Identification of Factors Contributing to Musculoskeletal Injuries in Military Basic Trainees

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ABSTRACT

Due to the physical activity requirements of the United States (U.S.) Armed Forces, musculoskeletal injuries are occurring at an alarming rate to military personnel. In the basic trainee population specifically, multiple studies have reported a range of exercise-related injury incidence from 14% to 42% in males and 27% to 61.7% in females. Depending on the severity, these injuries can exclude basic trainees from participation, ultimately altering career trajectory and creating the possibility of long-term disability. The studies of this dissertation examine variations in muscle strength, flexibility, and dynamic postural control as a means to identify those basic trainees with increased odds of reporting a back or lower extremity musculoskeletal injury during U.S. Army Basic Combat Training (BCT).

The Star Excursion Balance Test (SEBT) is used in clinical and research settings to assess dynamic postural control. Moderate to excellent intra-rater, inter-rater, and test-retest reliabilities of measures obtained from the SEBT have been published; however, current testing procedures are not time efficient for large-scale application. The first study of this dissertation determined the inter-rater and test-retest reliabilities of the shortened testing version of the SEBT—the Quick Star Excursion Balance Test (QSEBT). Forty-six healthy participants (21 males, 25 females; age = 23.5 ± 4.3 years; height = 170.6 ± 8.3 cm; mass = 72.7 ± 15.4 kg) were evaluated by 2 examiners simultaneously in the performance of 8 tasks of the QSEBT bilaterally, followed by repeating the test to assess test-retest reliability. Intraclass correlation coefficients (ICC) for inter-rater comparisons of the QSEBT for all 8 reach directions ranged from 0.83 to 0.98 for both stance legs. ICCs for test-retest reliability of the QSEBT ranged from 0.64 to 0.88 bilaterally. It was concluded that measures obtained from the
QSEBT have moderate to excellent reliability for novice examiners when they are instructed on how to administer the test and provided with oral instructions to read to participants. Researchers and clinicians can use the QSEBT to assess dynamic postural control by recording measurements in real-time.

The second study of this dissertation examined the predictive validity between individual and combinations of measures in the reporting of a back or lower extremity musculoskeletal injury to a medical provider during U.S. Army BCT at Fort Jackson, South Carolina. Four hundred and twenty-seven participants (141 females, 286 males; age: 21.43 ± 3.61 years; height: 171.63 ± 9.37 cm; mass: 73.55 ± 13.29 kg) completed baseline survey questionnaires, body composition testing, baseline physical performance measures (QSEBT, Weight-Bearing Lunge Test (WBLT), and Single Leg Wall Squat (SLWS)), and participated in the self-report of injury questionnaires. Ultimately, 147 participants reported at least one injury during training. Multiple logistic regression was applied to assess the relationship between the measures taken prior to beginning BCT and the report of musculoskeletal injury. We estimate that the odds of reporting an injury during BCT is 0.979 times less for each centimeter increase in reach distance of the 3-direction composite QSEBT score (dominant stance leg), after adjusting for sex, bone mineral density, and the average days of 30 minutes of exercise per week in the two months prior to BCT (95% CI [0.958, 1.001], p = 0.06). We estimate that with each 6 centimeter increase in the 3-direction composite score (2 centimeters in each direction), the odds of an injury during training decrease by 11.8%. The measures obtained on the WBLT and SLWS did not contribute to the final model. Dynamic postural control assessments may contribute to identifying basic trainees at an increased odds of injury during BCT. Future study will examine the predictive validity of the physical performance tests on diagnosed musculoskeletal injury from a medical provider, as well as attrition from training.