Sex Differences in Cardiovascular and Subjective Stress Reactions: Prospective Evidence in a Realistic Military Setting

Marcus K. Taylor, PhD1, Gerald E. Larson, PhD1, Melissa D. Hiller Lauby, PhD2, Genieleah A. Padilla, BA1, Ingrid E. Wilson, MS, MA1, Emily A. Schmied, MPH1, Robyn M. Highfill-McRoy, MPH1, Charles A. Morgan III, MD3,4

- This study characterized sex differences in cardiovascular and subjective stress reactions among military survival trainees.
- Females showed greater residual elevation in systolic blood pressure (SBP) during recovery and reported greater psychological impact of mock captivity than males.
- This may elucidate sex differences in posttraumatic stress development (PTSD).

**BACKGROUND & PURPOSE**

- Heightened physiological arousal in response to acute stress exposure is both a prospective marker and core characteristic of PTSD.1-2
- Growing evidence suggests males and females exhibit different patterns of acute stress response, which may explain sex differences in PTSD development.3-4 However, the available research is largely from controlled, laboratory studies.
- Military survival school provides an ideal setting to examine sex differences in acute stress reactions under standardized and highly realistic conditions.
- The purpose of this study was to evaluate sex differences in cardiovascular and subjective stress reactions in military survival school trainees.

**METHODS**

- **Participants.** 185 (77.8% male) healthy, active-duty military personnel attending military survival school (mean ± SD age = 25.2 ± 4.4 years).
- **Measures.** Physiological and self-report data were collected at three time points: T1 (1st day of the academic phase of survival training, T2 directly after a stressful mock-captivity event, T3) approximately 24 hours after release from mock captivity (see Figure 1 for timeline).
- **Physiological measures (T1, T2, T3):** heart rate (HR), SBP, diastolic blood pressure (DBP), tympanic temperature, arterial peripheral oxygen saturation (SpO2).
- **Self-report measures (T1, T2, T3, unless otherwise noted):** psychological impact5, dissociative states6, perceived stress (T1), locus of control (T1), prior trauma (T1), dispositional resilience (T1), personal and service characteristics (T1).
- **Analysis.** Descriptive statistics, repeated measures Analysis of Covariance (ANCOVA); Bonferroni corrections were implemented for all comparisons at 0.05/3 = 0.017.

**RESULTS**

- No sex differences were observed for dissociative states or HR reactivity, recovery, or residual elevation (p > 0.017).
- Females exhibited significantly lower DBP (F1,162 = 8.2, p < 0.017, ηp² = 0.05), although no sex differences were observed for reactivity, recovery, or residual elevation (p > 0.017).
- Females had lower SBP than males at all three time points (F1,7,260.4) = 4.2, p < 0.05, ηp² = 0.03), but showed greater residual elevation in SBP (relative T1-T3Δ). F1,159) = 12.1, p < 0.017, ηp² = 0.07)
- Females reported greater psychological impact of mock captivity than males (F1,177) = 8.2, p < 0.05, ηp² = 0.04).
- No sex differences were observed for dissociative states or HR reactivity, recovery, or residual elevation (p > 0.017).
- Exploratory causal steps modeling suggested stress-induced HR may partially mediate sex differences in psychological impact of acute stress.

**CONCLUSIONS**

- This study demonstrated sex-specific cardiovascular stress reactions in military personnel, along with greater psychological impact of stress exposure in females.
- Results of this study may help to elucidate sex differences in physiological response to trauma and development of posttraumatic stress.
- Future studies continuing this line of research would benefit from collecting additional cardiovascular metrics, including cardiac output, stroke volume, peripheral resistance, and pre-ejection period.

**REFERENCES**