CHANGES IN POSTURAL SWAY AND GAIT CHARACTERISTICS AS A CONSEQUENCE OF ANTERIOR LOAD CARRIAGE

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INTRODUCTION:

Previous research has indicated that carrying a backpack elicits an increase in postural sway during quiet standing (Heller et al. 2009) and stride-to-stride gait variability during walking (Qu and Yeo, 20011). Despite these initial enquires into the effects of carrying external loads on postural stability, little research has examined the effects of anterior load carriage. This gap in the literature is important because many daily (e.g. carrying a laundry basket) and occupational (e.g. courier delivery) activities require loads to be carried in front of the body. Within this context, to further develop the external load-postural stability database we examined the effects of increasing loads carried anteriorly on postural sway and gait parameters in healthy adults.

METHODS:

Twenty-nine subjects (19 males, 10 females, age = 33.8 ± 12.7 years, height = 1.73 ± 0.07 m, mass = 75.1 ± 13.7 kg) were assessed in four conditions; (1) carrying no load (CON), (2) carrying a load with no added weight (i.e. empty box), (3) carrying a load with 5% body mass, and (4) carrying a load with 10% body mass. Anteroposterior and mediolateral centre of pressure (COP) displacement (cm) and the mean COP velocity (cm·s-1) were used to characterise postural sway. Coefficient of variation of the stride length, stride time and double support time were calculated from 1 min of treadmill walking at a preferred pace for gait assessment.

RESULTS:

When compared to CON, anteroposterior COP displacement increased with the addition of a 5% ($P < 0.001$, $d = 0.74$) and 10% ($P < 0.001$, $d = 1.59$) load. The anteroposterior COP displacement also increased from the 5% to the 10% load ($P < 0.001$, $d = 0.75$). The addition of the 10% load increased stride time ($d = 1.71$) and stride length ($d = 1.20$) variability when compared to CON ($P < 0.001$). Additionally, stride length variability was significantly greater during 10% compared to 0% ($P = 0.004$, $d = 1.08$) and 5% ($P = 0.001$, $d = 1.01$) conditions.

CONCLUSION:

In summary, the increase in postural sway and gait variability with added weight is dependent on the magnitude of the load, where the greater the load, the greater the effect on static and dynamic stability. Changes in the mass-inertia characteristics of the body is one of several mechanisms that have been offered to explain the increased postural sway and gait variability when holding an external load. Given that increased postural sway (Johansson et al. 2017) and gait variability (Verghese et al. 2009) are indicators of increased fall-risk, it can be inferred from the present findings that carrying heavy loads in front of the body increases the likelihood of fall-related incidents.

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