

# DO ACTIVE-DUTY AIR FORCE MEMBERS WITH RECENT LOWER BODY INJURY PROFILES DEMONSTRATE LOWER FORCE PLATE JUMP PERFORMANCE?

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## BACKGROUND

- Active-duty military members are susceptible to injury and/or chronic pain due to repetitive / intense operations.
- Jump assessments on portable force plate systems have become popular for identifying movement patterns and capabilities that place individuals at greater risk for injury.
- Although the primary purpose of these assessments is to guide rehabilitation and strength and conditioning program strategies, it is important to identify which assessments are influenced by individualistic features such as prior injury.
- PURPOSE:** Evaluate whether force plate jump assessments differ between active-duty Air Force members who have and have not incurred a recent lower body musculoskeletal injury/pain profile.

## METHODS

**WHO:** 706 active-duty Air Force members completed a battery of movement assessments as part of a larger initiative by the Air Force Research Laboratory's Movement Matters project.

**INJURY SURVEY:** Participants completed surveys to identify whether they had experienced any musculoskeletal pain or sustained a musculoskeletal injury to the lower body, resulting in an injury profile within the 6 months prior to evaluation.

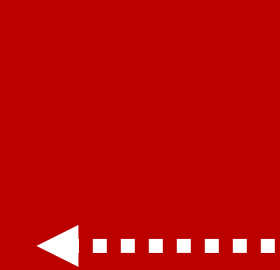
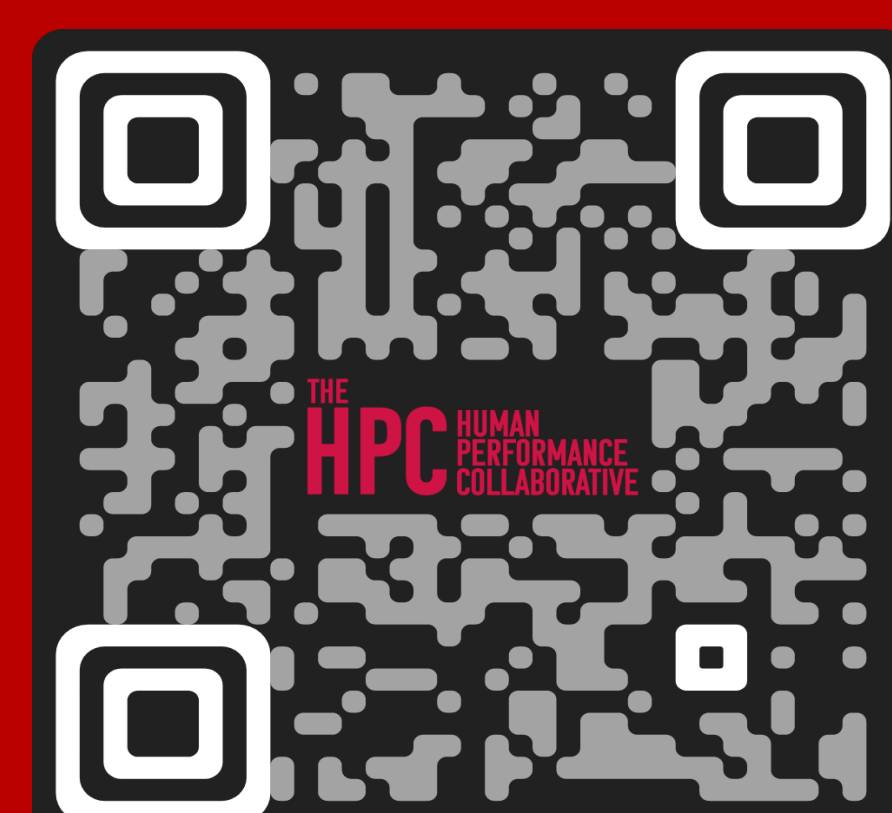
**JUMP ASSESSMENTS:** 3 maximal effort on dual force plates in the following order:

- arm-swing countermovement jumps (ASCMJ)
- no arm-swing countermovement jumps (CMJ)
- loaded CMJs with a weighted vest (6, 8, or 10 kg)
- drop jumps from 30 cm box (DJ),

**ANALYSES:** The mean of the three trials were compared between Pain (N= ~75) and No-Pain (N=~624) groups using independent samples T-tests with Benjamini & Hochberg p-value corrections and effect sizes (ES).

Musculoskeletal injury or pain resulting in injury profiles reduces the ability to perform difficult jump maneuvers, such as landing or with more weight.

This information is important for informing assessment selection for military populations, as determining return to work status may be dependent on operational demands.



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## RESULTS

- ASCMJ: No metrics were different between Pain & No-Pain CMJ: Small difference between Pain and No-Pain for Peak Landing Force Relative to Jump Height, but not Jump Height (Table 1) or other metrics.
- LCMJ: All metrics were different between Pain & No-Pain DJ: No-Pain Group had a deeper Countermovement Depth, higher Jump Height, less Passive Stiffness, and less Peak Drop Landing Forces
- Data are presented in Table 1.

Table 1. Force-time metrics for jump assessments by individuals with (n=75) and without musculoskeletal related injury profile (n=624).

Metric	Pain	No Pain	ES
Arm Swing Countermovement Jumps (ASCMJ)			
Countermovement Depth (cm)	-39.63±9.44	-39.49±11.3	-0.013
Eccentric Mean Power / BM (W×kg <sup>-1</sup> )	5.59±1.2	5.62±1.5	-0.019
Jump Height (cm)	32.89±8.6	34.58±10.17	-0.179
Peak Landing Force /Height (N×cm <sup>-1</sup> )	128.4±36.8	119.2±42.5	0.230
RSI Modified (m×s <sup>-1</sup> )	32.62±12.63	35.26±13.73	-0.200
No Arm Swing Countermovement Jumps (CMJ)			
Countermovement Depth (cm)	-37.41±6.59	-38.28±7.86	0.121
Eccentric Mean Power / BM (W×kg <sup>-1</sup> )	5.62±1.03	5.82±1.11	-0.183
Jump Height (cm)	28.23±7.76	30.27±8.77	-0.246
Peak Landing Force /Height (N×cm <sup>-1</sup> )	149.2±42.7	135.0±46.4	0.318*
RSI Modified (m×s <sup>-1</sup> )	28.96±10.18	31.33±10.69	-0.227
Loaded Countermovement Jumps (LCMJ)			
Countermovement Depth (cm)	-35.27±6.31	-36.9±8.17	0.223*
Eccentric Mean Power / BM (W×kg <sup>-1</sup> )	5.96±1.14	6.28±1.26	-0.273*
Jump Height (cm)	24.32±6.37	26.79±7.91	-0.345*
Peak Landing Force /Height (N×cm <sup>-1</sup> )	178.2±48.8	157.4±53.6	0.406*
RSI Modified (m×s <sup>-1</sup> )	25.21±9.45	27.92±9.87	-0.280*
Drop Jumps (DJ)			
Countermovement Depth (cm)	-31.27±7.94	-33.36±8.97	0.246*
Jump Height (cm)	25.27±6.6	28.19±8.32	-0.389*
Passive Stiffness (N×m)	12451±5619	10824±6274	0.273*
Peak Drop Landing Force (N)	3610±1039	3282±999	0.322*
RSI Flight Time Contact Time (ratio)	0.99±0.36	1.01±0.35	-0.063

\*, p < 0.05 = statistically significant difference

RSI, Reactive Strength Index

ES < 0.2 = Negligible effect size; ES < 0.5 small effect size

## CONCLUSION

- ASCMJ Metrics were not different for Air Force members with recent musculoskeletal related injury profiles.
- Landing forces were higher for the Pain group during the CMJ, LCMJ, and DJ assessments.
- Movement strategies and performance outcomes during the LCMJ and DJ were poorer for the Pain group.

## ACKNOWLEDGEMENTS

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