INFLUENCE OF ACUTE CONCURRENT EXERCISE PERFORMED IN PUBLIC FITNESS FACILITIES ON AMBULATORY BLOOD PRESSURE AMONG OLDER ADULTS IN RIO DE JANEIRO CITY

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ABSTRACT

Cordeiro, R. Monteiro, W. Cunha, F, Pescatello, LS, and Farinatti, P. Influence of acute concurrent exercise performed in public fitness facilities on ambulatory blood pressure among older adults in Rio de Janeiro city. J Strength Cond Res 32(10): 2962–2970, 2018—The project “Third-Age Academies” (TAAs) is a public policy providing supervised physical activities to over 40,000 seniors at open-access facilities (squares etc.) in Rio de Janeiro, Brazil. We investigated whether TAA concurrent exercise circuit induced postexercise hypotension (PEH) in individuals older than 60 years. Blood pressure (BP) was measured by 24-hour ambulatory BP monitoring (ABPM) after counterbalanced CEX and nonexercise (CONT) sessions (n = 16; 66.8 ± 1.4 years; systolic/diastolic BP (SBP/DBP): 132.5 ± 4.3/78.0 ± 2.8 mm Hg). For statistical analyses purposes, groups were divided as exhibiting normal SBP (≤120 mm Hg) or high SBP (>120 mm Hg), based on 24-hour ABPM after CONT. The CEX included 2 aerobic and 9 resistance exercises performed alternately in circuit order (40 minutes at 60–70% heart rate reserve using body mass or fixed loads). 24-hour ambulatory BP monitoring lowered in individuals with high BP (n = 11; medicated = 5) (SBP: −6.6 ± 1.9 mm Hg; mean arterial pressure [MAP]: −4.3 ± 1.5 mm Hg; p < 0.015), particularly within the first 5–6 hours after exercise (SBP: −13.5 ± 2.6 mm Hg; DBP: −9.4 ± 2.2 mm Hg; and MAP: −11.4 ± 1.6 mm Hg, p < 0.05). Significant BP lowering was not detected among participants with normal BP (n = 5; medicated = 4). In conclusion, CEX provoked PEH in older adults with prehypertension to established hypertension. Because of the potential of TAAs to reach large numbers of older adults, our findings are encouraging and should be confirmed in subsequent studies.

KEY WORDS postexercise hypotension, ambulatory blood pressure monitoring, elderly, circuit training

INTRODUCTION

Hypertension is a major cardiovascular disease risk factor in which prevalence increases with age (19). For instance, the incidence of hypertension is 3-fold greater among people aged over 65 years than people aged 35–44 years (29). Regular exercise participation is acknowledged as a nonpharmacologic strategy to reduce blood pressure (BP) and counteract hypertension (30,31). More recently, growing evidence suggests that antihypertensive benefits of exercise may result from successive decreases after acute exercise sessions (10,18,24), referred to as postexercise hypotension (PEH) (30).

Aerobic exercise is often recommended to lower BP among adults with hypertension (31). However, recent evidence indicates that antihypertensive effects of exercise may be equally potent after resistance (26,28) or concurrent exercise (i.e., aerobic and resistance performed in close proximity) (9,25). In addition, from a practical perspective, exercise sessions designed to lower BP and promote general health (15) rarely include aerobic or resistance exercise in isolation of one another. To date, a single meta-analysis (9) tested the moderator effect of resting BP on tensional responses to concurrent exercise and reported that systolic BP (SBP) was reduced more among middle-aged samples with hypertension (−5.3 mm Hg) vs. prehypertension (−2.9 mm Hg) or people with normal BP (0.9 mm Hg). It is therefore unclear whether concurrent exercise would be efficacious as antihypertensive therapy in older patients.
Research on the effects of acute concurrent exercise on BP is also limited; actually, to date only 8 studies investigated PEH after concurrent exercise (12,14,21,22,27,32,33,36). Of these, 3 trials included patients with established hypertension (12,14,27). Their results were mixed; Meneses et al. (27) reported no changes in BP among middle-aged women (55–59 years; ~130/68 mm Hg); Dos Santos et al. (12) found concurrent exercise lowered BP (~3–5 mm Hg) in older women (aged 60–65 years) on medication to manage their uncontrolled hypertension (~166/91 mm Hg); and Ferrari et al. (14) detected acute reduction just for diastolic BP (DBP) during the first hour in laboratory (~6 mm Hg). This last study was also the only trial that assessed BP change after acute concurrent exercise through ambulatory monitoring—albeit short-term PEH occurred, this effect did not last, and therefore, no change was observed within day or night time measurements.

In short, the prevalence of hypertension among older people is high, and there is increasing evidence that effects of exercise to lower BP might rely, at least in some extent, on the summation of acute exercise effects (10). Because of the potential health impact of TAAs for large number of senior citizens, it would be important to determine whether exercise routines applied in these public-access facilities might induce PEH. Therefore, this study investigated the influence of a single bout of acute concurrent exercise on acute BP assessed under ambulatory conditions, in older individuals at TAAs in Rio de Janeiro city. We hypothesized that a single bout of concurrent exercise circuit applied in TAAs would be capable to induce PEH in physically inactive older individuals.

![Figure 1. Illustration of exercises included in TAA’s concurrent exercise circuit. TAA = Third-Age Academies; AE = aerobic exercise; RE = resistance exercise; %HRR = percentage of heart-rate reserve; RPE = rating of perceived exertion.](image-url)
**Methods**

**Experimental Approach to the Problem**

The study was conducted in Rio de Janeiro, RJ, southeast of Brazil. The experimental protocol was designed to verify whether the standard circuit exercise routine applied in TAAs was capable to induce PEH in a small cohort of previously inactive older participants. Volunteers were recruited after advertisement in 2 TAAs located close to the university’s facilities. The recruitment occurred at the moment when new participants registered at TAAs; therefore, they had no previous familiarization with the exercise circuit. The whole study was completed over 10 months because of the difficulty to recruit physically inactive older seniors who fulfilled the inclusion and exclusion criteria. After inclusion in the experimental protocol, data collection for each participant lasted from 8 to 10 days.

The experiment included 4 visits on separated days. On the first visit, the participants underwent clinical screening. Later and to confirm the potential eligibility of the selected volunteers, we contacted their assistant physicians. On the second visit, body mass, height, and BP were assessed at the laboratory (oscillometric method). Furthermore, participants were attached to the ambulatory BP monitoring (ABPM) device and worn it for 24 hours, until the next moment when new participants registered at TAAs; therefore, they had no previous familiarization with the exercise circuit. The whole study was completed over 10 months because of the difficulty to recruit physically inactive older seniors who fulfilled the inclusion and exclusion criteria. After inclusion in the experimental protocol, data collection for each participant lasted from 8 to 10 days.

The experiment included 4 visits on separated days. On the first visit, the participants underwent clinical screening. Later and to confirm the potential eligibility of the selected volunteers, we contacted their assistant physicians. On the second visit, body mass, height, and BP were assessed at the laboratory (oscillometric method). Furthermore, participants performed a familiarization session with the concurrent exercise circuit applied in TAAs. On the third and fourth visits, participants performed either control or concurrent exercise sessions interspersed with 48- to 72-hour intervals, according to a randomized counterbalanced order. Immediately after the end of exercise and control sessions, the participants were attached to the ambulatory BP monitoring (ABPM) device and worn it for 24 hours, until the next afternoon. All procedures took place at the same time of the day (3–4 PM) to minimize circadian effects on BP.

**Subjects**

A controlled trial was performed including individuals not performing regular physical activity (2 or more days per week) within the past 6 months. Characteristics of participants were: $n = 16$ (15 women), age (Mean ± SEM): 66.8 ± 1.4 years (range 61 to 78 years); and SBP/DBP (Mean ± SEM): 132.5 ± 4.3/78.0 ± 2.8 mm Hg. A single dropout occurred because of personal reasons. To be eligible, they should be at least 60 years of age, nonsmokers, and cleared by their physicians to practice physical activities. Exclusion criteria included cardiac or chronic kidney disease, stroke within the last year, orthopedic problems compromising exercise performance, and use of medications potentially influencing BP-lowering postexercise (including inhaled/oral steroids, b-blockers, or calcium antagonists) (11,37). All participants signed an informed consent form as approved by the ethics committee board of the Salgado de Oliveira University (Trial registration: RBR-7BWVPJ; U1N111-1188-7441; Ethical Committee Process 30184114.4.0000.5289).

**Procedures**

**Concurrent Exercise and Control Sessions.** The concurrent session included 2 aerobic and 9 resistance exercises performed alternately in circuit order. The proportion between exercises for upper and lower body was similar. Figure 1 illustrates the order of the exercises performed in the concurrent exercise circuit, which are described in Table 1 and illustrated in Figure 1.

Exercise bouts were subdivided in 3 phases: (a) warm-up and stretching (5–10 minutes); (b) calisthenics (5–10 minutes), to increase heart rate up to 50% of age-predicted heart-rate reserve (HRR) in the conditioning phase; (c) conditioning, single circuit of concurrent exercise (~40 minutes) with moderate intensity, that is 60–70% HR reserve calculated as follows: (HRmax − HR at rest) × % intensity + HR at rest; where HRmax = 220 – age (20). In the nonexercise control session, the participants remained seated at rest at the TAA facilities, talking to each other or reading. The rating of perceived exertion (RPE) by the Borg CR-10 Scale (4) was obtained at the end of each circuit station. Heart rate was measured continuously using a cardiotachometer.

**Table 1. Exercises included in the Third-Age Academy concurrent exercise circuit.**

<table>
<thead>
<tr>
<th>Station</th>
<th>Modality (duration)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Aerobic (~5 min)</td>
<td>Walk simulation</td>
</tr>
<tr>
<td>2nd</td>
<td>Resistance (~4 min)</td>
<td>1. Leg extension</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Seated bench press</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Squat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Lat pull-down</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Seated leg curl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Seated shoulder press</td>
</tr>
<tr>
<td>3rd</td>
<td>Aerobic (~5 min)</td>
<td>Ski simulation</td>
</tr>
<tr>
<td>4th</td>
<td>Resistance (~4 min)</td>
<td>1. Leg extension</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Seated bench press</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Squat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Lat pull-down</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Seated leg curl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Seated shoulder press</td>
</tr>
<tr>
<td>5th</td>
<td>Aerobic (~5 min)</td>
<td>Walk simulation</td>
</tr>
<tr>
<td>6th</td>
<td>Resistance (~4 min)</td>
<td>1. Seated leg-press machine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Seated rowing machine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Plantar flexion machine</td>
</tr>
<tr>
<td>7th</td>
<td>Aerobic (~5 min)</td>
<td>Ski simulation</td>
</tr>
</tbody>
</table>
Preparticipation Health Screening, Anthropometric, and Ambulatory Blood Pressure Assessment. All participants underwent health screening by a physician including personal data, clinical status and medical history, use of medications, and habitual physical activity within the past 2 months. Body mass was measured to the nearest 1 g by means of a digital scale (Welmy, São Paulo, SP, Brazil), and height was measured in mm using a wall-mounted stadiometer (American Medical do Brazil, São Paulo, SP, Brazil). Changes in 24-hour BP profile were measured by automatic noninvasive ambulatory monitor (Spacelabs Medical, Redmond, WA, USA), attached to the left arm of participants by a trained researcher immediately after the end of concurrent exercise and control sessions (always between 3 and 4 PM). The start time was set at the end of experimental sessions. Measurements were taken for 24 hours, every 20 minutes during the waking hours (between approximately 4–10 p.m. and 7 AM–4 PM of the next day) and every 30 minutes during the sleeping hours (between approximately 10 PM–7 AM). In short, the 15 hours when the participants were awake represented the “waking hours,” the 9 hours when they were sleeping represented the “sleeping hours,” and the 15 waking hours plus the 9 sleeping hours represented “24 hours.”

Participants were instructed to proceed with normal activities, not to shower or exercise until the next morning, and to keep their arms still and extended when ABPM measurements were being taken. They also recorded in a standard journal activities performed during each measurement, any unusual physical or emotional events, and sleep and wake times. Ambulatory BP monitoring measurements during the first hour were verified through an automated Omron 705IT device (Omron Healthcare Co., Kyoto, Japan) at the contralateral arm. Differences up to 5 mm Hg were considered acceptable between the 2 devices (6). Recordings were averaged for each hour and analyzed for daytime, sleep, and 24 hours by means of specific software (ABP Report Management System Software v.2.00.09; Spacelabs Medical).

Statistical Analyses
A post hoc power analysis was performed (G*Power 3.1.5; Universität Düsseldorf, Düsseldorf, Germany) for both protocols considering an effect size $f = 0.30$; $\alpha$ error probability = 0.05; number of groups $= 2$; correlation among repeated measures $= 0.5$; nonsphericity correction $\varepsilon = 1$; and number of measurements $= 24$. Estimated statistical power was of 0.99. Data normality was confirmed by the Kolmogorov-Smirnov test and results are expressed as mean values ±

![Table 2. Characteristics of individuals classified as exhibiting high and low SBP (mean ± SEM).*](image)

<table>
<thead>
<tr>
<th>Variable</th>
<th>SBP &gt; 120 mm Hg, $n = 11$ (10 women)</th>
<th>SBP &lt; 120 mm Hg, $n = 5$ (4 women)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>64.9 ± 1.4</td>
<td>70.8 ± 2.7</td>
</tr>
<tr>
<td>Body mass (kg)</td>
<td>79.6 ± 2.7</td>
<td>65.1 ± 3.2</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>164.7 ± 2.0</td>
<td>159 ± 3.2</td>
</tr>
<tr>
<td>BMI (kg·m$^{-2}$)</td>
<td>29.5 ± 1.3</td>
<td>31.1 ± 1.2</td>
</tr>
<tr>
<td>SBP at office (mm Hg)</td>
<td>139.9 ± 3.5</td>
<td>116.3 ± 1.2$^\dagger$</td>
</tr>
<tr>
<td>DBP at office (mm Hg)</td>
<td>81.9 ± 3.2</td>
<td>69.3 ± 2.6$^\dagger$</td>
</tr>
<tr>
<td>MAP at office (mm Hg)</td>
<td>101.1 ± 3.5</td>
<td>84.5 ± 1.7$^\dagger$</td>
</tr>
<tr>
<td>HR (b·min$^{-1}$)</td>
<td>77.6 ± 2.9</td>
<td>77.1 ± 4.1</td>
</tr>
<tr>
<td>24-hour SBP (mm Hg)</td>
<td>130.0 ± 1.9</td>
<td>113.1 ± 0.8$^\dagger$</td>
</tr>
<tr>
<td>24-hour DBP (mm Hg)</td>
<td>69.7 ± 1.4</td>
<td>67.8 ± 2.3</td>
</tr>
<tr>
<td>24-hour MAP (mm Hg)</td>
<td>90.2 ± 0.9</td>
<td>82.9 ± 1.5$^\dagger$</td>
</tr>
<tr>
<td>Medication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diuretic + AT1 blocker or ACE inhibitor</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>AT1 blocker</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>ACE inhibitor</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Without drug therapy</td>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>

*BMI = body mass index; SBP = systolic blood pressure; DBP = diastolic blood pressure; MAP = mean arterial pressure; HR = heart rate; AT1 = angiotensin II receptor type 1; ACE = angiotensin-converting enzyme.

$^\dagger$Significant difference between groups ($p < 0.05$).
Data homogeneity and sphericity were verified by Levine's and Mauchly's tests, respectively, and Greenhouse-Geisser correction was applied whenever necessary.

Environmental conditions between CONT and CEX were compared by independent t-tests, whereas total exercise duration, TRIMP, and RPE were compared by paired t-tests. In regards to ABPM data, average 24-hour BP changes between CONT and CEX were initially compared for the whole sample, by means of t-tests for paired samples. For further analysis, subjects were assigned into 2 subgroups based on average SBP 24-hour ABPM after CONT: (a) normal SBP (SBP ≤120 mm Hg); (b) high SBP (SBP >120 mm Hg). This cutoff point was adopted because of currently accepted SBP values to identify prehypertension (19). Characteristics of individuals classified as exhibiting normal and high SBP were compared by t-tests for independent samples. Blood pressure differences within groups after CONT and CEX throughout 24-hour ABPM during each hourly interval were tested by 2-way analysis of variance with repeated measures (time × condition). Pair-wise differences were verified by Fisher post hoc tests in the event of significant F ratios. All statistical calculations were performed using software SPSS 20.0 (SPSS Inc, Chicago, IL, USA), and probability level was fixed at p ≤ 0.05 for statistical significance.

RESULTS

Table 2 depicts the characteristics of participants. Groups classified with normal and high BP were similar except for BP, which as expected was significantly lower among those classified with normal SBP at rest. Consistently, most patients included in this group were on medication. Therefore, in general, patients exhibited prehypertension to established hypertension.

Total exercise duration and environmental conditions might influence BP. No difference between control vs. concurrent exercise sessions was detected for duration (40 ± 1 vs. 41 ± 1 minutes, p = 0.23), environment temperature (26 ± 1 vs. 26 ± 1°C, p = 0.70), or relative humidity (59 ± 1 vs. 60 ± 1%, p = 0.19). The TRIMP elicited by CEX was similar across groups classified as normal and high SBP (25.4 ± 0.6 a.u. vs. 25.7 ± 0.6 a.u., p = 0.75, respectively), as well as RPE assessed by the Borg CR-10 scale (4.2 ± 0.2 vs. 4.1 ± 0.2, p = 0.74, respectively).

Figure 2 shows average 24-hour BP difference after CEX and CONT for the whole sample. Significant reductions in CEX vs. CONT were detected for SBP (−5.2 mm Hg; p = 0.003), and mean arterial pressure (MAP) (−2.3 mm Hg, p = 0.03), but not DBP (−1.3 mm Hg; p = 0.23). Figure 3 displays ABP over 24 hours after CEX and CONT after stratification of participants in groups exhibiting normal SBP (≤120 mm Hg, ranging from 111 to 114 mm Hg) and high SBP (>120 mm Hg, ranging from 122 to 140 mm Hg). Among participants with high SBP, concurrent exercise lowered SBP vs. control during 24 hours (−6.5 ± 1.9 mm Hg, p = 0.004), waking hours (−6.5 ± 2.4 mm Hg, p = 0.023), and sleeping hours (−7.5 ± 1.5 mm Hg, p = 0.001).

Figure 2. Average 24-BP variation after control (CONT) and concurrent exercise (CEX) sessions. SBP = systolic blood pressure; DBP = diastolic blood pressure; MAP = mean arterial pressure (n = 16).
BP lowered only during waking hours (−4.3 ± 1.6 mm Hg, \( p = 0.020 \)), and MAP during 24 hours (−4.3 ± 1.5 mm Hg, \( p = 0.015 \)) and waking hours (−5.0 ± 1.6 mm Hg, \( p = 0.011 \)).

Significant changes in BP vs. control were not detected in the few patients classified as exhibiting normal SBP. Postexercise hypotension was consistently detected within the first 5–6 hours postexercise in individuals with high SBP (SBP: −13.5 ± 2.6 mm Hg; DBP: −9.4 ± 2.2 mm Hg; and MAP: −11.4 ± 1.6 mm Hg, \( p < 0.05 \)), but not in those with normal SBP (SBP: 0.4 ± 2.7 mm Hg; DBP: −3.1 ± 12 mm Hg; and MAP: −2.0 ± 0.6 mm Hg, \( p > 0.05 \)).

**DISCUSSION**

This study assessed whether acute concurrent exercise performed in public open-access settings (i.e., TAAs in Rio de Janeiro city) was capable of eliciting PEH among community dwelling older adults. The main finding was that 24-hour ambulatory SBP was reduced by ~7 mm Hg and DBP by ~2 mm Hg from control in individuals with resting BP compatible with prehypertension, the most prominent reductions occurring during the first 5–6 hours postexercise (SBP by ~14 mm Hg and DBP by ~9 mm Hg). These findings are encouraging considering the potential of TAAs to reach large numbers of older adults. Indeed, the public health impact of such facilities is promising because CEX elicited comparable BP reductions with more structured exercise facilities (25).

It is worthy to notice that the present exercise circuit has been applied as regular intervention in TAAs. In 2013, this program was available in more than 230 squares in Rio de Janeiro.
Postexercise Hypotension in Older Adults

Janeiro city, with over 40,000 registered attendants aged at least 60 years with free access to supervised physical activity (7). In terms of public health policy, this is an important feature because the proximity and accessibility of exercise facilities have been shown to associate with physical activity levels (1,23). Moreover, vulnerable social groups as the elderly are especially susceptible to adopt unhealthy behaviors, including physical inactivity, because of unfavorable social and built environments (16,17). Assuming that participation in physical activity depends not only on individual lifestyles, but also on the environment in which senior citizens live, this study opens very interesting perspectives for public policies designed to improve the cardiovascular health of this specific group (13).

This study adds to the current knowledge by demonstrating that exercise usually performed in TAAs was able to elicit PEH in older people for several hours, especially when resting SBP was high. These findings concur with data from previous research demonstrating hypotensive effects in older individuals because of aerobic (32) and resistance (34) exercises. In addition, the magnitude (approximately −3 to −14 mm Hg) and duration (5–6 hours) of PEH induced by the present mixed circuit were equivalent to data reported for other exercise modalities in different age groups (8). This is clinically relevant because the contribution of PEH toward producing long-term BP lowering has been acknowledged (10,18,24). Furthermore, reductions of this magnitude seem to diminish the risk of cardiovascular mortality and morbidity (19,31).

To date, few studies have investigated the hypotensive effects of concurrent exercise, and most of them observed young healthy participants (21,22,27,32,33,36). Only 2 studies compared the isolated effects of concurrent exercise (adopting traditional weight training) on PEH in older adults (12,14). Dos Santos et al. (12) compared the acute BP response with concurrent exercise including aerobic plus eccentric or traditional resistance exercise in 60 hypertensive older women who were currently taking BP medication to manage their uncontrolled hypertension (~166/91 mm Hg). Acute concurrent exercise in untrained women elicited PEH by a magnitude of ~3–5 mm Hg, which is compatible with our data.

In the single study measuring BP response after acute concurrent exercise through 24-hour ABPM, Ferrari et al. (14) applied 3 cross-over interventions to 20 men with essential hypertension aged 60–70 years: (a) 45 minutes of non-exercise control session; (b) 45 minutes of treadmill aerobic exercise at 65–70% VO2max; and (c) 45 minutes of concurrent exercise (i.e., 20 minutes of strength exercise including 4 sets of 8 repetitions of exercises for lower and upper limbs with load corresponding to 70% 1 repetition maximum (RM), followed by 25 minutes of aerobic exercise). During the first hour in laboratory, SBP did not significantly decrease, but changes in DBP vs. control sessions were of −5 mm Hg after aerobic and of −6 mm Hg after concurrent exercise. However, these effects seemed to be quite short because DBP remained reduced by −7 mm Hg only after aerobic exercise within daytime period. Contrary to our findings, significant BP reductions after acute concurrent exercise were not detected for daytime, sleeping, or 24-hour assessments.

A single meta-analysis investigated the hypotensive effects of isolated concurrent training (9), including 69 trials with 4,110 participants of middle to older age (56 ± 14 years) and prehypertension (SBP 134.6 ± 10.9/DBP 80.7 ± 7.5 mm Hg). Unfortunately, only chronic effects were analyzed. However, it is interesting to notice that similar to our circuit, CEX was in general performed at moderate intensity (aerobic 55% maximal oxygen consumption; resistance 60% of 1 RM), and sessions lasted approximately 60 minutes. Overall, concurrent training moderately reduced SBP (~–3.2 mm Hg) and DBP (~–2.5 mm Hg) vs. controls, which rivaled the effects usually reported for exclusive aerobic exercise. These reductions are compatible with the acute effects presently observed. Moreover, greater SBP/DBP reductions were observed among samples with high vs. normal BP, which also concurs with our findings.

Some limitations of this study must be acknowledged. First, our sample was small, and the predominance of women limits generalization of results. However, this is a characteristic of participants attending TAAs, and such proportion only reflected the population usually served. Second, it was not possible to determine with precision the external overload applied to exercises because the equipment of TAAs consists of articulated machines that use body mass as load. Adjustments for progressive weights were therefore impossible. Finally, this trial did not address whether exercise practiced in TAAs would be capable to induce chronic BP reduction vs. a nonexercise control group. However, our data are promising because cumulative PEH has been suggested as a potential determinant of BP lowering because of exercise training.

In conclusion, a concurrent circuit session performed in TAAs at Rio de Janeiro city was capable to provoke clinically relevant PEH in prehypertensive and hypertensive older individuals, especially during the first 5–6 hours of postexercise recovery. Further studies are warranted to ratify these findings and to investigate whether this specific concurrent exercise routine would be able contribute to chronic BP reduction in this population.

Practical Applications

Considering the prevalence of prehypertension and hypertension among older people and the potential relationship between acute and chronic BP reduction, our data have evident implications for practitioners, particularly those involved in the TAA project. Of note, this is still more relevant when considering that over 40,000 senior citizens are formally enrolled in TAAs, which currently apply the
present concurrent exercise circuit. In short, our findings suggest that the circuit routine applied in TAAAs may be an efficient low-cost public health strategy to promote cardiovascular health among senior citizens.

Acknowledgments

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