

MINIMIZING POSTURAL INSTABILITY WHEN CARRYING LOAD: THE EFFECTS OF CARRYING GROCERY BAGS ON THE ELDERLY

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INTRODUCTION

Each year, approximately one-third of independent adults age 65 years and older experience a fall [1]. Not only do falls reduce physical function; they also yield psychological trauma, including loss of confidence in performing independent physical tasks, feelings of vulnerability, and fear of future falls [2]. Consequently, approximately 40% of nursing home admissions are related to falls or postural instability [2].

Of these falls, many occur when the independent elderly experience postural instability in the form of increased sway during daily activities [1]. To decrease the prevalence of falls, it is imperative that the effects on stability caused by daily activities be assessed.

Because one of the independent activities of daily living is shopping for one's own groceries, this study aimed to determine ways to minimize an elderly person's postural instability while carrying grocery bags [3]. Though research has demonstrated the effect carrying load in a backpack can have on balance [4], the authors could not find any literature examining the effect of carrying groceries.

It was hypothesized that carrying a loaded bag of groceries draped across one's arm, with this arm crossed across the body close to the body (a fall prevention tip recently promoted on a national news program [5]) would not result in reduced sway magnitude as compared to the carrying the same bag traditionally in a single hand by one's side. Whereas, it was hypothesized that carrying equally weighted bags, one in each the right and left hand would reduce medial-lateral sway compared to carrying bags of unequal weights, such as canned goods in the right hand and boxed goods in the left.

METHODS

Twenty-one independent elderly adults participated in this study (9 males, 12 females; mean age: 71.8 ± 5 years; mean height: 171.1 ± 9 cm; mean weight: 78.2 ± 15 kg). They were without recent operations, injuries, or diseases that would prevent them from lifting 4.5 kilograms, and they regularly did their own grocery shopping. They self-reported individual fall history and grocery shopping habits in a questionnaire prior to testing.

Each subject performed the seven randomized tasks shown in Table 1, while standing quietly with eyes open on a force-measuring platform (Model BP5050, Bertec Corporation, Columbus, OH). Two plastic bags holding a combination of six canned goods and three boxed goods (total weight: 4.5 kg) were used, with the distribution of weight changed according to the testing condition. For Tasks C – G the bag(s) held consisted of a mix of canned and box goods. To create an unequal weight distribution for Task B, a bag containing only the canned goods was held in the dominant hand and only the boxed goods in the other. For Tasks D – F the bags were held in or across the dominant arm. Each task lasted for 60 seconds and data was collected at 1000 Hz using Bertec Acquire 4. After the third of seven trials, the subject was given a two-minute break.

From the center of pressure data the Medial-Lateral (M/L) Sway Range and M/L Sway Velocity were calculated. Anterior-Posterior (A/P) Sway Range and Sway Velocity were also calculated for secondary analyses. Paired t-tests using SASS (version 17.0, Chicago, IL), $p < 0.05$, were performed to test the four main hypotheses with a Bonferroni Correction such that $p < 0.0125$ indicated significance.

Table 1. Seven Testing Conditions Performed

Cond.	Description
A	Arms at Side, No Load
B	Two bags (unequal weight) held traditionally hands at side
C	Two bags (equal weight) held traditionally hands at side
D	One bag held traditionally hand at side
E	One bag draped on arm, arm crossed across body
F	Two bags draped on arm, arm crossed across body
G	Two bags (equal weight) carried in backpack

RESULTS AND DISCUSSION

It has been shown that postural instability in the medial-lateral direction is correlated to falls in older adults [6]. As the way that grocery bags are traditionally carried has the potential to increase instability in this direction, the primary analysis of this work centered on the medial-lateral sway parameters. Figure 1 shows the mean M/L Sway Range for each of the testing conditions.

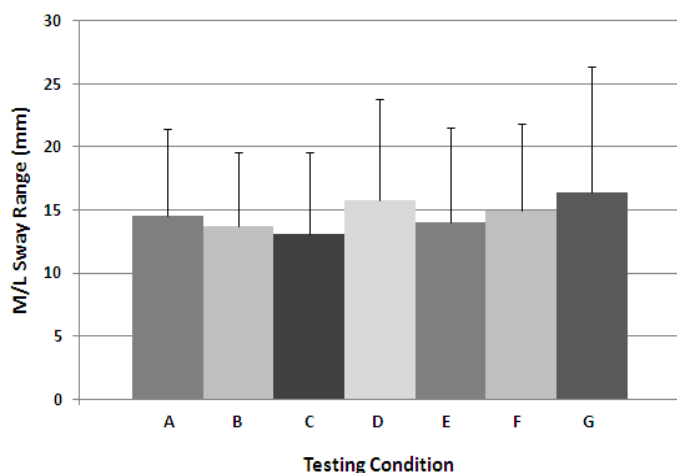


Figure 1. Mean Medial-Lateral Sway Range (mm) and Standard Deviation for the 7 Testing Conditions

Condition E, one grocery bag draped across the subject's arm and the arm crossed across the body, did result in a lower mean M/L Sway Range (14.0 ± 8 mm) compared to Condition D, when the same bag was held traditionally (15.8 ± 8 mm). Condition E had been proposed as a way to prevent falls by bringing the carried load closer to the center of

gravity of the individual [5]. Despite this, the difference was not statistically significant ($p = 0.179$), supporting the first hypothesis of this study. Since the bag is placed in front of the body, it was thought that it could increase sway in the Adirection, but this was not observed ($p = 0.282$). As such, this condition does not appear meaningfully better than traditional methods of carrying groceries. Qualitatively, subjects also reported a dislike of carrying groceries this way.

Condition C, two bags of approximately equal weight, held traditionally with one in each hand, caused, on average, the least amount of sway (13.2 ± 6 mm) in the medial-lateral direction. When the bags were held with unequal weight, as in Condition B, the mean sway range increased only slightly (13.8 ± 6 mm). There was no significant difference between the two conditions ($p = 0.604$), proving the second hypothesis of this study wrong. It had been assumed that the weight asymmetry would cause the subject to “wobble” back and forth more than would occur if equal weights were held. These findings suggest that the load distribution for relatively small amounts of groceries is not a meaningful factor for creating postural instability. It is possible that when multiple bags of much heavier weight are carried, a more significant difference would be observed. However, many subjects reported their habits to include frequent trips to the grocery with fewer bags to carry home.

CONCLUSION

The results of this study suggest that the way that groceries are carried does not play a meaningful role in increasing medial-lateral sway while standing. Future work is needed to examine the effect of carrying groceries while walking.

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