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Standing Weight Perception across Unweighted Conditions in a Lower Body Positive Pressure Treadmill

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AGAP 2.0 Background

- The following series of experiments studied participants standing in a lower body positive pressure treadmill (LBPP-TM) while at rest
- Data was collected on the cardiovascular responses of heart rate (HR) and arterial blood pressure (systolic and diastolic; SBP/DBP), and body weight perception (BWP)
- This first study will examine at BWP responses of participants in the LBPP-TM across different chamber air pressures (CAP)
- Specific to perceptions, exercise studies consistently report lower effort perceptions with greater CAP, which suggest a reduced physiological and mechanical strain on the body.
- However, BWP at rest is less known

Lower Body Positive Pressure Treadmill

- The Alter-G® is the LBPP-TM used in the Proehl Exercise Physiology laboratory at SUNY Cortland
- LBPP-TM forces air into an inflatable chamber in which the user is secured
- The forced air produces either an increase or decrease in chamber air pressure (CAP)
- Positive pressure on the lower body translates into body weight support which allows an assistive lift

Introduction

- Because previous studies have noted that reductions of strain or stress result in lower ratings of perceived exertion or effort sense

- Perceived exertion or effort sense is how hard you feel like your body is working. It is based on the physical sensations a person experiences during physical activity

- However, body weight perception refers to the personal awareness of your own weight. Particular to this study, we assessed how aware an individual was at different (un)weighted conditions
- Participants were put into the Alter-G at four different (un)weighted conditions (100%BWset, 70%BWset &, 35%BWset, 90%BWset)

Purpose of the Study

- To examine whether changes in chamber air pressure resulted in changes in body weight perception.

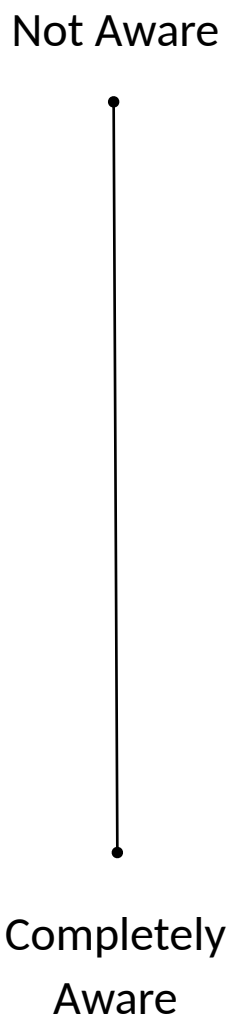
Hypotheses

- **H_1**: Changes to chamber air pressure will result in significant differences across chamber air pressure settings of 100%BW_{set}, 70% BW_{set}, 35% BW_{set}, and 90% BW_{set}.

- **H_2:** Significant changes in chamber air pressure will result in significant differences in body weight perception across chamber air pressure settings of 100%BW_{set}, 70% BW_{set}, 35% BW_{set}, and 90% BW_{set}.

Methods

- 21 apparently healthy college-aged participants were studied (**Table 1**)
- CAP was measured using Davis Vantage weather station
- Perception of body weight (BWP) was measured using a 10 cm visual analogue scale (VAS) with anchors at 0 cm (*Not Aware*) and 10 cm (*Completely Aware*)



Protocol

- Prior to participants entering the treadmill the VAS was explained and they were informed of the protocol
- BWP was measured four times throughout the experiment
  - BWP is first measured at 100%BW_{set}
  - 4:45 of each 5 min experimental condition (i.e., 70%Bw_{set}, 35%Bw_{set}, and 90%BW_{set}

Statistical Analyses

- Descriptive statistics (mean±SD) were calculated for all variables
- A repeated-measures analysis of variance (RM-ANOVA) was calculated to determine if differences existed with CAP and BWP
- A 4 (BWP) x 2 (grouping) factorial analysis of variance was used to assesses differences in BWP between male and female participants, body weight grouping, and BMI grouping
- Significance was set at $p \leq 0.05$

Table 1. Participant Descriptive Statistics

	Female (*n* = 12)	Male (*n* = 9)	Overall (N = 21)
Age (y)	20.7±1.6	21.3±0.9	20.9±1.4
Ht (cm)	164.8±7.9	182.6±5.9	171.6±11.3
Wt (kg)	62.2±8.7	79.4±8.5	68.9±12.3
BMI ($kg \cdot m^2$)	22.6±2.1	24.0±2.2	23.3±2.3

Results: Chamber Air Pressure

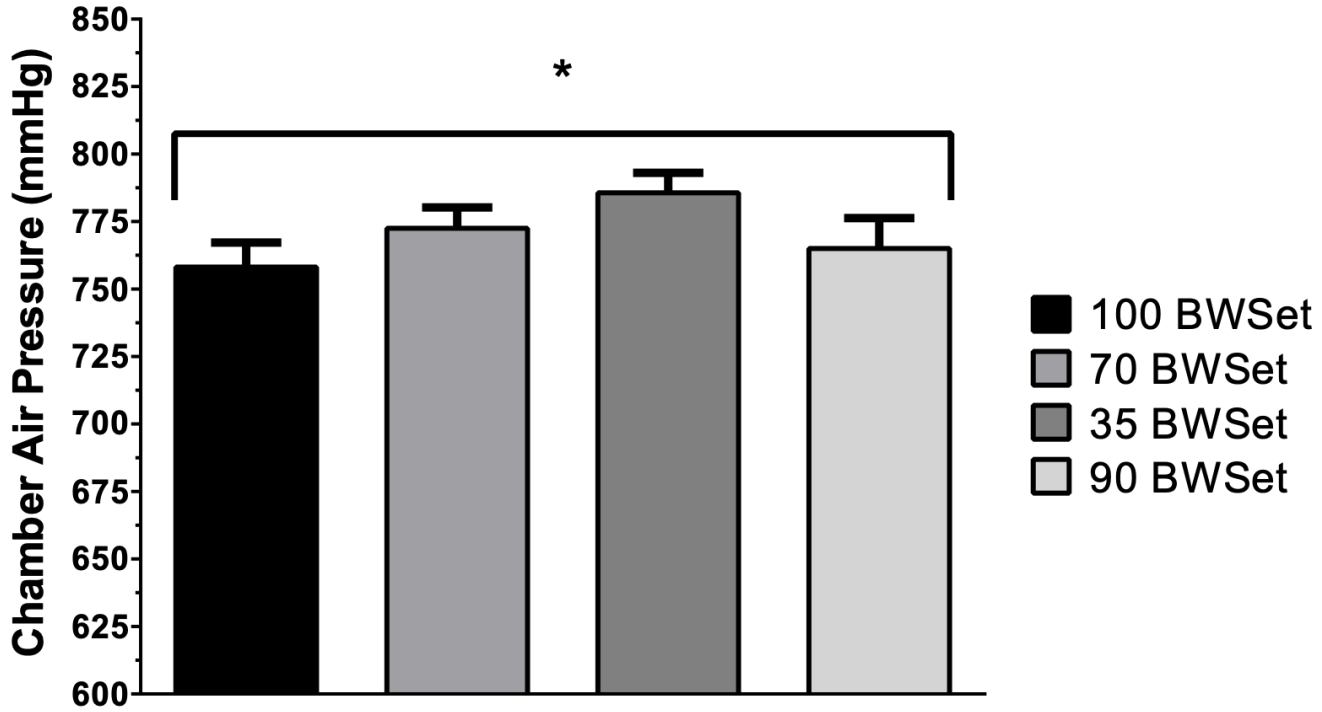


Figure 1. Differences in chamber air pressure for the Alter-G® treadmill. ***Note:*** The body is most supported by the treadmill during 35%BW_{Set} and least supported during 100%BW_{Set}. * denotes all BW_{Sets} were significantly different from each other (*ps* < 0.001).

Results: Body Weight Perceptions

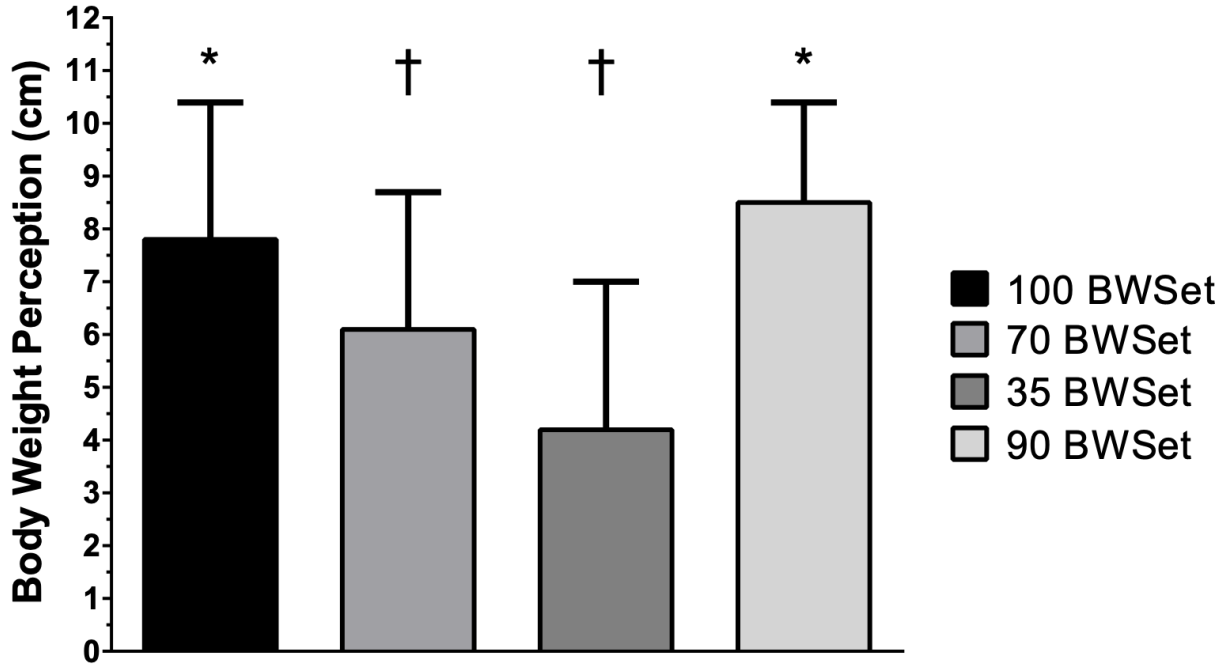


Figure 2. Body weight perception as measured by a 10 cm visual analog scale while air pressure changes in the treadmill. ***Note***: The body is most supported by the treadmill during 35%BW_{Set} and least supported during 100%BW_{Set}. * denotes that 100%BW_{Set} and 90%BW_{Set} were higher than 70%BW_{Set} and 35%BW_{Set} (*ps* < 0.026). † denotes that condition is statistically different from all three other conditions (*ps* < 0.026). 100%BW_{Set} was no different from 90%BW_{Set} (*p* = 1.00).

Results: BWP Comparison between Female vs. Male Participants

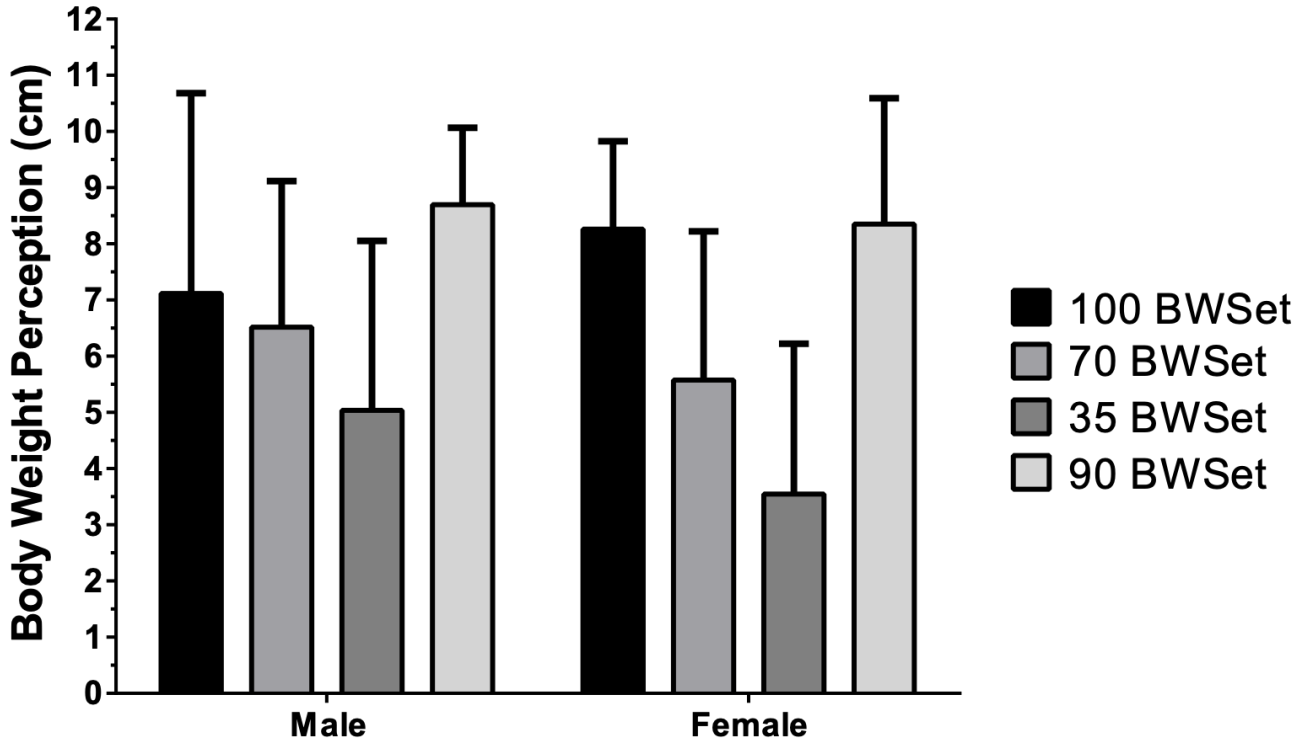


Figure 3. Body weight perception response across male and female participants as measured by a 10 cm visual analog scale while air pressure changes in the treadmill.

Results: BWP Comparison based on Weight Grouping

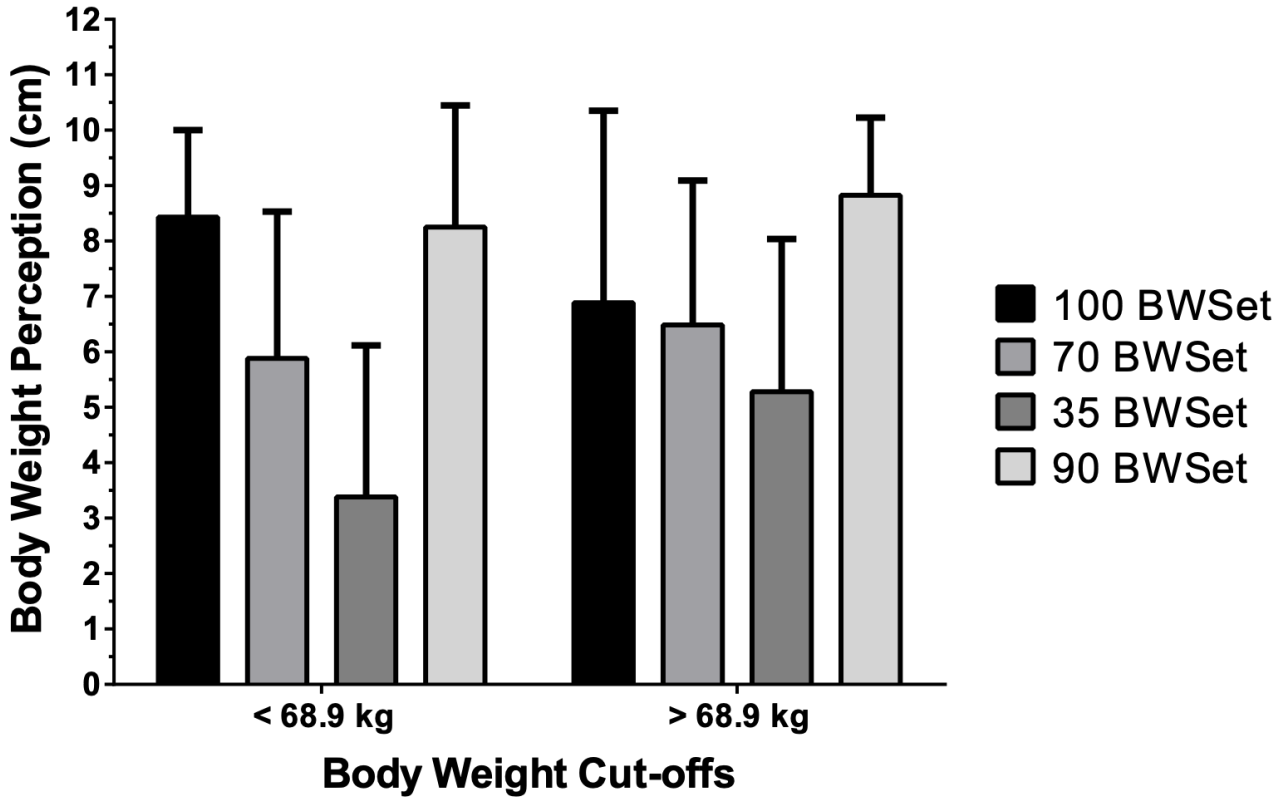


Figure 4. Body weight perception response based on weight grouping as measured by a 10 cm visual analog scale while air pressure changes in the treadmill.

Results: BWP Comparison based on BMI Grouping

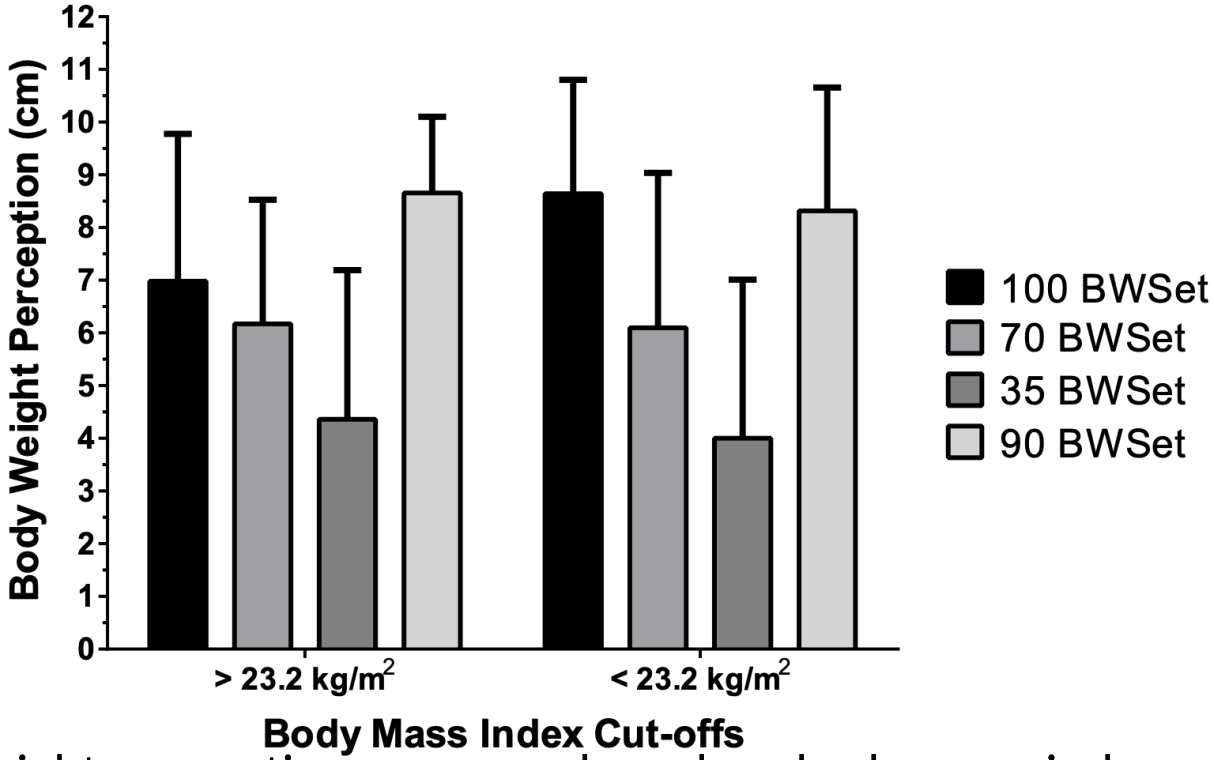


Figure 5. Body weight perception response based on body mass index grouping as measured by a 10 cm visual analog scale while air pressure changes in the treadmill.

Discussion

- CAP measures reported significant values when compared to each other, suggesting that chamber air pressures at 100%BW_{set}, 70%BW_{set}, 35%BW_{set}, and 90%BW_{set} were significantly different
- This suggests that when the condition was changed in the machine it appropriately changed the air pressure inside the machine to be different from one another
- Females were less aware of their body weight during 70%BW_{set}, 35%BW_{set}, and 90% BW_{set} than males
- Heavier participants had more awareness than lighter participants, on average, during the BW_{sets}

Conclusions

- This is one of the first studies to look at body weight perception during resting standing state
- Changes in chamber air pressure suggest a successful manipulation of air pressure inside the inflatable chamber
- Changes in body weight perception suggest that the greater the body weight support produced, the less aware participants are of their body weight
- Body weight perception differences were also noted between male and female participants, when grouped by body weight, and when grouped by BMI
- Future research is needed to better understand the multifactorial influence on body weight perception both at rest and during exercise
- Collectively, manipulating chamber air pressure appears to alter perception of both body weight at rest and effort sense during exercise in users of a lower body positive pressure treadmill

Thank You!

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Overview of Talk

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