The Effects of a Prior Exercise Bout on the Energetic and Cardiometabolic Responses to Acute Mental Stress

Gabriel ZIEFF, William NIEMEYER, Erik D. HANSON, Claudio BATTAGLINI, Michelle L. MEYER, Herman PONTZER, Lee STONER

Methods

Study Design

• Two randomized cross-over trials (RCT)
  • RCT 1: Stress vs. Control (No Stress)
  • RCT 2: Exercise + Stress vs. Exercise + Control (No Stress)

Participants/ Sampling

• RCT 1: n=20, 21.0 (2.5) years, 55% F, 23.6 (4) kg/m^2
  • RCT 2: n=20, 20.0 (1.9) years, 60% F, 24.2 (4.5) kg/m^2

Primary Outcomes

• Energy Expenditure (Indirect calorimetry; kcal/kg/min)
• Arterial Stiffness (Pulse-wave velocity [PWV]; m/s)

Figure 1. Schematic of Lab Visits in RCT 1 (A) and RCT 2 (B)

Acute Lab Stressor (RCT 1 and RCT 2): Trier Social Stress Test

• 10-min psychosocial task
• 5-min mock job interview + 5-min mental math
• Uses social evaluative pressure and elements of uncertainty/surprise to induce stress

Whole-body Aerobic Exercise (RCT 2 only)

• 25 minutes elliptical exercise using arms and legs
• Moderate-intensity (55-70% heart rate reserve)

Analysis

• Mixed model regression: condition x time interactions

Results

RCT 1:

Arterial Stiffness

• Small interactions for PWV (B=0.68 m/s, 95% CI: 0.39, 0.97)
  • Stress: ↑0.81 m/s, Control: ↑0.15 m/s

Energy Expenditure

• Small interactions for EE (B=0.0010 kcal/kg/min, 95% CI: 0.0004, 0.001)
  • Stress: ↑0.0016 kcal/kg/min, Control: ↑0.0005 kcal/kg/min

RCT 2:

Arterial Stiffness

• Small interactions for PWV (B=0.47 m/s, 95% CI: 0.21, 0.72)
  • Stress: ↑0.43 m/s, Control: ↓0.05 m/s

Energy Expenditure

• No interaction effect
  • Small main effects of condition (B=0.0005 kcal/kg/min, 95% CI: 0.0003, 0.0008) and time (B=0.0011 kcal/kg/min, 95% CI: 0.0006, 0.0016)

Comparing RCT 1 and 2

Figure 2. Prior exercise dampened the arterial stiffness (A) and energy expenditure (B) responses

Problem

Mental stress is associated with cardiovascular disease (CVD) risk, but the arterial stiffness and energy expenditure (EE) responses to acute mental stress, and whether prior exercise impacts post-stress cardiometabolic reactivity are not known.

Objective

To assess arterial stiffness and EE responses to acute mental stress and to determine the impact of a prior exercise bout on these responses

Take Home

Arterial stiffness and EE may be key players in the relationship between mental stress and CVD risk. Exercise may beneficially moderate this relationship.