

# Lower Body Functional Performance is Associated with Pain Interference and Pain Intensity for Women in High-Stress Occupations

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## BACKGROUND

- Musculoskeletal pain is common in tactical populations, and tactical personnel often work despite pain. If pain compromises operational readiness through reduced physical task performance or decision-making, there may be catastrophic consequences.
- Muscular strength and power are critical for occupational performance, but their connection with physical pain is unclear, especially for female tactical athletes.

**Purpose:** To evaluate associations between muscular strength and power with self-reported pain interference and pain intensity for women in high-stress occupations.

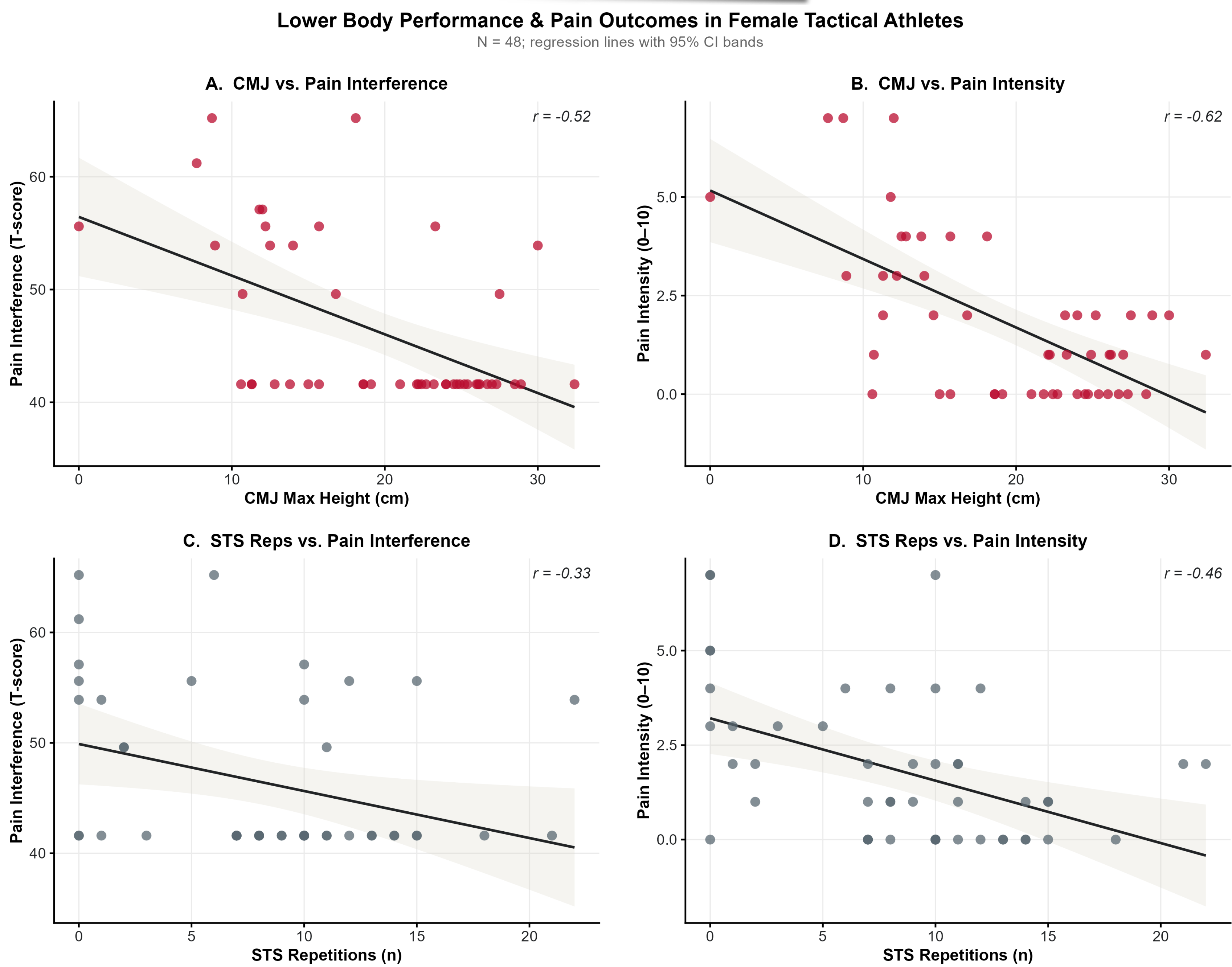
## METHODS

- Participants:** Fifty-one women in high-stress occupations (i.e., law enforcement [n=36], fire/EMS [n=14], and military personnel [n=1]) completed physical performance testing and patient-reported outcome measures (37.9 ± 10.8 years; BMI 27.2 ± 3.8 kg/m<sup>2</sup>).
- Physical Performance Assessments:**
  - Lower-body power was measured as the highest jump height (cm) from three maximal-effort countermovement jump (CMJ) repetitions performed on force plates. Participants completed the CMJs with their hands on hips.
  - Lower-body functional strength/endurance was assessed using a 30-second single-leg sit-to-stand (STS) test. Participants completed as many repetitions as possible during a 30-second trial. The total number of completed repetitions was recorded.
- Pain Measures:**
  - Pain interference was assessed using the 4-item PROMIS-29 Pain Interference domain. Raw scores were converted to standardized T-scores (score of 50 = the U.S. population average; higher scores = greater pain-related interference with daily activities).
  - Pain intensity was assessed using the PROMIS Global Health pain item, which rates average pain during the past 7 days on a 0–10 scale (higher values = greater pain severity).
- Statistical Analysis:** Descriptive statistics were calculated for all study variables, and Pearson correlations characterized relationships between physical performance and pain outcomes. Two multiple linear regression models were constructed to evaluate associations between lower-body performance and pain outcomes, controlling for age and BMI. Statistical significance was set at  $\alpha = 0.05$ .

## KEY TAKEAWAY

Greater lower body power was associated with lower pain intensity, while higher BMI was associated with greater pain interference.

## RESULTS



**Bivariate analyses demonstrated inverse associations between physical performance and pain outcomes.** CMJ height was moderately associated with lower pain interference ( $r = -0.52$ ) and lower pain intensity ( $r = -0.62$ ), whereas STS performance demonstrated weaker associations with pain interference ( $r = -0.33$ ) and pain intensity ( $r = -0.46$ ).

**Both regression models were significant after adjustment for age and BMI:**

- Pain Interference model: Adjusted  $R^2 = 0.300$ ,  $F(4,43) = 6.037$ ,  $p = 0.0006$ .
- Pain Intensity model: Adjusted  $R^2 = 0.346$ ,  $F(4,45) = 7.471$ ,  $p = 0.0001$ .

Table 1. Multiple Linear Regression Models Predicting Pain Outcomes.

| Outcome           | Predictor                | $\beta$ (95% CI)              | Std. $\beta$ | p-value      |
|-------------------|--------------------------|-------------------------------|--------------|--------------|
| Pain Interference | CMJ Max Height (cm)      | -0.330 (-0.745 to 0.094)      | -0.330       | 0.123        |
|                   | STS Repetitions (n)      | 0.037 (-0.431 to 0.506)       | 0.029        | 0.873        |
|                   | Age (years)              | 0.135 (-0.064 to 0.334)       | 0.198        | 0.178        |
|                   | BMI (kg/m <sup>2</sup> ) | <b>0.554 (0.038 to 1.069)</b> | <b>0.295</b> | <b>0.036</b> |
|                   |                          |                               |              |              |
| Pain Intensity    | CMJ Max Height (cm)      | -0.149 (-0.260 to -0.037)     | -0.533       | <b>0.010</b> |
|                   | STS Repetitions (n)      | -0.018 (-0.140 to 0.104)      | -0.049       | 0.772        |
|                   | Age (years)              | 0.004 (-0.048 to 0.055)       | 0.019        | 0.892        |
|                   | BMI (kg/m <sup>2</sup> ) | 0.060 (-0.076 to 0.197)       | 0.115        | 0.377        |
|                   |                          |                               |              |              |

Models adjusted for age and BMI.  $\beta$  = unstandardized regression coefficient; Std.  $\beta$  = standardized regression coefficient; CI = confidence interval; CMJ = countermovement jump; STS = single-leg sit-to-stand. Bold values indicate  $p < 0.05$ .

## DISCUSSION AND CONCLUSIONS

- CMJ demonstrated stronger associations with pain outcomes than STS performance.** Tests of lower body power (i.e., CMJ) may be more sensitive indicators of musculoskeletal health for female tactical athletes as compared to functional movements (i.e., STS).
- Higher BMI was associated with greater pain interference;** however, the direction of this relationship remains unclear. Increased BMI may elevate injury risk and thereby pain. Conversely, pain-related limitations in daily activities may contribute to increases in BMI.
- Seven participants (13.7%) were unable to perform a single STS repetition.** This lack of functional capacity emphasizes the need for individualized approaches to strength and conditioning.
- Substantial floor effects were observed for both pain measures.** Over half of participants (51%) reported the minimum possible PROMIS Pain Interference T-score, and nearly one-third (31%) reported no pain, demonstrating the variability in pain experiences among women in high-stress occupations. These floor effects may have reduced the ability to detect stronger pain and physical performance associations.
- These findings emphasize the heterogeneity of female tactical personnel and support individualized approaches to training, rehabilitation, and wellness programming.

## ACKNOWLEDGMENTS

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