

**108 - COMPARISON OF HYPOTENSIONARY POST-EXERCISE RESPONSE ON SEDENTARY YOUNG WOMEN**

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**INTRODUCTION**

The Systemic Arterial Hypertension (SAH) is the most popular of the cardiovascular diseases, and it is defined as systolic arterial pressure of 140 mmHg (millimeters of mercury) or higher, and a diastolic pressure of 90 mmHg or higher, in individuals that are not using anti-hypertensive medication. It is also the chief risk factor to the most common complications like vascular cerebral accident and acute myocardial infarction, besides terminal chronic renal disease (BRASIL, 2006).

Brum et al (2004) emphasizes that the post-exercise hypotension is defined by the reduction of arterial pressure during the period of recovery, keeping the observed post-exercise pressure values lower than those measured before exercise. It constitutes a highly relevant clinical occurrence, but that still presents some doubtful aspects in relation to the variables that can contribute to its manifestation (POLITO AND FARINATTI, 2006).

According to the study of Forjaz et al (1998), in the last years it was verified that not only the chronic physical exercise, but also one session of physical exercise provokes a decrease on post-exercise arterial pressure (systolic and diastolic) on both normotensive and hypertensive individuals.

The intensity of the previous exercise can affect the magnitude of the pressure fall on normotensive and hypertensive individuals, the duration of the activity will also influence on the magnitude and permanence of the lower-than-initial levels. The several hemodynamic factors respond on a different manner according to the analyzed population, the ergometer used, time, intensity, the kind of exercise (NUNES et al, 2008).

The investigation of the cardiovascular behavior on youngsters after resisted exercise is scarce (SACCOMANI et al, 2008). Though there are some studies that use youngsters to observe the behavior of the arterial pressure after resisted training (PAULA et al, 2008, DUTRA et al, 2008).

However, this study began with the goal of analyzing and comparing the hemodynamic alterations on the recovery period that can happen on normotensive and sedentary female teenagers after a single session of continued exercise and one session of resisted exercise.

**MATERIALS AND METHODS****Sample**

This study, of experimental, descriptive and intentional nature, was developed with 10 normotensive and sedentary female youngsters, on an age bracket of 15 to 18 years.

The research was initiated after the approval of the project on the Committee of Ethics on Research of the Federal University of Piauí, the authorization of the manager of the academy and the voluntary acceptance of the respective parents or people responsible for the youngsters that make up the sample.

The evaluated youngsters and their respective responsible people were appropriately informed of the procedures, risks and benefits and the parents signed the Enlightened and Free Consent Term (EFCT), according to the Resolution 196/96 of the Brazilian Health Council, accepting the participation of the youngsters on the study.

Shortly after, it was made an anamnesis and anthropometric measures were collected, like body mass and stature and Body Mass Index (BMI) to a better characterization of the sample. As exclusion criteria of this research were considered: the use of ergogenic substances, the regular practice of physical exercise, presence of arterial hypertension, osteomioarticular problems and as exclusion criteria being inside the age bracket of 15 to 18 years, being normotensive, sedentary and not presenting articular problems.

The evaluated teenagers were oriented according to the VI Brazilian Guidelines of Arterial Hypertension (2010), at 24 hours before the training and being with full bladder, tea, soft drinks. The exercises were applied on an academy at the city of Teresina, on the period between 8 and 10 a.m. with accompaniment of the researchers of this study.

**Proceedings and data collection**

The body mass was measured with the help of a manual balance, with 100 grams precision, of the wemy brand. The subject have to be positioned upright, with the backs to the scale, with lateral remoteness of the feet, being the platform between them. Then he has to place himself at the center of the platform, erect with sight positioned on a fixed point ahead him (FILHO, 2003).

For the stature measurement it was used a scale fixed on the manual balance of the same brand, calibrated on centimeters (cm). The subject has to be upright, in an erect position, arms extended along the body, united feet, trying to put the posterior surfaces of the heels in contact with the instrument, pelvic waist, scapular waist and occipital region with the subject on a state of inspirational apnea (FILHO, 2003).

From these measurements it was calculated the Body Mass Index (BMI) by the quotient body mass/ (stature)<sup>2</sup>, being the body mass expressed on kilograms (kg) and the stature on meters (m) (GUEDES; GUEDES, 2003).

After the anthropometric and rest cardiac frequency measurements, two distinct experimental sessions were realized in two different days: continuous exercise (ergometric treadmill) and resisted exercise.

The measurements of arterial pressure (AP) of each subject were obtained by a single trained evaluator, by the auscultative method with the help of an aneroid sphygmometer and stethoscope of the BICMED brand and was determined by the auscultation of the first sound of phase I and the last sound of phase IV of Korotkoff for the identification of SAP and DAP respectively. The arterial pressure was measured on both experimental sessions, 10 minutes pre-exercise and post-exercise on the recovery periods 15 minutes, 30 minutes and 45 minutes.

The training of continuous exercise was made on an ergometric treadmill of the brand (Moviment RT 150 PRO), with five minutes of warm-up and 30 minutes of effective training at the intensity of 60% to 80% of the reserve cardiac frequency

(FCRES), with the help of the frequency counter of the brand polar to control the training cardiac frequency (minimum and maximum), obtained through the equation of Karvonen from the rest cardiac frequency (FCREP) measured before the realization of the training and with the help of the BORG scale.

A week later they were submitted to a single session of resisted training with weights (alternated by segment), three series of 15 repetitions and an interval of 30 seconds, with apparatus of the brand gervasport fitness equipment on this sequence: flying pectoral, horizontal leg press, seated row, extensor chair, direct curl, lying leg curl, triceps pulley, seated calf raise, and at the end of the series of each exercise the subjects were asked to point out the perceived intensity on the OMNI-RES of Robertson y col. (2003) perception effort scale.

The charge was determined according to the OMNI-RES scale (destined to verify the intensity on resisted exercises), each volunteer realized three attempts on each apparatus regarding as suitable the moderate level between four and six.

After the collection of data the hemodynamic responses of the systolic arterial pressure, the diastolic arterial pressure and the mean arterial pressure were compared (FOSS e KETEVIAN, 2000) and put on tables for better visualization and comparison of the arterial pressure measurements.

### Statistical Analysis

The data were analyzed through the ANOVA Split-plot, and the Post Hoc de Fisher LSD test (SPSS, version 15.0).

### RESULTS

The table 1 show the variables (age, body mass, stature and body mass index) collected and expressed on mean and standard deviation for the better characterization of the sample.

**Table 1:** Description of the variables of characterization of the sample (values in mean and standard deviation)

| Variables                                  | Mean | Standard deviation |
|--|------|--------------------|
| Age (years)                                | 16,1 | 1,1                |
| Body Mass (Kg)                             | 49,1 | 3,9                |
| Stature (m)                                | 1,58 | 0,1                |
| BMI (body mass index) (Kg/m <sup>2</sup> ) | 19,6 | 1,7                |

The table 2 presents the values of SAP, DAP and MAP of the group during the pre and post-exercise situation on the two types of training (aerobic and resisted).

Concerning rest, there were intra-group statistically significant reductions on SAP at the moments R30 and R45 on both experimental sessions. To the MAP, it was evidenced hypotension at the moments R30 for aerobic exercise and R45 for both experiments. There was significant difference between the aerobic and resisted groups at the moment R30.

**Table 2:** Comparison of absolute values of systolic arterial pressure (SAP), diastolic arterial pressure (DAP), mean arterial pressure (MAP) for the experimental sessions (AER for aerobic and RES for resisted). Values expressed on mean and ( $\pm$ ) standard deviation

|            | Rest            | R15             | R30              | R45              |
|------------|-----------------|-----------------|------------------|------------------|
| SAP (mmHg) |                 |                 |                  |                  |
| AER        | 106,0 $\pm$ 5,1 | 104,0 $\pm$ 5,2 | 98,0 $\pm$ 4,2*  | 97,0 $\pm$ 4,8*  |
| RES        | 125,4 $\pm$ 4,0 | 122,9 $\pm$ 2,6 | 122,3 $\pm$ 3,8* | 122,0 $\pm$ 2,9* |
| DAP (mmHg) |                 |                 |                  |                  |
| AER        | 69,8 $\pm$ 0,4  | 68,0 $\pm$ 9,1  | 69,9 $\pm$ 0,3   | 66,0 $\pm$ 6,9   |
| RES        | 69,9 $\pm$ 0,3  | 72,0 $\pm$ 6,3  | 69,8 $\pm$ 0,4   | 67,0 $\pm$ 4,8   |
| MAP (mmHg) |                 |                 |                  |                  |
| AER        | 82,4 $\pm$ 3,4  | 79,6 $\pm$ 6,9  | 78,5 $\pm$ 2,8*  | 76,3 $\pm$ 4,8*  |
| RES        | 82,0 $\pm$ 2,3  | 82,3 $\pm$ 4,2  | 82,2 $\pm$ 2,6†  | 77,6 $\pm$ 3,8*  |

AER= aerobic experimental session; RES = resisted experimental session; R15 = 15 minutes of recovery; R30 = 30 minutes of recovery; R45= 45 minutes of recovery. \*p<0,05 in relation to rest; †p<0,05 in relation to aerobic experimental session at the same moment.

### DISCUSSION

The present study compared the SAP, DAP and MAP responses after a session of continued exercise on ergometric treadmill and a session of resisted exercise in relation to pre-effort moment and between the two training sessions realized on a normotensive sample of sedentary adolescents. It was demonstrated that both the resisted and the aerobic exercise promote significant reductions on arterial pressure in relation to pre-exercise (table 2)

On this study was observed a significant reduction on SAP after resisted and aerobic exercise in relation to rest at the moments R30 and R45 on a normotensive sample. The results found on literature point out a bigger influence of the aerobic exercise on PEH. Tomasi et al (2008) verified significant reduction on SAP in all measures realized during the 60 minutes of post-aerobic exercise monitoring, being the intermediate measures (20, 30 and 40 minutes) those that presented the highest hypotensive peak. It does not show alteration on arterial pressure after resisted exercise, which did not happen on this study.

On the study of Saccomani et al (2008), where 28 adolescents were used in one control group and one experimental group that made two passages of 12 repetitions on muscular apparatus, it was shown that the values of SAP on all measurement (R15,R30,R45.R60) were smallest than the rest and the occurrence of a hypotensive peak at the last measurement. The findings of this study point that SAP on resisted exercise started on R30 and continued on R45.

It was verified on the findings of Jesus et al (2009) that on both trainings occurred a reduction of post-exercise SAP and DAP in relation to rest condition, being observed that the aerobic exercise of 25 minutes had a precocious hypotension effect in relation to resisted exercise. The resisted exercise also showed a reduction of MAP, although being significant, later in relation to rest condition. Polito et al (2009) observed that the two types of training seem to exert a positive effect on post-effort SAP, being the aerobic exercise more efficient for anticipating its reduction. On this study was observed this same behavior only on mean arterial pressure.

In relation to MAP was observed hypotension, in relation to rest, at the moment R30 post-aerobic exercise and at the moment R45 on both experimental sessions. Therefore, the aerobic was more efficient in triggering the post-exercise

hypotensive effect.

In comparison with this study, it was observed on the results of Saccomani et al (2008) that the MAP had a significant decrease in all measurements in relation to rest and presents in the last measurement a hypotensive peak in relation to the control group after resisted training. On the study of Dutra et al (2008) there was a significant decrease on MAP at 45 minutes of recovery in relation to rest and at 60 minutes when compared to the control session after exercise realized on treadmill.

However, on DAP there was no verifiable significant inter-group and intra-group differences on the two types of training realized. In accordance to this finding, the study of Christofaro et al (2008) on the analysis of DAP it was not verified significant interaction between group and time. Therefore, there were no identifiable differences on the initial measurement and on post-effort values between the different measurements on both trainings. But on the study of Tomasi et al (2008) it was observed a significant difference on DAP on aerobic exercise, but only on the measurement taken 20 minutes after the activity, and in relation to resisted exercise, it remained unaltered.

Hemodynamic and neurohumoral alterations seem to be involved in this answer (LATERZA et al, 2006). Because of this, these alterations can also occur somehow on normotensive female youngsters after realization of exercise, as it was treated on the results of this study.

Among the hemodynamic alterations that can exert influence on post-exercise hypotension are the reduction of the cardiac debt, the reduction of the peripheral resistance and the decrease of the rest cardiac frequency. Nunes et al (2008) affirms that the arterial pressure is the product of the cardiac debt and peripheral vascular resistance and that reductions on blood arterial pressure observed after the realization of a physical exercise session should result on the decrease of the cardiac debt, the peripheral vascular resistance or both.

Other alterations on neurohormonal factors like sympathetic nervous activity, circulating hormones and endothelial local factors. Beyond that, alterations on the sensibility of adrenergic cardiac receptors involved on the control of the cardiac frequency could be involved on the post-exercise hypotensive mechanisms (RONDON et al, 2010). The sympathetic nervous system is the main moment-to-moment control mechanism of the peripheral vasomotor activity, the determination of its basal activity therefore depends on structural factors and the availability of the vasoactive local factors (BURGI et al, 2010).

Bechara et al (2010) highlights that the nitric oxide (NO), liberated by the vascular endothelium during the moderate physical training is the main responsible for the relaxation of the blood vessels and, consequently, the improvement of the blood flow. On a general way, aerobic physical training can improve the vascular bioavailability of NO, preserves and improves the endothelial function on healthy individuals and, chiefly, restores the endothelial dysfunction on patients suffering from cardiac insufficiency, diabetes mellitus, arterial hypertension, arteriosclerosis or their related risk factors.

## CONCLUSION

The result of this study showed that an acute session of aerobic and resisted physical exercise, according to the protocol used in the study, realized by normotensive sedentary female youngsters was capable of reducing the pressure post-exercise levels, thus showing that the hypotensive response do not occur only on hypertensive people. The aerobic exercise has the hypotensive effect on a smaller interval of time, showing its efficiency in provoking the precocious hypotensive effect in relation to the resisted one.

Therefore, it is necessary the realization of additional studies on different intensities and bigger times on the resisted exercise and on aerobic exercise to determine a training standard directed to hypertensive people without health risks and to analyze if there is continuity of the hypotensive response after the period used on this study.

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#### COMPARISON OF HYPOTENSIONARY POST-EXERCISE RESPONSE ON SEDENTARY YOUNG WOMEN

##### ABSTRACT

**Introduction:** The post-hypotension exercise is a phenomena that acts on the reduction on blood pressure when it is below the resting levels regarding hypotensive and normotensive individuals after their physical activity routine. **Objective:** This study aims at analyzing and comparing the acute effect of the aerobic and strength physical training performed by female youths regarding the hypertensive response after a physical activity routine. **Methods:** Ten female youths who did not use to perform any physical activity (age 16,1±1,1years old; body mass index 19,6±1,7kg/m<sup>2</sup>) performed two sessions: a non-stop 30-minute treadmill routine of effective training with an intensity ranging from 60% to 80% FCRES, with the Borg scale; the other session involved strength training which was performed by using eight kinds of exercise equipment regarding the upper and the lower limbs. The intensity was measured using the scale (OMNI-Res) after each set. The systolic, diastolic blood pressure and the mean arterial pressure was measured during the pre-exercise rest 10 minute as well as in the 15min, 30min and 45minute intervals. Data are expressed through the measurement of variability and standard deviation (±SD). **Results:** Regarding rest, there was some statistically significant intragroup reduction on the systolic blood pressure in the R30 and R45 intervals in both experimental sessions. Concerning the mean arterial pressure, some hypotension was noticed in the 30-minute interval regarding aerobic training and in the 45-minute set for both experiments. In the 30-minute set there was some intergroup difference. **conclusion:** In the sets that were analyzed, especially the 30(R30) and the 45 minute- intervals acute sessions of aerobic and strength training were very effective to reduce the systolic blood pressure and the mean arterial pressure of female youths who had a sedentary lifestyle, and the aerobic training was more effective to cause the post-exercise hypotensive effect.

**KEY-WORDS:** strength training, aerobic training, post-exercise hypotension.

#### COMPARAISON DES RÉPONSE HYPOTENSIVE POST-EXERCICE DANS JEUNES SÉDENTAIRES

##### SOMMAIRE

**Introduction:** L'hypotension post-exercice est un phénomène qui agit pour diminuer la pression artérielle en dessous des niveaux de repos on individuels hypertendus et normotendus. **Objectif:** Les objectifs de cette étude étaient d'analyser et de comparer l'effet aiguë de l'exercice aérobie et exercices de résistance effectués par les jeunes femmes dans les réponse tensionnelle post-exercice. **Méthodes:** Dix jeunes femmes, et non-exercice (âge: 16,1 ± 1,1 ans, IMC: 19,6 ± 1,7 kg / m<sup>2</sup>) a tenu en deux sessions: l'une pour 30 minutes d'exercice continu entrainement sur tapis roulant dans l'intensité effective de 60% à 80% FCRES avec l'aide de l'échelle (BORG) et un appareil d'exercice de résistance en utilisant huit divisé en membres inférieurs et supérieurs avec une intensité particulière à la fin de chaque série avec l'échelle (OMNI-Res). La pression systolique, diastolique et moyenne a été mesurée au repos avant d'exercer 10 minutes après l'exercice de 15 min, 30 min et 45 min. Les données sont exprimées en moyenne et écart type (±ET). **Résultats:** Pour le reste, il ya eu une réduction statistiquement significative de la pression systolique intragroupe des moments dans R30 et R45 dans les deux sessions expérimentales. Pour le PAM, il a été l'hypotension dans les temps à l'ARE R30, R45 et pour les deux expériences. Et la différence intergroupe à la R30 temps. **Conclusion:** Sessions aiguë de l'ARE et RES ont été efficaces dans la réduction de la PAS et du MAP dans les jeunes sédentaires analysés par moments, surtout, R30 et R45, et l'ARE a été plus efficace dans la réalisation de l'effet post-exercice hypotenseur.

**MOTS-CLÉS:** Exercice de Résistance, Exercice aérobie, Hypotension Post-exercice.

#### COMPARACIÓN DE LA RESPUESTA HIPOTENSORA POST-EJERCICIO EN JÓVENES SEDENTARIAS

##### RESUMEN

**Introducción:** La hipotensión post-ejercicio es un fenómeno que actúa en la disminución en la presión arterial por debajo de los niveles de reposo en hipertensos y normotensos post-esfuerzo físico. **Objetivos:** Los objetivos de este trabajo fueron analizar y comparar el efecto agudo del ejercicio aeróbico y ejercicio resistido realizado por las mujeres jóvenes en la respuesta presión arterial post-ejercicio físico. **Métodos:** Diez mujeres jóvenes, no practicantes de ejercicio físico (edad: 16,1 ± 1,1 años, IMC: 19,6 ± 1,7 kg / m<sup>2</sup>), celebrada en dos sesiones: una para 30 minutos de ejercicio continuo en estera ergo métrica de entrenamiento efectivo en intensidad de 60% a 80% de la FCRES con auxilio de la escala de (BORG) y otra de ejercicio resistido utilizando ocho aparatos divididos en miembros superiores e inferiores con la intensidad determinada, al final de cada serie con la escala (OMNI-Res). La presión arterial sistólica, diastólica y media fue medida en reposo pre-ejercicio 10 minutos, post-ejercicio en 15 minutos, 30 minutos y 45 minutos. Los datos se expresan como media y desviación estándar (± DE). **Resultados:** En cuanto al reposo, se produjo una reducción estadísticamente significativa intra-grupal en la PAS en los momentos R30 y R45 en las dos sesiones experimentales. Para la PAM, se evidenció hipotensión en los momentos R30 para AER y R45 para ambos experimentos. Hubo diferencia inter-grupal en el momento R30. **Conclusión:** Sesiones Agudas de AER y RES fueron eficaces en la reducción de PAS y PAM en jóvenes sedentarias analizadas en el momento, especialmente R30 y R45 y en el caso de AER fue más eficaz en el logro del efecto hipotensor post-ejercicio.

**PALABRAS CLAVE:** Ejercicio Resistido, Ejercicio Aeróbico, Hipotensión post-ejercicio

**COMPARAÇÃO DA RESPOSTA HIPOTENSORA PÓS-EXERCÍCIO EM JOVENS SEDENTÁRIAS****RESUMO**

**Introdução:** A hipotensão pós-exercício é um fenômeno que atua na diminuição da pressão arterial abaixo dos níveis de repouso em indivíduos hipertensos e normotensos pós-esforço físico. **Objetivo:** Os objetivos desse estudo foram analisar e comparar o efeito agudo do exercício aeróbio e exercício resistido realizado por jovens do sexo feminino na resposta pressórica pós-exercício. **Métodos:** dez jovens do sexo feminino, não praticantes de exercício físico (idade:  $16,1 \pm 1,1$  anos; IMC:  $19,6 \pm 1,7 \text{ kg/m}^2$ ) realizaram em duas sessões: um de exercício contínuo de 30 minutos em esteira ergométrica de treino efetivo na intensidade de 60% a 80% da FCRES com auxílio da escala de (BORG) e outra de exercício resistido utilizando oito aparelhos divididos em membros superiores e inferiores com a intensidade determinada, no final de cada série com a escala (OMNI-Res). A pressão arterial sistólica, diastólica e média foi mensurada em repouso pré-exercício 10 minutos, pós-exercício em 15 min, 30 min, 45 minutos. Os dados estão expressos em média e desvio padrão ( $\pm$ DP). **Resultados:** Em relação ao repouso, ocorreram reduções estatisticamente significativas intra-grupo na PAS nos momentos R30 e R45 em ambas as sessões experimentais. Para a PAM, evidenciou-se hipotensão nos momentos R30 para AER, e R45 para ambos os experimentos. E houve diferença inter-grupo no momento R30. **Conclusão:** Sessões agudas de AER e RES foram eficazes em reduzir a PAS e PAM em jovens sedentárias nos momentos analisados, especialmente, R30 e R45; e o AER foi mais eficaz em ocasionar o efeito hipotensor pós-exercício.

**PALAVRAS-CHAVES:** Exercício Resistido; Exercício Aeróbio; Hipotensão Pós-exercício.