54 - COMPARISON BETWEEN THE EFFECT OF AN ACUTE RESISTANCE EXERCISE SESSION WITH INTENSE AND LIGHT LOAD CIRCUIT METHOD ON BLOOD PRESSURE

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INTRODUCTION

According to World Health Organization – WHO (2002), hypertension affects an average of 20% to 25% of the population, and this figure rises to 50% in older age groups. The literature indicates that this is one of the ten leading causes of death worldwide, since hypertension is an aggravating factor for cardiovascular disease. According to Pugliense (2005), one in every three to four people have abnormally high blood pressure at some point during the course of life.

Cardiovascular related diseases have become a major public health problem in Brazil. Only in 2007 there were 308,466 deaths of circulatory diseases, 12% caused by hypertension, reaching children in 2 to 3% (SBC; SBH;SBN, 2010). Also adding that according to American College of Sports Medicine (2003), more than 50 million Americans are hypertensive, having blood pressure at rest from 140/90 mmHg or more.

It is considered that the modern man has a quite busy life, becoming more susceptible to several risk factors that are crucial for triggering psychosomatic illnesses, among these chronic elevation of blood pressure, also known as hypertension (HA), has as risk factors: physical inactivity, stress, poor eating habits, overweight, obesity, smoking, excessive consumption of alcohol and sodium, socioeconomic factors, age, gender, ethnicity, genetics among others (VI BRAZILIAN GUIDELINES OF HYPERTENSION, 2010).

The forms of treatment for hypertension pointed out by the literature can be medicated and non-drug treatments. The non-drug way is given through the benefits of physical activity, combined with a balanced diet and reduction of ingestion of alcohol, sodium, caffeine and others. Yet, the drug treatment is given through drugs such as: diuretics, beta blockers, among others; in some cases a combination of such drugs is necessary (VI BRAZILIAN GUIDELINES OF HYPERTENSION, 2010).

Considering that physical activity provides with several changes in the cardiovascular, respiratory and endocrine systems, so that the physiological needs be provided, physical activity has been recommended as an adjunct in the treatment and prevention of hypertension. (BRUM; FORJAZ; TINUCCI; NEGRÃO, 2004).

Physical activity can cause acute and chronic adaptations to the body. The acute effects that can be provided by exercises are those that occur while performing physical activity, in isolated sessions of treatment while the chronic responses are those related to physiological adaptations that occur over a longer period of time, resulting from regular training and depending on the applied overload. (THOMPSON; CROUSE; GOODPASTER; KELLEY; MOYANA; PESCATELLO, 2001).

Such adaptations are modulated according to the intensity, duration and type of exercise, being that the resistance exercise has been considered safe and effective in the treatment of hypertension. According to Conley and Rozenek (2001), contra-resistance training consists of the performance of dynamic exercise, using specific implements or free loads, whose effects are the development of strength, power or muscular endurance. Confirming such results, the Amercian College of Sports Medicine (2003) cites that this modality is considered relatively safe to augment muscular strength and improve life quality in adults as much as in the elderly.

Studies developed by Mello and Ximenes (2009) and Politto and Farinatt (2006), confirm results on the decrease of blood pressure at rest after the performance of strength exercises, also called post-exercise hypotension (HPE).

Considering that the hypotensive mechanisms are numerous and some are complex, they may be related to the modification of the baroreflex control and the reduction of alpha-adrenergic responsiveness, besides humoral, hormonal and local substance secretion, which may lead to peripheral post-exercise maintenance, contributing to the HPE (MOTA, 2006). Yet, among the factors responsible for the hypotensive effect, it can be cited neuroendocrine adaptations, with noradrenalin release reduction and, at a lower degree, in adrenaline. (BROWNLEY; HINDERLITER; WEST, GIRDLER; SHERWOOD; LIGHT, 2003).

Therefore, the regular practice of physical exercise has been recommended for the treatment of hypertension. However, in spite of the description of hypotensive effect after resistance exercise practice given by the literature, it is still controversial concerning type, intensity and duration of exercise to achieve such goal safely.

Hence, this study aims at comparing the behavior of blood pressure after 60 minutes of recovery from a resistance exercise session in the circuit method with 40% and 80% of 1RM in normotensive individuals.

MATERIALS AND METHODS

Study participants: 12 male volunteers, aged 24,9 ± 2,43; body mass 71,68 ± 5,18kg; height 173 ± 0,16 in; IMC 23,83 ± 1,60 kg/m2.

The inclusion criteria adopted were: 1) all participants were normotensive; 2) had previous experience of at least six months with the ER. (POLITO; SIMÃO; SENNA; FARINATTI, 2003).

The following exclusion criteria were used: a) musculoskeletal or metabolic problems that might limit or contraindicate the practice of programmed exercises; b) use of ergogenic aids; c) use of cigarettes.

All of the participants signed a Free and Informed Consent according to the recommendations of Resolution 196/96 of the National Health Council, and responded negatively to the PAR-Q questionnaire. Before its completion, the present study was assessed and approved by the Ethics Committee of the Assis Gurgacz College. (OPINION 187/2008).

Body mass was measured using a digital scale labeled “Toledo” brand, and height using a wall stadiometer manufactured by “Sanny”, in accordance with the procedures described by Gordon, Chumlea and Roche (1998).

From these measurements the body mass index (BMI) was calculated by the body weight/height quotient, body mass expressed in kilograms (kg) and height in meters (m).

Adiposity was determined by using a scientific fat caliper of “Lange” brand (Cambridge Scientific Industries Inc.; Cambridge, Maryland). The thickness of subscapular, abdominal and triceps skin folds were measured in accordance with the procedures described by Harrison, Bursik, Carter, Johnston, Lohman and Pollock (1988).

The fat percentage was determined by a protocol for three folds (GUEDES; Guedes, 2003). It is noteworthy that the

measurement error was within ± 1.0 mm and the test-retest quotient of > 0.95.

The variables measured at rest and after the experimental sessions (80% 1-RM, 40% 1-RM and CONT), every 15 minutes to 60 minutes of recovery were systolic (SBP) and diastolic blood pressure (DBP).

BP measurement was performed using the oscillometric measurement method, using an Automatic Digital Blood Pressure Monitor, Model BP-A3BTO, manufactured by Microlife.

To determine the RE load used, the maximum repetition (1-RM) test was performed. The anthropometry, body composition, 1-RM test and the RE assessments were performed within three non-consecutive days, with and interval of at least 48 hours, at the same time, every day.

The 1-RM testing was conducted in the following machines: leg extension, incline press, legpress45, pulled into the machine, leg curl and rowing machine, all Righetto Fitness Equipment. Through the 1-RM load test, the maximum load possible to carry out the RE session was determined. Before the test, the volunteers performed five minutes of preparatory exercises and stretching with priority to the muscles involved in the test. Each volunteer performed up to five attempts at the test, following an interval of 3 to 5 minutes apart for resynthesis of energy reserves.

The ER sessions were randomized, one with the execution of three circuits in high-intensity resistance exercise (08 repetitions/exercise X 80% 1-RM) one with low intensity (16 repetitions/exercise X 40% 1-RM) and the other session being the control (CONT) without performing the exercise.

On the day set for the control session, the volunteers attended the gym and had no exercise, but SBP and DBP were collected using the same procedures and times of the RE session.

Data were analyzed using descriptive statistics with mean and standard deviation. Two-way ANOVA for repeated measures was applied for comparison of results within and between experimental sessions with Post-hoc test when necessary to detect possible differences. The significance level was $p<0.05$ and all procedures were performed in the software Statistics for Windows 6.0.

RESULTS

Table 1 describes the general characteristics of the sample, with the average values and standard deviations for the variables: Age, Body mass, Height, BMI and Percent Body Fat.

Table 1: General characteristics of the sample

	Mean	Standard Deviation
Age (years)	24,9	2,43
Body mass (kg)	71,68	5,18
Height (cm)	1,73	0,04
BMI (kg/m^2)	23,83	1,60
% body fat (%)	16,84	2,99

Table 2 presents the results of the comparison between SBP and DBP in the control session, the session of resistance exercise with a load of 40% and the session of resistance exercise with a load of 80% 1RM in circuit method.

According to the results there was no significant difference in BP between exercise sessions. Also, there was neither significant increase of SBP and DBP in the volunteers evaluated after the exercise sessions, nor was there any hypotensive effect during recovery period.

Table 2: Comparison of SBP and DBP in the control session, the session of resistance exercise with a load of 40% and the resistance exercise session with a load of 80% 1RM in circuit method.

	Control Session		40% de 1RM		80% de 1RM	
	SBP (mmHg)	DBP (mmHg)	SBP (mmHg)	DBP (mmHg)	SBP (mmHg)	DBP (mmHg)
Rest	127,18±13,86	72,98± 8,54	125,98±11,63	76,28±15,04	130,38± 8,47	74,06± 8,05
Final effort	126,17±11,27	74,75± 9,01	138,42±14,92	79,17±13,27	144,25±36,32	87,75±36,12 [a]
15 min recovery	126,67±12,28	68,83±16,24	131,00±14,79	74,17±12,04	125,67±12,06	73,08± 11,70
30 min recovery	126,00±12,52	70,33± 8,23	128,83±12,57	69,92± 5,66	122,42± 8,66	67,83± 9,51
45 min recovery	124,92±10,94	72,92± 8,33	125,58±19,71	75,00±13,18	126,58±19,00	74,08± 11,52
60 min recovery	126,83±10,89	77,83±10,81	118,67± 8,88	67,25± 3,86	123,33±19,09	74,08± 9,21

DISCUSSION OF RESULTS

This study aimed at comparing the behavior of blood pressure and double product after 60 minutes of recovery from a resistance exercise session in circuit method with 40% and 80% of 1RM in normotensive individuals.

According to the results, a significant reduction in DBP was verified when comparing the final values of resistance exercise and after 30 minutes of recovery of the 80% of 1RM session.

It was expected to find the SBP and DBP values higher after the completion of resistance exercise at both intensities, besides observing the SBP and DBP values higher at the 80% load.

These results may have occurred due to the fact that the sample consisted of normotensive individuals. If the volunteers were hypertensive, there might have been HPE or even differences in BP between exercise sessions. However, the mechanisms responsible for HPE still remain controversial and not conclusive in the literature. Nevertheless, some factors have been related to the decrease in BP resulting from the exercise. Among them, decreased peripheral vascular resistance may be related to vasodilatation afforded by exercise in active and inactive muscles. Decrease in sympathetic nerve activity, changes in the functioning of arterial and cardiopulmonary pressoreceptors, thermoregulation caused by the dissipation of heat produced by exercise, increased levels of serotonin and vasodilator hormones such as nitric oxide, are also cited as possible hypotensive factors (McDONALD, 2002).

The BP responses can be differed in normotensive and hypertensive individuals, since the hypotensive post-exercise effect can be associated with the health status of individuals. Thus, studies report that the decrease in systolic (SBP) and diastolic (DBP) blood pressure after exercise in hypertensive patients ranges from 18mmHg to 20mmHg and 7mmHg to 9mmHg

respectively. In normotensive individuals, these variations are less evident (SBP – 8mmHg to 10mmHg; DBP – 3mmHg to 5mmHg). These values clearly show that the pressure decline has greater magnitude in hypertensive patients (KENNEY & SEALS, 1993).

Another highlight is the method of assessing blood pressure, where some authors recommend that the measurement be performed immediately after the exercise. Although the method has direct risks associated with this technique, it is the most accurate method on the acute blood pressure responses. Due to its invasive nature, some authors consider this practice the most appropriate. (PERLOFF, GRIM, FLACK, FROHLICH, HILL, MCDONALD, 1993).

Contradictory results to those reported in some studies might be due to variations in exercise protocols, including variations in the type and sequence of exercises, number of repetitions for a given % of 1RM, as well as the pauses between exercise series (LIZARDO & SIMÕES, 2005).

Studies show that tensional levels rise during exercise and predominantly in the static effort, having already been observed in young and healthy adults, levels of intra-arterial pressure exceeding 400/250mmHg, without causing damage to health (FORJAZ, REZK, MELO, SANTOS, TEIXEIRA, NERY, 2003).

According to Teixeira (2000) a significant reduction in blood pressure is achieved by low intensity training (50% of peak oxygen intake). Thus, the low-intensity exercise lowers blood pressure because it causes a reduction in cardiac output, which can be explained by the decrease in heart rate at rest and decreased sympathetic tone in heart, because of the lower sympathetic intensification.

In addition, acute physical exercise (performing a single exercise session) is enough to cause a decrease in blood pressure during exercise recovery in both normotensive and hypertensive individuals (Hannum & Kasch, 1981).

Studies by Kenney & Seals (1993) show that the magnitude and duration of pressure decline can be influenced by several factors such as the studied sample (normotensive or hypertensive), the type, the intensity and the duration of exercise.

Among other factors is the muscle group used, according to Benn, McCartney, & McKelvie (1996), the reason for the difference in pressure responses between exercises for upper and lower limbs is the way the stimulus is applied to the muscle.

Santos & Simão (2005) conducted a series of resistance exercise (RE) in nine young normotensive volunteers with previous experience in RE for at least 12 months. Three sets of 10RM in four exercises were performed (pull ahead in Pulley, horizontal leg press, biceps curl and leg curl), with a two-minute interval, and BP was measured at the beginning and end of the sequence for 60 minutes. There were no significant reductions in SBP and DBP after exercise, when compared to values obtained at rest. However, there was a tendency to the hypotensive effect of SBP when compared to the post-exercise measures among themselves.

Although aerobic exercises are the most evidently recommended and have gained prominence when it comes to health promotion, greater emphasis is being given with the same objective to the resistance exercise practice (KELLEY, 1997).

According to the American Heart Association (2000), the resistance exercise is recommended for individuals with cardiopulmonary compromise, since a lower heart rate during activity if compared to aerobic exercise of moderate to high intensity would cause minor elevations of double product. This position recommends the development of muscular strength in individuals with heart disease, a key factor in life quality (POLLOCK, FRANKLIN, BALADY, CHAITMAN, FLEG, FLETCHER, LIMACHER, STEIN, WILLIAMS, BAZARRE; 2000).

Some studies have shown that the cardiovascular overload in resistance exercises are usually lower than that observed in moderate intensity aerobic exercises. For Haslam, McCartney, McKelvie and McDougall (1998), exercise with weights would promote a higher demand for myocardial oxygen consumption for about 30 seconds, representing a value well below a conventional exercise, for example. Therefore, the risks associated with ischemia or compromises in left ventricular function can be considered relatively small in this type of exercise.

CONCLUSION

It is concluded that there was no significant difference in blood pressure between sessions of resistance exercise in loads of 40 and 80% of 1-RM as well as no significant hypotensive effect was observed.

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COMPARISON BETWEEN THE EFFECT OF AN ACUTE RESISTANCE EXERCISE SESSION WITH INTENSE AND LIGHT LOAD CIRCUIT METHOD ON BLOOD PRESSURE

ABSTRACT

Introduction: The literature reports that after a resistance exercise session a hypotensive effect can be observed, which could contribute to the treatment of hypertension. However, there is still controversy about the type, intensity and duration of exercise to achieve this goal safely. Objective: This study aims at comparing the behavior of blood pressure after 60 minutes of recovery from a resistance exercise session in the circuit method with 40% and 80% of 1RM. Methods: The participants were 12 normotensive men aged 24,9 ± 2,43; body mass 71,68 ± 5,18kg; height 173 ± 0,16 in; IMC 23,83 ± 1,60 kg/m2 and % fat of 16,84±2,99. The volunteers attended the laboratory for four trial sessions of weight training on alternated days: 1 – maximum load (1-RM) in six exercises (leg extension, bench press machine, leg curl and rowing machine), 2, 3 and 4 – in random order for the experimental sessions: 3 circuit of 8 repetitions of resistance exercise at 80% 1-RM session, 3 circuit of 16 repetitions of resistance exercise at 40% 1-RM session and a control (CONT) without performing the exercise. The variables measured at rest and after the experimental sessions, within 60 minutes of recovery were systolic blood pressure (SBP) and diastolic. Data were analyzed using descriptive statistics with mean and standard deviation. Two-way ANOVA for repeated measures was applied for comparison of results within and between experimental sessions with Post-hoc de Tukey test ($p < 0,05$). The software Statistics for Windows 6.0 was employed. Resuslts: There was no increase in SBP and DBP in volunteers evaluated after the exercise sessions, as well as hypotensive effect was not observed during the recovery period. However, there was significant reduction in DBP at 30 min compared with the value at the end of the exercise. Conclusion: It is concluded that there was no significant difference in blood pressure between sessions of resistance exercise in loads of 40 and 80% of 1-RM, as well as no hypotensive effect was observed.

KEY WORDS: resistance exercise, blood pressure, post-exercise hypotension

COMPARAISON ENTRE L'EFFET AIGU D'UNE SÉANCE DE MUSCULATION DANS LA MÉTHODE CIRCUIT AVEC CHARGE INTENSE ET LÉGÈRE SUR LA PRESSION ARTÉRIELLE

RÉSUMÉ

Introduction: La littérature rapporte qu'après une séance de musculation il est possible d'observer un effet hypotenseur, ce qui pourrait contribuer au traitement de l'hypertension. Cependant, la controverse persiste par rapport au type, l'intensité et la durée de l'exercice pour atteindre cet objectif en toute sécurité. Objectif : Comparer le comportement de la pression artérielle après 60 minutes de récupération d'une séance d'exercice circuit en résistance avec 40% et 80% de 1RM. Méthodologie: 12 hommes avec pression artérielle normale âgés de 24,9±2,43 ans, masse corporelle 71,68± 5,18 kg, stature de 173±4 cm, IMC de 23,83±1,60 kg/m2 et graisse de 16,84±2,99 ont fait partie de cet étude. Les participants sont allés au laboratoire pour quatre séances experimentelles dans des jours alternés: 1 – determiner la charge maximale (1-RM) en six exercices (leg extension, développé couché, presse à cuisses, tirage nuque, leg curl arrière et tirage sol); 2, 3 et 4 – dans un ordre randomisé pour les séances expérimentales: 3 circuit de 8 répétitions de musculation à 80% 1-RM, 3 circuit de 16 répétitions de musculation à 40% 1-RM et une séance contrôle (CONT) sans effectuer l'exercice. Les variables mesurées au repos et après les séances expérimentales, jusqu'à 60 minutes de récupération, ont été la pression artérielle systolique (PAS) et diastolique (PAD). Les données ont été analysées à l'aide de statistiques descriptives avec la moyenne et l'écart type. ANOVA two-way pour mesures répétées a été appliqué pour la comparaison des résultats obtenus entre et dans chacune des séances expérimentales avec Post-hoc de Tukey lorsque cela est nécessaire pour détecter d'éventuelles différences ($p <0,05$). Le logiciel Statistic for Windows 6.0 a été mis en place. Résultats : Selon les résultats, il n'y avait pas d'augmentation significative de la PAS et la PAD

chez les sujets évalués après les séances d'exercices, ainsi que l'effet hypotenseur n'a pas été observée au cours de la période de récupération. Cependant, il y avait une réduction significative de la PAD à 30 min par rapport à la valeur de la fin de l'exercice. Conclusion : L'étude conclut qu'il n'y a pas eu de différence significative de la pression artérielle entre les séances d'exercice en résistance avec les charges de 40% et 80% de 1-RM, ainsi que l'effet hypotenseur significatif n'a pas été observé.

MOTS CLÉS: musculation, pression artérielle, hypotension postexercice.

COMPARACIÓN ENTRE EL EFECTO AGUDO DE UNA SESIÓN DE EJERCICIOS RESISTIDOS EN EL MÉTODO CIRCUITO CON CARGA INTENSA Y LEVE SOBRE LA PRESIÓN ARTERIAL

RESUMEN

Introducción: La literatura relata que después de una sesión de ejercicios resistidos se puede observar un efecto hipotensor, lo qué podría contribuir para el tratamiento de la hipertensión arterial. Sin embargo, todavía hay controversias cuanto al tipo, intensidad y duración del ejercicio para alcanzar este objetivo de forma segura. Objetivo: Comparar el efecto agudo de una sesión de ejercicios resistidos en el método circuito con carga intensa y leve sobre la presión arterial. Metodología: Hicieron parte del estudio 12 hombres normotensos con edad de 24.9±2,43 años, masa corporal 71,68±5,18 kg, estatura de 173±4 cm, IMC de 23,83±1,60 kg/m2 y % grasa de 16,84±2,99. Los voluntarios comparecieron al laboratorio de musculación durante cuatro sesiones experimentales en días alternados: 1 – determinación de la carga máxima (1-RM) en seis ejercicios (extensión de piernas en máquina, press de brazos en máquina, prensa de piernas, pull over con polea alta, flexión femoral, remo en máquina); 2, 3 y 4 – en orden randomizado para las sesiones experimentales: 3 series de 8 repeticiones de ejercicio resistido a 80% 1-RM, 3 series de 16 repeticiones de ejercicio resistido a 40% 1-RM y una sesión control (CONT) sin la realización de ejercicio. Las variables mensuradas en reposo y después de las sesiones experimentales, hasta 60 minutos desde la recuperación, fueron presión arterial sistólica (PAS) y diastólica (PAD). Los datos fueron analizados a través de estadística descriptiva, con valores medios y desviación estándar. ANOVA two-way para medidas repetidas fue aplicada para comparación de resultados obtenidos intra y entre sesiones experimentales con Post-hoc de Tukey cuando necesario para detectar las posibles diferencias ($p < 0,05$). Fue empleado el software Statistic for Windows 6.0. Resultados: De acuerdo con los resultados, no fue verificado un aumento significativo de PAS y PAD en los voluntarios evaluados después de las sesiones de ejercicio, tampoco fue observado efecto hipotensor durante El período de recuperación. Sin embargo, fue observada una reducción significativa de PAD a los 30 minutos, en comparación con el valor de final de ejercicio. Conclusión: Se concluye que no hubo diferencia significativa en la presión arterial entre las sesiones de ejercicio resistido en cargas de 40 y 80% de 1-RM, tampoco fue observado efecto hipotensor significativo.

PALABRAS CLAVE: ejercicio resistido, presión arterial, hipotensión post ejercicio.

COMPARAÇÃO ENTRE O EFEITO AGUDO DE UMA SESSÃO DE EXERCÍCIOS RESISTIDOS NO MÉTODO CIRCUITO COM CARGA INTENSA E LEVE SOBRE A PRESSÃO ARTERIAL

RESUMO

Introdução: A literatura relata que após uma sessão de exercícios resistidos pode-se observar um efeito hipotensor, o que poderia contribuir para o tratamento da hipertensão arterial. Contudo, ainda controvérsias quanto ao tipo, intensidade e duração do exercício para atingir este objetivo de forma segura. Objetivo: Comparar o comportamento da pressão arterial após 60 minutos de recuperação de uma sessão de exercício resistido no método circuito com 40% e 80% de 1RM. Metodologia: Foram avaliados 12 homens normotensos: 24,9±2,43 anos, massa corporal 71,68± 5,18 kg, estatura 173±4 cm, IMC de 23,83±1,60 kg/m2 e % gordura de 16,84±2,99. As sessões experimentais foram em dias alternados: determinação da carga máxima (1-RM) em seis exercícios (cadeira extensora, supino reto na máquina, leg press, puxada na máquina, cadeira flexora e remada máquina); em ordem randomizada para as sessões experimentais: 3 circuitos de 8 repetições de exercício resistido a 80% 1-RM, 3 circuitos de 16 repetições de exercício resistido a 40% 1-RM e uma sessão controle (CONT) sem exercício. As variáveis mensuradas no repouso e após as sessões experimentais, até 60 minutos da recuperação, foram a pressão arterial sistólica (PAS) e diastólica (PAD). Foi utilizada estatística descritiva (média e desvio padrão). ANOVA two-way para medidas repetidas foi aplicada para comparação dos resultados obtidos intra e entre sessões experimentais com Post-hoc de Tukey ($p < 0,05$). Foi empregado o Software Statistic for Windows 6.0. Resultados: Não foi verificado aumento significativo da PAS e PAD após as sessões de exercício, bem como não foi observado efeito hipotensor durante o período de recuperação. No entanto, foi observada redução significativa da PAD aos 30 min, quando comparado com o valor de final do exercício. Conclusão: Conclui-se que não houve diferença significativa na pressão arterial entre as sessões de exercício resistido nas cargas de 40 e 80% de 1-RM, bem como não foi observado efeito hipotensor.

PALAVRAS CHAVES: exercício resistido, pressão arterial, hipotensão pós-exercício.