

## Non-Pharmacological Treatment of Cardiovascular Disease | Importance of Physical Exercise

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Cardiovascular diseases are currently the major health problem and are directly involved in more than 17 million deaths each year, which represents 50% of all deaths from noncommunicable diseases.<sup>1</sup> In addition to their effects on individual well-being, cardiovascular diseases are responsible for a high economic impact. A recently published study showed that in Brazil, only four diseases – arterial hypertension, myocardial infarction, atrial fibrillation and heart failure – reached an estimated total financial cost of 56.2 billion reais in the year 2015.<sup>1</sup>

The treatment of cardiovascular diseases involves the use of specific drugs and adherence to non-pharmacological interventions.<sup>2</sup> This Editorial will be dedicated to the role of physical exercise in the treatment of cardiovascular diseases.

Brazil has a prominent position worldwide regarding the study of the effects of physical exercise in different clinical conditions. The practice of physical exercises has been recommended for decades for health promotion and treatment of several cardiovascular diseases. The regular practice of exercises results in several benefits, such as increased functional capacity and improved body composition, insulin resistance, endothelial function, arterial hypertension, antioxidant status, and quality of life.<sup>3-9</sup>

Concerning heart failure, exercises have been recommended for almost three decades in the treatment of stable patients. In addition to increasing effort tolerance, it improves the quality of life and reduces hospitalizations for heart failure.<sup>2</sup> Despite a large number of studies evaluating the effects of exercise, its influence on different situations of cardiac aggression has yet to be fully clarified.<sup>10</sup>

In articles recently published in this journal, the role of exercise and its molecular mechanisms of action have been evaluated in different heart disease experimental models.<sup>3,5,11-13</sup> The beneficial effects on cardiac remodeling have been frequently observed, such as attenuation of myocardial hypertrophy and left ventricular dysfunction.<sup>7,14</sup> However, unexpected results have drawn attention to the need for better clarification of the subject. For instance, Rodrigues et al.<sup>13</sup> submitted beta-adrenergic receptor knockout mice, which

may develop heart failure, to treadmill training for eight weeks. Surprisingly, the trained knockout animals showed a higher increase in functional capacity and myocardial contractility than the trained control animals. As an exaggerated contractility stimulus may lead to deterioration of cardiac function in the long-term, additional studies are required to define the role of exercise in cardiac function in beta-adrenergic receptor knockout mice in later life.

Topics of great uncertainty regarding exercise prescription include the intensity and duration of exercise. Recently, Ellingsen et al.<sup>15</sup> published the first multicenter randomized trial comparing the effects of high-intensity interval training (HIIT) with those of continuous training at moderate intensity or recommendation for regular exercises in patients with heart failure with reduced ejection fraction. In both specific training groups, the results were only moderately better than the recommendation for regular exercise. Moreover, 51% of patients in the HIIT group exercised below the prescribed heart rate, and 80% of the individuals from continuous training group at moderate intensity trained at a frequency above their target. Thus, considering that HIIT was not superior to the continuous training group at moderate intensity in reducing the remodeling process or improving clinical outcomes, and the difficulty in attaining adherence to the prescribed intensity, the authors recommend that continuous training at moderate intensity should remain as the standard modality for patients with chronic heart failure.

Another factor that remains to be clarified is whether the practice of exercise in short and intense periods repeated throughout the day, called accumulated exercise, can be an alternative for sedentary individuals. Martinez et al.<sup>16</sup> observed that both continuous and accumulated exercise improved the physical fitness of healthy rats. However, only the continuous exercise was able to reduce body weight gain and improve endothelial function. Aortas obtained from the group submitted to continuous exercise showed a reduction in the contractile response to norepinephrine and an increase in acetylcholine-induced relaxation, which was not observed in the group trained using accumulated exercise.<sup>16</sup>

A greater consensus is observed in the literature regarding the role of physical exercise on the vascular system. Lemos et al.<sup>12</sup> showed that regular aerobic exercise for nine weeks led to the attenuation of sympathetic activity and reduction in vascular resistance, thus contributing to a decrease in blood pressure in spontaneously hypertensive rats. Resistance training was also effective in improving the bradycardic response and baroreflex sensitivity of spontaneously hypertensive rats.<sup>11</sup> However, the fact that these effects were not accompanied by a reduction in systemic blood pressure<sup>11</sup> suggests that aerobic exercise is superior to resistance training for arterial hypertension control.

### Keywords

Cardiovascular Diseases; Heart Failure; Exercise/prevention and control; Physical Fitness; Ventricular Remodeling; Quality of Life.

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Despite the great advances regarding the understanding of physical exercise effects on the healthy cardiovascular system or that submitted to different types of aggression, we are still far from clarifying the physical exercise mechanisms of action and from scientifically defining the best prescription for patients with cardiovascular disease.

## References

1. Stevens B, Pezzullo L, Verdian L, Tomllison J, George A, Bacal F. et al. The economic burden of heart conditions in Brazil. *Arq Bras Cardiol.* 2018;111(1):29-36.
2. Comitê Coordenador de Cardiologia; Rohde LEP, Montera MW, Bocchi EA, Colanfranceschi AS, Freitas A, Frazz AS, et al. Diretriz brasileira de insuficiência cardíaca crônica e aguda. *Arq Bras Cardiol.* 2018;111(3):436-539.
3. Winter SCN, Macedo RM, Francisco JC, Santos PC, Lopes APS, Meira LF, et al. Impact of a high-intensity training on ventricular function in rats after acute myocardial infarction. *Arq Bras Cardiol.* 2018;110(4):373-80.
4. Ghorbanzadeh V, Mohammadi M, Dariushnejad H, Abhari A, Chodanai L, Mohaddes G. Cardioprotective effect of crocin combined with voluntary exercise in rat: Role of Mir-126 and Mir-210 in heart angiogenesis. *Arq Bras Cardiol.* 2017; 109(1):54-62.
5. Naderi R, Mohaddes G, Mohammadi M, Alihemmati A, Khamaneh A, Ghyasi R, et al. The effect of garlic and voluntary exercise on cardiac angiogenesis in diabetes: The role of Mir-126 and Mir-210. *Arq Bras Cardiol.* 2019;112(2):154-62.
6. Gomes MJ, Martinez PF, Campos DHS, Pagan LV, Bonomo C Lima AR, et al. Beneficial effects of physical exercise on functional capacity and skeletal muscle oxidative stress in rats with aortic stenosis-induced heart failure. *Oxid Med Cell Longev.* 2016;2016:8695716.
7. Pagan LU, Damatto RL, Cezar MD, Lima AR, Bonomo C, Campos DH, et al. Long-term low intensity physical exercise attenuates heart failure development in aging spontaneously hypertensive rats. *Cell Physiol Biochem.* 2015;36(1):61-74.
8. Gomes MJ, Martinez PF, Pagan LU, Damatto RL, Cezar MDM, Lima Ar, et al. Skeletal muscle aging: Influence of oxidative stress and physical exercise. *Oncotarget.* 2017;8(12):1235-45.
9. Reyes DRA, Gomes MJ, Rosa CM, Pagan LU, Zanati SC, Damatto RL, et al. Exercise during transition from compensated left ventricular hypertrophy to heart failure in aortic stenosis rats. *J Cell Mol Med.* 2019;23(2):1235-45.
10. Cattadori G, Segurini C, Picozzi A, Padeletti L, Anzà C. Exercise and heart failure: An update. *ESC Heart Fail.* 2018;5(2):222-32.
11. Gomes MFP, Borges ME, Rossi VA, et al. The effect of physical resistance training on baroreflex sensitivity of hypertensive rats. *Arq Bras Cardiol.* 2017; 108(6):539-45.
12. Lemos MP, Mota GRD, Marocolo M, Moura EOC, Medeiros A. Exercise training attenuates sympathetic activity and improves morphometry of splenic arterioles in spontaneously hypertensive rats. *Arq Bras Cardiol.* 2018;110(3):263-9.
13. Rodrigues AC, Natali AJ, Cunha DN, Costa AJ, Moura AC, Araujo Carneiro JR, M, et al. Moderate continuous aerobic exercise training improves cardiomyocyte contractility in  $\beta$ 1 adrenergic receptor knockout mice. *Arq Bras Cardiol.* 2018; 110(3):256-62.
14. Cai M, Wang Q, Liu Z, Jia D, Feng R, Tian Z. Effects of different types of exercise on skeletal muscle atrophy, antioxidant capacity and growth factors expression following myocardial infarction. *Life Sci.* 2018 Nov 15;213:40-9.
15. Ellingsen O, Halle M, Conraads V, Stevien A, dalin N, Delagardelle C, et al. SMART-EX Heart Failure Study (Study of Myocardial Recovery After Exercise Training in Heart Failure) Group. High-intensity interval training in patients with heart failure with reduced ejection fraction. *Circulation.* 2017; 135(9):839-49.
16. Martinez JE, Taieiro EF, Chies AB. Effects of continuous and accumulated exercise on endothelial function in rat aorta. *Arq Bras Cardiol.* 2017;108(4):315-22.

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