106 - COMPARISON BETWEEN THE EFFECTS OF AEROBIC TRAINING AND RESISTANCE TRAINING IN THE MAXIMUM OXYGEN CONSUMPTION IN PRACTITIONERS FROM A GYM

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INTRODUCTION

Regular physical activity represents an important factor to reduce the rates of morbity and mortality related to cardiovascular disorders (American Heart Association, 1992). For this reason, the number of people who engage in physical exercise programs in gyms and clubs has increased significantly (SABA, 2001).

The *American College of Sports Medicine (ACSM)* recommends that apparently healthy adults practice physical exercises to maintain or develop the main physical fitness components, such as cardiorespiratory fitness, muscular resistance and strength, flexibility and body composition (ACSM, 1998).

In most gyms, the programs to develop the cardiorespiratory fitness are composed of exercises in ergometers or of different types of gymnastics, while muscular resistance and strength are developed through resistance training programs (MATTOS, 2005).

Resistance training has been considered of little or even no importance to the development of the cardiorespiratory system. Besides that, such training, in high intensity, was considered dangerous due to the great increase of blood pressure (UCHIDA, 2006).

There have been few studies about the impact of high intensity resistance training impact in the cardiorespiratory system, creating doubts and bad interpretation o of moderate or high intensity, which reinforced its use in great scale in the main physical activity centers that focused on the development of the cardiorespiratory system and on health improvements (SANTARÉM, 2004).

Although aerobic physical exercises are directly associated with the improvement of cardiorespiratory fitness, as they involve great active muscular mass and demand significant heart work, high intensity resistance training that requires great muscular groups can also contribute to the improvement of cardiorespiratory fitness.

The maximum oxygen consumption (VO_2max) is the measure that best represents cardiorespiratory fitness, for it is directly related to oxygen uptake, transport and use by the cardiovascular, respiratory and muscular systems (POWERS & HOWLEY, 2000; WILMORE & COSTILL, 2001).

OBJECTIVE

The objective of this study was to compare the effects of aerobic training and resistance training in the maximum oxygen consumption in exercise practitioners from a gym.

METHODOLOGY

Sample

The sample of the study was composed by 11 adult subjects, with ages varying from 18 to 22 years, enrolled in a gym in the city of Guarapuava (Paraná), who had not participated in any previous physical exercise programs and did not present health risk when doing intense exercise.

All subjects signed in a term of participation consent and had their build, weight and body mass index (BMI) evaluated. Maximum oxygen consumption was estimated through the 2,400 meters walk/run test, proposed by Cooper (1977) and by the equation adapted by the A*MERICAN COLLEGE OF SPORTS MEDICINE* (2000).

Procedures

The sample was divided into 2 groups for the realization of the training programs. One group practiced aerobic exercises and the other practiced resistance exercises. After 6 weeks of training, the groups were reevaluated and advised to be in abstinence on exercised for 4 weeks, so that there could be the results remission. After this period, the groups were evaluated again and on the training they had not participated on during the first 6 weeks. After that, they were reevaluated.

Aerobic training was developed in a frequency of 3 sessions per week, lasting 40 minutes each (10 minutes - elliptical ergometer, 10 minutes - cycle ergometer, 2,400 meters - treadmill), in a period of 6 weeks, totalizing 18 sessions. The intensity of the sessions progressed weekly in 50 to 70, 60 to 80, and 70 to 90% of the maximum heart rate. Resistance training was developed in a frequency of 3 sessions per week, lasting 40 minutes, consisting of general exercises (such as squatting, horizontal leg press, stiff-legged deadlift, seated calf raise, barbell bench press, bar pull ups, parallel bar dips, abdominal exercises) with 2 sets of 10 to 15 repetitions, in a period of 6 weeks, totalizing 18 sessions. The intensity of the training progressed weekly in 60 to 75, 70 to 85, 75 to 90, 85 to 95, 90 to 100, and 95 to 100% of the maximum repetition.

Statistical Analysis

The results were presented in individual values, average and pattern deviation. The comparison of the results before and after training was made by the *t Student* test, for paired data. The level of significance adopted was p = 0,05.

RESULTS

Twenty seven of subjects gave up during the study. From 11 subjects who started the study, 8 continued.

Table 1 Sample's Demographic characteristics

Subjects	Gender	Age	Height	Weight	BMI
1	F	21	162	53.5	20.4
2	F	21	159	49.2	19.5
3	M	20	173	65.2	21.7
4	F	18	164	54.0	20.1
5	F	21	165	57.3	21.1
6	M	22	176	66.8	21.8
7	M	18	168	76.3	28.9
8	M	19	186	70.5	20.4
Average		**20**	**169.2**	**61.6**	**21.7**
SD		*1.5*	*8.9*	*9.5*	*3.0*

Table 1 presents individual values as well as the average and standard deviation of the sample's demographic data.

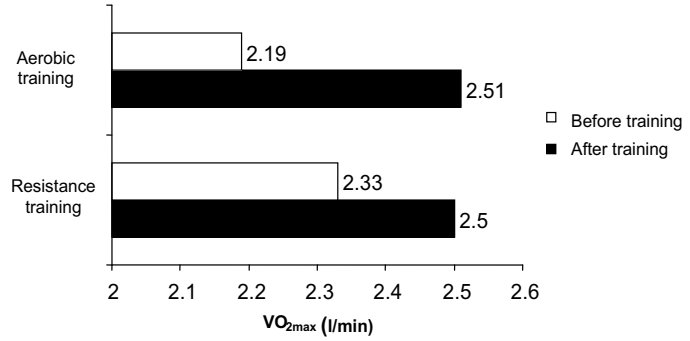
Table 2 VO_2 max values before and after aerobic and resistance training

	AEROBIC TRAINING				RESISTANCE TRAINING			
			Difference				Difference	
Subjects	VO_2 (l/min)	VO_2 (l/min)	l/min	%	VO_2 (l/min)	VO_2 (l/min)	l/min	%
1	1.51	1.79	0.28	18.5	1.65	1,83	0,18	10,9
2	1.31	1.66	0.35	26.7	1.54	1.64	0.1	6.5
3	2.55	3.02	0.47	18.4	2.73	2.97	0.24	8.8
4	2.03	2.26	0.23	11,3	2.04	2.32	0.28	13.7
5	1.79	1.92	0.13	7,3	1.94	2.05	0.11	5.7
6	2.84	3.30	0.46	19.7	3.03	3.15	0.12	4
7	2.54	2.85	0.31	12.2	2.71	2.79	0.08	3
8	2.98	3.28	0.3	10.1	2.98	3.27	0.29	9.7
AVERAGE	**2.19**	**2.51**	**0.32***	**15.53***	**2.33**	**2.50**	**0.18***	**7.79***
SD	*0.62*	*0.68*	*0.11*	*6.39*	*0.60*	*0.63*	*0.08*	*3.64*

* Significant statistic difference between the two training programs (p=0,05).

Table 2 presents VO_2max estimated values before and after aerobic and resistance training. All the subjects tested had their VO_2max increased after the training programs. Aerobic training lead to an increase of 0,32 l/min (liters/minute). This represents an increase of 15,5% of VO_2max. Resistance training promoted an average increase of 0,18 l/min, which is an increase of 7,8% of the initial value (Graphic 1).

Graphic 1 Comparison of Vo2 max before and after aerobic and resistance training



Therefore, the magnitude of VO_2max increase before and after training was significantly greater in the aerobic training when compared to the resistance training (15,5% versus 7,8%, p=0,001).

DISCUSSION AND CONCLUSIONS

In the present study, both aerobic training and resistance training induced the increase of VO_{2max}, being both, therefore, recommended to compose programs that have, as a target, the development of the cardiorespiratory system (AHA, 1992; ACSM, 1998).

Aerobic training was superior in the increase of VO_2max in comparison to resistance training. This result is in accordance with other studies that investigated the effects of aerobic training in the cardiorespiratory system (GOLDBERG et al., 1994; BUCCI et al., 2005).

Studies have shown that resistance training also improves the components of physical fitness, such as muscular resistance and strength, flexibility and maintenance of body composition, through metabolic acceleration and lipidic mobilization, besides contributing to a better postural control, in comparison to aerobic training.

The security and efficiency of resistance training are other positive factors, because the practicity of movements, less articulatory impact and greater muscular vascularization permit a harmonious body development with minimum lesion risk (SANTAREM, 2004).

Other studies were done in order to verify improvements in VO_{2max} through resistance training, making use of other methodologies, such as light or moderate weights that lead to a little improvement of VO_{2max}, both in healthy subjects and in hypertensive subjects. However, the authors present the length of rest between exercise sets, population characteristics and training volume as limitations to the training protocols, which may affects the changes in VO_{2max} (POLLOCK, 1981).

In relation to the data presented, aerobic training is specific to improve VO_{2max}, estimating 15.5% of improvement in 6 weeks, when compared to 7.8% presented by the resistance training (an improvement of 0.18 l/min versus 0.32l/min through aerobic training). That is a difference of 0.14 l/min between the training programs. On the other hand, resistance training is specific for muscular gain and resistance, but presented significant improvement in $VO_{2max.}$

In summary, both aerobic and resistance training lead to the improvement of cardiorespiratory fitness. Therefore, it is essential that physical education professionals prescribe high intensity resistance training for people whose objective is to have both muscular-skeletal and cardiorespiratory improvement or even experience both kinds of training in one exercise session, potentializing gains in different fitness components as well as in quality of life, body aesthetics, body's functional capacity and other benefits.

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COMPARISON BETWEEN THE EFFECTS OF AEROBIC TRAINING AND RESISTANCE TRAINING IN THE MAXIMUM OXYGEN CONSUMPTION IN PRACTITIONERS FROM A GYM

ABSTRACT

The objective of this study was to compare the effects of aerobic and resistance training in the maximum oxygen consumption in practitioners from a gym. The sample was composed by 8 subjects, of both genders, from 18 to 22 years old. The subjects were divided into 2 groups and, afterwards, participated on 2 training programs: aerobic and resistance. Maximum oxygen uptake and anthropometric data were collected in the beginning and end of the first and second training programs. There was an interval of 4 weeks between the two training programs, consisting of 4 weeks of rest without any physical activity. Both programs presented improvement of VO_{2max}. Aerobic training VO_{2max} increase was 15.5%, and resistance training VO_{2max} increase was 7.8%. Although resistance training presented a smaller increase in VO_{2max}, it has been a motivating exercise alternative due to its variety of movements and load, which establishes new routines or the practitioners. On the other hand, aerobic training is sometimes monotonous by the location of equipments and its routine.

KEY WORDS: aerobic, resistance, cardiorespiratory fitness.

COMPARAISON ENTRE LES EFFECTS DES ENTRAINEMENTS AÉROBIQUE ET EN RÉSISTANCE SUR LA CONSOMMATION MAXIMALE D'OXYGÈNE EN PRACTICANTS DE GYM.

RESUMÉ

L'objectif de cet étude c'était comparer les effects des entraînement aérobique et en résistance sur la consommation maximale d'oxygène en practicants de gym. L'echantillon utilizé a été constitué par 8 sujects, des deux sexes, d'ages variés entre 18 et 22 ans. Ils ont eté divisés en deux groupes et submis à deux types d'entrainement: aérobique et en résistance. Les donnés antropometrique et la consommation maximale d'oxygène ont été colectés avant et après le premier et le deuxiéme entrainement. Il y a eu un periode de 4 semmaines sans quelque exercise physique entre les deux entrainements. Il y a eu une amélioration significative de la VO_{2max} dans les deux entrainements. L'entrainement aérobique a presenté une augmentation de 15,5% de la VO_{2max} et le entrainement en résistance, de 7,8%. Malgré de contribuir moins pour l'augmentation de la $VO_{2max,}$ l' entrainement en résistance se present comme une alternatif d'exercises motivant pour ses variations de movements et chargements, pendant l'entrainement aérobique a constitué une option monotone par sa localization d'equipments et de sa routine.

MOTS-CLES: aérobique, en résistance, aptitude cardiorespiratoire.

COMPARACIÓN DE LOS EFECTOS DEL ENTRENAMIENTO AERÓBIO Y DEL ENTREINAMIENTO RESISTIDO EN EL CONSUMO MÁXIMO DE OXÍGENO EN PRACTICANTES DE ACADEMIA

RESUMEN

El objetivo del actual estudio era comparar el efecto del entrenamiento aerobio y del entrenamiento resistidos en el consumo máximo de oxígeno an practicantes de academia. La muestra fue compuesta par 8 sujeitos, de ambos los sexos, de 18 a 22 años. Ellos fueram divididos aleatoriamente en dos grupos y, después, que sometidos a dos tipoes de entrenamiento: aeróbio y resistido. Los datos antropométricos y el consumo máximo de oxígeno fueram colectados al principio y al final de los dos entrenamientos, que fueram intercalados por un período de cuatro semanas de resto sin ningún ejercicio físico. Tenía 27% de desistances durante el programa. Hubo mejora significativa en el VO2max en ambos los entrenamiento. El entrenamiento aerobio causó un aumento del 15.5% y el entrenamiento resistido de el 7.8% del VO2máx. Aunque contribuye en un menor porcentaje para el aumento del VO2máx, el entrenamiento resistido fue presentado como una alternativa de ejercicio motivante devido a su variación de ejercicios y de cargas que establecían siempre una nueva rutina para el participante en cambio del entrenamiento aeróbio que alternadamente llegó a ser monótono por la localización de los dispositivos y de su rutina.

PALAVRAS-LLAVES: aerobio, resistido, aptitud cardiorrespiratoria.

COMPARAÇÃO DOS EFEITOS DO TREINAMENTO AERÓBIO E DO TREINAMENTO RESISTIDO NO CONSUMO MÁXIMO DE OXIGÊNIO EM PRATICANTES DE ACADEMIA

RESUMO

O objetivo do presente estudo foi comparar o efeito do treinamento aeróbio e treinamento resistido no consumo máximo de oxigênio de praticantes de academia. A amostra foi composta por 8 sujeitos, ambos os sexos, de 18 a 22 anos. Foram aleatoriamente divididos em dois grupos que posteriormente submetidos em dois treinamentos: aeróbio e resistido. Foram coletados os dados antropométricos e o consumo máximo de oxigênio no início e ao final do 1º treinamento e inicio e término do 2º treinamento, sendo intercalado por um período de quatro semanas de repouso sem qualquer exercício físico. Houve 27% de desistências durante o programa. Houve melhora significativa no VO_{2max} em ambos os treinamentos. O treinamento aeróbio acarretou num aumento de 15,5% e o treinamento resistido de 7,8% do $VO_{2máx}$. Apesar de contribui num menor percentual para o aumento do $VO_{2máx}$, o treinamento resistido apresentou-se como uma alternativa de exercício motivante devido sua variação de exercícios e cargas estabelecendo sempre uma nova rotina para o participante ao contrario do treinamento aeróbico que por sua vez se tornava monótono pela localização dos aparelhos e sua rotina.

PALAVRAS-CHAVES: aeróbio, resistido, aptidão cardiorrespiratória.