CARDOVASCULAR AND BLOOD OXIDATIVE STRESS RESPONSES TO EXERCISE AND ACUTE WOODSMOKE EXPOSURE IN ACTIVE INDIVIDUALS


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ABSTRACT

Wildland firefighters and those who recreate outdoors experience woodsmoke exposure during fire season. There is a rationale to indicate that concurrent exercise and woodsmoke exposure are deleterious to cardiovascular function, but the short-term underpinnings are currently understudied. PURPOSE: The purpose of the laboratory-based study was the examination of the concurrent effects of exercise and woodsmoke exposure on acute indicators of cardiovascular function, including heart rate variability (HRV), pulse wave velocity (PWV), blood pressure (BP), augmentation index (Alx), and blood oxidative stress. METHODS: Ten recreationally active participants performed two moderate-intensity exercise (70% VO2peak) trials (Clean Air 0µg/m3 and Woodsmoke 250µg/m3) in a randomized, crossover design. HRV, PWV, BP, Alx, and blood oxidative stress were measured at PRE, POST, and 90-minutes post-exercise for each trial. Blood oxidative stress was quantified through lipid damage (LOOH, 8-ISO), protein damage (3-NT and PC), antioxidant capacity (TEAC), and antioxidant potential (FRAP). RESULTS: HRV, PWV, BP, Alx, and oxidative stress were unaffected by woodsmoke exposure (p>0.05). CONCLUSION: Moderate-intensity aerobic exercise while exposed to woodsmoke particulate matter (250µg/m3) did not alter HRV, PWV, or blood oxidative stress.

INTRODUCTION

• Smoke inhalation from biomass combustion continues to be a significant public health problem across the United States (US), particularly in heavily forested regions of the west [1].
• Health dangers are associated with the inhalation of biomass particulate matter (PM); with attention focused on the potential impact of airborne molecules ≏ 2.5 µm in diameter (PM2.5).
• Populations frequently impacted by wildfire-generated PM2.5 include wildland firefighters (WLFF) and those who exercise and recreate outside within smoke affected regions [2].
• Aerobic exercise produces high ventilatory rates that elevates the inhaled PM2.5 dose.
• Disease-causing physiologic mechanisms include the potential that acute smoke inhalation perturbs cardiovascular control (PWV, Alx, SBP, DBP), spikes circulating markers of oxidative stress (LOOH, 8-ISO, 3-NT, PC, TEAC, FRAP), and impacts autonomic balance (lnRMSSD, lnHF, lnLF, lnRMSSD) [3].

PURPOSE

• Purpose: to examine the concurrent effect of exercise and woodsmoke inhalation on variables of cardiovascular and autonomic function in addition to markers of blood oxidative stress.

METHODS

Pre 45-min at 75% VO2peak Post 90-min Post

• Ten recreationally active participants (males: n=7, females=3, age=30 ± 3 years) performed two moderate-intensity exercise (70% VO2peak) trials (Clean Air 0µg/m3 and Woodsmoke 250µg/m3).
• Participants were tested on two occasions with data collection beginning between the hours of 6:00 AM and 9:00 AM.
• Participants were asked to arrive at the laboratory following an overnight fast, having abstained from alcohol for 24-hours, and caffeine for 12-hours.
• Collection of Cardiovascular Function Measurements and Biomarkers:
  - HRV was assessed via a 10-minute recording in supine position using an electrocardiogram.
  - PWV, SBP and DBP were measured using Sphygmocor.
  - Plasma samples for markers of oxidative stress were collected via venipuncture at the antecubital space and later assayed.
  - Samples for all markers were collected before exercise (PRE), immediately following exercise (POST) and 90-minutes after exercise (90-P).
• 2 x 3 repeated measures ANOVA were performed to examine differences between the trials of all markers.

RESULTS

Cardiovascular Function Measurements

• Moderate-intensity exercise did not result in any smoke-dependent alterations in autonomic recovery, cardiovascular function, or blood oxidative stress.
• Future research should seek to determine whether or not differences in exercise intensity, duration, and frequency can impact smoke-dependent physiological alterations in response to concurrent exercise and exposure.

REFERENCES

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