55 - COMPARATIVE STUDY OF THE EFFECT OF EXERCISE AEROBIC AND ANAEROBIC EXERCISE ON FIBRE OF THE BICEPS BRACHII AND PECTORALIS MAJOR WISTAR RATS

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INTRODUCTION

Since the dawn of humanity man tries to overcome its limitations of using devices that seek to artificially increase the performance, so we give the name of ergogenic agents. These may be physiological, nutritional, pharmacological and psychological (BAGATELLE and BREMMER, 1996; ANARUMA and ANARUMA, 1996). The most widespread to be conducted within the ethical principles is seeking to promote the improvement of performance through physical training and thus produce physiological changes and adaptations that make the muscles more powerful and accurate when performing certain moves. Endurance training in sports to increase resistance to fatigue should preferably reach the slow-twitch fibers. The training, aiming to increase strength and athletic performance in sports where the use of force is necessary, should have the muscle mass, and then hit the fast twitch fibers. The gain in strength is achieved primarily through aerobic training. The mass gain is achieved primarily with anaerobic work and can be achieved through various types of stimuli, among which the isometric contraction is more appropriate (McARDLE et al., 1992).

According to Mcardle, Katch and Katch (1998), skeletal muscle is not only a homogeneous group of fibers with properties similar metabolic and functional. Each muscle contains a combination of different types of fibers. We differentiate these muscle fibers in the slow-twitch type, also called slow twitch, or ST fibers, or tonic fibers, or fiber type I and type of rapid contraction - also called fast twitch, that is FT fibers, or fibers of phasic type II, which, in turn, divided into specific subcategories of function, according to Weineck (1991). According to physiological criteria, biochemical, metabolic and morphological the muscles are formed by fibers with different characteristics and therefore react to the use of different ways. Genetic inheritance is that the individual will determine how this distribution. The reaction of muscle to different stimuli that is subjected to is given, then, according to the type of muscle fiber that predominates in muscle, the specificity of training and nutritional status of the athlete. According Brooke and Kaiser (1970), the physiological point of view, we can identify the slow twitch muscles and fast twitch fibers. The fibers are slow twitch oxidative (SO - Slow Oxidative), have small diameter and are fatigue resistant, fast-twitch fibers are subdivided into two groups, which have fast-twitch oxidative metabolism / glycolytic (FOG - Fast Oxidative / glycolytic), intermediate diameter and are resistant to fatigue and fast twitch fibers that have exclusively glycolytic metabolism (FG - Fast Glycolytic) with large diameter and are sensitive to fatigue.

Endurance training in sports to increase resistance to fatigue, should preferably reach the slow-twitch fibers. The training, aiming to increase strength and athletic performance in sports where the use of force is necessary, should have the muscle mass, and then hit the fast twitch fibers. The gain in strength is achieved primarily through aerobic training. The mass gain is achieved primarily with anaerobic work and can be achieved through various types of stimuli, among them; the best would be to isometric contraction (MCARDLE et al., 1992).

OBJECTIVE

Due to the variety of fibers, the reaction of muscle as a result of stimuli applied to it, takes a different way. Our purpose was to compare the effect of isometric exercise with the effect of dynamic exercise at different contraction of the biceps brachii muscle fibers and pectoralis major muscle.

MATERIALS AND METHODS

We used 30 male Wistar rats, with ninety days of age at the start of the experiment. The animals were separated into groups of five per cage and maintained at the Animal Laboratory of Biodynamics, Department of Physical Education, IB, UNESP - Rio Claro, at temperatures of 25 ° C and cycles of light and dark every twelve hours. Were fed normally suitable for rodents and water ad libitum, containing: 13% maximum moisture, maximum of 23% protein, ether extract at least 2.5%, raw fibrous maximum of 9%, ash 8% max, maximum 1.8% calcium, phosphorus, minimum 0, 8%. The record weight of mice was done throughout the course of studies, when the first day of the week. The animals were divided into three groups: Sedentary (S), aerobic training (Tae), trained anaerobic (Tan). The sedentary animals were kept in a cage without any physical activity. Aerobic exercise consisted of 1 hour of swimming with extra charge of 5% of its weight, three times a week for eight weeks (CALIS, 2002). The anaerobic training consisted of isometric exercise on a suspension cable, type clothesline that was attached to two iron rods. This was put on a tank with water to motivate the animals to exercise. For its implementation, the animals were placed suspended by the forepaws to hold the cable. This position required the rats to perform an isometric contraction in the muscles of your front leg to remain hanging on the wire. This training consisted of four sets of suspension for a maximum time of 3 minutes each series at intervals of one-minute rest between sets on alternate days during a period of eight weeks AURICCHIO (2002). The weight of the animals was monitored throughout the experimental period at the end of the period of aerobic and anaerobic training; the animals were sacrificed in an atmosphere of carbon dioxide. The biceps brachii and pectoralis major on the right side were removed carefully so that a portion of the middle third of each muscle was placed in liquid nitrogen. The muscles were then cut with a microtome cryostat at -20 ° C and stained by the coloring of H / E (hematoxylin-eosin), histochemical reaction for NADH-Reductase Tetrazolim (Dubowitz, et al. 1973) for the identification of fibers based on their metabolic capacity (Fig. 1). Later they had the cross section area measures an image analyzing system to then be compared between groups.

RESULTS

Evaluation of body weight:

Animals in groups that were submitted to aerobic training (Tan) had significantly greater weight gain ($P < 0.05$) than the sedentary animals (S) and trained aerobic (Tae).

Table 1. Evaluation of body weight of rats in aerobic training

Groups	Initial weight (g)	Final Weight (g)	Weight gain (g)	PG on (%)
S	223 ± 31	386 ± 53	163 ± 22	73,09 %
Tae	226 ± 26	371 ± 72	145 ± 46	64,15
Tan	233,9 ± 34,32	407,0 ± 78,7	173,1 ± 28,2*	74%

*p < 0,05 when compared to "Tae" group

Morphometric analysis of the biceps muscle of animals subjected to aerobic and anaerobic:

The identification of fibers based on histochemical reaction for NADH-TR helps differentiate the white fibers (FG), lightly stained, red fibers (SO), stained intensely for reaction. As for the intermediate or mixed fibers (FOG) are shown stained intermediate way compared to other fibers. These differences are based on the histochemical activity of oxidative enzymes, such as red fibers, fatigue resistant, have higher levels of these enzymes in their protoplasm reacting so strongly to the substrate contained in the reagents. On the other hand, pure glycolytic fibers have less oxidative enzymes and stain less intensely. This technique enabled us to identify the two muscles studied, three types of fibers distributed in equal proportions. In the biceps muscle, the size of the cross section area of muscle fibers (Table 2) shows that the size of oxidative fibers showed no significant difference when compared to each other ($p > 0.05$). Glycolytic-oxidative fibers suffered slight increase in cross section only in group Tan, than these fibers have suffered the effects of anaerobic exercise ($p \leq 0.05$). Since the pure glycolytic fibers, the Tan group were the most responded to exercise when compared between the groups ($p \leq 0.05$).

In the biceps muscle, the size of the cross section area of muscle fibers (Table 2) oxidative fibers showed no significant difference when compared to each other ($p > 0.05$). Glycolytic-oxidative fibers suffered slight increase in cross section only in-group Tan, that is, these fibers have suffered the effects of anaerobic exercise ($P \leq 0.05$). As to glycolytic fibers, pure fibers Tan group were more concerned with the exercise reacted when compared to other fibers. ($P \leq 0.05$).

Table 2. Measure the area (µm2) cross section of the biceps brachii muscle identified according to their metabolic characteristics.

Groups	Oxidative	Oxidat. Glicol.	Glycolytic
S	1521 ± 382	2256 ± 477	3482 ± 586
Tae	1479 ± 351	2378 ± 438	3141 ± 625
Tan	1578 ± 415	2528 ± 483*	4340 ± 723 **

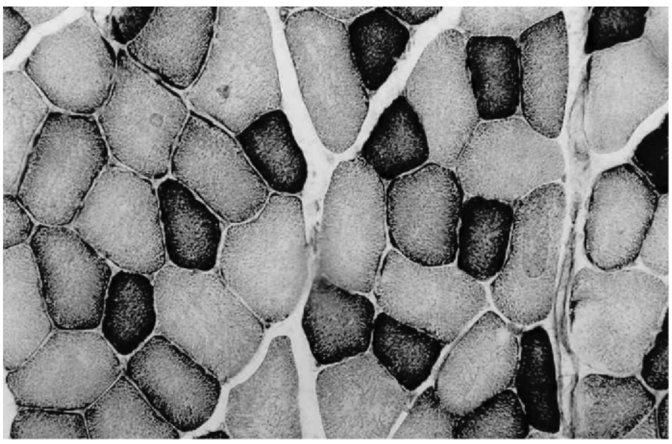
* p < 0,05 when compared to "S" group
** p< 0,05 when compared with "S" and "Tae" groups

Morphometric analysis of the pectoralis major of animals subjected to aerobic and anaerobic: As for the size of the fibers of the pectoralis major muscle presented in table 3, note that the oxidative fibers, despite showing averages slightly less than the s, the statistical point of view all groups showed a similar size when compared with each other ($p > 0.05$). With respect to oxidative-glycolytic fibers, nor was a statistical difference when comparing the size of the area between the groups ($p > 0.05$). Now with regard to pure glycolytic fibers, livestock and tan tae group showed significant hypertrophy index when compared with the control group ($p < 0.05$). When compared between the training itself, there is no difference ($p > 0.05$).

Table 3. Measure the area (µm2) cross section of the pectoralis major muscle identified according to their metabolic characteristics. Aerobic training.

Groups	Oxidative	Oxidat. Gyicol.	Glycolytic
S	1818 ± 553	2930 ± 855	4011 ± 1082
Tae	1536 ± 485	2917 ± 764	5095 ± 1264*
Tan	1773 ± 611	3017 ± 967	5038 ± 1145*

* p < 0,05 when compared to "S" group



Photomicrograph of the middle third of the biceps muscle (cross section) showing the distribution pattern of muscle fibers stained by the histochemical reaction for NADH-TR (500X).

DISCUSSION

The morphometric data of different muscle fibers that make up the two muscles studied here show that only pure FG fibers respond to both types of incentives proposed in this experiment, the aerobic and anaerobic exercise. FOG fibers of biceps also reacted slightly increasing its size in the group subjected to anaerobic exercise. Pure glycolytic fibers of two muscles react quickly to the exercise was hypertrophied and improving the capacity to store and consume their substrates. The muscle fibers where the predominant metabolism is the oxidation, or SO fibers, do not exhibit this hypertrophic response. These have a functional limitation to the size increase that is related to the ability of oxygen diffusion from capillaries to fibers. This type of fiber reacts improving their metabolic capacity to perform the contraction consuming their substrates with improved efficiency and speed. Hypertrophy observed in the FG fibers of two muscles allow us to assert that improved its ability to perform movements which require the use of force and power, since these fibers, having a diameter larger than the others, have this more evident physiological capacity.

CONCLUSIONS

About the weight of the animals:

- The weight of the animals, exercise training caused a reduction in body mass in group t.
- The anaerobic training produced no change in weight in animals.

About the biceps brachii:

- From the viewpoint morphoquantitative, oxidative fibers (SO) does not change the size of the cross section area in both types of exercise. Oxidative-glycolytic fibers (FOG) do not react in the hypertrophied aerobic exercise, anaerobic exercise but to react. The pure glycolytic fibers (FG) react as much, aerobic exercise, anaerobic hypertrophied as in themselves.

About the pectoralis major muscle:

- From the standpoint of pure morphoquantitative oxidative fibers (SO) and oxidative-glycolytic fibers (FOG) did not react when stimulated hypertrophy, both by aerobic exercise, such as the anaerobic. Since the pure glycolytic fibers (FG) react to both the aerobic training, as in the anaerobic.

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COMPARATIVE STUDY OF THE EFFECT OF EXERCISE AEROBIC AND ANAEROBIC EXERCISE ON FIBRE OF THE BICEPS BRACHII AND PECTORALIS MAJOR WISTAR RATS

ABSTRACT

Physical training is used to produce physiological changes and adaptations that make the muscles more powerful and accurate to perform certain movements. The muscle fibers that comprise a muscle are classified according to criteria physiological, biochemical and metabolic fibr5as in slow-twitch and oxidative (SO), fast twitch and glycolytic metabolism and oxidative (FOG) and fast twitch fibers and metabolism exclusively glycolytic (FG). These fibers react differently depending on the stimulus that is applied to them. Aiming to describe the effect of exercise compared aerobic and anaerobic exercise on the fiber used 30 Wistar rats with 90 days of age divided into groups Sedentary (S), aerobic training (Tae) Trained and Anaerobic (Tan). Aerobic exercise consisted of 1 hour of swimming with a load of 5% of body weight three times a week for 8 weeks. The anaerobic training consisted of four sets of suspension of 3 minutes with 1 minute intervals between the series on a cable attached to two iron rods. After the training period picked up the biceps brachii and pectoralis major were placed in liquid nitrogen, cut in a cryostat and stained with hematoxylin and eosin, histochemical reaction for NADH-TR and myofibrillar ATPase reaction was pre-incubated at pH 4.3, 4.6 and 9.4 for the identification of its fibers. After identifying their cross-sectional areas were measured. The SO and FOG fibers did not differ in the extent of their areas when subjected to two years, since the FG fibers were increased in both the aerobic training, anaerobic training in how to. We conclude that the FG fiber hypertrophy and give more power to muscle contraction.

KEY- WORDS: aerobic training, anaerobic training, muscle fibers.

ÉTUDE COMPARATIVE DE L'EFFET DE L'AÉROBIE ET ANAEROBIE EXERCICE SUR LES FIBRES DU BICEPS BRACHIAL ET MUSCLE GRAND PECTORAL DES RATS WISTAR

RÉSUMÉ

L'entraînement physique est utilisée pour produire des changements physiologiques et les adaptations qui rendent les muscles plus puissants et précis pour effectuer certains mouvements. Les fibres musculaires qui constituent un muscle sont classés selon des critères physiologiques, biochimiques et métaboliques dans fibr5as lentes et oxydatif (SO), à contraction rapide et métabolisme glycolytique et oxydatif (FOG) et à contraction rapide des fibres et le métabolisme exclusivement glycolytiques (FG). Ces fibres réagissent différemment en fonction du stimulus qui leur est appliquée. Visant à décrire l'effet de l'exercice l'exercice aérobie et anaérobie rapport sur la fibre utilisé 30 rats Wistar avec 90 jours d'âge divisés en groupes sédentaires (S), l'entraînement aérobie (Tae) a été formé et anaérobies (Tan). L'exercice aérobie était constitué de 1 heure de natation avec une charge de 5% du poids corporel trois fois par semaine pendant 8 semaines. L'entraînement anaérobie était composé de quatre ensembles de suspension de 3 minutes avec 1 minute d'intervalle entre la série sur un câble fixé à deux barres de fer. Après la période de formation pris le biceps brachial et muscle grand pectoral ont été placés dans dans l'azote liquide, coupé dans un cryostat et colorées à l'hématoxyline et l'éosine, la réaction histochimique pour le NADH-TR et la réaction ATPase myofibrillaire a été pré-incubées à pH 4,3, 4,6 et 9,4 pour l'identification de ses fibres. Après identification de leurs zones transversales ont été mesurés. Les fibres SO et FOG ne diffère pas de l'étendue de leurs domaines lorsqu'il est soumis à deux années, puisque les fibres FG ont été augmentés en l'entraînement aérobie, l'entraînement anaérobie sur la manière. Nous concluons que l'hypertrophie des fibres FG et donner plus de pouvoir à la contraction musculaire.

MOTS-CLÉS: l'entraînement aérobie, l'entraînement anaérobie, les fibres musculaires

ESTUDIO COMPARATIVO DEL EFECTO DE EJERCICIO AERÓBICO Y EL EJERCICIO ANAERÓBICO SOBRE LA FIBRA DEL BÍCEPS BRAQUIAL Y PECTORAL MAYOR RATAS WISTAR

RESUMEN

El entrenamiento físico se utiliza para producir cambios fisiológicos y las adaptaciones que hacen que los músculos más poderosos y precisos para realizar ciertos movimientos. Las fibras musculares que componen un músculo se clasifican en función de criterios fisiológicos, bioquímicos y metabólicos en fibr5as de contracción lenta y la oxidación (SO), de contracción rápida y metabolismo glucolítico y oxidativo (FOG) y fibras de contracción rápida y metabolismo exclusiva glucolíticas (FG). Estas fibras reaccionan de manera diferente dependiendo del estímulo que se aplica a ellos. Con el objetivo de describir el efecto del ejercicio en comparación ejercicio aeróbico y anaeróbico en la fibra se realizó en 30 ratas Wistar con 90 días de edad divididos en grupos sedentarios (S), el entrenamiento aeróbico (Tae) entrenados y anaeróbicas (Canela). El ejercicio aeróbico consistía en una hora de natación con una carga de 5% del peso corporal tres veces por semana durante 8 semanas. El entrenamiento anaeróbico consistió en cuatro juegos de suspensión de 3 minutos con intervalos de 1 minuto entre las series en un cable enchufado a dos barras de hierro. Después del período de formación recogió el bíceps braquial y el músculo pectoral mayor se colocaron en nitrógeno líquido, cortado en un criostato y se tiñeron con hematoxilina y eosina, la reacción histoquímica para la NADH-TR y la reacción de la ATPasa miofibrilar se pre-incubadas a pH 4.3, 4.6 y 9.4 para la identificación de sus fibras. Después de la identificación de sus áreas transversales se midieron. Las fibras y en el FOG no difieren en la extensión de sus áreas cuando se somete a dos años, ya que las fibras FG se incrementaron tanto en el entrenamiento aeróbico, entrenamiento anaeróbico sobre la forma. Llegamos a la conclusión de que la hipertrofia de las fibras FG y dar más poder a la contracción muscular.

PALABRAS CLAVE: entrenamiento aeróbico, entrenamiento anaeróbico, las fibras musculares

ESTUDO COMPARADO DO EFEITO DO EXERCÍCO AEROBIO E DO EXERCÍCIO ANAEROBIO SOBRE AS FIBRAS DOS MUSCULOS BICEPS BRAQUIAL E PEITORAL MAIOR DE RATOS WISTAR

RESUMO

O treinamento físico é utilizado para produzir alterações e adaptações fisiológicas que deixam os músculos mais potentes e precisos para executar determinados movimentos. As fibras musculares que compõe um músculo são classificadas de acordo com critérios fisiológicos, bioquímicos e metabólicos em fibr5as de contração lenta e metabolismo oxidativo (SO), fibras de contração rápida e metabolismo glicolítico e oxidativo (FOG) e fibras de contração rápidas e metabolismo exclusivamente glicolítico (FG). Estas fibras reagem de maneira diferente dependendo do estímulo que é aplicado a elas. Com o objetivo de descrever o efeito comparado dos exercícios aeróbio e do exercício anaeróbio sobre estas fibras utilizamos 30 ratos Wistar com 90 dias de idade divididos em grupos Sedentário (S), Treinado Aeróbio (Tae) e Treinado Anaeróbio (Tan). O exercício aeróbio consistiu de 1 hora de natação com carga de 5% do peso corporal, três vezes por semana durante 8 semanas. O treinamento anaeróbio consistiu de 4 séries de suspensão de 3 minutos, com intervalos de 1 minuto entre as séries, em um cabo fixado à duas hastes de ferro. Após o período de treinamento colheu-se o músculo bíceps braquial e o músculo peitoral maior que foram colocados em nitrogênio liquido, cortados em criostato e corados com hematoxilina e eosina, pela reação histoquímica NADH-TR e pela reação de ATPase miofibrilar pré-incubada em pH 4,3; 4,6 e 9,4 para a identificação de suas fibras. Após a identificação as suas áreas de secção transversa foram medidas. As fibras SO e FOG não apresentaram diferença na medida de suas áreas quando submetidas aos dois exercícios, já as fibras FG tiveram um aumento, tanto no treinamento aeróbio, como no treinamento anaeróbio. Concluímos que as fibras FG hipertrofiam e dão mais potência à contração do músculo.

PALAVRAS CHAVE: treinamento aeróbio, treinamento anaeróbio, as fibras musculares