
1369 Board #3 May 30, 1:00 PM - 3:00 PM

Excess Body Weight Influences Gait and Energy Cost of Walking in Older Adults

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(No relationships reported)

Being overweight in old age is associated with slow walking speed, altered gait, and increased risk of developing a mobility disability.

PURPOSE: To determine if overweight, older adults alter stride frequency and other components of gait to minimize the energy cost of walking.

METHODS: Using body mass index (BMI) men and women 65-80 yr were separated into normal weight (NW, BMI < 25 kg.m-2, n = 13) and overweight groups (OW, BMI > 25 kg.m-2, n = 12). Subjects walked at 0.8 m.s-1 on an instrumented treadmill and stride length, stride frequency, stride width, single- and double-limb support time, weight acceptance and push-off forces were measured. Subjects completed three, six-minute walking trials, one at preferred stride frequency, one at a +10% faster stride frequency, and one at a -10% slower stride frequency. Energy cost of walking was determined by indirect calorimetry. Group differences were tested using repeated measures analysis of variance and independent T-tests, and associations were tested with Pearson correlations. Significance was $p \leq 0.05$ for all tests.

RESULTS: OW had greater BMI (29.5 ± 4.1 kg.m-2) than NW (22.4 ± 1.8 kg.m-2, $p < 0.001$). OW had 62% higher absolute energy cost of walking (301 ± 108 vs. 186 ± 104 J.m-1, $p < 0.001$) and 20% higher relative energy cost of walking (3.48 ± 0.95 vs. 2.91 ± 0.94 J.kg-1.m-1, $p = 0.046$) across all conditions, and the energy cost of walking was 8% higher for OW at the faster stride frequency than at preferred frequency ($p < 0.001$). Preferred stride frequency was not different between OW (48.4 ± 5.1 strides.min-1) and NW (46.9 ± 6.2 strides.min-1, $p = 0.626$), nor were stride length, stride width, or forces. At preferred stride frequency OW spent less time in single-limb support (33.1 ± 1.5 vs. 34.9 ± 1.6 %GC, $p = 0.021$) and more time in double-limb support (17.5 ± 11.6 vs. 15.4 ± 1.4 %GC, $p = 0.026$) than NW. Relative energy cost of walking was correlated with BMI ($r = 0.51$, $p = 0.005$) and push-off force ($r = -0.34$, $p = 0.050$).

CONCLUSIONS: Excess body weight is associated with higher energy cost of walking in older adults, which may increase task difficulty and fatigue. Increased energy cost in OW occurred concurrently with less time spent in single-limb support and more time in double-limb support gait phases, and was exacerbated at faster stride frequencies.

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1370 Board #4 May 30, 1:00 PM - 3:00 PM

Within-subject Variability Of Step Width And Trunk Kinematics During Gait In Pregnant Fallers And Non-fallers

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Over 25% of pregnant women fall. Increased gait variability, particularly in regard to step width and trunk frontal plane movement, has been observed in some populations at high risk of falling. Pregnant women have been shown to have greater mediolateral translation of the trunk during walking. However, it is not known if pregnant women, particularly those who have fallen while pregnant, have increased variability during gait.

PURPOSE: To examine the effects of pregnancy and fall history on within-subject step width and trunk variability during gait.

METHODS: Data were collected on 29 pregnant subjects and on 40 controls. Pregnant women self-reported to be "fallers" (n=15) or "non-fallers" (n=14). An 8-camera motion capture system (120 Hz) was used to collect five trials of subjects walking at their freely-chosen speed. Right foot heel strike (RHS) and left foot toe off were determined from force plate data (1080 Hz). The 3D angles of the thorax and pelvis were assessed at RHS. Frontal plane movement of the C7 marker and the ROMs of the thorax and pelvis during gait were calculated. Variability was defined as the within-subject standard deviation of each variable over the 5 trials. A two-factor ANOVA (trimester (control, 2nd, 3rd) x fall group (control, pregnant faller, pregnant non-faller)) was performed on each measure ($\alpha=0.05$).

RESULTS: No differences in the variability of step width or frontal plane motion were found between pregnant women and controls or between pregnant fallers and non-fallers ($p>0.05$). Variability of the thoracic rotational ROM was less in the 3rd trimester than controls (1.1 ± 0.5 vs 1.6 ± 0.7 , $p=0.03$), as well as in the pregnant non-fallers compared to controls (1.1 ± 0.7 vs 1.6 ± 0.7 , $p=0.02$).

CONCLUSIONS: Other populations who fall (e.g. the elderly) demonstrate heightened variability in specific gait measures; however, pregnant women do not exhibit this, despite the fact that they are at a high risk of falling. This may indicate that pregnant women do not fall for the same reasons that others fall. The decreased variability in thoracic rotational ROM seen in the pregnant women in the 3rd trimester and the pregnant non-fallers may reflect pregnancy-related adaptations to movement in order to protect against a fall. *Funding: NIOSH K01008458.

1371 Board #5 May 30, 1:00 PM - 3:00 PM

Knee Moments Do Not Increase Proportionally To The Load Carried While Walking

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In recent years, loads carried by combat soldiers have increased to more than 100 lbs, and this has been accompanied by a 7-fold increase in overuse injuries. Many of these lower extremity injuries occur at the knee. Studying knee biomechanics with steadily increasing loads could identify a threshold where the risk of injury to a Soldier increases disproportionately to the load carried.

PURPOSE: Examine the dose-response relationship between load carried and sagittal plane knee mechanics during walking.

METHODS: 25 active duty male volunteers (20.9 ± 3.3 yrs; 178.1 ± 8.3 cm; 86.3 ± 14.6 kg) carried 5 vest borne loads while walking on a force sensing treadmill at 1.34m/s for 10 minutes. Soldiers first walked with body weight only, which served as a baseline condition. The 5 loads (15, 25, 35, 45 and 55 kg) were presented randomly with at least 3 min rest between loads. Kinematic and kinetic data were collected. Knee extensor moments (Mkne) and range of motion (ROM) from footstrike to mid-stance were compared across all 5 loads using repeated measures ANOVAs ($p < .05$).

RESULTS: Post hocs revealed (Table 1) significant differences between each increasing load for Mkne ($p < .025$) but no differences for ROM ($p \geq .175$). The Mkne increase from 45 to 55 kg was 1.9 times greater than any other increase in Mkne.

CONCLUSIONS: At a constant velocity and with no change in ROM across trials, the elevated Mkne was likely a mechanism by which the body responded to increasing loads. If these elevated Mkne are not sustainable, then Soldiers may be exposed to a greater risk of injury. Therefore, the disproportionate changes to Mkne at heavier loads suggest a threshold exists above which injury risk may be magnified.

1372 Board #6 May 30, 1:00 PM - 3:00 PM

Greater Step Widths Reduce Knee Abduction Moments in Knee Osteoarthritis Patients during Stair Ascent

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(No relationships reported)

Research shows that increased step width (SW) during stair descent reduces first and second peak internal knee abduction moments in healthy adults but not in knee osteoarthritis (OA) patients.

PURPOSE: To study the effects of increased SW on knee abduction moment and knee pain in healthy and knee OA adults during stair ascent.
