

Preliminary findings from the U.S. Department of Defense-funded research grant at the University of South Florida.

Improving Low Back Muscular Strength and Core Muscular Endurance in U.S. Army Soldiers

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Introduction

Military personnel in the US Armed Forces encounter extremely demanding physiological and psychological stressors,¹ such as heavy and awkward body armor and full combat load, hostile environments, and dangerous terrain. Not surprisingly, the incidence and adverse consequences of low back injury and illness is high in the military.^{2,3,4} Low back pain was a leading cause of non-battle injuries in theater of operations during Operation Iraqi Freedom/Operation Enduring Freedom, and is a large contributor to non-expiration of active service attrition in the US Armed Forces.^{2,3,4} Military low back pain is associated with a

relatively poor prognosis following onset of injury, as relatively few military personnel return to duty following injury and treatment.^{2,3,4} While various prevention and treatment strategies for military low back pain have been implemented and tested, no gold standard exists. In 2011, an interprofessional research team from the University of South Florida (USF) and U.S. Army—Baylor University, led by the USF Lincoln College Endowed Chair in Chiropractic and Biomechanical Research, was awarded a research grant from the U.S. Department of Defense (DOD) to compare the effectiveness of lumbar progressive resistance exercise versus core stability exercise on lumbar muscular strength and core muscular endurance in U.S. Army Soldiers.

Methods

In the USF study, 582 USF Army Soldiers in training to become combat medics at

Fort Sam Houston TX were randomized (by platoon) to one of two exercise training groups: lumbar extension high intensity progressive resistance exercise (HIPRE, n = 298) or core stability exercise (CORE, n = 284). Both groups performed the assigned exercise training one time per week for 11 weeks under supervision, in addition to their usual Army physical fitness training. The HIPRE group performed lumbar extension exercise on specialized equipment (MedX, Ocala, Florida) that included one warm-up set and one full exertion set of exercise at each session. The CORE group performed one set of five standard, floor-based core stability exercises. Before and after the 11-week intervention period, isometric lumbar extension muscular strength and dynamic lumbar extension muscular endurance was assessed with a lumbar dynamometer, and isometric core muscular endurance was assessed with the prone Plank Test.

Key Findings

Data collection for the study was recently completed and preliminary results will be presented at the American Occupational Health Conference of the American College of Occupational and Environmental Medicine, San Antonio, Texas, April 2014.⁵ Key findings following the 11-week intervention period include:

- ▶ Isometric lumbar extension muscular strength: Adjusted (by baseline score) lumbar extension muscular strength was 9.7 percent greater ($p = 0.001$) for HIPRE compared to CORE. Lumbar extension muscular strength gains were observed in both HIPRE and CORE (13.3 percent HIPRE vs 3.3 percent CORE, $p < 0.05$). Improvements were generally greater in participants who adhered to the exercise program.
- ▶ Dynamic lumbar extension muscular endurance: Adjusted (by baseline) lumbar extension muscular endurance was 12.3 percent greater ($p = 0.001$) in HIPRE compared to CORE.
- ▶ Lumbar extension muscular endurance gains were observed in HIPRE (11.4 percent, $p < 0.05$), but not CORE.
- ▶ Isometric core muscular endurance: No significant improvements in core muscular endurance were observed for HIPRE and CORE. ◀FCA

Conclusions

This study demonstrated that lumbar extensor HIPRE is more effective than core stability exercise to improve lumbar extension muscular strength and endurance in U.S. Army soldiers. Neither lumbar extensor HIPRE nor core stability exercise is effective to elicit core muscular endurance gains in soldiers. While the direct clinical implications of these findings on reduction of risk for low back injury and illness in the military are unknown, improving the muscular integrity of the low back region may help soldiers become more physically fit to counteract the extreme physical demands required in combat. Future full-scale prevention clinical trials are needed to determine if targeted exercise programs for the lumbar and core muscles, administered alone or along with other interventions, are effective countermeasures against low back injury and illness in the U.S. Armed Forces.

References:

1. Konitzer LN, Fargo MV, Brining TL, Reed ML. Association between back, neck, and upper extremity musculoskeletal pain and the individual body armor. *J Hand Ther*. 2008; 21: 143-9.
2. Cohen S, Griffith S, Larkin T, et al. Presentation, diagnoses, mechanisms of injury, and treatment of soldiers injured in Operation Iraqi Freedom: an epidemiological study conducted at two military pain management centers. *Anesth Analg*. 2005;101(4):1098-1103.
3. Cohen S, Nguyen C, Kapoor S, et al. Back pain during war: an analysis of factors affecting outcome. *Arch Intern Med*. 2009;169(20):1916-1923.
4. Cohen S, Brown C, Kurihara C, et al. Diagnoses and factors associated with medical evacuation and return to duty for service members participating in Operation Iraqi Freedom or Operation Enduring Freedom: a prospective cohort study. *Lancet*. 2010;375:301-309.
5. Mayer JM, Childs JD*, Neilsen B, Koppenhaver SL, Quillen WS. Effects of lumbar extensor progressive resistance exercise versus core stabilization exercise on low back strength and endurance in soldiers: preliminary results of a randomized clinical trial. American Occupational Health Conference, American College of Occupational and Environmental Medicine, San Antonio, TX, April 2014 (accepted) (*presenting author).