CENTER FOR RESEARCH IN HUMAN MOVEMENT VARIABILITY

# An Investigation in Muscle Activation During Load Carrying

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## INTRODUCTION

- Carrying items, making beds and moving items can all be considered activities of daily living (ADL) that can become difficult as aging progresses
- Chronic obstructive pulmonary disease is a pathology that may cause difficulty for older adults performing ADLs particularly with symptoms of limited airflow and muscle weakness and muscle fatigue [1,2]
- Various muscles that help to control a load and assist walking may also control and assist with inhalation and exhalation especially in times of distress or fatigue[3]
- Understanding fully how carrying something in each hand affects walking is essential to assisting the lives of those with breathing difficulties
- The purpose of this study was to examine the effect of two different bimanual loads, 5% and 10% body weight (BW), on self-selected gait measures

## METHODS

| N | Age (years) | Sex | Height (m) | Mass (kg) |
|---|---|---|---|---|
| 14 | 23.21 ± 2.46 | male = 8 | 1.76 ± 0.08 | 73.09 ± 8.12 |

**Table 1:** Demographics of subjects

- Healthy subjects (Table 1) underwent three conditions as described in Table 2 and seen in Figure 1
- Weights were distributed evenly between both wrists as seen in Figure 2

| Condition | Description | Time |
|---|---|---|
| 1 | Baseline Walking | 5:00 mins |
| 2 | Walking with 10% BW | |
| 3 | Walking with 5% BW | |

**Table 2:** Description of Conditions: order of conditions started with the baseline with 5% and 10% trials being randomized

**Figure 2:** (above) Wrist weights attached to the arms: weight was chosen by taking 5% and 10% of their body weight and rounding to the nearest pound

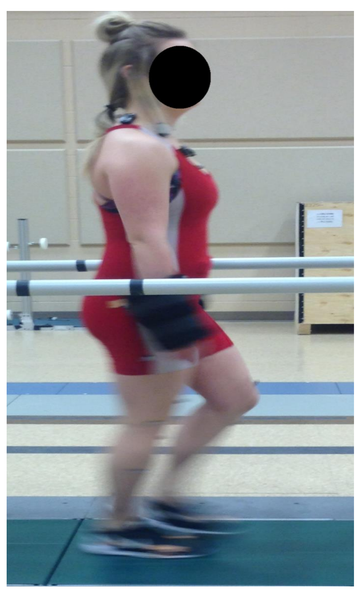

**Figure 1:** (right) Walking trial: subjects chose their own self-selected pace before baseline

- Dependent variables included:
  - Mean, standard deviation, and coefficient of variation of stride length and step width
  - Sample entropy (m=2, r=.2*STDEV, N = 442) of stride length and step width time series
- 1x3 repeated measures ANOVA were used to compare means between conditions

## RESULTS

Mean Step Width

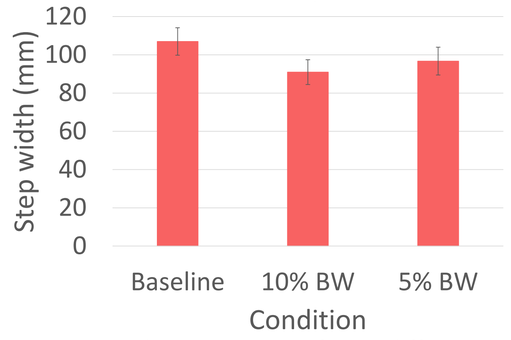


**Figure 3.** There were significant differences between all conditions: baseline and 10% ($p<.001$), baseline and 5% ($p=.002$), and between 5% and 10% ($p=.014$)

Coefficient of Variation of Step Width

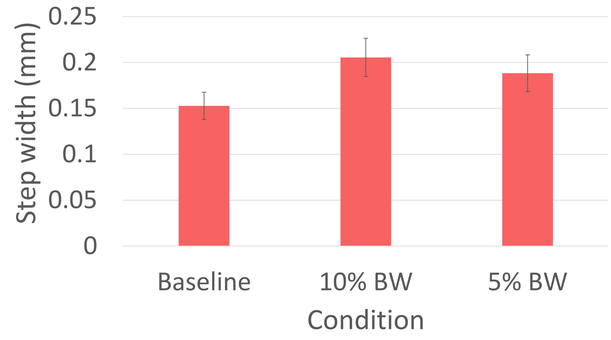


**Figure 4.** There were significant differences between all conditions: between baseline and 10% ($p<.001$), baseline and 5% ($p=.008$), and between 5% and 10% ($p=.0005$)

- Both mean step width and coefficient of variation (Figures 3 &4) were significantly different between each condition (baseline compared to 10% BW, baseline compared to 5% BW, and 10% BW compared to 5% BW)
  - Mean step width was decreased significantly from baseline as additional weight was added
  - Coefficient of variation of step width increased significantly from baseline as additional weight was added
- No significant findings were found for the other measure of gait and or conditions

## DISCUSSION

- With a minimal 2.5% body weight increase load to each hand, step width mean and CoV were different.
- Step width coefficient of variation can discriminate between healthy young and old subjects[4] and has been associated with falls in older individuals[5]. Including an older populations may yield more significant information about how a bimanual load might affect gait patterns.
- Step length did not show any differences. It is possible that as a population, healthy young are adaptable and the task may not have been difficult enough to elicit a change.
- In addition, step width has been shown to require additional active control during walking whereas, step length does not[6]. The additional weight during each arm swing, may cause an increase in medial-lateral movement yet momentum from the forward swing may not affect stride length. Therefore active control would be important to compensate for the weights.
- Additional data including postography and muscle activation is currently being processed.

## REFERENCES

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