

D. E. Gonzalez¹, K. Hines¹, R. Sowinski¹, C. Rasmussen¹, N. Barringer², & R. B. Kreider¹

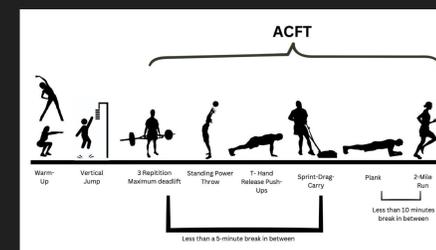
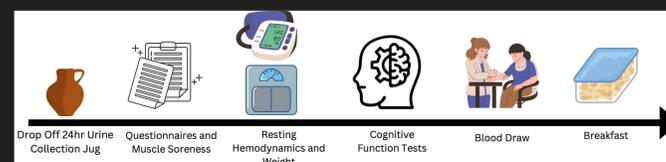
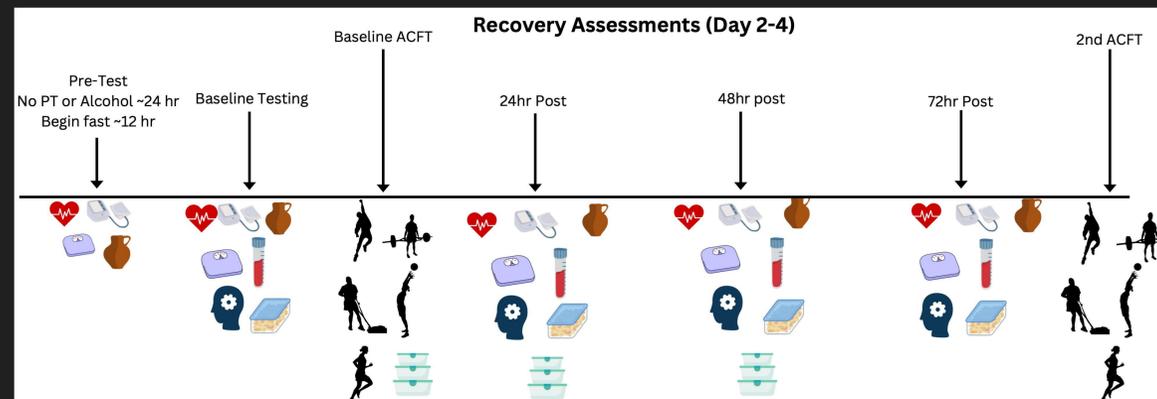
¹Exercise & Sport Nutrition Lab, Texas A&M University, College Station, TX, USA;

²Lionel University, Carpinteria CA, USA;

Abstract

Purpose: This study assessed the sex differences in recovery from performing the Army Combat Fitness Test (ACFT) while consuming military-style meals-ready-to-eat (MRE) for 3 days. **Materials and Methods:** Twenty-three (n=23, 17 males and 6 females) Corps of Cadet members participated in the study. Participants reported to the lab in a fasted state, donated a 24h urine and fasted blood sample, had their muscle soreness assessed, and consumed an MRE meal (≈1,250 kcals, 145 g carbohydrate, 45 g protein, 60 g fat) for breakfast on the baseline (BL) testing day. After four hours, participants performed a standard ACFT. Participants returned fasted to the lab daily at 0600 with 24h urine samples after 24h and 48h and were given an MRE for breakfast and two for lunch and dinner. On the third day, participants returned to consume an MRE breakfast, donated a 24h urine and fasted blood sample, had their muscle soreness assessed, and repeated the ACFT four hours later. Blood and urine samples were assessed for biomarkers of catabolism. Muscle soreness was assessed using an algometer in three sites on the thigh. Data were analyzed using either 1) general linear model statistics with repeated measures, mean percent changes from baseline (BL) with 95% confidence intervals and partial eta-squared effect size, or 2) an independent t-test with Cohen's d effects size. **Results:** Percent change from BL analysis (Figure 1) showed the females had lower testosterone levels at 24h (-12.3% [-24.1, -0.6], p=0.039) and 48h (-13.2% [-25.5, -1.0], p=0.035). Percent change from BL also showed the females had higher levels of muscle soreness at 24h (281.3% [8.3, 554.3], p=0.044) and 48h (400.2% [19.9, 554.3], p=0.041). For the urine biomarkers, univariate analysis showed a time x sex effect for creatinine (p=0.018, $\eta_p^2=0.146$), wherein the males displayed higher values at 24h (p=0.034, $\eta_p^2=0.196$) and 48h (p=0.013, $\eta_p^2=0.258$) than the females. Percent change from BL analysis showed females had higher urine nitrogen at 48h (47.0% [3.2, 90.9], p=0.036). There were differences between the sexes for relative protein intake (p<0.001, d=-2.273), wherein males consumed 1.65 g/kg/d while females consumed 2.06 g/kg/d. **Conclusions:** Results indicate that males recover better than females despite females having a greater relative protein intake. This may be attributed to the greater relative ACFT load, promoting more protein degradation among females than males. **Practical Application:** These data provide insight into the sex differences in recovery following the ACFT. Professionals working with military personnel may prioritize dietary strategies, such as ensuring high-quality proteins are consumed to promote recovery, especially among females.

Experimental Design



Background

The current ACFT utilizes an age and sex based scoring stratification to account for physiological differences to allow for equal access to advancement and individualized assessment of physical fitness level. With the recent memorandum issued by the Secretary of Defense to re-examine the fitness standards used in the military, it is important to understand how men and women recover differently from the ACFT as it is both a fitness standard and predictor of occupational performance. The introduction of the new Army Fitness Test (AFT) removes the standing power throw and gender based scoring for combat roles, but maintains the other five events. Therefore, analyzing the differences in recovery from the ACFT may provide valuable insight to the AFT, as both assessments are comprised of identical events. Additionally, this investigation may enhance understanding of sex-based differences in recovery from occupational tasks due to the correlation between the ACFT and occupational tasks.

Methods

- Randomized, double-blind, placebo-controlled, and crossover design.
- 23 TAMU Corps of Cadet members (17 men and 6 women) were recruited.
- Consumed pork- or plant-based MREs over a 3 day period.
- Completed a battery of questionnaires and cognitive testing, had their subjective muscle soreness assessed with an algometer and VAS rating scale, and donated a fasting (>12 hour) blood.
- Performed ACFT on baseline day and 72 hours later.
- Recovery assessed at 24, 48, and 72 hours.

Statistical Analysis

Data were analyzed by General Linear Model (GLM) univariate analyses with repeated measures using weight as a covariate and mean and percent changes from baseline with 95% confidence intervals.

Results

The females had lower testosterone levels at 24h (-12.3% [-24.1, -0.6], p=0.039) and 48h (-13.2% [-25.5, -1.0], p=0.035) and higher levels of muscle soreness at 24h (281.3% [8.3, 554.3], p=0.044) and 48h (400.2% [19.9, 554.3], p=0.041). The males displayed higher values at 24h (p=0.034, $\eta_p^2=0.196$) and 48h (p=0.013, $\eta_p^2=0.258$) than the females in terms of urine creatinine. The females had higher urine nitrogen at 48h (47.0% [3.2, 90.9], p=0.036). There were differences between the sexes for relative protein intake (p<0.001, d=-2.273), wherein males consumed 1.65 g/kg/d while females consumed 2.06 g/kg/d.

Conclusions

Results indicate that males recover better than females despite females having a greater relative protein intake. This may be attributed to the greater relative ACFT load, promoting more protein degradation among females than males.

Practical Application

These data provide insight into the sex differences in recovery following the ACFT. Professionals working with military personnel may prioritize dietary strategies, such as ensuring high-quality proteins are consumed to promote recovery, especially among females.

Acknowledgements

This study was funded by the United States Department of Agriculture (USDA) National Pork Board as part of a Department of Defense subaward to Texas A&M University (M2401649).

Figures

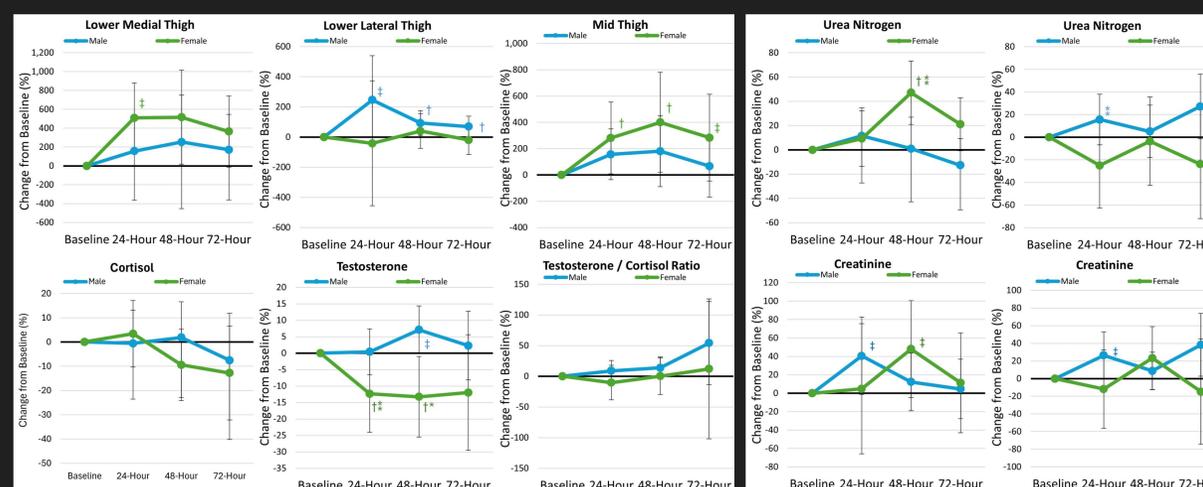


Figure 1 & 2: Army Combat Fitness Test, percent change from baseline analysis results. † = p ≤ 0.05 difference from baseline; ‡ = p ≥ 0.05 - p < 0.10 difference from baseline; * p < 0.05 difference between sex; ‡* p > 0.05 to < 0.05 difference between sex.

