

Effects of moderate-intensity intermittent hypoxic training on health outcomes of patients recovered from COVID-19: the AEROBICOVID study protocol for a randomized controlled trial

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Abstract

Background: Recent studies point to a lower number and reduced severity of cases in higher altitude cities with decreased oxygen concentration. Specific literature has shown several benefits of physical training, so, in this sense, physical training with hypoxic stimulus appears as an alternative that supports the conventional treatments of the COVID-19 patient's recovery. Thus, this study's primary aim is to analyze the effects of moderate-intensity intermittent hypoxic training on health outcomes in COVID-19 recovered patients. **Methods:** A clinical trial controlled double-blind study was designed. Participants (30–69 years old) will be recruited among those with moderate to severe COVID-19 symptoms, approximately 30 days after recovery. They will be included in groups according to the training (T) and recovery (R) association with hypoxia (H) or normoxia (N): (a) T_H:R_H, (b) T_N:R_H, (c) T_N:R_N, and last (d) the control group. The 8-week exercise bike intervention will be carried out with a gradual load increase according to the established periods, three times a week in sets of 5 min, 90 to 100% of the anaerobic threshold (AT), and a 2.5-min break. Blood will be collected for genotyping. First, after 4 weeks (partial), after 8 weeks, and later, 4 weeks after the end of the physical training intervention, participants will perform assessments. The primary outcome is the maximum oxygen consumption (VO_{2peak}). The secondary outcomes include lung function, inflammatory mediators, hematological, autonomic parameters, AT, body composition analysis, quality of life, mental health, anthropometric measurements, and physical fitness. The statistical analysis will be executed using the linear regression model with mixed effects at a 5% significance level. **Discussion:** This study is designed to provide evidence to support the clinical benefits of moderate-intensity intermittent hypoxic training as a part of the treatment of patients recovered from COVID-19. It may also provide evidence on the efficacy and

safety of intermittent hypoxic training in different health conditions. Lastly, this study presents an innovative strategy enabling up to 16 participants in the same training session. Trial registration: ClinicalTrials.gov RBR-5d7hkv. Registered after the start of inclusion on 3 November 2020 with the Brazilian Clinical Trials Registry © 2021, The Author(s).

Author keywords

Exercise; Hypoxia-inducible factor 1 alpha subunit; Inflammation; Respiratory function tests; SARS virus