Load Magnitude and Locomotion Strategy Alters Knee Mechanics in Recruit-Aged Women

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Female soldiers experience a greater incidence of Knee Osteoarthritis (OA). A proposed mechanism of OA is ruck marching, involving load carriage at a fast pace. Knee Total Joint Moment (KTJM) and changes of percent (%) contribution in each plane of motion moment has been linked to OA. PURPOSE: To determine the interactive effects of load magnitude and locomotion on KTJM % contribution in women. METHODS: Twelve healthy females (Age: 24.75 ± 2.17y) completed 3 testing sessions collecting kinematic and kinetic data. Subjects wore combat boots and weighted vest. Trials were conducted at body weight (BW), and loaded; +25%, +45%. At each load, 2 locomotion types (running [RN] and forced march [FM]) were performed at +10% above their gait transition velocity were performed. KTJM was calculated utilizing Euclidian norm with % contribution derived from KTJM for each plane: Knee Flexion (KF%), Adduction (KA%), and Rotation (KR%), and normalized to system weight. Multifactorial RMANOVA, load by locomotion (3x2), were conducted on Heel strike [HS] and Midstance [MS] data for each plane. Bonferroni-corrected pairwise comparisons were conducted when necessary (α=p<.05). RESULTS: KF% at HS there was an interaction (p<.05). Simple main effect of load (p<.02) during RN; +25% (p<.02) and +45% (p<.01) greater than BW. No simple main effect of load for FM. There was a main effect of locomotion (p=.006), with RN (64.9 ± 4.8%) greater than FM (49.8 ± 2.7%). KF% at MS, there was an interaction (p=.02); RN was greater than FM at all load conditions (p<.04). KA% at HS, there was no interaction (p=.09). There was a main effect of load (p=.01); BW greater than +25% (p=.03). KA% at MS there was no interaction (p=.31). There was a main effect of locomotion (p=.003), with FM (43.8 ± 3.1%) greater than RN (29.9 ± 4.1%). No significant findings for KR%. CONCLUSION: At HS as load increased KF% increased for the RN, demonstrating appropriate movement response to load increases where the individual relies more on knee flexors/extensors to absorb energy. No change in KF% between load conditions for FM demonstrates an inability to modulate movement to accommodate to changes in load. At MS, RN exhibited greater KF% than FM. Thus, the FM strategy promotes successful task execution over safe task execution even if increased KA% is a consequence, potentially predisposing to OA.