

## **Is a Two-Day Cardiopulmonary Exercise Test a Valid Tool for The Diagnosis of Post-Exertional Malaise in Long COVID?**

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### **ABSTRACT**

A two-day cardiopulmonary exercise testing (CPET) protocol (maximal ramp-incremental cycle test repeated 24hr apart) in myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS) patients has suggested that day-2 performance is decreased relative to day-1. This difference has been attributed to post-exertional malaise (PEM), suggesting the two-day CPET as a protocol to investigate PEM in Long COVID (LC) patients.

**PURPOSE:** We aimed to investigate any effects of PEM on exercise performance and cardiorespiratory and perceptual responses to a two-day CPET in LC patients to determine whether the day-1 CPET would impair performance, cardiorespiratory responses or perceptions of exercise at day-2. **METHODS:** Fifteen LC patients with one or more symptoms persisting for more than three months after their initial infection [n=7 females; n=1 hospitalized; mean(SD); age 53(11) yrs; body mass index 32.2(8.5) kg/m<sup>2</sup>; time between COVID-19 onset and CPET 13(7) months; forced expiratory volume in 1 second 89(15) %pred; forced vital capacity 92(14) %pred; diffusing capacity of the lungs for carbon monoxide 92(15) %pred; total lung capacity 86(12) %pred] were studied. Prior to any exercise testing, PEM was assessed relative to the past six months using the modified DePaul Symptom Questionnaire (mDSQ) (0-4 symptoms frequency and severity scores). Each performed a two-day CPET protocol; ramp was 10-20 W/min, with the same ramp rate used for the day-1 and day-2 CPET. Peak oxygen uptake, peak work rate, and gas exchange threshold were measured using standard techniques. Ratings of perceived dyspnea and leg effort during cycling were recorded at peak exercise using the modified Borg's Scale (0-10). One-sample t-tests were used to assess significance of test-retest mean difference. **RESULTS:** The mDSQ indicated the presence of PEM symptoms in 80% of participants. However, no significant differences between day-1 and day-2 CPET were found in any of the variables assessed. **CONCLUSION:** The absence of any difference in cardiorespiratory and perceptual responses in 2-day CPET testing, despite patient reported presence of PEM symptoms, suggests that the two-day CPET protocol may not be a valid tool for the diagnosis of PEM in LC patients.