Impact of Moderate Exercise on Air Displacement Plethysmography in Adult Females

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BACKGROUND

- Exercise prior to measuring body composition using air-displacement plethysmography (ADP) is contraindicated.
- Research has shown that exercise decreases body fat percentage (BF%) measurement immediately post-exercise.
- How BF% measurements subside post-exercise or how different exercise modalities impact post-exercise BF% is unclear. In addition, less is known about the impact of exercise and measuring BF% in adult females.

PURPOSE

- The purpose of the study was to determine how different modalities of moderate intensity exercise impact measures of BF% using ADP in adult females.

METHODS

- Fourteen female adults volunteered to participate in the study. In random order, participants visited the laboratory on four occasions that included three exercise and one non-exercise condition. All sessions were conducted at the same time of day at least 48 hours apart.
- Participants were asked to refrain from eating at least 2 hours and exercise at least 24 hours prior to appointments.
- Participants completed a 30-minute moderate exercise bout (45 to 55% HHR) using either treadmill (TR), cycle ergometer (CE), or arm ergometer (AE). For the control condition, subjects were seated throughout the session.
- BF% using ADP (BodPod) was measured immediately prior to exercise (PRE) as well as immediately post (IP), post-15 minutes (P15), post-30 minutes (P30), post-45 minutes (P45), and post-60 minutes (P60). The control (C) condition included 30 minutes of rest in lieu of exercise along with the other pre and post measures.
- Repeated measures ANOVA were used to determine differences in BF% among all time points within each modality. Where appropriate, pairwise comparisons with Bonferroni adjustments were used to determine differences.

MAIN FINDINGS

Table 1. Descriptive Characteristics of Participants (n=14)

Variables	Mean ± SD	Range
Age (y)	33.3 ± 11.4	20 - 45
Height (cm)	164.5 ± 5.9	153 - 173
Body Mass (kg)	69.1 ± 14.5	52 - 105
BMI ($kg \cdot m^{-2}$)	25.6 ± 5.3	18.7 - 38.6

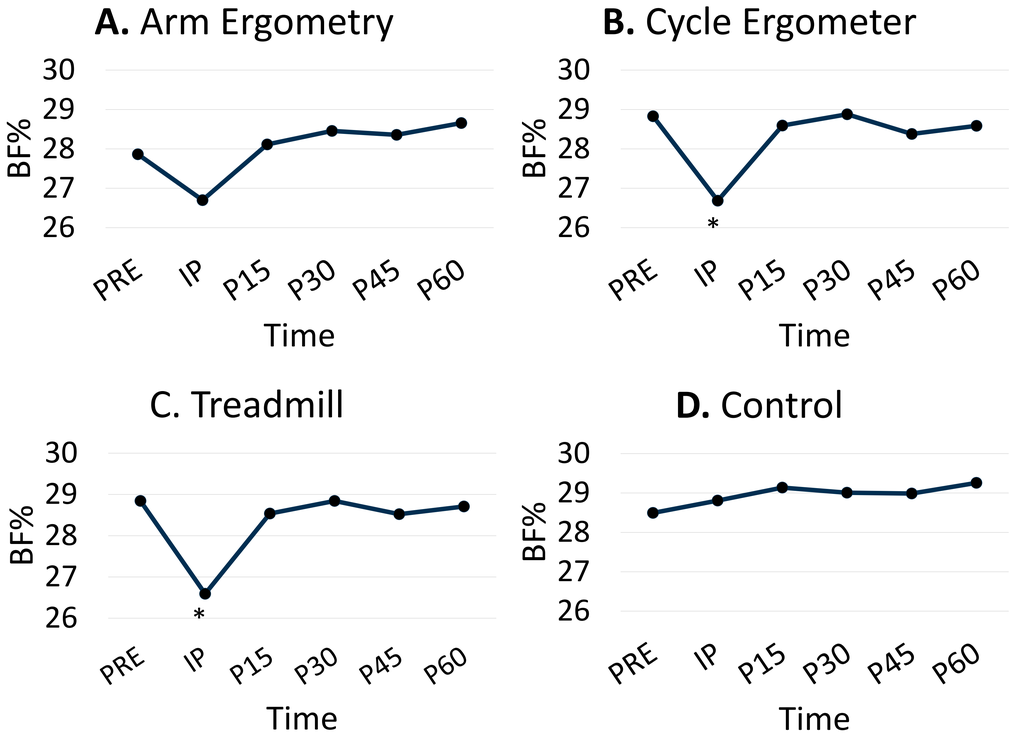

Figure 1. Body fat percentage (BF%) in response to exercise modality. Pre-exercise (PRE) time followed by immediate (IP), 15 minutes (P15), 30 minutes (P30), 45 minutes (P45), and 60 minutes post-exercise (P60). *Significant difference from all other time points ($p<0.05$).

RESULTS CONTINUED

- No differences were found among any of the PRE measurements across all conditions (avg BF% = 28.5 ± 0.5%).
- BF% dropped from PRE to IP by ~1.9% among TR, CE, and AE; however, only TR & CE significantly declined ($p < 0.05$).
- BF% did not significantly change in the control condition across time ($p > 0.05$).
- There were no significant differences between PRE and P30, P45, and P60 in any of the modalities ($p > 0.05$).

CONCLUSIONS

- Results demonstrate moderate intensity TR and CE significantly lower BF% measurements from ADP immediately upon completion of the exercise bout.
- The decrease in BF% is temporary and measurements observed at P15, P30, P45, and P60 were not statistically different than pre-exercise measurements.

PRACTICAL APPLICATIONS

- Results of the study can be used by practitioners using ADP to measure BF%. While exercise is a contraindication to BF% testing, it does not appear to be a limiting factor 15 minutes post-exercise. However, clinical relevance of the setting should be taken under consideration.

REFERENCES

McCrory, M. A., Gomez, T. D., Bernauer, E. M., & Molé, P. A. (1995). Evaluation of a new air displacement plethysmograph for measuring human body composition. *Medicine and science in sports and exercise*, *27*(12), 1686-1691.

Noreen, E. E., & Lemon, P. W. (2006). Reliability of air displacement plethysmography in a large, heterogeneous sample. *Medicine & Science in Sports & Exercise*, *38*(8), 1505-1509.

Otterstetter, R., Johnson, K. E., Kiger, D. L., Agnor, S. E., Edwards, J., Naylor, J. B., & Krone, S. J. (2013). The effect of acute moderate-intensity exercise on the accuracy of air-displacement plethysmography in young adults. *European journal of clinical nutrition*, *67*(10), 1092-1094.

Tyo, B. M., & Nicks, C. (2020). Effect of moderate intensity exercise on body composition measurements. *Measurement in Physical Education and Exercise Science*, *24*(3), 172-180.