31 - ACUTE EFFECT OF A SERIAL RESISTENCE EXERCISE SESSION WITH INTENSE LOAD ON BLOOD PRESSURE

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INTRODUCTION

Artery Hypertension (High Blood Pressure) (AH) is a chronic disease, asymptomatic, highly prevalent, socially and economically costly, mainly due to its complications, with great impact on morbid mortality in Brazil and in the world (CORRÊA; NAMURA; SILVA; CASTRO; MENEGHINI; FERREIRA, 2006).

Brazilian epidemiological studies estimate the prevalence of hypertension in 30% to 40% of adults over 40 years old, this disease being considered a public health problem. (MINISTRY OF HEALTH; THE PAN AMERICAN HEALTH ORGANIZATION, 2004).

In this sense, one of the great challenges of the scientific community is a way of preventing and treating the disease. Among these strategies, the exercise can provide hypotensive effect, being identified as an important factor to minimize the risk of heart disease and, therefore, it is recommended in the non-pharmacological treatment of hypertension. (V BRAZILIAN GUIDELINES FOR HYPERTENSION, 2006; LIZARD; Simoes, 2005).

According to the study by Simão, Manochio, Serra and Melo (2008) – which aimed at checking the blood pressure behavior after four months of aerobic training, strength and flexibility simultaneously in forty sedentary individuals – a 9% reduction in systolic blood pressure (SBP) and 2.2% in diastolic blood pressure (DBP) ($p<0.05$) has been observed, emphasizing the benefits of exercise for the treatment of hypertension.

The benefits of exercise can be attributed to the fact that during an exercise period, the human body suffers from cardiovascular and respiratory adaptations to meet the increased demands of active muscles and, as such adjustments are repeated, these changes occur in these muscles, allowing the body to improve its performance. In this way, physiological and metabolic processes come into play, optimizing oxygen delivery to tissues in activity. (WILMORE, Constill, 2001).

According to the literature, there seems to be a consensus that exercise is an important adjunct in the treatment of hypertension. (V BRAZILIAN GUIDELINES FOR HYPERTENSION, 2006); (SEVENTH REPORT OF THE JOINT NATIONAL COMMITTEE ON PREVENTION, DETECTION, EVALUATION, AND TREATMENT OF HIGH BLOOD PRESSURE, 2003); (MONTEIRO; Sobral Filho, 2004).

Among the forms of exercise, aerobic exercise has been the most recommended for treatment of hypertension. Moreover, there is an increasing scientific interest on the effects of resistance exercise (RE) in the treatment of hypertension. (FORJAZ; REZK; MELO; SANTOS; TEIXEIRA; NERY; TINUCCI, 2003).

Research indicates that resistance exercises using different intensities show a significant reduction in post exercise SBP (FISCHER, 2001; LIZARDO; SIMÕES, 2005). However, the reduction of DBP after resistance exercise still needs further investigation. (SANTOS; DIAS; SANTOS; GOLDONI; NOVAES; SIMÃO, 2007).

Most resistance training programs used in the studies employ the serial method. However, studies differ regarding the type of exercise, number of repetitions, intensity and recovery period. (LIZARDO; SIMÕES, 2005; POLITO; SIMÃO; SENNA; FARINATTI, 2003; MAIOR; AZEVEDO; BERTON; GUTIÉRREZ; SIMÃO, 2007).

Therefore, the behavior of the PA after the ER remains undefined in the literature, possibly by using different protocols for prescribing training, which shows the lack of parameters for its applicability.

Hence, the objective of this study was to investigate the effect of resistance exercise of high intensity on the responses of post-exercise blood pressure 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.

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, inclined press, legpress45, press in the machine, leg curl and rowing machine, all Righetto Fitness Equipment.

Through the 1-RM testing the maximum possible load to carry out the RE session was determined.

The volunteers performed five-minute preparatory exercises and stretching prioritizing the muscles involved in the test. Each volunteer performed up to five attempts during the test, following an interval of 3 to 5 minutes apart for resynthesis of energy reserves.

During the RE session, there were three sets of eight repetitions for each exercise, using the same exercises of 1RM with 80% of maximum load. The execution time of each movement was two seconds, a 90-second rest between sets and a 90-second rest between exercises. BP was measured during a 15-min rest, immediately after the end of RE, and in minutes 15, 30, 45 and 60 after RE.

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 mean and standard deviation of the response of SBP and DBP at pre-exercise rest, at the end of exercise session, and within 60 minutes of post-exercise recovery.

It is observed that there was a significant decrease in SBP after 60 minutes of post-exercise recovery when compared to the values at the end of exercises. But there was no significant difference in DBP at any time of the study.

Table 2: Comparison of SBP and DBP between the control session and the session of resistance exercise in serial method with 80% load of 1RM.

	Control Session		80% de 1RM	
	SBP (mmHg)	DBP (mmHg)	SBP (mmHg)	DBP (mmHg)
Rest	127,18±13,86	72,98±8,54	131,05±12,64	72,83±6,77
Final effort	126,17±11,27	74,75±9,01	137,42±17,35	78,42±14,85
15 recovery	126,67±12,28	68,83±16,24	130,42±12,00	67,83±10,17
30 recovery	126,00±12,52	70,33±8,23	122,50±11,60	77,42±7,84
45 recovery	124,92±10,94	72,92±8,33	125,92±15,25	66,25±17,00
60 recovery	126,83±10,89	77,83±10,81	120,92±6,39 [a]	71,17±10,36

[a] Final effort ≠60 min recovery

DISCUSSION OF RESULTS

It was observed in this study that there was a significant decrease in SBP at 60 minutes post-exercise when compared to the values of the end of exercises. However, when compared to resting values they remained similar, showing no hypotensive effect.

DBP values remained similar throughout the experimental session.

The DBP response was also observed in other studies, like this, they used heavy load (80% 1-RM) and observed no significant response of DBP in any of the comparisons (LIZARDO; SIMÕES, 2005; ASSUNÇÃO; DALTRO; SIMÃO; POLITO; MONTEIRO, 2007).

However, in a study conducted by Maior, Azevedo, Berton, Gutiérrez and Simão (2007), in which 15 normotensive young adults were evaluated, with heavy load (10-RM), there was a significant decrease in SBP in the 30 minutes of recovery when compared to the values at the end of exercise and at rest.

Additionally, in an investigation, with 17 normotensive volunteers, to perform exercises at 40% and 80% of 1-RM, there was significant decrease of SBP and DBP during post-exercise recovery of two exercise intensities, being observed until 90 minutes of recovery monitored in the study (REZK; MARRACHE; TINUCCI; MION JUNIOR; FORJAZ, 2006).

In another study, by using exercise protocols with intense and moderate load, a significant decrease in SBP was observed at the 10th minute post-exercise for both the charges in relation to the pre-stress and longer lasting decrease after the heavy load exercises, which remained after 60 minutes of recovery (POLITO; SIMÃO; SENNA; FARINATTI, 2003).

Lizardo and Simões (2005) also performed a study which compared intensities of 30% and 80% of 1 RM, and noted that both intensities resulted in a significant decrease in SBP, which was more evident between the period 80 and 100 minutes of session recovery which used 30% 1-RM. Moreover, only after the session 30% 1-RM decreased DBP in minutes 10 and 30 of recovery.

There was also significant hypotension SBP in a meta-analysis that used heavy load in just two exercises (leg press and Scott biceps), this response remained at all times of post-exercise monitoring. But in DBP there was no significant difference in both periods of study.

According to Monteiro and Sobral Filho (2004), the significant decrease in BP after the completion of resistance exercise may be related to hemodynamic factors such as reduction of cardiac output that is associated with decreased heart rate and even drop in systemic vascular resistance.

Despite having used a heavy load (80% 1RM), this study did not record a significant increase in BP at the end of the exercise, suggesting that the high-intensity resistance exercise is not totally contraindicated for hypertensive patients, as the literature indicates only low-intensity resistance exercise for this population (MONTEIRO; SOBRAL FILHO, 2004; V BRAZILIAN GUIDELINES FOR HYPERTENSION, 2006).

On the other hand, the hypothesis that the 1-RM may have been underestimated in this study is raised. In this sense, the visual deprivation during the load tests have been suggested and used to accurately obtain the charge (MAIOR; AZEVEDO; BERTON; GUTIÉRREZ; SIMÃO, 2007; MAIOR; VARALHO; MATOSO; EDMUNDO; OLIVEIRA; MINARI, 2007), however such technique was not employed in this study.

Another aspect to consider is that some studies with similar objectives to this, monitored the PA after the completion of the exercises for more than 60 minutes, and observed a hypotensive effect, even after 75, 90 and 120 minutes of exercise performance, suggesting that monitoring the PA for a longer period can bring different results than seen in this study (REZK; MARRACHE; TINUCCI; MION JR; FORJAZ, 2006; LIZARDO; SIMÕES, 2005; SIMÕES, 2006).

CONCLUSION

Although this study has not shown significant reduction in BP values after RE compared to resting values, it showed a steady decrease during the monitored recovery period, showing a significant decrease in SBP in the 60 minutes of recovery compared to the values of SBP at the end of the exercise. This result suggests that monitoring the PA for a longer period after exercise could reveal a PA behavior not observed with the observing time.

It is suggested the holding of future studies, employing a pre-hypertensive or hypertensive, sedentary population, and that the method of determining the load of 1-RM be repeated in order to not underestimate the exercise load.

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ACUTE EFFECT OF A SERIAL RESISTENCE EXERCISE SESSION WITH INTENSE LOAD ON BLOOD PRESSURE
ABSTRACT

Introduction: Physical exercise provokes a series of physiological responses resulting from autonomic and hemodynamic changes that may influence the cardiovascular system and some studies have demonstrated its beneficial effect on blood pressure. Objective: To investigate the effect of resistance exercise of high intensity on the responses of blood pressure. Methods: Study 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 three 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 and 3 – in random order for the experimental sessions: 3 sets of 8 repetitions of resistance exercise at 80% 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 when necessary to detect possible differences ($p < 0,05$). The software Statistics for Windows 6.0 was employed. Results: It is observed that there was a significant decrease in SBP after 60 minutes of post-exercise when compared to values at the end of the exercise, but there was no significant difference in DBP at any time of the study. Conclusion: It is concluded that there was significant decrease in SBP at the 60 minutes of recovery compared to the values observed at the end of the exercise, but when compared to resting values no hypotensive effect was observed.

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

EFFET AIGU D'UNE SÉANCE DE MUSCULATION AVEC UNE CHARGE INTENSE SUR LA PRESSION ARTÉRIELLE
RÉSUMÉ

Introduction: L'exercice physique provoque une série de réactions physiologiques résultant d'adaptations autonomes et hémodynamiques qui peuvent influer sur le système cardiovasculaire. Des études ont démontré son effet bénéfique sur la pression artérielle. Objectif: Rechercher l'effet de la musculation à haute intensité dans les réponses de pression artérielle. 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 trois 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 e 3 – dans un ordre randomisé pour les séances expérimentales: 3 séries de 8 répétitions de musculation à 80% 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: On constate qu'il y a eu une réduction importante de la PAS après 60 minutes de récuperation par rapport aux valeurs de la fin de l'exercice. Pourtant, il n'y a pas eu de différence importante de la PAD en aucun moment de l'étude. Conclusion: L´étude conclut qu'il y a eu une réduction importante de la PAS dans 60 minutes de récupération par rapport aux valeurs observées à la fin de l'exercice. Pourtant, l'effet d'hypotension n'a pas été observé par rapport aux valeurs de repos.

MOTS CLÉS : musculation, pression artérielle, hypotension postexercice.

EFECTO AGUDO DE UNA SESIÓN DE EJERCICIOS RESISTIDOS SERIADOS CON CARGA INTENSA SOBRE LA PRESIÓN ARTERIAL

RESUMEN

Introducción: El ejercicio físico provoca una serie de respuestas fisiológicas, resultantes de adaptaciones autonómicas y hemodinámicas que pueden influir en el sistema cardiovascular y algunos estudios demostraron su efecto benéfico sobre la presión arterial. Objetivo: Investigar el efecto del ejercicio resistido seriado de alta intensidad en las respuestas de 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 tres 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 y 3 – en orden randomizado para las sesiones experimentales: 3 series de 8 repeticiones de ejercicio resistido a 80% 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: Se observa que hubo una disminución significativa de PAS después de 60 minutos de recuperación post ejercicio cuando comparada a los valores del final del ejercicio, sin embargo no hubo diferencia significativa de PAD en ningún momento del estudio. Conclusión: Se concluye que hubo una reducción significativa de PAS a los 60 minutos de recuperación en relación a los valores observados al final del ejercicio, sin embargo cuando comparados a los valores de reposo no fue verificado efecto hipotensor.

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

EFEITO AGUDO DE UMA SESSÃO DE EXERCÍCIOS RESISTIDOS SERIADOS COM CARGA INTENSA SOBRE A PRESSÃO ARTERIAL

RESUMO

Introdução: O exercício físico provoca uma série de respostas fisiológicas, resultantes de adaptações autonômicas e hemodinâmicas que podem influenciar o sistema cardiovascular e alguns estudos demonstraram o seu efeito benéfico sobre a pressão arterial. Objetivo: Investigar o efeito do exercício resistido seriado de alta intensidade nas respostas de pressão arterial. Metodologia: Fizeram parte do estudo 12 homens normotensos com idade de 24,9±2,43 anos, massa corporal 71,68± 5,18 kg, estatura de 173±4 cm, IMC de 23,83±1,60 kg/m2 e % gordura de 16,84±2,99. Os voluntários compareceram ao laboratório de musculação durante três sessões experimentais em dias alternados: 1 - 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); 2 e 3 – em ordem randomizada para as sessões experimentais: 3 séries de 8 repetições de exercício resistido a 80% 1-RM e uma sessãocontrole (CONT) sem a realização de 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). Os dados foram analisados através de estatística descritiva, com valores de 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 quando necessário para detectar as possíveis diferenças ($p < 0,05$). Foi empregado o software Statistic for Windows 6.0. Resultados: Observa-se que houve uma diminuição significativa de PAS após 60 minutos de recuperação pós-exercício quando comparada aos valores do final do exercício, porém não houve diferença significativa de PAD em nenhum momento do estudo. Conclusão: Conclui-se que houve uma redução significativa de PAS aos 60 minutos de recuperação em relação aos valores observados ao final do exercício, porém quando comparados aos valores de repouso não foi verificado efeito hipotensor.

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