

Study evaluates guidelines for exercise for high blood pressure patients

24 September 2020, by Chl e Pinheiro



Brazilian researchers' finding that exercising in the evening reduces blood pressure more than in the morning can help health professionals choose the time of day for aerobic training depending on the type of anti-hypertensive drug they take. Credit: Leandro Campos de Brito / EEEF-USP

Researchers in the University of S o Paulo's School of Physical Education and Sports (EEFE-USP) in Brazil compared the effect of two widely used classes of anti-hypertensive drugs on post-exercise hypotension, an expected and beneficial fall in blood pressure after a session of aerobic exercise, especially in the late afternoon or early evening.

According to the researchers, the findings of their study can help health professionals choose the most beneficial time of day for patients to undergo physical therapy depending on the type of drug used to treat their high [blood pressure](#).

The strategy could be particularly advantageous for patients who do not respond well to treatment with medication. "People with resistant

hypertension, who take three or more types of drug, preferably including a diuretic, or four drugs or even more, without achieving the desired level of control may benefit by switching their [exercise session](#) to late in the day, subject to confirmation by further research," said Leandro Campos de Brito, a postdoctoral researcher at EEEF-USP's Exercise Hemodynamics Laboratory with a scholarship from FAPESP. Brito's research supervisor is Professor Cl udia L cia de Moraes Forjaz.

In this study, which was supported by FAPESP, the researchers compared the effect of angiotensin-2 receptor blockers (ARBs) and angiotensin-converting enzyme inhibitors (ACEIs) on patients who performed morning and evening exercise sessions.

Post-exercise blood [pressure](#) fell 11 millimeters of mercury (mmHg) in the evening and 6 mmHg in the morning on average in the group that took ARBs, and 6 mmHg and 8 mmHg respectively in the group that took ACEIs. Thus there was a difference of almost 50% in the evening values, while the morning values showed a similar drop for both groups.

The findings are published in the journal *Clinical and Experimental Hypertension*.

"Our hypothesis was that ACEIs attenuate post-exercise hypotension, especially in the evening," Brito said. "Our observation was that ACEIs did indeed attenuate the expected hypotensive effect of exercise in the evening, while ARBs did not."

The researchers reached this conclusion after submitting 29 men treated for [high blood pressure](#) with either ACEIs or ARBs for at least four months to two maximal cardiopulmonary exercise tests using a stationary ergometer exercise bicycle with increments of 15 watts per minute until they were unable to continue. The sessions took place from 7 am to 9 am and from 8 pm to 10 pm on two

different days with an interval of three to seven days between sessions. The order of execution was randomly determined, and the evaluators did not know which type of drug each volunteer was taking. Blood pressure was measured in the pre-exercise period and in the post-exercise period after 30 minutes of recovery.

Differences between ACEIs and ARBs

ACEIs and ARBs act on the same hypertension pathway by regulating angiotensin-2, a hormone that causes vasoconstriction (contracts the blood vessels) and raises blood pressure. The mechanisms are different, however. "Think of two freeways running alongside each other," Brito said. ARBs block angiotensin-2 receptors in blood vessels. ACEIs inhibit the enzyme responsible for converting angiotensin-1 into angiotensin-2.

"The one permits angiotensin-2's natural behavior in 24 hours but blocks its action. The other inhibits that behavior. In addition, by inhibiting this enzyme ACEIs chronically favor a different pathway that generates bradykinin and angiotensin-(1-7), both of which are vasodilators. Given that vasodilation has already been facilitated by the drug, this could reduce the vasodilatory effect of aerobic exercise, the main driver of the fall in blood pressure when the exercise training is performed in the evening," Brito said.

For this very reason, this drug class was expected to attenuate post-exercise hypotension, especially in the evening. The study did not set out to investigate the mechanism that causes the difference.

Influence of time of day

The study was part of Brito's Ph.D. research to estimate the effect of ten weeks of aerobic training at different times of day, concluding that the results were best in the evening. "In this study, we compared subjects treated with drugs for high blood pressure who performed exercise in the morning and others who trained in the evening," Brito said.

Researchers have increasingly discovered

significant variations depending on the time of day. "Our organism is guided by the circadian cycle, and blood pressure is no exception. The mechanisms that lower BP are more active in the evening to prepare us for rest, while those that raise it are more active in the morning when we wake up," Brito explained. "In other words, our theory is that the evening is a window of opportunity to achieve significant reductions."

Effects can be long-lasting

Anyone who does aerobic exercise should experience some degree of hypotension afterwards, but in people with high blood pressure, the drop is more significant. "Systolic pressure falls by 5 to 10 mmHg on average, and diastolic pressure by 4 to 6 mmHg, without negative symptoms such as nausea, lightheadedness or blurred vision," Brito said.

One exercise session is sufficient to produce a degree of cardiovascular protection, as studies have shown that the reduction can last all day. "Moreover, some research groups believe each exercise session acts like one brick in a wall in the sense that training has a chronic beneficial effect," he said.

In 2018, Brito and colleagues published a review article favoring this hypothesis in the *Journal of the American Society of Hypertension*.

Practical application

One of the strengths of this latest study is that the participants had been taking the medications for some time and the researchers were able to analyze the data in the patients' usual clinical context. "Other studies along these lines follow the 'washout' model, in which the patient is required to stop taking the medication for a period," Brito said.

Another positive point is that the scientists who measured the participants' [blood](#) pressure after the [exercise](#) sessions did not know which drug they were taking. This enhances the study's credibility and favors the practical application of its findings.

More information: Leandro C. Brito et al, Effects

of ACEi and ARB on post-exercise hypotension induced by exercises conducted at different times of day in hypertensive men, *Clinical and Experimental Hypertension* (2020). DOI: [10.1080/10641963.2020.1783546](https://doi.org/10.1080/10641963.2020.1783546)

Provided by FAPESP

APA citation: Study evaluates guidelines for exercise for high blood pressure patients (2020, September 24) retrieved 16 January 2021 from <https://medicalxpress.com/news/2020-09-guidelines-high-blood-pressure-patients.html>

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