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Blood Pressure Responses during Three Unweighted Conditions in a Lower Body Positive Pressure Treadmill

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Background Information

- Alter-G™ (Altering Gravity Treadmill)
- Lower Body Positive Pressure Treadmill (LBPPT).
- The Alter G Treadmill™ uses air pressure to allow people to exercise with less strain on the lower extremities[1,2.]
- Lower body positive treadmills (LBPPT) are used as therapy to help patients with limited mobility.

Background Information

- There have been very few studies that have measured Blood Pressure as the internal chamber pressure was changed.
- Exercise BP response on the LBPP TM has been reported and is reflective of the lower exercise intensity (Van Langen et al 2017 and others)
- No studies have measured *standing* BP on the LBPP TM without the addition of exercise.

Purpose of the Study

- The purpose of this study was to measure the effects of three different unweighted conditions on standing arterial blood pressure in a LBPP treadmill.
- A second purpose was to measure BP steady state over 5 minutes of standing in the LBPP TM at three different unweighted conditions.

Methods

Variables that were measured:

- Arterial Blood Pressure and heart rate were measured with a SunTech® automatic BP cuff.
- Internal Chamber Air Pressure (CAP) was measured with a Davis barometer.

Protocol

Blood pressure measured at 100%BWset (normal body weight) standing in LBPPT.

- 70%BWset: Blood Pressure recorded at 1, 3, and 5 min of stage.
- 35%BWset: Blood Pressure recorded at 1, 3, and 5 min of stage.
- 90%BWset: Blood Pressure recorded at 1, 3, and 5 min of stage.
- Mean arterial pressure (MAP) was calculated as the average pressure in arteries during a cardiac cycle.

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

Statistical Analysis

- Repeated measures ANOVA with Greenhouse-Geisser correction
- Bonferroni post-hoc test for significant F-statistics. Significance set to $p < 0.05$.

Results: Average Systolic Blood Pressure

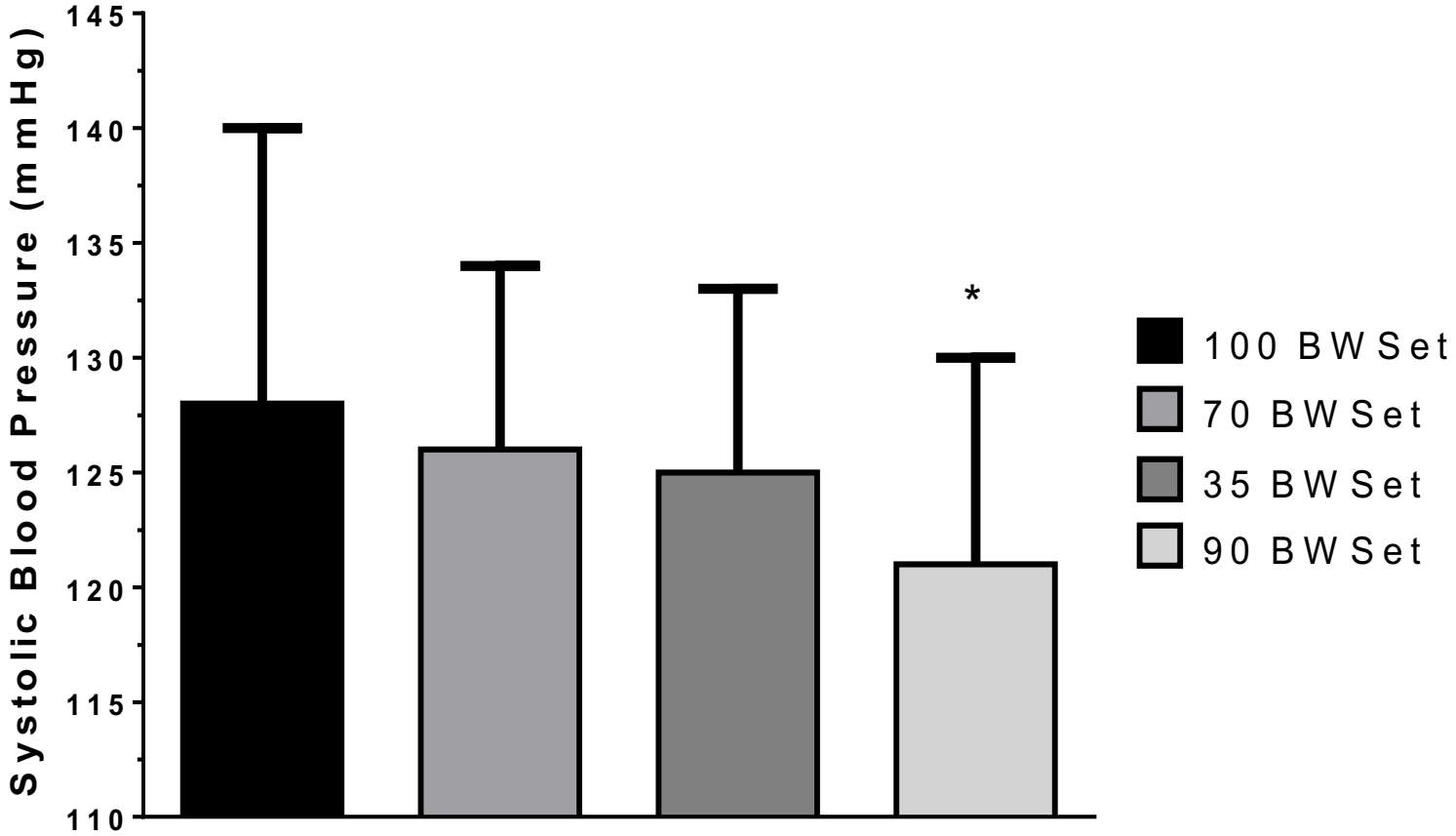


Figure 2. Standing systolic blood pressure responses while air pressure changes in the treadmill.
Note: The body is most supported by the treadmill during 35 BWSet and least supported during 100 BWSet. * denotes a significant difference between 90 BWSet and all other conditions (*ps* < 0.013).

Results: Average Diastolic Blood Pressure

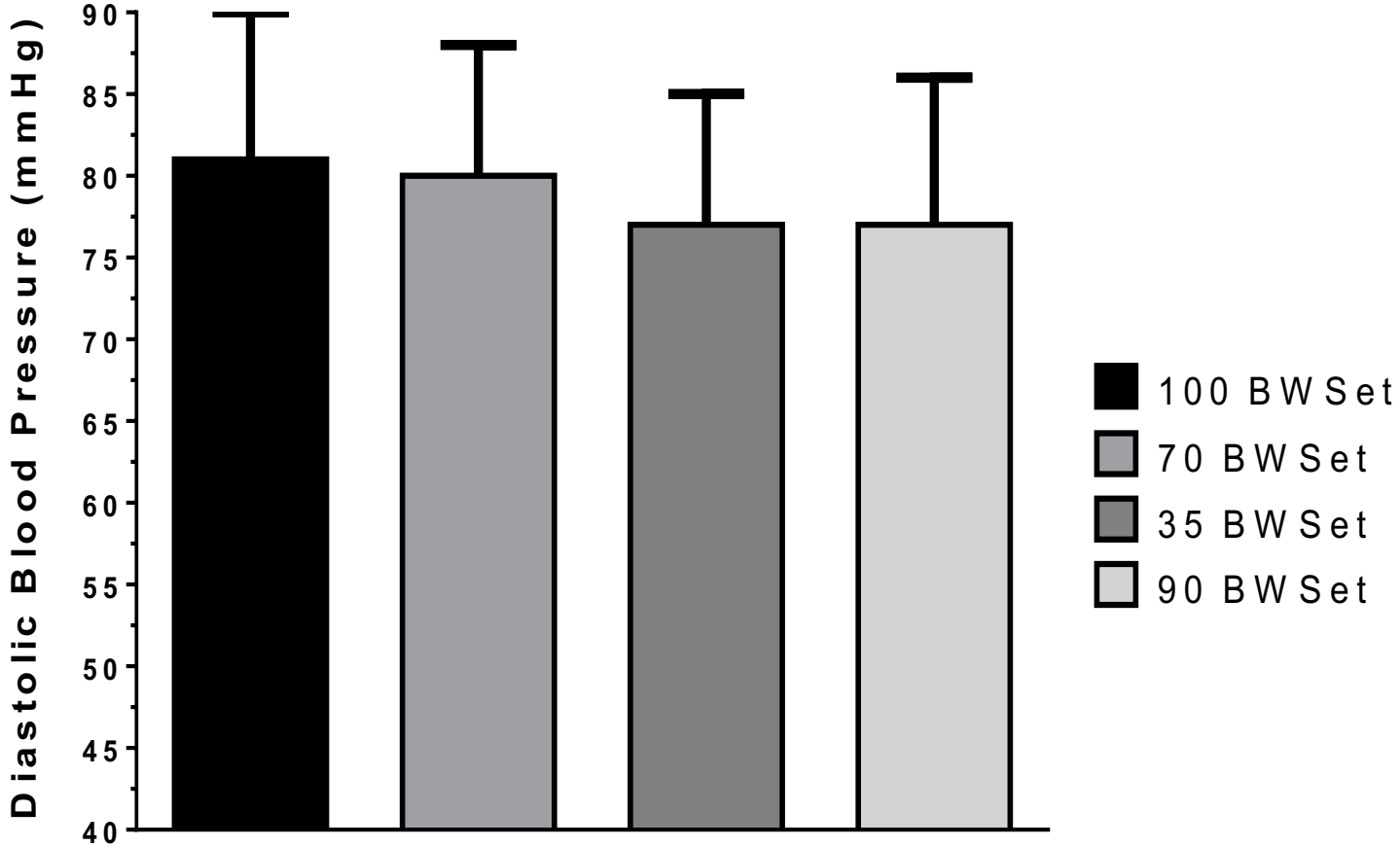


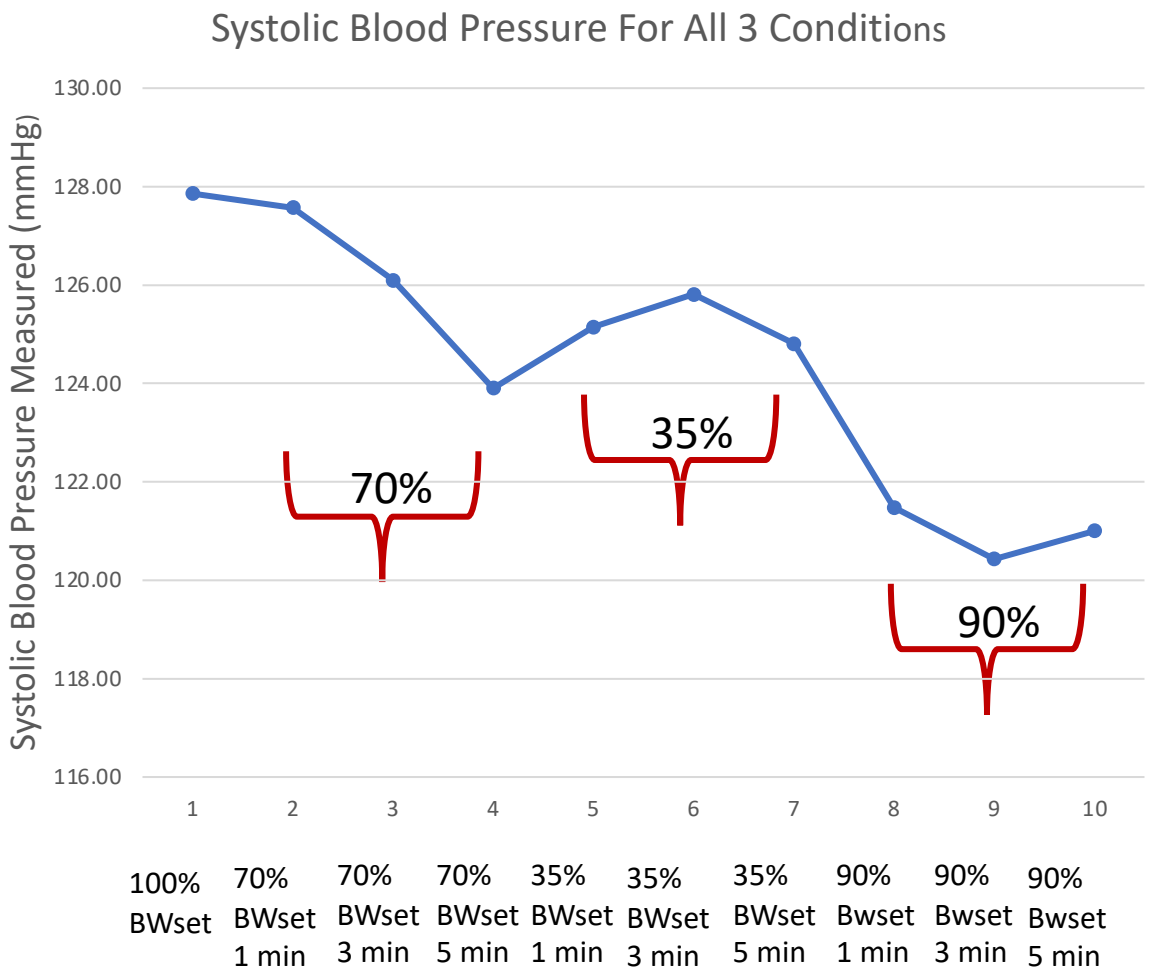
Figure 3. Standing diastolic blood pressure responses while air pressure changes in the treadmill.
Note: The body is most supported by the treadmill during 35 BWSet and least supported during 100 BWSet. No significant differences were observed (*ps* > 0.081).

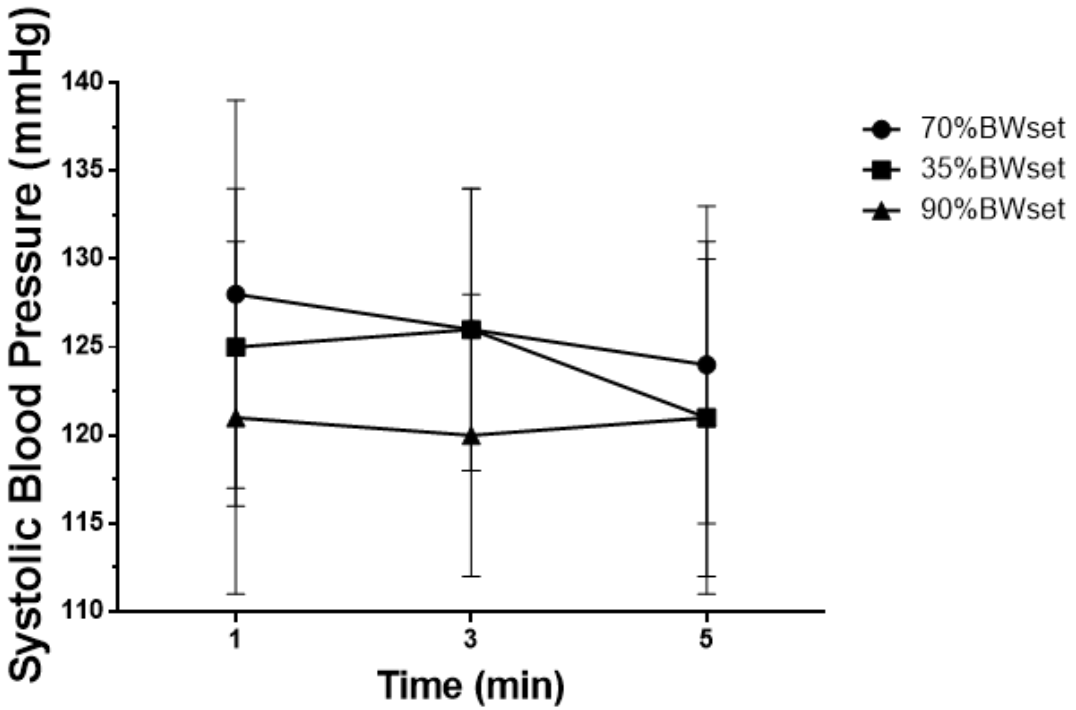
Mean Arterial Pressure

	Rest	100%BWset	70%BWset	35%BWset	90%BWset
MAP (mmHg)	95 ± 8	96 ± 7	96 ± 8	93 ± 7	92 ± 8

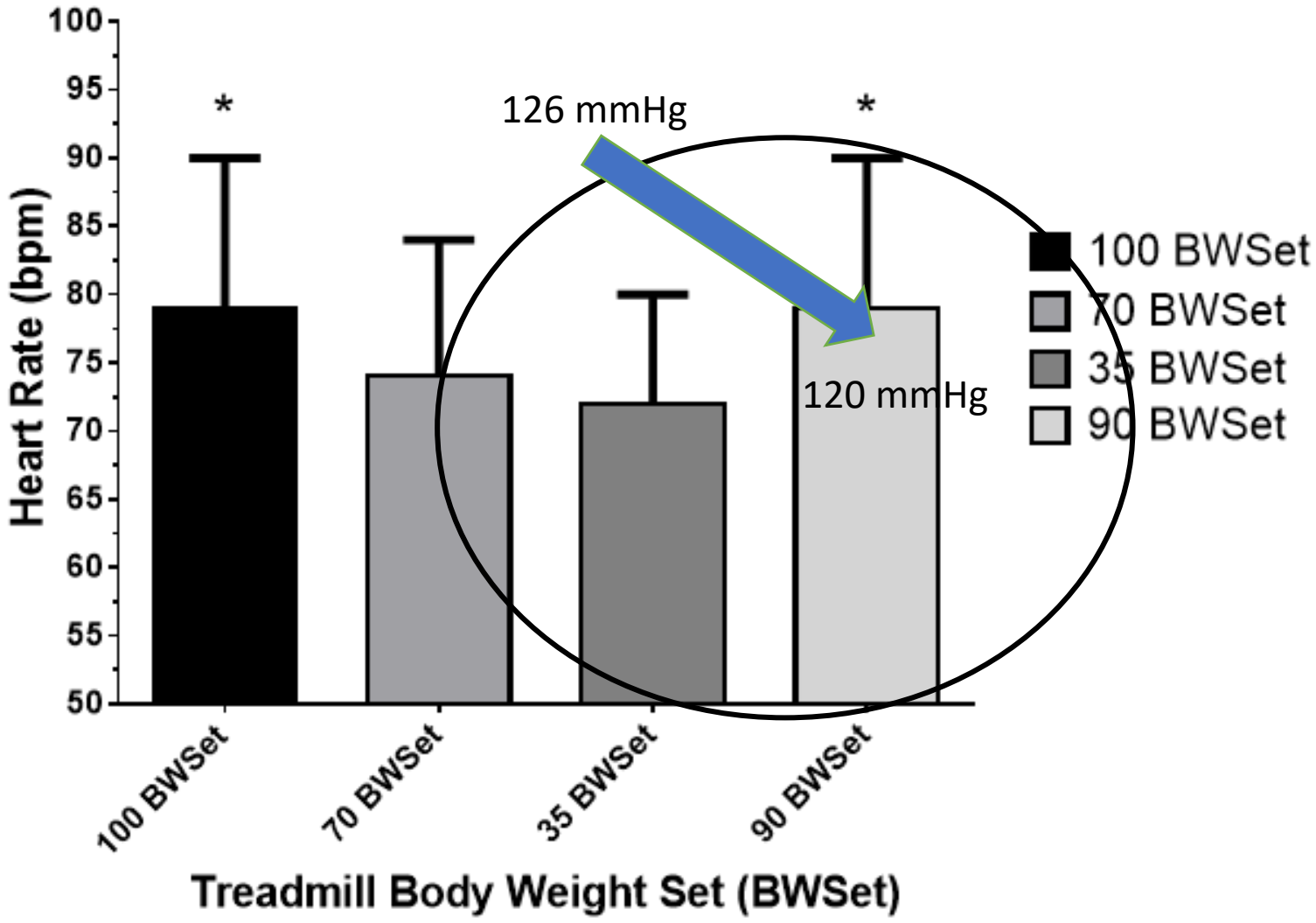
- 100%BWset was higher than 35%BWset ($p = 0.022$) and 90%BWset ($p < 0.001$).
- 70%BWset higher than from 90%BWset ($p = 0.002$).

Systolic Blood Pressure





Heart Rate


100
95
90
85
80
75
70
65
60
55
50
Heart Rate (bpm)
*
*
126 mmHg
120 mmHg
100 BWSet
70 BWSet
35 BWSet
90 BWSet
100 BWSet
70 BWSet
35 BWSet
90 BWSet
Treadmill Body Weight Set (BWSet)

Discussion

- SBP decreased over time, possibly due to less sympathetic nervous system drive (less stressed).

- The greatest change in systolic blood pressure was from the 35% BWset (most supported) to 90% BWset (least supported).

- The lower arterial BP *and* higher heart rate suggest possible venous pooling and decrease venous return[3].

Conclusions

- Systolic blood pressure was significantly lower at 90%BWset compared to other conditions.
- First investigation to show changes in blood pressure with changes in LBPPT chamber pressure during a standing resting condition.
- We recommend a cool down on the Alter G and slow release of pressure to prevent venous pooling and decrease in arterial BP.

Limitations

- Suntech automatic BP cuff was not consistent with time needed to record a BP (~20 to 45 sec)
- N = 21

Thank You

- Thank you to my mentors Dr. Hokanson, Dr. Lind, and Dr. Bellovary
- Thank you to my peers that did this research alongside me: Madison Rees and Matthew Ballesteros.
- Thanks to all the volunteers that participated in

the study

SUNY Cortland

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