Hypotensive Response Magnitude and Duration in Hypertensives: Continuous and Interval Exercise

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Abstract

Background: Although exercise training is known to promote post-exercise hypotension, there is currently no consistent argument about the effects of manipulating its various components (intensity, duration, rest periods, types of exercise, training methods) on the magnitude and duration of hypotensive response.

Objective: To compare the effect of continuous and interval exercises on hypotensive response magnitude and duration in hypertensive patients by using ambulatory blood pressure monitoring (ABPM).

Methods: The sample consisted of 20 elderly hypertensives. Each participant underwent three ABPM sessions: one control ABPM, without exercise; one ABPM after continuous exercise; and one ABPM after interval exercise. Systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate (HR) and double product (DP) were monitored to check post-exercise hypotension and for comparison between each ABPM.

Results: ABPM after continuous exercise and after interval exercise showed post-exercise hypotension and a significant reduction (p < 0.05) in SBP, DBP, MAP and DP for 20 hours as compared with control ABPM. Comparing ABPM after continuous and ABPM after interval exercise, a significant reduction (p < 0.05) in SBP, DBP, MAP and DP was observed in the latter.

Conclusion: Continuous and interval exercise trainings promote post-exercise hypotension with reduction in SBP, DBP, MAP and DP in the 20 hours following exercise. Interval exercise training causes greater post-exercise hypotension and lower cardiovascular overload as compared with continuous exercise. (Arq Bras Cardiol. 2015; 104(3):234-241)

Keywords: Blood Pressure; Hypertension; Exercise; Post-Exercise Hypotension; Blood Pressure Monitoring, Ambulatory.

Introduction

Systemic arterial hypertension (SAH) is a multifactorial clinical condition characterized by high and sustained blood pressure (BP) levels. Increased BP relates to age, the prevalence of SAH being higher than 50% among individuals aged 60-69 years1.

Regarding the therapeutic approach, the treatment of SAH can be based on pharmacological and non-pharmacological measures, mainly aimed at reducing cardiovascular morbidity and mortality1.

Non-pharmacological treatment comprises body weight reduction, sodium intake decrease, potassium intake increase, adhesion to a diet rich in fruits, vegetables and low-fat food, alcohol consumption decrease, smoking cessation and physical exercise practice, the latter being one of the most studied and used forms of non-pharmacological treatment of SAH2,3.

Some studies have shown that one single session of physical exercise promotes post-exercise hypotension (PEH), which means BP reduction after physical exercise to levels lower than those measured prior to exercise4,5.

Some studies have reported that, among hypertensives, physical exercise chronically reduces systolic blood pressure (SBP) and diastolic blood pressure (DBP) at rest, on average, 8.3 mmHg and 5.2 mmHg, respectively, the chronic reduction in BP being associated with a cumulative effect of acute reductions6,7. Therefore, in recent years, several studies have attempted to describe the benefits and peculiarities of physical exercise, mainly the aerobic one, to the SAH treatment8,9.

Although the acute hypotensive effect of physical exercise and its mechanisms have been reported, so far there is no effective and consistent argumentation on the effects of the manipulation of the various components of training workload (intensity, duration, rest intervals, exercise types, training methods) on the hypotensive response magnitude and duration. The established propositions lack investigation and scientific evidence.
In addition, knowing the efficiency of each type of physical training can help defining and guiding the therapeutic approach capable of more effectively contributing to the SAH treatment.

**Objective**

To compare the effects of dynamic exercises (continuous and interval) on the hypotensive response magnitude and duration in hypertensive individuals by using ambulatory blood pressure monitoring (ABPM).

**Methods**

**Sample**

This study sample comprised 20 elderly hypertensives who diligently participated in activities provided by a philanthropic entity of a municipality of inner São Paulo state, during the data collection period. This study included all individuals aged 60 years and older, with no limitation to exercise, who had medical clearance for participation in physical activity, self-reported sedentary lifestyle and unaltered pharmacological therapy for at least three months. Elderly individuals with the following characteristics were excluded from the study: disabling chronic cardiovascular, renal, pulmonary or psychological disorders. The present study was approved by the Committee on Ethics and Research of the Nursing School of Ribeirão Preto of the Universidade de São Paulo (protocol number 12116113.7.0000.5393), in accordance with the Brazilian Health Board 196/96 Resolution.

**Anthropometric assessment**

The anthropometric data of body weight, height and body mass index (BMI) were collected according to the World Health Organization recommendation1.

**Hemodynamic and cardiovascular measurements**

Indirect BP measurements prior to exercise sessions were taken after a 10-minute rest according to the specifications of the VI Brazilian Guidelines on Hypertension1.

Heart rate (HR) was measured before and during the exercise sessions by using a Polar® F6 heart rate monitor.

Cardiovascular overload was estimated based on the mean double product (DP) obtained from the results of each ABPM and calculated by using the formula: mean HR of 20 hours × mean SBP of 20 hours. Cardiovascular overload was compared under the following different situations: control, after continuous exercise, and after interval exercise.

The participants underwent three ABPM exams: control ABPM, ABPM after continuous exercise, and ABPM after interval exercise. All ABPM were performed during 20 hours of daily activities and in accordance with the V Brazilian Guidelines on Ambulatory Blood Pressure Monitoring and III Brazilian Guidelines on Home Blood Pressure Monitoring28.

The Spacelabs® (model 90207) device was used, the cuff being appropriately sized for the participant’s arm.

To prevent health damage, the routine use of anti-hypertensive drugs was maintained during ABPM.

**Cardiorespiratory assessment**

All participants underwent cardiopulmonary exercise test to assess cardiovascular health, to measure maximum oxygen consumption (VO2max) and to determine ventilatory anaerobic threshold (VAT) and respiratory compensation threshold (RCT) for the prescription of continuous and interval exercises.

The modified Bruce protocol, which is reserved for individuals with physical limitations, such as older and sedentary individuals, was selected for this study.1 In this test, VO2 was collected at rest and continuous electrocardiography monitoring during the cardiopulmonary exercise test, which was performed in a temperature-controlled (21-23°C) environment, at least one hour and a half after the last meal. The participants were encouraged to exercise until muscle fatigue was achieved.

The VAT and RCT (expressed as oxygen consumption [VO2] and treadmill velocity and inclination) corresponded to the points where the ventilatory response linearity was lost (ventilation (Ve), ventilatory equivalent of carbon dioxide (VCO2)), while VO2 continued to linearly increase regarding the power applied.

**Exercise protocols**

Participants randomly underwent two sessions of dynamic exercises in different days, at a minimum one-week interval between sessions, at which the ‘training intensity’ and ‘specific exercise method’ were manipulated. The exercise sessions were scheduled for the beginning of the morning and they preceded the installation of the ABPM equipment. In one session, the participants exercised continuously on the treadmill for 42 minutes at the VAT intensity. In the other, they exercised according to the interval exercise method.

The individuals exercised at the RCT for four minutes during the active phase, and, in the recovery phase, at 40% of VO2max for two minutes. The total session duration was 42 minutes.

**Ethical aspects**

The present study was approved by the Committee on Ethics and Research with Human Beings of the Nursing School of Ribeirão Preto of the Universidade de São Paulo (research protocol number 12116113.7.0000.5393), in accordance with the Brazilian Health Board 196/96 Resolution.

**Statistical analysis**

Descriptive analysis with absolute and percentage frequencies of the qualitative variables, and means, standard deviation and medians of quantitative variables was performed by using the Statistical Package for the Social Sciences – SPSS software, version 15.0.
The Shapiro-Wilk test was used to assess the normality of the distribution of quantitative variables. To assess the statistically significant differences, Wilcoxon non-parametric test was used for variables with no normal distribution. The t test was used for paired samples of variables with normal distribution. In all analyses, the 5% statistical significance level was adopted (p < 0.05).

**Results**

Table 1 shows the clinical variables of participants, according to the values obtained before the first physical exercise program. Tables 2 and 3 show the clinical variables obtained on ABPM recording (control and after continuous and interval exercise programs), considering wakefulness and sleep. Comparing the control and post-continuous exercise ABPM results, a statistically significant difference was observed in SBP, DBP, mean arterial pressure (MAP) and DP during wakefulness and sleep, and in sleep HR.

Similarly, comparing the control and post-interval exercise ABPM results, a reduction in post-interval exercise values was observed, with a statistically significant difference in SBP, DBP, MAP and DP during wakefulness and sleep. No HR difference was observed between post-interval exercise and control ABPM values.

Comparing continuous and interval exercise, a statistically significant difference was observed in wakefulness and sleep SBP, MAP and DP, and in wakefulness DBP. No difference was observed in sleep DBP and in wakefulness and sleep HR.

Table 4 shows significant PEH for SBP and DBP after the continuous and interval exercise programs, during wakefulness and sleep, as compared with the pre-exercise resting period.

**Discussion**

Our results indicate that continuous and interval physical exercise promotes PEH, and that BP reduction persists during wakefulness and sleep, at least in the first 20 hours following exercise practice. Similarly, PEH has been reported by several researchers. However, most of them have assessed the effect of physical exercise on BP for 60-120 minutes\(^{12-14}\).

Few studies have assessed the effect of the manipulation of several training workload components (interval versus continuous training, exercise intensity and duration) on the hypotensive response magnitude and duration for 24 hours.

Ciolac et al\(^{15}\) have been one of the first research teams to compare the effects of continuous and interval exercises on PEH for 24 hours using reserve HR as a criterion for physical exercise prescription. Those authors have reported a reduction in 24-hour mean SBP and DBP after continuous and interval exercise, with 2.6 mmHg and 2.3 mmHg reductions in SBP and DBP, respectively, after continuous exercise, and a significant 2.8 mmHg reduction in only SBP after interval exercise.

We found greater SBP and DBP reductions after both exercise modalities. Considering continuous exercise, reductions of 15.5 mmHg and 12.5 mmHg were found in SBP and DBP, respectively. Considering the interval modality, 18.5 mmHg and 14.5 mmHg reductions were observed in SBP and DBP, respectively. Differences were observed in wakefulness as compared with pre-exercise values.

Some methodological divergences might have contributed to the differences between our findings and those of the study by Ciolac et al\(^{15}\). We used other parameters for physical exercise prescription, such as VAT and RCT, because they are effective for exercise prescription and indicated by other researchers\(^{16,17}\). Heart rate is influenced by different factors, such as environment temperature, relative air humidity, hydration level, sleep, use of beverages that alter the sympathetic nervous system activity, exercise hour and psychological stress level\(^{18}\).

Blood pressure levels before exercise practice also influence the PEH magnitude, because, the higher the BP level before physical exercise, the greater its reduction\(^{19}\). In the study by Ciolac et al\(^{15}\), participants were hypertensives but had their BP under control. In our study, participants had high pre-exercise BP levels, despite all being on anti-hypertensive drugs.

**Table 1 – Participants’ mean values prior to the exercise program: minimum, maximum, median, mean and standard deviation of systolic and diastolic blood pressure (SBP, DBP, respectively), heart rate (HR), double product (DP), body mass index (BMI), abdominal circumference (AC), maximum oxygen consumption (VO\(_{2}\max\)), ventilatory anaerobic threshold (VAT) and respiratory compensation threshold (RCT) (Ribeirão Preto, 2013)**

| Variable          | Minimum | Maximum | Median | Mean   | Standard deviation |
|-------------------|---------|---------|--------|--------|--------------------|
| SBP (mmHg)        | 113.00  | 160.00  | 144.50 | 143.45 | 10.18              |
| DBP (mmHg)        | 72.00   | 103.00  | 88.50  | 88.50  | 7.11               |
| HR (bat/min)      | 66.00   | 85.00   | 75.95  | 76.00  | 5.10               |
| DP                | 8.50    | 12.70   | 10.95  | 10.87  | 1.04               |
| BMI (kg/m\(^2\)) | 22.20   | 39.70   | 28.44  | 29.36  | 3.84               |
| AC (cm)           | 86.00   | 115.00  | 101.00 | 110.08 | 9.48               |
| VO\(_{2}\max\) (mL/kg.min) | 17.50  | 27.00   | 23.30  | 22.84  | 2.58               |
| VAT (mL/kg.min)   | 12.20   | 18.20   | 15.64  | 15.35  | 1.74               |
| RCT (mL/kg.min)   | 14.00   | 21.69   | 19.00  | 18.87  | 1.79               |
Muscle mass is another important factor that can determine greater magnitude and longer duration of PEH, because, the greater the muscle mass involved in exercise, the higher the production of vasodilator agents, such as adenosine, potassium, lactate, nitric oxide and prostaglandin. Those vasodilator agents change peripheral vascular resistance, thus contributing to BP reduction. We believe that the use of a treadmill for exercise training contributed to the greater PEH magnitude detected in our study, because that ergometer involves a larger number of muscle groups. On the other hand, the bicycle favors the use of lower limb muscles.

In addition, Cunha et al. have assessed PEH after continuous and interval exercise practice for 120 minutes, using 60% of reserve HR as the intensity for continuous exercise and 80% (during one minute) and 50% (during two minutes) of reserve HR as the intensity for interval exercise. However, those authors have reported that the intensity used was within the same domain, probably below the VAT, and

Table 2 – Mean values of minimum, maximum and median of systolic and diastolic blood pressure (SBP, DBP, respectively) and mean arterial pressure (MAP) recorded during wakefulness and sleep on ambulatory blood pressure monitoring (ABPM) of participants (n = 20) undergoing continuous and interval exercise programs (Ribeirão Preto, 2013)

| Variable | Minimum | Maximum | Median | p        |
|----------|---------|---------|--------|----------|
| SBP (mmHg) |         |         |        |          |
| Control  |         |         |        |          |
| Wakefulness | 110.46 | 152.50 | 140.09 |          |
| Sleep    | 92.06   | 145.25 | 122.84 |          |
| Continuous exercise |         |         |        |          |
| Wakefulness | 109.31 | 138.00 | 129.79 | 0.001*  |
| Sleep    | 99.13   | 141.67 | 113.59 | 0.001*  |
| Interval exercise |         |         |        |          |
| Wakefulness | 101.35 | 130.19 | 124.63 | 0.001*/0.001† |
| Sleep    | 88.94   | 138.92 | 110.53 | 0.001*/0.01† |
| DBP (mmHg) |         |         |        |          |
| Control  |         |         |        |          |
| Wakefulness | 68.08  | 98.85  | 88.80  |          |
| Sleep    | 55.63   | 80.00  | 73.22  |          |
| Continuous exercise |         |         |        |          |
| Wakefulness | 64.96  | 91.35  | 77.56  | 0.001*  |
| Sleep    | 58.13   | 73.08  | 64.53  | 0.001*  |
| Interval exercise |         |         |        |          |
| Wakefulness | 63.35  | 84.46  | 73.08  | 0.001*/0.001† |
| Sleep    | 53.13   | 70.92  | 63.03  | 0.001*/0.079† |
| MAP (mmHg) |         |         |        |          |
| Control  |         |         |        |          |
| Wakefulness | 85.00  | 114.00 | 105.73 |          |
| Sleep    | 67.81   | 98.75  | 89.43  |          |
| Continuous exercise |         |         |        |          |
| Wakefulness | 83.00  | 107.00 | 93.56  | 0.001*  |
| Sleep    | 74.00   | 96.00  | 80.97  | 0.001*  |
| Interval exercise |         |         |        |          |
| Wakefulness | 76.54  | 98.46  | 89.56  | 0.001*/0.001† |
| Sleep    | 66.44   | 87.67  | 79.44  | 0.001*/0.017† |

* Wilcoxon test compared to control. † Wilcoxon test compared to continuous exercise.
Table 3 – Mean values of minimum, maximum and median of heart rate (HR) and double product (DP) recorded during wakefulness and sleep on ambulatory blood pressure monitoring (ABPM) of participants (n = 20) undergoing continuous and interval exercise programs (Ribeirão Preto, 2013)

| Variable | Minimum | Maximum | Median | p       |
|----------|---------|---------|--------|---------|
| HR (beat/min) |         |         |        |         |
| Control  |         |         |        |         |
| Wakefulness | 69.00   | 89.00   | 76.27  |         |
| Sleep    | 57.81   | 72.75   | 63.09  |         |
| Continuous exercise |         |         |        |         |
| Wakefulness | 66.69   | 85.46   | 74.94  | 0.062*  |
| Sleep    | 54.31   | 72.08   | 62.09  | 0.030*  |
| Interval exercise |         |         |        |         |
| Wakefulness | 66.88   | 85.58   | 75.36  | 0.313*  |
| Sleep    | 55.19   | 75.88   | 62.64  | 0.067*  |
| DP       |         |         |        |         |
| Control  |         |         |        |         |
| Wakefulness | 7.00    | 11.00   | 10.00  |         |
| Sleep    | 5.00    | 10.00   | 7.00   |         |
| Continuous exercise |         |         |        |         |
| Wakefulness | 8.21    | 11.35   | 9.67   | 0.002*  |
| Sleep    | 5.80    | 9.80    | 7.05   | 0.001*  |
| Interval exercise |         |         |        |         |
| Wakefulness | 8.05    | 11.22   | 9.12   | 0.001*  |
| Sleep    | 5.59    | 10.28   | 6.63   | 0.001*  |

* Wilcoxon test compared to control. † Wilcoxon test compared to continuous exercise.

Table 4 – Post-exercise hypotension (PEH) for systolic and diastolic blood pressure (SBP and DBP, respectively) during wakefulness and sleep as compared with values prior to continuous and interval exercise programs (Ribeirão Preto, 2013)

| Variable | Minimum | Maximum | Median | p       |
|----------|---------|---------|--------|---------|
| Continuous exercise |         |         |        |         |
| pre-exercise SBP (mmHg) | 135.0   | 152.0   | 145.0  |         |
| wakefulness mean SBP (mmHg) | 111.0   | 139.0   | 129.5  | < 0.001 |
| sleep mean SBP (mmHg) | 100.0   | 136.0   | 113.5  | < 0.001 |
| pre-exercise DBP (mmHg) | 75.0    | 102.0   | 90.0   |         |
| wakefulness mean DBP (mmHg) | 65.0    | 88.0    | 77.5   | < 0.001 |
| sleep mean DBP (mmHg) | 58.0    | 84.0    | 64.0   | < 0.001 |
| Interval exercise |         |         |        |         |
| pre-exercise SBP (mmHg) | 132.0   | 154.0   | 142.0  |         |
| wakefulness mean SBP (mmHg) | 102.0   | 131.0   | 123.5  | < 0.001 |
| sleep mean SBP (mmHg) | 90.0    | 137.0   | 109.5  | < 0.001 |
| pre-exercise DBP (mmHg) | 75.0    | 97.0    | 87.5   |         |
| wakefulness mean DBP (mmHg) | 64.0    | 85.0    | 73.0   | < 0.001 |
| sleep mean DBP (mmHg) | 55.0    | 69.0    | 61.5   | < 0.001 |

* Wilcoxon test comparing pre-exercise period with the wakefulness and sleep periods.
both sessions were defined as low-intensity. Those authors could not conclude whether interval exercise (characteristically of high intensity) could generate higher PEH as compared with continuous exercise (characteristically of moderate intensity), but have found statistical significance in the SBP reduction in both training sessions and in the DBP reduction for 30 minutes only after continuous exercise.

To assess the effect of the manipulation of the exercise training workload on BP reduction, Lacombe et al.\textsuperscript{14} have used a bicycle and a sample of individuals with a mean age of 57 ± 4 years, who had borderline BP levels or had been diagnosed with stage 1 SAH. The intensity of continuous exercise was 60% of \( VO_{2\text{max}} \) and that of interval exercise was 85% of \( VO_{2\text{max}} \) for two minutes, with recovery of 40% of \( VO_{2\text{max}} \) for two minutes. The continuous exercise sessions lasted 21 minutes and those of interval exercise, 20 minutes. The results indicated a significant reduction in only SBP for both sessions (3 ± 4 mmHg after continuous exercise and 4 ± 6 mmHg after interval exercise). However, that study has not provided a more comprehensive analysis of BP reduction, because BP was monitored for only 60 minutes after exercise training.

Considering the BP classification recommended by the V Brazilian Guidelines on Ambulatory Blood Pressure Monitoring and III Brazilian Guidelines on Home Blood Pressure Monitoring\textsuperscript{16}, the results of control ABPM revealed that, on the day participants practiced no physical exercise, their BP levels were compatible with borderline BP during wakefulness and ambulatory hypertension during sleep, despite the use of drug therapy for the disease; they were, thus, at high cardiovascular risk.

The ABPM after continuous exercise showed a reduction in SBP of 10.3 mmHg and in DBP of 11.24 mmHg as compared with control ABPM during wakefulness. Thus, wakefulness BP was classified as normal. Despite the significant reduction in SBP during sleep as compared with control ABPM (9.25 mmHg reduction), SBP was classified as borderline. During sleep, DBP decreased by 8.69 mmHg, being classified as optimal.

After interval exercise practice, the ABPM results during wakefulness indicated an SBP reduction of 15.46 mmHg and a DBP decrease of 15.72 mmHg as compared with those of the same period of control ABPM. Thus, SBP was classified as normal, and DBP as optimal. During sleep, an SBP reduction of 12.31 mmHg and a DBP decrease of 10.19 mmHg were observed as compared with control ABPM. Thus, SBP during sleep was classified as normal, and DBP as optimal, meaning a normalization in mean BP levels for 20 hours, for both wakefulness and sleep.

Other authors have found similar results comparing BP variation over the 24 hours following physical exercise training and that during a no exercise period\textsuperscript{21-22}. However, we found no studies assessing the effects of the manipulation of the different training workload components on the PEH magnitude and duration of elderly hypertensives.

When comparing ABPM performed after interval exercise with ABPM after continuous exercise, we identified in the former a significant reduction in SBP, DBP, and MAP during wakefulness, and in SBP and MAP during sleep.

Concerning DP, a significant reduction (\( p < 0.05 \)) during wakefulness and sleep was observed in ABPM after continuous and interval exercise as compared with control ABPM. In addition, a higher reduction in DP was observed during wakefulness and sleep after interval exercise as compared with continuous exercise.

The lower DP observed after continuous and interval exercise training is of great clinical relevance, because it indicates lower cardiovascular overload, and, thus, a reduction in the risk for adverse events, such as ischemic heart disease\textsuperscript{23-25}. In addition, we observed a higher benefit from interval exercise as compared with continuous, with lower cardiac overload in the 20 hours following exercise practice.

Heart rate was significantly reduced (\( p < 0.05 \)) only after continuous exercise training and only during sleep. In addition, HR reduction in the 24 hours following physical exercise practice as compared with the control session was not identified in other studies\textsuperscript{25-26}. We believe that acute HR reduction after continuous and interval aerobic exercise is not an expected response. Brandão Rondon et al.\textsuperscript{18} have shown that, after aerobic exercise training, HR remained significantly elevated for 60 minutes. According to those authors, that acute physiological HR response is due to the exacerbated sympathetic nervous activity for a few hours after exercise.

Our results showed that, the higher the exercise intensity, the greater the PEH magnitude over 20 hours. The hypotensive effects of continuous and interval exercises were sustained during daily activities, and BP decreased to normal levels. However, over 20 hours, we observed that interval exercise training determined a more significant reduction in BP and DP as compared with continuous exercise training.

Similarly to other researchers, we believe that the greater reduction in SBP, DBP, MAP, and DP after interval exercise practice results from the high BP levels generated during the exercise session and from the total duration of BP elevation\textsuperscript{27}. During more intense exercise training (interval exercise), BP levels are higher than during moderate intensity exercise (continuous exercise). Thus, there is greater pressure stress during interval exercise training with subsequent greater homeostatic imbalance\textsuperscript{11}.

Considering that the body systems are aimed at homeostasis, during the 20 hours following interval exercise, the physiological mechanisms of BP control would act more markedly than after continuous exercise to minimize the pressure stress generated during the exercise session and achieve homeostasis. Some of the mechanisms involved in that adjustment are as follows: baroreceptor action; vascular relaxation due to stress; fluid exchange through capillary walls; decrease in peripheral vascular resistance mediated by vasodilator agents produced during muscle contraction\textsuperscript{19}, and decrease in systolic volume\textsuperscript{21}. Thus, exercise sessions that induce greater acute BP increases, such as interval exercise, would also induce greater PEH in the following 20 hours.

We believe that working with reported morbidity might have limited the participation of individuals who ignored their hypertensive condition. In addition, the strategy adopted to recruit participants might represent a selection bias, because the sample was small and previously defined. In addition, all individuals
could be submitted to neither the same dietary regimen nor to the same pharmacological prescription. To minimize that bias and to preserve the participants’ clinical conditions, they were instructed to maintain, from the beginning to the end of data collection, their same dietary and pharmacological regimens.

Conclusion

In conclusion, continuous and interval exercise trainings promote PEH, with reductions in SBP, DBP, MAP and DP over the 20 hours following the physical activity. In addition, interval exercise generates greater PEH and smaller cardiovascular overload, measured as a smaller DP, as compared with continuous exercise.

Our results can also be useful to guide the appropriate therapeutic approach and BP reduction in elderly hypertensives. Exercise prescription for that population can be improved, eliminating the need for daily practice, which could contribute to better planning and to encourage patients’ adherence.

We suggest that further studies be conducted with larger and more diversified samples to support our findings.

Author contributions

Conception and design of the research: Carvalho RST, Pires CMR, Marchi-Alves LM; Acquisition of data: Carvalho RST, Junqueira GC, Marchi-Alves LM; Analysis and interpretation of the data and Statistical analysis: Carvalho RST, Marchi-Alves LM; Writing of the manuscript: Carvalho RST, Freitas D, Marchi-Alves LM; Critical revision of the manuscript for intellectual content: Carvalho RST, Pires CMR, Freitas D, Marchi-Alves LM.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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