences it was used the test of Tukey. The values were expressed as average and standard deviation, being adopted the level of significance of $p<0,05$. Statistical package STATISTICA for Windows was used, version 5.0, from Statsoft, Inc.

3, RESULTS AND DISCUSSION:

Table 1, presents the respective averages and the standard deviation of the dependent variables considered in the study, in order to visualize the results in its set.

Table 1. Averages and standard deviation of the analyzed dependent variables

	Sedentary with normal diet	Sedentary with sucrose diet	Trained with normal diet	Trained with sucrose diet
Total cholesterol (mg/dL)	250,00 ± 29,15^{ab}	358,66 ± 102,30^{b}	161,70 ± 40,42^{c}	185,30 ± 39,17
Triglycerides (mg/dL)	271,33 ± 117,04^{ab}	324,33 ± 53,80^{b}	167,50 ± 41,65^{c}	215,40 ± 51,71
HDL (mg/dL)	21,67 ± 12,04^{xy}	32,67 ± 2,50^{y}	60,20 ± 12,65^{z}	37,00 ± 7,45
LDL (mg/dL)	225,27 ± 52,59^{xy}	275,93 ± 138,65^{y}	77,30 ± 49,61^{z}	119,22 ± 59,65

a = statistically different of the sedentary group with carbohydrate rich diet and of the trained groups in such a way for the independent variable physical exercise as for the independent variable diet

b = statistically different of the trained groups in such a way for the independent variable physical exercise as for the independent variable diet

c = statistically different of the group trained with carbohydrate rich diet in such a way for the independent variable physical exercise as for the independent variable diet

x = statistically different of the sedentary group with carbohydrate rich diet and of the trained groups only for the independent variable physical exercise

y = statistically different of the trained groups only for the independent variable physical exercise

z = statistically different of the trained group with carbohydrate rich diet only for the independent variable physical exercise

3.1 Total Cholesterol:

Table 1 presents greater serum concentration in the sedentary group with carbohydrate rich diet, compared with the sedentary one without diet. In the trained groups, the group with carbohydrate rich diet presented a bigger concentration of this lipid. With regard to dependent variable total cholesterol, we met significant difference with relation to the groups exercised and sedentary ($p<0,000000$) and with relation to the diet ($p<0,002741$).

As state of training and diet had interaction statistics between the independent variable on the serum total cholesterol concentration, the post-hoc test of Tukey demonstrated that it had significant difference between the sedentary groups without carbohydrate rich diet, sedentary group with carbohydrate rich diet and the group trained without carbohydrate rich diet. Statistically significant differences were also found between the sedentary groups with carbohydrate rich diet, group trained without carbohydrate rich diet and group trained with carbohydrate rich diet. It was observed, equally, difference between the groups trained without carbohydrate rich diet, sedentary group without carbohydrate rich diet and sedentary group with carbohydrate rich diet. The group trained with carbohydrate rich diet only presented significant difference in relation to the sedentary group with carbohydrate in the diet. These results indicate that the carbohydrate rich diet is a determinative factor in the increase of the serum total cholesterol concentration. On the other hand, the physical exercise of long duration (aerobic) showed to be efficient, in this sample, when compared with the groups that had been kept sedentary. However, comparing only the exercised groups, the significance statistics disappeared; these results are not senseless in the measure that has, in literature, much controversy on the effective paper of the exercise in the capacity to reduce the cholesterol and total cholesterol concentrations LDL.

The results of the present study are similar to told for KANTOR et al. (1984), KANTOR et al. (1987); FÖGER et al. (1994), SADY et al. (1986) had observed fall in the total cholesterol concentration after exercise. The results of this experiment had also revealed compatible with those from LEON et al. (2001), which had found a significant reduction of the total cholesterol levels in the aerobic exercise.

FERGUSON (1998), observed a reduction of the total cholesterol in its study after a program of physical exercise for men and women when they had compared the condition of daily pre-training with the after-training condition. According to this exactly author, other articles examining the chronic effect of the training of exercise of long duration on the serum cholesterol of men and women apparently healthful have presented resulted conflicting; while some have reported significant changes to the total cholesterol, others have suggested modest changes, but statistically significant in its decline. This decline in the total cholesterol can be explained by a bigger consumption of this lipid for the skeletal muscle in continuous exercises of long duration, with high energy expenditure.

According to FODOR et al. (2000), a very great increase in the total cholesterol levels influences directly in the risk of cardiovascular disease (DAC). According to these authors, sessions of physical exercises can help to decrease these levels and, consequently, bring benefits to the health decreasing the risks to develop DAC.

3.2 Triglycerides (TG):

We can observe in the table a 1 a bigger concentration of this lipid in the sedentary group with carbohydrate rich diet compared with all the others. A significant difference between the sedentary and exercised groups is observed ($p<0,000142$) and when we compare groups with or without carbohydrate rich diet ($p<0,046054$). These results statistically point significant differences in concern to the independent variables diet and exercise, without interaction between them. In this direction, it can be affirmed that the diet as physical exercise, independently had the capacity to reduce the serum concentration of TG.

KRAMSCH et al. (1981), had observed similar results to the presented ones in the present experiment; what makes us to confirm the scientific evidences that physical exercises decreases the concentration of TG for having an increase in the mobilization and the consumption of these in its reduced form (FFA) during the exercise.

According to LEON et al. (2001), in a revision study, the regular physical exercise assists particularly in the reduction of the blood lipids, increasing the HDL levels and reducing the TG levels. This probably occurs, according to PETIT et al. (2003), because of the increase of hydrolysis of TG, increase of the activity of lipoprotein lipase (LPL) that remains high for at least 48 hours after the exercise. It is important to stand out that according to this author, the fat is less accessible to the cellular metabolism because it must first be reduced its complex form (as TG) for its basic components: glycerol and free fatty acids (FFA), for posterior use.

STANKIEWICZ-CHOROSZUCHA et al. (1978), had concluded that the biggest cause of the reduction of the levels of TG in the muscle during physical exercise is a deficiency in the use of the carbohydrates. The high increase of the level of FFA during exercise does not have relation with the effect of the levels of TG supply to intramuscular during exercise, being able these TG to be used directly in the skeletal muscle (type 1 fibers), when the FFA were reduced.

According to BJÖRNTORP (1992), one of the consequences of biggest importance to the organism proportionate for the physical training of long duration in moderate intensities is the increase of the capacity to carry oxygen to the exercised muscles efficiently, using more fat as energy substrates. The results of the present experiment point reductions in the TG concentrations had been inversed to the increase of HDL production. This inverse relation gives, probably, for the TG use as substrate in the HDL production; result equally found also for OSCAI (1990).

3.3 Cholesterol of high density (HDL):

When comparing the sedentary groups (with and without carbohydrate rich diet), we find less level of HDL for the animals with carbohydrate rich diet (table 1). Also, this can be seen in the trained groups where animal with carbohydrate rich diet had shown a lesser level of HDL in comparison to the ones without carbohydrate rich diet. Statistically, the groups had only presented difference in relation the physical exercise independent variable ($p<0,000002$). The changeable diet did not present significance ($p<0,099762$).

According to DURSTINE et al. (1994), reductions in the TG levels and increases in the HDL concentrations have been noticed after only a session of exercises and these changes can activate the function of improvement in the lipidic profile and lipoproteins observed in trained individuals. According to FERGUSON (1998), in its studies to determine the threshold of the energy expenditure in aerobic exercises, necessarily to compare the changes in the blood lipids and lipoprotein concentrations and activity of LPL, in trained men, had observed that immediately after the exercise the HDL concentrations significantly had been raised and thus kept 24 hours after exercise. The HDL concentration also was raised immediately 48 hours after a session of exercises with energy expenditure of 1.500 Kcal. According to with these authors, when compared the values of the activity of LPL 24 hours before the exercise, had evidenced that the exercise had produced a significant increase in LPL after 24 hours. The LPL was significantly bigger 24 hours after the exercise and had remained high after 48 hours of the exercise. KANTOR et al. (1987), had found a similar result, with an increase in the HDL concentration after exercise. VISICH et al. (1996), had observed that 24 hours after the exercise the concentration of HDL and LPL had increased.

The published and here shown evidences ratify the results found in our study and the potential mechanism of increase of the concentrations of HDL in the present study could have been in function of the increase of the activity of the LPL. The LPL is directly involved with the degradation of TG that promote substrate for the HDL production and are clearly its metabolic activity for some hours after the ending of the exercise, what we also find in KANTOR et al. (1987). As a potential mechanism to find the increase in the HDL concentrations, it can be for the decrease of the activity of the transporting protein ester cholesterol (CETP). The CETP facilitates to the transport of ester cholesterol and TG between HDL and other lipoproteins (VLDL and LDL).

3.4 Cholesterol of low density (LDL):

The sedentary groups had presented very superior averages of LDL to those presented by the trained groups ($p<0,000008$), showing already from the examination of the averages that the physical exercise imposed significant reductions in this variable. It only had significant difference between the groups exercised and sedentary and not having any significance on the diet between the averages difference.

Our results are consistent with the ones of LEON et al. (2001), when telling significant reduction in the serum concentrations of LDL, TG and total cholesterol (CT) with training of physical exercises, where was also observed frequently increasing in the HDL. On the other hand, the LEON results et al. (2001) in human beings, had also pointed positive and significant effect on the diet and the physical exercise interaction with diet in the reduction of the serum concentrations of TG, LDL and of the CT, what was not the case in our study.

FERGUSON (1998), told that the LDL concentrations had been noticed after the exercise in its study, significantly lesser immediately after the sessions of exercise and this, probably, occurred due the reduction of concentration of the total cholesterol. Similar results in the permanent fall of LDL had been told by FÖGER et al. (1994), KANTOR et al. (1984), KANTOR et al. (1987), SADY et al. (1986); it also has stories of acute reductions in the LDL concentrations, or either, the LDL concentrations the exercise had after decreased in relation to its concentrations before the exercise session (CROUSE et al., 1995, DAVIS et al., 1992, DURSTINE et al., 1996, and GORDON et al., 1994).

Concerning to the type of physical exercise used as model of training, FÖGER et al. (1994), KANTOR et al. (1984), KANTOR et al. (1987), SADY et al. (1986), in its studies, had found a fall in the concentrations of LDL, typically aerobic exercises of long duration in human beings. This model of physical exercise was used in the present study. The possible explanation for low of the LDL concentrations after the exercise can be for the increase in the consumption of LDL for the fabric peripheral, also observed for MALINOW et al. (1969).

4, CONCLUSIONS:

From this study we can conclude that the increase of consumption of simple carbohydrate in the diet increases significantly the levels of total cholesterol, triglycerides, and LDL; and decrease the levels of HDL of sedentary rats. The physical exercise of long duration and moderate intensity determined positive modification in the lipidic profile with reduction of the levels of LDL, increase in the HDL levels, and reduction in the levels of triglycerides; the acute and permanent effects of the physical exercise imply in a positive modification in the lipidic profile, being able to positively contribute for the improvement in the degree of health and quality of life of all those who adopt an active style of life.

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METABOLIC ALTERATIONS ASSOCIATED TO PHYSICAL EXERCISE OF SWIMMING AND THE INCREASE OF THE SIMPLE CARBOHYDRATE IN THE DIET OF FEMALE RATS

ABSTRACT

The experiment aimed to study the metabolic alterations in glycemia and in the lipidic profile associated to the increase in the simple carbohydrate in the diet of Wistar rats submitted the continuous physical exercise of swimming. The animals were divided in four groups: sedentary with and without the addition of sucrose diluted 5% in water in the diet and, trained with and without the addition of sucrose diluted 5% in water in the diet; where they had swum 1 hour per day, 5 days per week during 8 weeks, with 5% overweight. A bigger total cholesterol concentration was found in the sedentary animals with relation to the trained ones and in the animals with diet with the addition of sucrose in relation to those that had not received sucrose in the diet. A significant difference between the groups sedentary and trained was observed when we compared groups with or without the addition of sucrose with the diet, in regard to concentration of triglycerides. The trained animals had presented bigger levels of HDL when compared with the sedentary ones. We still observed that, if comparing the sedentary groups (with and without the addition of sucrose in the diet), we have a lesser concentration of HDL for the animals with the addition of sucrose on the diet. This can also be seen in the trained groups, where the animals with diet supplemented of sucrose had shown a lesser level of HDL in comparison to the animals that had been without receiving sucrose. The sedentary groups presented very superior averages of LDL to those presented by the trained groups, showing that the physical exercise imposed significant reductions in this kind of cholesterol. We conclude that the increase of consumption of simple carbohydrate in the diet increased significantly the levels of total cholesterol, triglycerides, and LDL in sedentary rats. The long-duration physical exercise and moderate intensity determined positive modification in the lipidic profile with reduction of the levels of LDL, increase in the levels of HDL, and decrease in the levels of triglycerides in the trained rats.

Key-Words: Physical exercise, lipidic profile and simple carbohydrate

MODIFICATIONS METABOLIQUES ASSOCIEES A L'EXERCICE PHYSIQUE DE NAGE PAR CONSÉQUENCE DE L'AUGMENTATION DU TENEUR DE HYDRATES DE CARBONE SIMPLES DANS L'ALIMENTATION DE RONGEURS

RÉSUMÉ

La recherche a eté menée avec l´objectif de vérifier les modifications métaboliques dans le profil lipidique associées à l'augmentation du teneur en hydrates de carbone simples dans l'alimentation des souris femelles Wistar soumises à l'exercice physique continu de nage. Les animaux on été divisés en quatre groupes: animaux sédentaires avec et sans l'addition de saccharose à 5% dilués dans l'eau à l'alimentation et animaux entraînés avec et sans l'addition de saccharose. La nage a été faite pendant 1 heure par jour, 5 jours sur 7, dans une période de 8 semaines, avec excès de poids de 5%. Il a été trouvé un taux plus important de cholestérol total chez les animaux sédentaires par rapport aux entraînés et dans les animaux nourris avec l'addition de saccharose par rapport a ceux qui n'ont pas été nourris avec cette l'alimentation, aussi bien qu'une interaction entre les variables indépendantes diète et entraînement. Une différence significative entre les groupes sédentaire et entraîné a été observée lors de la comparaison entre les groupes d'animaux qui ont reçu ou pas l'addition de saccharose à l'alimentation, en ce qui concerne le taux de triglycérides. Les animaux entraînés ont présenté le taux de HDL plus important par rapport aux sédentaires. Il a été observé aussi, en comparant les animaux du groupe sédentaire (avec et sans l'addition de saccharose à l'alimentation), q'une plus petite concentration de HDL a été verifiée chez les animaux qui ont reçu l'addition de saccharose à l'alimentation. La même réponse a été obtenue chez les animaux entraînés. Le taux de LDL chez les animaux sédentaires a été plus élevé que celui observé chez les congenères entraînés. Ces données montrent que l'exercice physique a imposé des réductions considérables dans cette variable. Dans ce contexte on peut conclure que l'augmentation de la consommation d'hydrates de carbone simples dans l'alimentation a fait accroître le taux de cholestérol total, triglycérides et LDL chez les souris femelles sédentaires. L'exercice physique de longue durée et intensité modérée a déterminé la modification positive dans le profil lipidique, en réduisant le taux de LDL et de triglycérides, et en augmentant le taux de HDL chez les souris femelles entraînées.

Mots-clés: exercice physique, profil lipidique, teneur en hydrates de carbone.

ALTERACIONES METABÓLICAS ASOCIADAS AL EJERCICIO FÍSICO DE NATACIÓN Y EL AUMENTO DEL TENOR DE CARBOHIDRATOS SIMPLES EN LA DIETA DE RATAS

RESUMEN

El experimento motivó al estudio de las alteraciones metabólicas en el perfil lipóideo y glicérico asociados al aumento en el tenor de carbohidratos simples en la dieta de ratas Wistar que fueron sometidas a un ejercicio físico continuado de natación. Se dividieron los animales en cuatro grupos: sedentarios con y sin la adición de sacarosa al 5% disuelta en agua en la dieta, y, entrenadas con y sin la adición de sacarosa al 5% disuelta en agua en la dieta; donde nadaron una hora por día, 5 días por semana durante 8 semanas, con sobrepeso de 5%. Fue encontrada una mayor concentración de colesterol total en los animales sedentarios en relación a los entrenados y en los animales con dieta con la adición de sacarosa en relación a los que no recibieron sacarosa en la dieta, así como también fue encontrada una interacción entre las variables independientes dieta y entrenamiento. Una diferencia significativa ha sido observada entre los grupos sedentario y entrenado cuando se comparó con o sin la adición de sacarosa en la dieta, con relación a la concentración de los triglicéridos. Los animales entrenados presentaron los niveles de HDL mayores cuando fueron comparados con los sedentarios. Observamos también, que si comparamos a los grupos sedentarios (con y sin la adición de sacarosa en la dieta), se encuentra una menor concentración de HDL en los animales con la adición de sacarosa en la dieta. También esto puede ser visto en los grupos entrenados, donde los animales que estaban con dieta suplementar de sacarosa mostraron una menor tasa de HDL en comparación a los animales que quedaron sin recibir sacarosa. Los grupos sedentarios presentan promedios de LDL muy superiores a aquellos que fueron presentados por los grupos entrenados, mostrando que el ejercicio físico impone reducciones significativas en esta variable. Concluimos que el aumento del consumo de carbohidratos simples en la dieta aumentó significativamente los niveles de colesterol total, los triglicéridos, LDL, en las ratas sedentarias. El ejercicio físico de larga duración e intensidad moderada, determinó una modificación positiva en el perfil lipóideo con reducción de los niveles de LDL, con aumento en los niveles HDL, y disminución de los triglicéridos en las ratas entrenadas.

Palabras-claves: ejercicio físico, perfil lipóideo, tenor de carbohidratos

ALTERAÇÕES METABÓLICAS ASSOCIADAS AO EXERCÍCIO FÍSICO DE NATAÇÃO E AO AUMENTO DO TEOR DE CARBOIDRATOS SIMPLES NA DIETA DE RATAS

RESUMO

O experimento objetivou estudar as alterações metabólicas no perfil lipídico e glicemia associados ao aumento no teor de carboidratos simples na dieta de ratas Wistar submetidas a exercício físico contínuo de natação. Dividiu-se os animais em quatro grupos: sedentárias com e sem a adição de sacarose a 5% diluída em água na dieta e, treinadas com e sem a adição de sacarose a 5% diluída em água na dieta; onde nadaram 1 hora por dia, 5 dias por semana durante 8 semanas, com sobrepeso de 5%. Foi encontrado uma maior concentração de colesterol total nos animais sedentários com relação aos treinados e nos animais com dieta com a adição de sacarose em relação aos que não receberam sacarose na dieta, bem como uma interação entre as variáveis independentes dieta e treinamento. Uma diferença significativa entre os grupos sedentário e treinado foi observada quando comparamos grupos com ou sem a adição de sacarose à dieta, com relação a concentração de triglicérides. Os animais treinados apresentaram os níveis de HDL maiores quando comparados aos sedentários. Observamos ainda que, se compararmos os grupos sedentários (com e sem a adição de sacarose na dieta), tem-se uma menor concentração de HDL para os animais com a adição de sacarose à dieta. Também isto pode ser visto nos grupos treinados, onde os animais com dieta suplementada de sacarose mostraram uma menor taxa de HDL em comparação aos animais que ficaram sem receber sacarose. Os grupos sedentários apresentam médias de LDL muito superiores àquelas apresentadas pelos grupos treinados, mostrando que o exercício físico impôs reduções significativas nesta variável. Concluímos que o aumento de consumo de carboidratos simples na dieta aumentou significativamente os níveis de colesterol total, triglicérides, LDL, em ratas sedentárias. O exercício físico de longa duração e intensidade moderada determinou modificação positiva no perfil lipídico com redução dos níveis de LDL, aumento nos níveis de HDL, diminuição nos níveis de triglicérides nas ratas treinadas.

Palavras-Chave: Exercício físico, perfil lipídico e teor de carboidratos

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