



SEX DIFFERENCES IN ROTC ACFT PERFORMANCE: EXPLORING NORMALIZATION METHODS

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Introduction

- Accurate assessment of physical fitness is critical in military context, where peak performance is essential for operational readiness.
- The recently introduced Army Combat Fitness Test (ACFT) emphasizes power and strength.
- Failure on the ACFT may result in punitive measures, while high scores can be advantageous.
- Understanding sex differences in ACFT performance due to physiological differences is needed to guide exercise program development.
- Normalization methods are commonly employed to interpret performance relative to body composition (BC)

Purpose

To assess the effects of normalization approaches on sex differences in ACFT performance among US Army Reserve Officers' Training Corps (ROTC) cadets.

Methods

- 73 male (age=21.5±3.8 yrs, mass=79.7± 3.1kg, BF%=18.6±5.6) and 24 female (age=19.5±1.3yrs, mass=63.5±8.6kg, BF%=25.1±4.8) ROTC cadets completed the ACFT.
- BF% was collected before using a handheld bioimpedance device.
- Performance on each event was normalized to total mass, FFM index (FFMI) calculated as FFM/height(cm)², fat free mass (FFM), and FFM to fat mass ratio (FFM:FM).
- Student's t-tests were computed for each event between sexes and for each normalization method. α was set to 0.002 following Bonferroni correction.

Key Findings

- Males generally outperform females except for plank in absolute performance
- When normalized, particularly to fat free mass/fat mass ratio, differences decrease for deadlift, power throw and push-ups

Results

- Without normalization (figure 1), large differences (p<0.002) existed between sexes on MDL, SPT, SDC, HRP, and 2MR with the PLK the only event with no sex differences (p=0.358).
- When normalized to FFM:FM there are no sex differences for MDL (p=0.373) or SPT (p=0.168).
- Sex differences remain across all normalization methods for both SDC and 2MR (p<0.002).
- All normalization methods reduce differences in HRP [total mass (p=0.984), FFMI (p=0.239), FFM (p=0.234), and FFM:FM (p=0.175)].
- Sex differences increase when PLK is normalized to FFM:FM (p<0.002, d=-0.82) and FFM (p=0.004, d=-0.70).

Summary and Conclusion

- Sex differences are observed in absolute performance on all ACFT events, except for PLK
- While males generally outperforming females, when normalized, particularly to FFM:FM, differences lessen for MDL, SPT, and HRP.

Practical Applications

- When analyzing disparities in ACFT performance between sexes, it's important to choose normalization methods that factor in BC variables.
- Regardless of sex, understanding the impact of BC on ACFT performance can aid designing exercise programs and monitoring their effectiveness.

Figure 1: Sex differences (Effect sizes and t scores) across different normalization methods

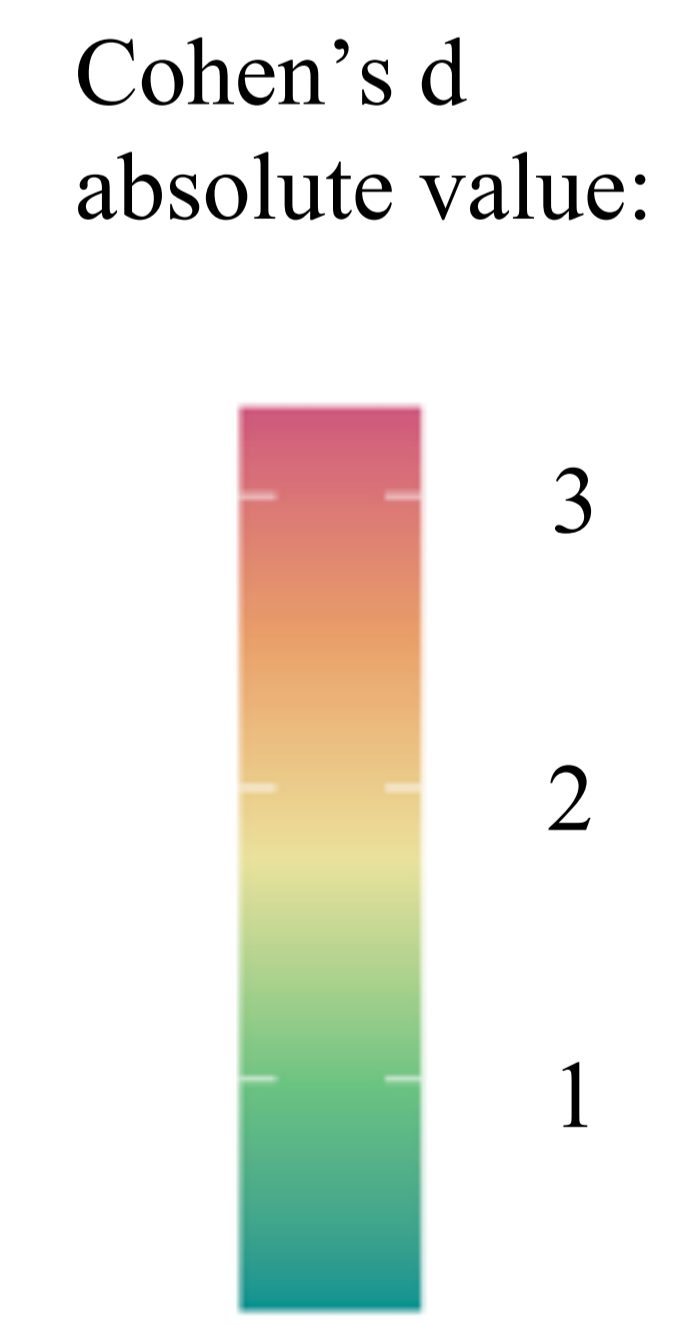
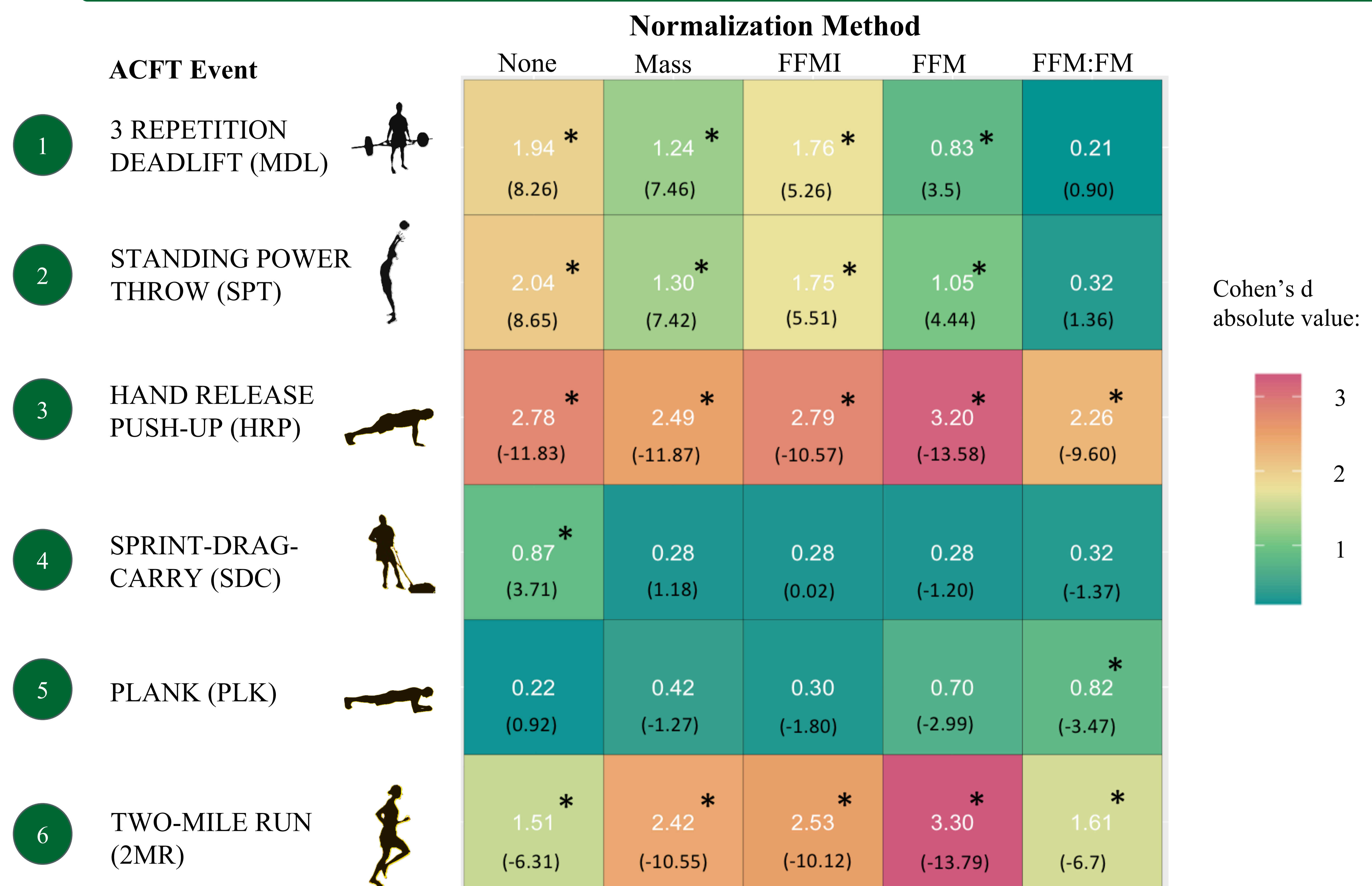


Figure 1: Sex differences in ACFT components across different normalization methods. Values in white are Cohen's d effect sizes (absolute values) where the highest scores indicated by more red cells and lowest in more green cells. The t value is indicated in parenthesis. To protect from type 1 error, a Bonferroni correction was applied to the original 0.05 alpha, and it is now set at 0.002. * p < 0.002. Abbreviations: ACFT: Army Combat Fitness Test, MDL: 3 Repetition Maximum Deadlift, SPT: Standing Power Throw, HRP: Hand-Release Push-up, SDC: Sprint- Drag-Carry, PLK: Plank Hold Time, 2MR: 2 Mile Run, FFM: Fat Free Mass, FFMI: Fat Free Mass Index, FFM:FM: Fat Free Mass to Fat Mass ratio.



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