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Impact of working technique on cumulative loadings among other factors

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Background: Variation in working techniques is thought to prevent overuse injuries (Srinivasan et al., 2012). Variable anthropometry among individuals contributes to low back loadings (Srinivasan et al., 2012). The impact of technique and anthropometry on low back loadings, however, has never been quantified in a box transferring task. Consequently, the goal of this study was to quantify the impact of anthropometric and technique parameters on asymmetrical and cumulative loadings.

Methods: Participants (n=65) transferred four boxes back and forth from a conveyor to a hand-trolley 32 times. Kinematic and ground reaction forces were used as inputs for a 3D biomechanical loading model able to estimate the net moments at L5/S1 (Plamondon et al., 2014) . Mean cumulative moments of the 32 transfers in sagittal flexion and asymmetry at the L5/S1 joint were estimated. Anthropometric characteristics, handling duration and inter-trial variability in net moments at L5/S1 (normalized to upper body weight) were used as predictors of the dependent variables. Stepwise multiple linear regressions were done to identify the elements that significantly determined mean cumulative moments acting on the back.

Results: About 64% (in sagittal flexion) and 48% (in asymmetry) of the variance in mean cumulative moments at L5/S1 was explained by a four-variable model. Transfer duration (in sagittal flexion) and upper body weight (in asymmetry) showed a significant positive linear association with cumulative loadings, and explained 34% and 35% of the variance, respectively. A significant positive linear association was found between cumulative loadings and inter-trial variability in net moments at L5/S1 ($p<.001$).

Conclusions: Working technique, defined by transfer duration and inter-trial variability in net moments at L5/S1, positively influenced cumulative back loadings. These results indicated that variation in working techniques while performing the same task may not be sufficient to prevent workers from overuse injuries (Srinivasan et al., 2012). Still, more kinematic data are necessary to accurately represent working techniques.