ARM SWING IN CHILDREN CARRYING BACKPACKS

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INTRODUCTION: Arm swing during walking helps maintain balance and reduce twisting of the trunk. By limiting horizontal excursions of the body, arm swing aids in maintaining horizontal velocity (Hinrichs, Cavanagh, & Williams, 1987). When arm swing is restricted, it is predicted that there will be a greater degree of torque placed on the vertebra, increasing pressure on the intervertebral discs (Jackson, 1983; Li et al., 2001). This may be exaggerated when adding weight, specifically to the trunk, such as when carrying a backpack.
Arm swing not only affects torsion on the spine, it also influences the lower limbs. Reciprocal swinging of the arms has been directly tied to stride rate. As arm swing is restricted, stride rate tends to increase (Eke-Okoro, Gregoric, & Larsson, 1997). Increased vertical ground reaction forces have also been tied to fixed-arm walking (Li et al., 2001). Li et al. (1996) found differences between adults and children 9 years of age as they corresponded to centre of pressure under the foot. These differences were attributed to torques induced by the lower limbs because arm swing was restricted in children's walking patterns. The purpose of this study was to determine the amount of arm swing in children during load carriage.

METHOD: This study was approved by the University of Puget Sound Institutional Review Board. Experimental procedures were explained to 36, 10-12 year old children and their parents and written informed consent was obtained from both.
The children were filmed on three separate occasions at 60Hz walking 1000 m around a 400 m track carrying 15% of their body weight in a backpack. Two strides were filmed in the saggital plane of motion at 100 m and again at 900 m. A total of 216 sessions were recorded and analyzed for arm swing, stride rate and walking velocity using Peak Performance (v5.3) software.
Arm swing was measured from the elbow to the shoulder to the hip across 6 phases of gait: heel down, opposite toe off, opposite heel down, toe off, clearance, tibia vertical and ending in the next heel down (Rose & Gamble,1994). Two complete strides were analyzed for each session. Mean velocity across both strides were recorded so that correlations could be run between velocity and total arm movement recorded as the mean degrees of motion for each stride. Mean arm swing in both the rested and fatigued states was compared using dependent t-tests ($a < .05$).