RESPONSES TO CARDIORESPIRATORY ENDURANCE EXERCISE ANCHORED TO A VIGOROUS HEART RATE INTENSITY

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Introduction

- Exercise prescription to improve cardiorespiratory endurance (CE) is often based on percentages of the reserve or maximum heart rate (HR_{max}) or oxygen consumption rate ($\dot{V}O_{2max}$) that reflect vigorous intensities (77-95% HR_{max}, 64-90% $\dot{V}O_{2max}$).
- Exercise anchored to heart rate (HR) requires adjustments in the power output (P) that result in decreases in the metabolic rate ($\dot{V}O_2$).
- It is unclear if exercise at the recommended HR range reflects a vigorous metabolic stimulus and desired exercise duration.

PURPOSE: This study examined the P and metabolic ($\dot{V}O_2$) responses to exercise at a constant HR in the middle (86% HR_{max}) of the vigorous intensity range and quantified the time spent in the severe (>respiratory compensation point [RCP]), heavy (<RCP, >ventilatory threshold [VT]), and moderate (<VT) exercise intensity domains.

Methods

- Nine women (mean±SD, age 22.8±4.0 years, height 168±6 cm, weight 64±6 kg) completed a graded exercise test to exhaustion (GXT) to determine $\dot{V}O_{2max}$ (34.8±6.6 mL·kg^{-1}·min^{-1}), HR_{max} (185±10.5 b·min^{-1}) and the power output at $\dot{V}O_{2max}$ (PPO) (266±40 W).
- $\dot{V}O_2$ and P were recorded and normalized to their respective values at PPO in 10% intervals of time to exhaustion (T_{Lim}).
- Separate, one-way repeated measures ANOVAs and post-hoc t-tests with a Bonferroni corrected alpha of $p<0.005$ were used to examine changes in normalized $\dot{V}O_2$ and P.
- Polynomial regression analyses were used to determine the pattern of responses for the composite, normalized $\dot{V}O_2$, P responses (linear and quadratic) vs. normalized time (10-100%) for the HR trial.

Conclusions

- There was a decrease in the metabolic cost that tracked P for exercise anchored at 86% HR_{max}.
- The decreases in P resulted in the majority of the time spent in the moderate intensity domain and the relative $\dot{V}O_2$ was below the recommend range for vigorous exercise for 60% of the trial.
- Thus, for some subjects, the metabolic intensity for exercise anchored at 86% HRmax may be too low to maximize CE fitness.

Practical Applications

Researchers and practitioners should consider the dissociation between HR and $\dot{V}O_2$ responses during exercise anchored to HR to ensure the desired metabolic stimulus is met when examining or prescribing exercise to improve CE.

Results

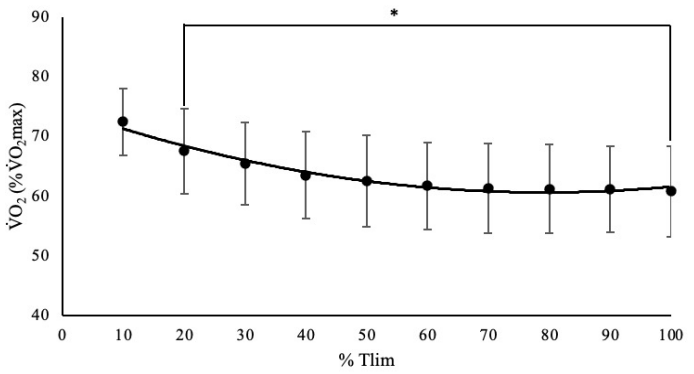

Figure 1. The time course of change in normalized $\dot{V}O_2$ values (% $\dot{V}O2_{max}$) during the 86%HR_{max}. * Indicates a significant decrease when compared to the initial value.

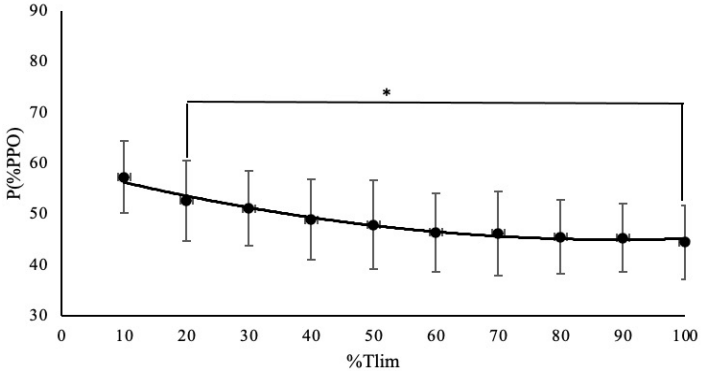

Figure 2. The time course of changes in the normalized power output (P) values (%PPO) during the 86%HRmax. * Indicates a significant decrease when compared to the initial value.

Results

Table 1. Individuals and mean±SD responses for the time spent in the moderate, heavy and severe intensity domain. During the 86%HR_{max}.

	Moderate	Heavy	Severe
Subject	Time (min)	Time (min)	Time (min)
1	61.33	1.67	0.00
2	60.00	1.00	0.00
3	15.33	9.33	1.67
4	49.00	0.00	0.00
5	56.67	7.00	0.00
6	63.00	0.00	0.00
7	61.67	1.67	0.00
8	32.67	9.67	0.00
9	60.33	1.33	0.00
Average	51.11	3.5	0.2
SD	16.50	4.0	0.6

Acknowledgements

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