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Analysis of Inter-Limb Asymmetry of Landing Forces and Ankle Injury in Warfighters: A Prospective Study

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Landing is a biomechanically demanding movement performed during military tasks that increases the risk for ankle injuries (AIs). Inter-limb asymmetry of landing forces may detect risk of AIs in warfighters. **PURPOSE** To assess baseline inter-limb kinetic asymmetries during a landing task in Marine Officer Candidates (MOCs) at the start of military training and compare asymmetries between those who did and did not sustain AIs during training. **METHODS** 672 MOCs (24.9 ± 3.0 y, 174.3 ± 8.3 cm, 77.3 ± 10.8 kg, 550 men) participated. Dual force plates (Hawkin Dynamics, Portland, ME) captured kinetic data during a drop jump task from an 18-in box. Kinetic data included relative peak limb landing force ($rPLLF_{left}$, $rPLLF_{right}$) defined as peak landing force of a limb relative to body weight (N/kg). Limb Symmetry Index (LSI, [$rPLLF_x$/$rPLLF_y$]/100], %) classed MOCs into symmetrical (≥ 90%) or asymmetrical (< 90%) landing. Deidentified injury data were derived from internal medical reports. Independent samples *t* tests or Mann-Whitney U test, as appropriate, assessed differences between LSI, $rPLLF_{right}$ and $rPLLF_{left}$ in injured and uninjured MOCs. Paired samples *t* tests assessed same variables between injured MOCs with asymmetry and uninjured MOCs with asymmetry best matched (sex, age, height, weight). Statistical significance was set α=.05, two-sided. **RESULTS** Mean ± SD of $rPLLF_{left}$, $rPLLF_{right}$ and LSI were 27.4 ± 11.8 N/kg, 27.9 ± 11.6 N/kg, and 74.8% ± 0.2%, respectively. Four hundred and ninety three (73.4%) and 179 (26.6%) MOCs showed asymmetrical and symmetrical landing, respectively. Injured (n = 30) and uninjured MOCs showed no significant differences in $rPLLF_{left}$ (27.5 ± 13.0 N/kg vs 27.4 ± 11.8 N/kg, p = .905), $rPLLF_{right}$ (26.1 ± 12.8 N/kg vs 27.9 ± 11.5 N/kg, p = .535) and LSI (U = 8565.0, z = -1.0, p = .305). Injured MOCs with asymmetry (n = 25) best matched showed no significant differences in $rPLLF_{left}$ (25.9 ± 11.1 N/kg vs 26.3 ± 9.2 N/kg, p = .902), $rPLLF_{right}$ (27.2 ± 12.7 N/kg vs 27.1 ± 13.1 N/kg, p = .989) or LSI (U = 276.0, z = -.48, p = .631). **CONCLUSION** Inter-limb asymmetry of landing forces may not differ between MOCs who sustained AIs and those that did not, suggesting that other lower-limb biomechanical factors may be more pertinent for ankle injury risk detection in warfighters.

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