

Resistance exercise for the management of arterial hypertension: An intervention that works!

Fernando Ribeiro PhD 

Institute of Biomedicine - iBiMED, School of Health Sciences, University of Aveiro, Aveiro, Portugal

Correspondence: Fernando Ribeiro, School of Health Sciences, University of Aveiro - Building 30, Agrad do Crasto - Campus Universitário de Santiago, 3810-193 Aveiro, Portugal.

Email: fernando.ribeiro@ua.pt

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Despite progress in awareness, prevention, and treatment, hypertension remains a major public health issue and the most common preventable cause of cardiovascular disease and all-cause mortality.¹ The Global Burden of Diseases, Injuries, and Risk Factors Study 2017 estimated that high systolic blood pressure accounted for 10.4 million deaths and 218 million disability-adjusted life-years worldwide.¹ Over the last decades, the population growth and aging has increased the prevalence of hypertension dramatically; the number of adults with elevated blood pressure doubled from 1975 (594 million) to 2015 (1.13 billion)² and is estimated to reach 1.56 billion by 2025.³

Lifestyle interventions and drug treatment are well-established strategies to lower blood pressure.^{4,5} Lifestyle measures comprehend salt restriction, moderation in alcohol intake, healthy diet, smoking cessation, weight loss (goal is ideal body weight), and regular physical activity.^{4,5} Interestingly, successful lifestyle changes may delay or prevent the need for drug therapy in patients with grade 1 hypertension, and also improve the effects of antihypertensive drugs.⁵ Yet, despite the unquestionable benefits of nonpharmacological lifestyle-oriented interventions, most patients with hypertension will also require drug treatment.⁵ In the current issue of the journal, Taati and colleagues⁶ explore the topic of lifestyle interventions to lower blood pressure in a group of women with high-normal/stage 1 hypertension. The authors assessed the effects of a dynamic resistance exercise training program and/or green tea extract on ambulatory and office blood pressure among middle-aged women (35 and 55 years old). Forty-four women with high-normal/stage 1 hypertension were randomly allocated to one of four groups: (a) resistance exercise, (b) green tea, (c) resistance exercise plus green tea, and (d) placebo/control group. The resistance exercise was

performed at 50% of one-repetition maximum twice each week for 6 weeks, each session comprised 2 sets of 10 repetitions of 6 resistance exercises. Blood pressure (ambulatory and office) was measured at baseline and after the intervention. We commend Taati and colleagues⁶ for enrolling only women in their study for a couple of reasons. First, sex differences in the prevalence of hypertension and blood pressure levels are well recognized. Second, there is compelling evidence supporting the benefits of exercise training to prevent and treat several diseases in both men and women, yet women are often underrepresented in exercise medicine and sports research, creating significant knowledge gaps on sex differences in responses to exercise.⁷ Additionally, men and women seem to respond differently to dynamic resistance exercise training.^{8,9} By enrolling only women in this study, the authors are providing important information on the blood pressure response to dynamic resistance exercise in this population.

A strong point in the Taati and colleagues⁶ study is the timing of the blood pressure assessment. They performed the blood pressure evaluation 48 hours after the last session of the exercise training program, hence avoiding the confounding effects of post-exercise hypotension from the last resistance exercise session. This period of time was sufficient to avoid the blood pressure-lowering effect induced by a single exercise session – which may persist for 24 hours¹⁰⁻¹² – and at the same time was short enough to avoid the detraining effects on blood pressure.

Regular physical exercise is widely recommended by the professional societies to lower blood pressure in adults with hypertension.^{4,5,13-16} For instance, physical exercise, namely aerobic and resistance exercise, is recognized as one of the best proven non-pharmacological interventions for prevention and treatment of

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hypertension in the 2017 American College of Cardiology/American Heart Association Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults.⁴ Exercise has been shown to consistently reduce systolic and diastolic blood pressure, on average $-8/-5$ mm Hg. A recent network meta-analysis of 391 randomized controlled trials comparing the effectiveness of different exercise regimens and medications on systolic blood pressure concluded that in adults with hypertension the blood pressure reduction induced by exercise is similar to that achieved with antihypertensive medications (eg, angiotensin-converting enzyme inhibitors, angiotensin II receptor blockers, beta-blockers, calcium channel blockers, and diuretics).¹⁷ The blood pressure reduction was not dependent on the type of exercise; aerobic, dynamic resistance, isometric resistance, and concurrent (combination of aerobic and resistance) exercise were equally effective in lowering baseline systolic blood pressure in comparison with control (Figure 1).¹⁷ Additionally, the meta-analysis did not find a difference between the effects of medications and those of exercise (0.18 mm Hg, 95% CI: -1.35 to 1.68).¹⁷ Similarly, another recent network meta-analysis (93 trials: 81 related to drugs, 12 related to exercise) comparing the efficacy of first-line antihypertensive drugs (angiotensin-converting enzyme inhibitors, angiotensin II receptor blockers, calcium channel blockers, and thiazide-like diuretics) with exercise (aerobic and dynamic resistance exercise training) on blood pressure among individuals with hypertension ($n = 32\ 404$) concluded that there was insufficient evidence to suggest that first-line

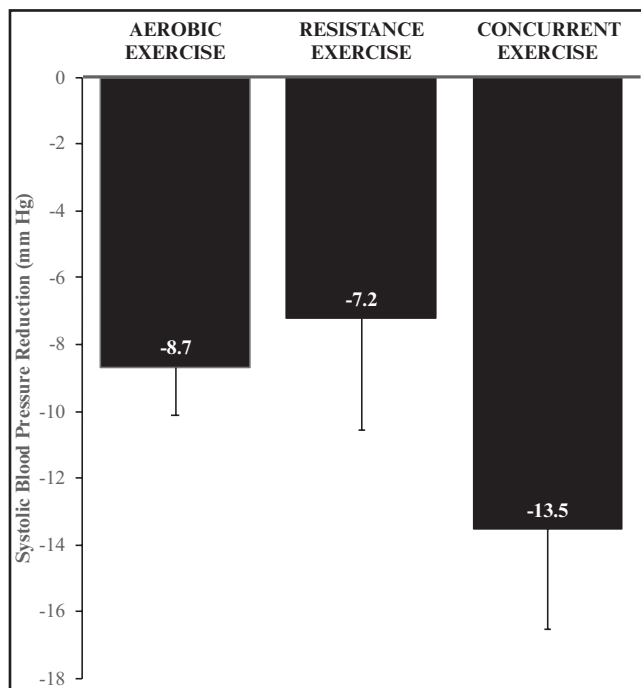


FIGURE 1 Systolic blood pressure response to aerobic, dynamic resistance, and concurrent/combined (ie, a combination of aerobic and resistance training performed together in a single session or on separate days) exercise interventions among adults with hypertension (adapted from¹⁷). Values are mean change and 95% confidence interval

antihypertensive drugs significantly reduced blood pressure to a greater extent than did the exercise programs.¹⁸

The results of Taati and colleagues⁶ published in this issue of the journal also show a significant reduction in ambulatory systolic blood pressure as a result of resistant exercise. Their main findings could be summarized as follows: (a) dynamic resistance exercise alone reduced daytime (-12.4 mm Hg) and 24-hour (-6.9 mm Hg) ambulatory systolic blood pressure; (b) green tea alone did not reduce ambulatory blood pressure; and (c) the combination of green tea and resistance exercise did not promote a larger reduction in daytime (-11.8 mm Hg) and 24-hour (-7.4 mm Hg) ambulatory systolic blood pressure per comparison to dynamic resistance exercise alone. The study of Taati and colleagues⁶ by showing that dynamic resistance exercise decreases both office and ambulatory blood pressure challenges most of the current recommendations for exercise and hypertension and raises a pertinent question: Is dynamic resistance exercise a stand-alone antihypertensive lifestyle therapy? This study shed some light on this topic, as a simple dynamic resistance exercise intervention induced average reductions in blood pressure superior to the reductions usually achieved with aerobic exercise ($\sim 8/5$ mm Hg). Historically, only aerobic exercise has been broadly recommended in the guidelines for the management of arterial hypertension. Most of the current recommendations for exercise among individuals with hypertension are to engage in dynamic resistance exercise as a supplement to aerobic exercise;^{4,5,13-16} just recently, dynamic resistance exercise was acknowledged as a stand-alone antihypertensive lifestyle therapy, instead of an adjuvant to aerobic exercise, by the American College of Sports Medicine exercise recommendations for hypertension.^{19,20} Presently, there is compelling evidence supporting the antihypertensive effects of different types of exercise, including dynamic resistance exercise.²⁰⁻²⁵ Dynamic resistance exercise seems to be as effective as aerobic exercise in reducing blood pressure among individuals with hypertension. In 2016, a meta-analysis (64 controlled studies, 71 interventions; $n = 23\ 444$) determining if dynamic resistance exercise alone could lower blood pressure to the level reported with aerobic exercise showed that dynamic resistance exercise programs reduced systolic and diastolic blood pressure by $-5.7 / -5.2$ mm Hg among adults with hypertension.²¹ Similar results were later reported in a network meta-analysis showing a -7.2 mm Hg (95% CI: -10.7 to -3.87) decrease in systolic blood pressure as a result of dynamic resistance exercise interventions in adults with hypertension.¹⁷

The magnitude of the ambulatory systolic blood pressure reduction reported in the Taati and colleagues⁶ study is impressive, especially since they enrolled women with blood pressure at baseline close to “normal” (office systolic blood pressure of the resistance exercise group: 135 mm Hg). It is important to note that the resting blood pressure level is moderator of the blood pressure response to exercise training. The exercise-induced decrease in blood pressure occurs in a dose-response fashion as a function of resting blood pressure, with the greatest reductions observed in individuals with higher resting blood pressure.^{17,20,23} This is clear in previous studies showing the largest blood pressure reductions

following dynamic resistance interventions in individuals with hypertension (−5.7/−5.2 mm Hg), compared to prehypertension (−3.0 / −3.3 mm Hg), and normal blood pressure (0.0 / −1.0 mm Hg).²¹ The study of Taati and colleagues⁶ by showing a decrease of −12.4 mm Hg in daytime ambulatory systolic blood pressure, raises another important question: Could dynamic resistant exercise be particularly effective in middle-aged women? The magnitude of the blood pressure reduction was remarkable in this study, increasing the therapeutic potential of dynamic resistance exercise in women, a topic that warrants further investigation.

This study is not without limitations as Taati and colleagues⁶ point out. Despite some limitations, the current contribution by Taati and colleagues⁶ in this issue of *The Journal of Clinical Hypertension* reinforces the effectiveness of resistance exercise as a stand-alone lifestyle therapy to improve blood pressure among women with high-normal/stage 1 hypertension.

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ORCID

Fernando Ribeiro  <https://orcid.org/0000-0001-9094-1493>

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