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**Leveraging Machine Learning Techniques to Reveal Relationships between Neuromuscular Traits in Previously Concussed Warfighters**

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Military personnel are at higher risk for concussion than civilians. Recent studies have demonstrated an increased risk of musculoskeletal injury following concussion, but the underlying mechanisms are still unknown. Changes in neuromuscular function following concussion may be implicated. **PURPOSE:** To compare military personnel with a concussion history in the previous 2 years (CH) with matched controls (NCH) in physiological, musculoskeletal and biomechanical performance using independent samples statistics (Aim 1) and using a machine learning decision tree algorithm (Aim 2). **METHODS:** Air Force Special Operations Command Operators and Naval Special Warfare Operators self-reported injury history, and completed physiological, musculoskeletal, and biomechanical analysis. The physiology testing battery included body composition, anaerobic power/capacity, and aerobic capacity. Testing included lower extremity strength, including time to peak torque for each muscle group, and balance using the Neurocom. Biomechanical analysis consisted of a single-leg jump and landing task, including landing kinematics of the hip, knee and ankle. A one-way Analysis of Variance (ANOVA) was used to compare CH (n=24) to NCH (n=24; Aim 1), as well as the C5.0 decision tree algorithm (Aim 2). **RESULTS:** No differences were demonstrated using one-way ANOVA. The C5.0 algorithm revealed CH demonstrated quicker time to peak knee flexion angle during the single-leg landing task (<=0.170 secs; CH: n=22 vs. NCH: n=14), longer time to peak torque in knee extension isokinetic strength testing (>500 msecs; CH: n=18 vs. NCH: n=4) and larger knee flexion angle at initial contact (>7.7°; CH: n=18 vs. NCH: n=2). **CONCLUSION:** This study revealed differences between Warfighters in neuromuscular traits based on CH using the C5.0 machine learning algorithm. Future research should validate these findings in larger sample sizes and assess if neuromuscular changes following concussion are related to injury risk.

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