Effect of Resistance Training with Different Intensities on Blood Pressure in Hypertensive Patients

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Background: The effect of resistance training (RT) on the behavior of blood pressure (BP), heart rate (HR) and double product (DP) is strongly related to the characteristics of exercise and is inconsistent with hypertensive individuals.

Objectives: To compare the acute and late cardiovascular response in sessions of 50% and 75% of maximum estimated repetition in grade-1 hypertensive individuals.

Methods: For 24 hours, the study analyzed systolic blood pressure (SBP) and diastolic blood pressure (DBP) in 14 mild hypertensive men, trained (TG) and untrained (UG), under protocols of 75% and 50% on maximum estimated repetition. The level of cardiovascular stress in eight exercises for the two intensities mentioned was concomitantly observed.

Results: In the TG, the variable SBP showed differences between the protocol of lower intensity compared to the other, 50% with control (p=0.028) and 50% to 75% (p=0.022), and DBP differed only in the protocols of 50% with control (p=0.024). In the UG, the difference occurred in all protocols, as well in SBP [50% and control (p=<0.0001); 75% and control (p=0.039); and 50% and 75% (p=0.001)] as in DBP [50% and control (p=0.002); 75% and control (p=0.002); and 50% and 75% (p=0.002)]. On cardiovascular stress, the exercises seated row, leg press in the TG and high row, leg curl and abdominal crunch in the UG differed in both protocols.

Conclusion: The results indicate safety in RT in mild hypertension men. It became evident that the lower intensity protocol showed higher efficiency in promoting post-exercise hypotension.

Keywords: Hypertension; Monitoring ambulatory; Resistance training; Exercise

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Introduction

Resistance training (RT) enables the reduction of post-workout blood pressure, post-exercise hypotension (PEH) in normotensive individuals and especially in hypertensive individuals¹,²; however, there are discrepancies when specifying the influence of intensity in that response in hypertensive individuals.

During the RT, response of hemodynamic variables, heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP) are dependent on variables of such training mode: load, training volume, tension time, muscle mass mobilized, interval between sets and interval between exercises³-⁵. Hence, the cardiovascular stress may be mediated by these variables, and over exposure to this stress in individuals with cardiovascular restrictions increases systematically the risk of acute complications.

Some studies confirm the PEH in RT in hypertensive individuals⁶-¹⁰, but a study that reported no PEH in this group of individuals was found¹¹. Thus, due to the
quantitative limitation of investigations in this context, one cannot infer consistent conclusions. The objective of this study was to determine and compare the effect of PEH of a RT session with different intensities: 75% of a maximum repetition estimated (1MER) and 50% of 1MER in mild hypertensive individuals, and check the cardiovascular stress promoted in different exercises.

**Methods**

A descriptive cross-sectional study was conducted with 14 male individuals with mild hypertension, under no medication and no injury of target organs and/or musculoskeletal limitations. Stratified into two groups: TG - regular RT practitioners for at least six months and UTG - without practicing RT for at least six months (Table 1).

Individuals using nutritional and/or hormonal ergogenic drugs six months before and/or during data collection were excluded from the experiment, as well as those who failed to carry out the six familiarization sessions within a maximum period of 15 days, in non-consecutive sessions.

The research study was approved by the Ethics Committee in Research from Universidade Estadual do Pará, under number 33/2011. All participants signed an Informed Consent according to CNS Resolution 466/12 and were evaluated by a cardiologist for further classification of hypertensive level or otherwise, a determining factor in the inclusion of individuals in the study.

All participants were instructed not to have any beverages and/or food with high concentrations of caffeine and/or alcohol on the days of data collection and took notes of food intake along with a minimum water intake of 33 mL/kg/day.

The sample was subsequently subjected to a period of familiarization with the RT in order to analyze and correct the motor process in each exercise, which consisted of six non-consecutive sessions: the first three with two sets of 10 repetitions with 60% of the maximum load perceived for 10 maximum repetitions (MR); and the last three sessions with three sets of 10 repetitions with 80% of the maximum load perceived for 10MR and intervals of 60s between THE sets and exercises in two different stages. The following exercises were performed: lat pulldown — LT; seated row — SR; bench press — BP; high row — HR; leg press — LP; leg extension — LE, leg curl — LC; and abdominal crunch — AC, in this sequence, for two weeks. Then the participants underwent ABPM for checking pre-workout pressure values, which established the control protocol (rest).

The third and final stage consisted of four non-consecutive days. The first two days, for the application of the test and load prediction retest, similar to the studies conducted by Dias et al. O’Connor et al. equation was adopted for calculating the 1MER load and, from this estimate, the percentages for the two protocols were extracted.

Then the sample was subjected to the protocols (50% and 75% of 1MER) performed in random sequence (draw) by the individuals of different groups, to eliminate any effect of the order with an interval of 72 hours between the protocols.

**Resistance training protocols**

- **Resistance training at 50% of 1MER (RT50)**
  The protocol consisted of three consecutive sets of 12 repetitions with load equivalent to 50% of 1MER, and rhythmicity of 2.6 s for each movement cycle, properly controlled by a metronome. The interval between sets and exercises was 90 s and 120 s, respectively, controlled by a timer.

- **Resistance training at 75% of 1MER (RT75)**
  The protocol consisted of three consecutive sets of 8 repetitions with load equivalent to 75% of 1MER, and rhythmicity of 4.0 s for each movement cycle, controlled by a metronome. The interval between sets and exercises was 90 s and 120 s, respectively, controlled by a timer.

**Data collection**

To collect the data, the individual investigated sat for 15 min at the analysis site; then, ABPM device was placed on the non-dominant arm for checking BP at rest and at 20 min, 25 min and 30 min. After this period, the apparatus was removed and a heart rate monitor transmitter was placed on the chest by the xiphoid process; the receiver
clock was held by the assistant evaluator in order to
record the HR of the individual being evaluated.

Then, the individual being evaluated warmed up (one
set of 12 repetitions with 30% of 1MER) in the LP
equipment and HR equipment. Then the participant
walked to the LP equipment to begin the experiment
protocol. In the end of the last set of each exercise,
precisely between the penultimate repetition and the end
of the training, BP was recorded by auscultation.
Simultaneously with this measurement, the assistant
evaluator recorded the HR; this procedure was repeated
at the end of each of the eight exercises.

Finally, the ABPM device was again placed on the
individual being evaluated to check BP, which was taken
for analysis 24 hours after deployment.

To analyze the BP behavior, a properly calibrated BP
monitoring device Dyna — ABPM of Cardios (USA) was
used, and the procedures recommended by the Brazilian
Society of Cardiology were adopted. For acute BP
checking during the two training protocols, a previously
calibrated aneroid Tycos (USA) sphygmomanometer
was used concurrently with a stethoscope for auscultation
of Korotkoff sounds. The first and fourth phases were
used to record the systolic and diastolic values,
respectively.

A Polar S510 (Finland) heart rate monitor was used to
control HR. This variable was recorded along with the
BP in the end of the third set in each exercise and was
the precise moment of the first Korotkoff noise was
adopted to enable the subsequent calculation of DP. The
tension time in each set during the training protocol was
controlled by a metronome, MT-1000 — Fender (USA)
Tuner connected to a headset used by the individual
being evaluated and supervised by the assistant evaluator
through the cursor on the device display. The interval
between sets and exercises was monitored by a LifeStyle
WA 40041C - Adidas (USA) timer.

Statistical Analysis
The exploratory evaluation of the data was performed
using the Shapiro-Wilk normality test to see if the
samples had Gaussian distributions and to identify and
purge outliers used the box-plot test. To ensure equal
conditions of general and base characteristics before the
application of exercise protocols, Student’s t test was
used for independent samples. The assessment of
dependent variables was analyzed by Student’s t test
for paired samples, which evaluated the intra-group
effect of 50% 1MER and 75% 1MER protocols on SBP
(mmHg), DBP (mmHg), HR (bpm) and DP (mmHg x
bpm). The simple ANOVA for repeated measures was
used in order to compare the differences in mean SBP
and DBP at three moments (control, 50% and 75% 1MER)
for which all the conditions necessary for execution were
met: normality and sphericity with the Mauchly test.
The significance level was previously set at p=0.05. All
analyses were performed with the Statistical Package
for the Social Sciences version 20.0 (SPSS Inc, Chicago,
Illinois, USA).

Results
The analysis of leveling characteristics between the
groups showed that the variables did not show any
statistically significant differences between the groups
in different protocols (Table 1).

| Table 1 |
| Characteristics of the groups studied |
| UTG | TG | UTG x TG |
| --- | --- | --- | --- |
| **min-max** | **mean±SD** | **min-max** | **mean±SD** | **p-value** |
| Weight (kg) | 76.0-103.0 | 87.1±9.5 | 72.0-92.0 | 80.0±7.7 | 0.15 |
| Height (cm) | 170.0-189.0 | 178.7±6.4 | 167.0-184.0 | 175.9±6.7 | 0.43 |
| BMI kg/cm² | 25.7-28.8 | 27.2±1.3 | 23.6-27.5 | 25.8±1.4 | 0.08 |
| Age (years) | 28.0-35.0 | 31.4±2.6 | 25.0-34.0 | 29.3±3.0 | 0.18 |

BMI — body mass index; UTG — untrained group; TG — trained group; SD — standard deviation; Min — minimum; Max — maximum
The SR, BP, HR, LP and AC exercises revealed significant differences in the HR variable, and the SR and LP exercises revealed significant differences in the in the DP variable in the TG during the exercises in this protocol (Table 2).

Only the exercise AC showed significant differences in the variable SBP; the exercises LT, HR and AC in the variable HR; and the exercises HR, LC and AC in the variable DP in the UTG during the exercises in different protocols (Table 3).

In Figure 1, it can be observed that in the UTG, the response of SBP in the 24 hours following completion of the three protocols was different (F=53.172; p=<0.0001; η²=0.899, where η² is the eta-square: the protocol of 50% and control (p=0.039) and between the program at 50% and 75% (p=0.001).

Figure 2 shows that in the TG, SBP response in the 24 hours following completion of the 50% protocol was different compared to the other ones (F=8.656; p=0.005; η²=0.591), where η² is the eta-square: protocol of 50% and control (p=0.028) and between 50% and 75% (p=0.022).

It was found that in the UTG, DBP response in the 24 hours following execution of three protocols was different (F=24.723; p=<0.0001; η²=0.805, where η² is the eta-square: the protocols 50% and control (p=0.002), 75% and control (p=0.002) and 50% and 75% (p=0.002) (Figure 3). For the TG, DBP response in the 24 hours following completion of the 50% protocol with control (F=177.981; p=0.012; η²=0.522, where η² is the eta-square: protocol of 50% and control (p=0.024) (Figure 4).

### Table 2
Mean SBP values (mmHg), DBP (mmHg), HR (bpm) and DP (mmHgxbpm) performed in the 75% program of 1MER and 50% of 1MER in the TG

<table>
<thead>
<tr>
<th>Exercises</th>
<th>Load</th>
<th>SBP (mean±SD)</th>
<th>DBP (mean±SD)</th>
<th>HR (mean±SD)</th>
<th>Double Product (mean±SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LT</td>
<td>75%</td>
<td>182.86±7.56</td>
<td>92.86±4.88</td>
<td>127.86±15.85</td>
<td>23364.29±2868.38</td>
</tr>
<tr>
<td></td>
<td>50%</td>
<td>178.57±9.0</td>
<td>91.43±3.78</td>
<td>120.43±7.32</td>
<td>21530.0±2022.16</td>
</tr>
<tr>
<td>SR</td>
<td>75%</td>
<td>172.86±7.56</td>
<td>92.86±4.88</td>
<td>129.0±15.44*</td>
<td>22310.0±2856.44*</td>
</tr>
<tr>
<td></td>
<td>50%</td>
<td>172.86±7.56</td>
<td>91.43±3.78</td>
<td>121.14±9.19*</td>
<td>20970.0±2210.60*</td>
</tr>
<tr>
<td>BP</td>
<td>75%</td>
<td>171.43±14.64</td>
<td>92.864.88</td>
<td>127.57±14.71*</td>
<td>21977.14±4056.38</td>
</tr>
<tr>
<td></td>
<td>50%</td>
<td>170.0±11.55</td>
<td>90.0±0.0</td>
<td>120.14±5.52*</td>
<td>20448.57±1987.68</td>
</tr>
<tr>
<td>HR</td>
<td>75%</td>
<td>170.0±17.32</td>
<td>90.0±0.0</td>
<td>132.14±11.23*</td>
<td>22567.14±3802.58</td>
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<tr>
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<td>50%</td>
<td>161.43±6.90</td>
<td>88.57±3.78</td>
<td>127.57±11.29*</td>
<td>20635.71±2503.65</td>
</tr>
<tr>
<td>LP</td>
<td>75%</td>
<td>157.14±7.56</td>
<td>82.86±4.88</td>
<td>147.86±6.61*</td>
<td>23225.71±1343.87*</td>
</tr>
<tr>
<td></td>
<td>50%</td>
<td>158.57±9.0</td>
<td>82.86±4.88</td>
<td>136.71±5.15*</td>
<td>21654.29±959.34*</td>
</tr>
<tr>
<td>LE</td>
<td>75%</td>
<td>175.71±11.34</td>
<td>84.29 7.86</td>
<td>141.43±7.95</td>
<td>24902.86±2795.61</td>
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<tr>
<td></td>
<td>50%</td>
<td>165.71±7.87</td>
<td>85.71±5.34</td>
<td>140.71±5.61</td>
<td>23344.29±1873.87</td>
</tr>
<tr>
<td>LC</td>
<td>75%</td>
<td>151.43±17.73</td>
<td>82.86±4.88</td>
<td>129.86±7.71</td>
<td>19665.71±2554.02</td>
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<td></td>
<td>50%</td>
<td>150.0±5.77</td>
<td>92.86±4.88</td>
<td>125.71±5.73</td>
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<tr>
<td>AC</td>
<td>75%</td>
<td>152.86±9.51</td>
<td>91.43±3.78</td>
<td>129.43±4.72*</td>
<td>19802.86±1675.81</td>
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<tr>
<td></td>
<td>50%</td>
<td>152.86±7.56</td>
<td>92.86±4.88</td>
<td>123.71±5.49*</td>
<td>18932.86±1616.22</td>
</tr>
</tbody>
</table>

*Significant differences, p<0.05
TG — Trained group; SBP — systolic blood pressure; DBP — diastolic blood pressure; HR — heart rate; SD — standard deviation; LT — lat pulldown; SR — seated row; BP — bench press; HR — high row; LP — leg press; LE — leg extension; LC — leg curl; AC — abdominal crunch
Table 3
Mean SBP (mmHg), DBP (mmHg), HR (bpm) and DP (mmHg x bpm) in the 75% program of 1MER and 50% of 1MER in the UTG

<table>
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<tr>
<th>Exercises</th>
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<th>DBP (mean±SD)</th>
<th>HR (mean±SD)</th>
<th>Double Product (mean±SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LT</td>
<td>75%</td>
<td>187.14±9.51</td>
<td>91.43±3.78</td>
<td>144.00±15.97*</td>
<td>26990.0±3669.63</td>
</tr>
<tr>
<td></td>
<td>50%</td>
<td>185.71±7.87</td>
<td>91.43±3.78</td>
<td>139.43±15.27*</td>
<td>25948.57±3539.51</td>
</tr>
<tr>
<td>SR</td>
<td>75%</td>
<td>177.14±7.56</td>
<td>91.43±3.78</td>
<td>137.86±11.95</td>
<td>24454.29±2704.0</td>
</tr>
<tr>
<td></td>
<td>50%</td>
<td>175.71±5.35</td>
<td>91.43±3.78</td>
<td>135.43±8.81</td>
<td>23797.14±1719.29</td>
</tr>
<tr>
<td>BP</td>
<td>75%</td>
<td>184.29±7.87</td>
<td>91.43±3.78</td>
<td>137.14±14.24</td>
<td>25245.71±2605.86</td>
</tr>
<tr>
<td></td>
<td>50%</td>
<td>182.86±4.88</td>
<td>87.14±4.88</td>
<td>136.57±11.24</td>
<td>24954.29±1935.56</td>
</tr>
<tr>
<td>HR</td>
<td>75%</td>
<td>170.0±10.0</td>
<td>90.0±0.0</td>
<td>138.43±7.72*</td>
<td>23550.0±2112.66*</td>
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<td></td>
<td>50%</td>
<td>168.57±10.69</td>
<td>87.14±4.88</td>
<td>134.71±5.53*</td>
<td>22730.0±2031.35*</td>
</tr>
<tr>
<td>LP</td>
<td>75%</td>
<td>167.14±7.56</td>
<td>82.86±4.88</td>
<td>146.14±5.49</td>
<td>24427.14±1434.06</td>
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<td>50%</td>
<td>172.86±11.13</td>
<td>84.29±5.35</td>
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<tr>
<td>LE</td>
<td>75%</td>
<td>182.86±7.56</td>
<td>87.14±7.56</td>
<td>143.14±5.01</td>
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<td>LC</td>
<td>75%</td>
<td>164.29±5.35</td>
<td>81.43±3.78</td>
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<tr>
<td>AC</td>
<td>75%</td>
<td>160.0±5.77*</td>
<td>81.43±3.78</td>
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<td>81.43±3.78</td>
<td>121.43±5.68*</td>
<td>18560.0±1019.66*</td>
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</tbody>
</table>

*Significant differences p<0.05
UTG — untrained group; SBP — systolic blood pressure; DBP — diastolic blood pressure; HR — heart rate; DP — double product; SD — standard deviation; LT — lat pulldown; SR — seated row; BP — bench press; HR — high row; LP — leg press; LE — leg extension; LC — leg curl; AC — abdominal crunch

Figure 1
Behavior of systolic blood pressure in the 24-hour period in the UTG
UTG — untrained group; SBP — systolic blood pressure; 1MER — one maximum estimated repetition
**Figure 2**
Behavior of systolic blood pressure in the 24-hour period in the TG
TG — trained group; SBP — systolic blood pressure; 1MER — one maximum estimated repetition

**Figure 3**
Behavior of diastolic blood pressure in 24-hour period in the UTG
UTG — untrained group; DBP — diastolic blood pressure; 1MER — one maximum estimated repetition

**Figure 4**
Behavior of diastolic blood pressure in 24-hour period in the TG
TG — trained group; DBP — diastolic blood pressure; 1MER — one maximum estimated repetition
Discussion

In the acute analysis of the cardiovascular variables, only a few exercises revealed a significant difference, with greater magnitude in the protocol of higher intensity.

In the TG, the exercises SR, BP, HR, LP and AC in the variable HR and the exercises SR and LP in the DP presented differences between the intensities. In the UTG, the AC exercise in the variable SBP; the exercises LT, HR and AC in the variable HR and the exercises HR, LC and AC in the variable DP showed significant differences between the intensities of 75% and 50% of 1MER.

The results of SBP and DBP in this study did not differ due to the training intensity, except for the AC exercise in the UTG, which showed a significant difference in SBP. This result is corroborated by the study of Castinha-Neto et al.\(^\text{15}\), which reported that the intensity variable had no independent effect on SBP and DBP, although the protocol of greater intensity tended to trigger higher values of these variables (Tables 2 and 3). This behavior of matching SBP levels can possibly be assigned to the interdependent behavior of the variables HR, systolic volume (SV) and peripheral vascular resistance (PVR), because the cardiac output (CO) is the product of HR by SV, and SBP is the product of CO by PVR. By understanding the dynamics of these variables, we can justify this finding by these relations, since the number of repetitions, muscle contraction, breathing and other RT variables affect the SV, PVR and the adrenergic response that are consequently reflected in the CO and BP variables. It can be assumed that the reason for the similarity between training intensities was triggered by the decrease in end-diastolic volume resulting from vascular occlusion, which attenuates the CO and hence the SBP in the protocol of higher intensity, bringing this variable to values close to those found in the lower-intensity protocol that dynamically provides lower values in the PVR\(^\text{16}\).

More important than any analysis of a single physiological variable, analysis of DP stands out for measuring indirectly, yet with a good correlation, the consumption of myocardial oxygen, stratifying the level of cardiovascular stress triggered. Tables 2 and 3 show that only the SR and LP exercises in the individuals from the TG, HR, LC and AC in the UTG, respectively, showed significant differences between the intensities.

Thus, if the results presented in the TG are analyzed, then a higher HR value will be observed. In the LP exercise, this can be justified by the position in the device, since the LP exercise consists in raising the lower limbs above the heart level; in the SR exercise, this may be due to the vascular occlusion of accessory muscles, since this exercise requires strong isometric contraction of the large posterior muscle chain. These two situations can possibly trigger a greater chronotropic exertion resulting from the hemodynamic demands of the active muscles. In the UTG, these findings may be due to lower tolerance to the cumulative effect of fatigue in these individuals because the exercises that presented greater cardiovascular stress were offered in the end of the training protocol\(^\text{17}\). Another fact that is worthy of note is the disparate behavior of BP in individuals with similar characteristics\(^\text{18}\).

In this study, the tension time was controlled because some investigations found that this variable was determining in the magnitude of cardiovascular stress during RT\(^\text{17,19}\). Corroboration of the results found here with studies\(^\text{15,20,21}\) that detected greater hemodynamic response in the protocols of greater intensity compared to those of lower intensity is true. This increase in cardiovascular stress was triggered mainly by the increase in HR that probably emerges from greater metabolic demand, i.e., greater active muscle volume, since the higher the load mobilized the greater the amount of active muscle fibers.

Although greater acute responses of RT were found in the protocol of higher intensity in individuals with mild hypertension, it can be seen that the two training programs were proven to be safe, since no exercise exceeded the myocardial ischemia threshold.

The PEH behavior is presented as a beneficial event mainly in hypertensive individuals. The results of this study (Figures 2 and 4) concerning the trained individuals, it is observed that the protocol of higher intensity did not cause any significant differences in SBP (p=0.202) and DBP (p=0.411) compared to the control group. However, it is observed that the 50% protocol of 1MER compared to the control protocol proved effective in reducing these variables: SBP (p=0.028) and DBP (p=0.024).

Figures 1 and 2, on the SBP and DBP of the UTG, respectively, in the protocols 50% and 75% of 1MER compared to the control protocol, triggered significant reductions, which allows to state that the two intensities promote BP reduction in untrained hypertensive individuals. However, although the protocols present PEH, it can be seen that the magnitude and duration were
different compared to rest, because the lower-intensity protocol triggered an effect of longer duration and greater magnitude curves.

This study is not consistent with the investigations of Canuto et al.\textsuperscript{11}, who reported no influence of the two different intensities in BP after RT; Duncan et al.\textsuperscript{21}, who reported PEH only in the higher-intensity protocol; and Gonçalves et al.\textsuperscript{22}, who reported inefficiency of resistance training in improving the hemodynamic responses of hypertensive elderly individuals. However, it is consistent with most investigations\textsuperscript{8-10,23-30} that showed a reduction after RT in hypertensive individuals.

Fisher\textsuperscript{24} found that hypertensive individuals suffer greater magnitude of reductions in PEH compared to normotensive individuals, a fact that cannot be seen in this study, because the sample was exclusive of hypertensive individuals. It is consistent, however, with Costa et al.\textsuperscript{25}, who showed more consistent results in untrained hypertensive individuals compared to a phenotypically similar trained group as well as with the findings of Oliveira et al.\textsuperscript{31}, which presented similar results to those show in this study, regarding training intensity, showing that lower intensities cause more promising results in hypertensive individuals.

According to the literature, some RT variables are potentially involved in this post-exercise behavior. Jannig et al.\textsuperscript{26} reported that the order of exercises influences the duration of PEH in hypertensive men and women; and Mediano et al.\textsuperscript{27} reported that training with higher volumes had a greater influence on the magnitude of this depressant response in a group of untrained hypertensive individuals, which corroborates Moraes\textsuperscript{9}, who reported a systematic relationship of PEH with pressure pre-training levels. These findings are inconsistent with the ones found by Bentes et al.\textsuperscript{31}, which, despite reporting the PEH, found no significant differences between the intensity and the order of exercises, but in a sample of healthy women.

The training characteristics also appear to influence the PEH. Exercises for the upper limbs showed a slight reduction of BP after a RT protocol compared with exercises for the lower limbs, just like active intervals exercises promote greater PEH in hypertensive women\textsuperscript{8}. Thus, we see the complexity of prescription of RT in viewing the post-exercise hypotensive effect of this training modality.

Studies using the ABPM method for analyzing the behavior after training in hypertensive patients\textsuperscript{9,26,30} evidenced PEH. It is worth noting the study by Moraes et al.\textsuperscript{9}, which, after endogenous control, assigned such BP behavior to the action of kallikrein, a proteolytic polypeptide that has great direct and indirect vasodilation influence by protein cleavage on bradykinogen, a plasma protein substrate, thus creating plamacinines, especially bradykinin and kallidin, two powerful vasodilators that act directly on the endothelium.

No other study that proposed to investigate the influence of RT in PEH in hypertensive individuals analyzed any intrinsic factor. However, this behavior can also be explained by the neural control of circulation, because although there are few studies that prove this response after RT, adaptations to this training mode can be assumed, similar to aerobic training\textsuperscript{32}, since lower-intensity protocols trigger increased vagal activity and reduction in sympathetic hypertonia after physical exercise\textsuperscript{30-32}. Although the low-intensity protocols are not the most recommended for the potential promotion of muscle strength, these intensities are promising regarding the cardiovascular effects of RT as they effectively trigger PEH.

Just like Bentes et al.\textsuperscript{31}, this study suggests positive effects of this training modality to the cardiovascular system. Such behavior should be observed carefully because any intervention without any unwanted effects that may facilitate minimal reductions in the tensional values of BP is beneficial, especially in hypertensive individuals.

**Conclusions**

It is concluded that the RT is safe from the cardiovascular point of view for individuals with mild hypertension. Concerning the behavior of BP after RT, the lower-intensity protocol was more effective in promoting PEH in both groups, with results of greater magnitude in the UTG.

**Potential Conflicts of Interest**

No relevant conflicts of interest.

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