



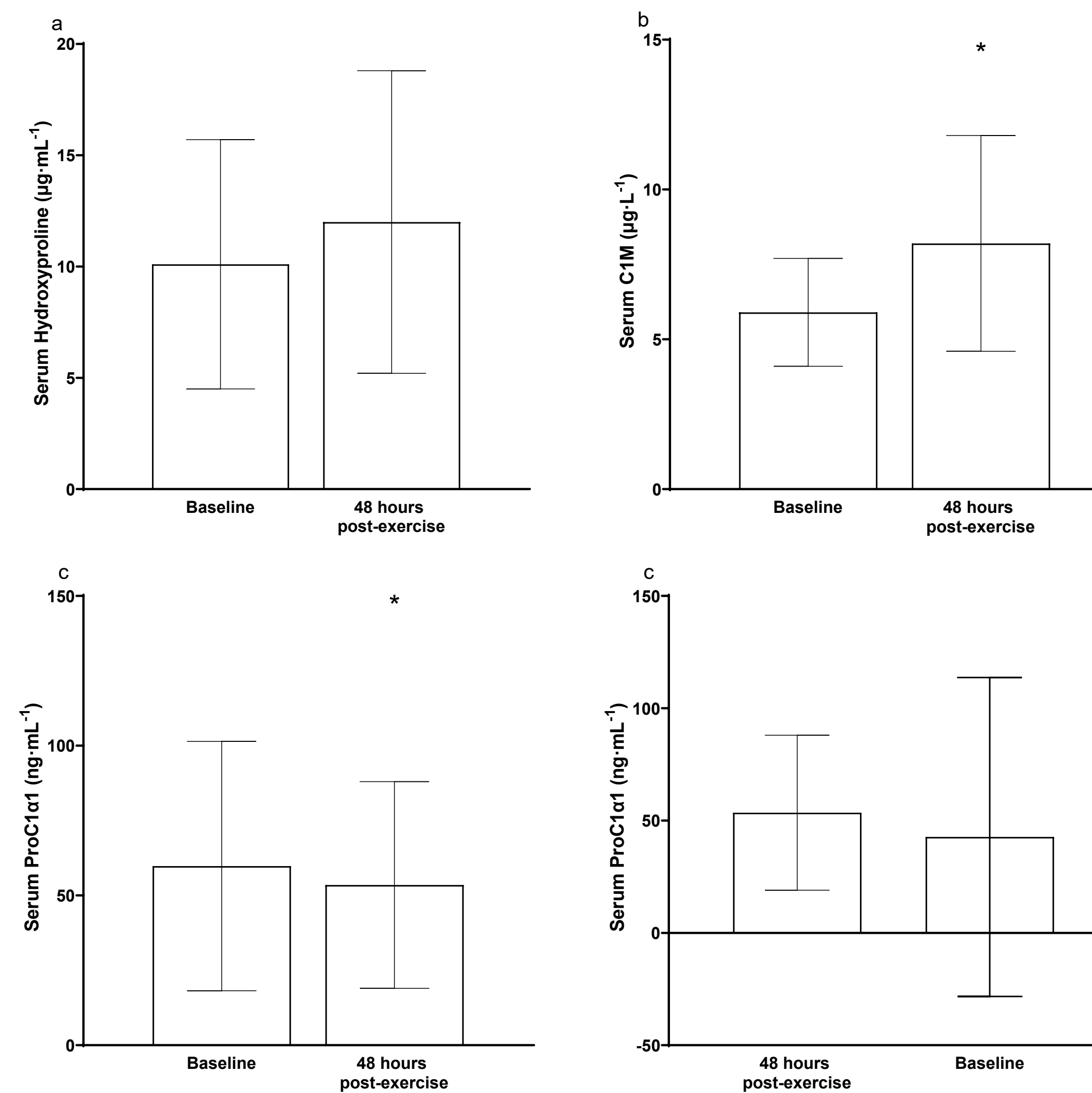
ACUTE EFFECTS OF HIGH-INTENSITY ECCENTRIC EXERCISE ON STRENGTH, SORENESS, AND COLLAGEN BIOMARKERS

Tyler J. Neltner¹, Prakash K. Sahoo¹, Robert W. Smith¹, Jocelyn E. Arnett¹, Dolores G. Ortega¹, John Paul V. Anders², Sathish Kumar Natarajan¹, Terry J. Housh¹, Richard J. Schmidt¹, Glen O. Johnson¹
¹University of Nebraska- Lincoln ²The Ohio State University

INTRODUCTION

- Following eccentric exercise, there is typically a reduction in strength accompanied by an increase in muscle soreness and collagen degradation.
- The acute effects of eccentric exercise on collagen synthesis remain unknown.
- **The purpose of this study was to examine the effects of high-intensity eccentric exercise on strength, muscle soreness, and blood biomarkers of collagen degradation (hydroxyproline, HYP and c-terminal telopeptide of type I collagen, C1M) and synthesis (pro-c1α1 and procollagen type I N-terminal propeptide, PINP)**

Fig. 1 a) Serum hydroxyproline levels at baseline ($X \pm SD = 10.1 \pm 5.6 \mu\text{g} \cdot \text{mL}^{-1}$) and 48 hours post-exercise ($12.0 \pm 6.8 \mu\text{g} \cdot \text{mL}^{-1}$). No significant change ($p = 0.49$).
b) Serum C1M levels at baseline ($X \pm SD = 5.9 \pm 1.8 \mu\text{g} \cdot \text{L}^{-1}$) and 48 hours post-exercise ($8.2 \pm 3.6 \mu\text{g} \cdot \text{L}^{-1}$). *Baseline < 48 hours post-exercise at $p = 0.03$.
c) Serum ProC1α1 levels at baseline ($X \pm SD = 59.8 \pm 41.6 \text{ ng} \cdot \text{mL}^{-1}$) and 48 hours post-exercise ($43.5 \pm 34.5 \text{ ng} \cdot \text{mL}^{-1}$). *Baseline > 48 hours post-exercise at $p = 0.01$.
d) Serum PINP levels at baseline ($X \pm SD = 42.7 \pm 71.0 \text{ ng} \cdot \text{mL}^{-1}$) and 48 hours post-exercise ($21.3 \pm 37.1 \text{ ng} \cdot \text{mL}^{-1}$). No significant change ($p = 0.28$).



CONCLUSION

- Eccentric exercise caused an immediate reduction in MVIC with an accompanying increase in muscle soreness
- MVIC recovered to pre-exercise values 24 hours after the eccentric exercise.
- Muscle soreness remained elevated across 72 hours.
- C1M was sensitive to increases in collagen degradation, hydroxyproline was not
- Pro-c1α1 was sensitive to decreases in collagen synthesis, PINP was not

PRACTICAL APPLICATIONS

- This study provides researchers and clinicians with information regarding biomarkers sensitive to changes in collagen degradation and synthesis following high-intensity eccentric exercise.
- There can be a dissociation between muscle soreness and strength following high-intensity exercise.
- Prescribed exercise should not be limited based off soreness alone



METHODS

- Ten college aged, recreationally trained men participated.

 - 1) Fasted baseline blood draw
 - 2) Rating of muscle soreness
 - 3) 1 repetition maximum testing
 - 4) Maximal voluntary isometric contraction
 - 5) 5 x 10 eccentric leg extension muscle actions at a load of 110% concentric 1RM
 - 6) MVIC and rating of soreness
 - 7) 24-hour MVIC and rating of muscle soreness
 - 8) 48-hour fasted blood draw
 - 9) 48-hour MVIC and rating of muscle soreness
 - 10) 72-hour MVIC and rating of muscle soreness

Fig. 2 Maximal voluntary isometric contraction values and self-reported soreness at pre-exercise, immediately post-exercise, 24 hours, 48 hours, and 72 hours. *MVIC: Pre-exercise ($X \pm SD = 437.0 \pm 77.2 \text{ n} \cdot \text{m}$) > immediately post-exercise ($387.4 \pm 67.3 \text{ n} \cdot \text{m}$) at $p < 0.001$. **Muscle soreness: Pre-exercise ($X \pm SD = 1.4 \pm 0.7$) < immediately post-exercise (6.4 ± 1.8 ; $p < 0.001$), 24 hours (3.7 ± 1.6 ; $p < 0.001$), 48 hours (2.4 ± 1.5 ; $p < 0.001$), and 72 hours (2.3 ± 1.2 ; $p < 0.001$) post-exercise

