Exercise Prescription Methods

Counterpoint Rebuttal

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Ferri Marini et al. provide a thoughtful analysis of selected variables that may influence aerobic exercise prescription. The key consideration in our original Counterpoint article was to address the validity of the % heart rate (HR) reserve to % oxygen consumption ($\dot{V}o_2$) reserve relationship (%HRR-%$\dot{V}o_2$R). As previously noted, the American College of Sports Medicine (ACSM) adopted %HRR-%$\dot{V}o_2$R as the standard for prescribing cardiorespiratory exercise in its 1998 Position Stand (1).

Ferri Marini et al. argue that, although several subsequent studies have confirmed the 1:1 %HRR-%$\dot{V}o_2$R relationship, others have not. In our original Counterpoint article, we noted that the studies that did not support the relationship either reversed the axes in the regression—rendering a comparison invalid—or used different time frames for measuring HR versus $\dot{V}o_2$ that resulted in inflated HRs relative to their respective $\dot{V}o_2$ values. Since Ferri Marini et al. authored one of the conflicting studies, we hope that they reanalyzed their data and will report if this methodologic adjustment altered their findings. Regardless, most studies that have examined the %HRR-%$\dot{V}o_2$R relationship support its use in exercise prescription.

In the practice of exercise prescription, it is unconventional to prescribe exercise using a measured $\dot{V}o_2$ and calculated %$\dot{V}o_2$R. Rather, exercise is commonly prescribed using HR (preferably determined using %HRR) or workload, or a subjective measure of somatic effort, such as rating of perceived exertion. The knowledge that %HRR values generally coincide with %$\dot{V}o_2$R invariably comes into play when a target workload needs to be calculated from $\dot{V}o_2$ data. A key concern is that such workload prescriptions should not be based on %$\dot{V}o_2$max if the exercise intensity corresponds to %HRR.

Ferri Marini et al. appropriately highlight the role of cardiovascular drift during extended exercise bouts. Indeed, both HR and $\dot{V}o_2$ rise (2,3) with exercise over time. Exercise professionals generally prescribe a range of HR values for a given client's exercise intensity (such as 40%–59%HRR or 60%–89%HRR for moderate and vigorous intensity, respectively, or a narrower range within these cut points) and, after a warmup, begin the session at a workload that elicits the lower end of that range, allowing the HR to drift upward toward the higher end of the range during the session—only reducing the workload if the upper limit of the HR range is exceeded. Here, $\dot{V}o_2$ would also rise over this period, but it is unclear if the 1:1 %HRR-%$\dot{V}o_2$R relationship is preserved during prolonged exercise. Another approach might be to maintain a specific HR during exercise by reducing the absolute intensity (workload) as the session proceeds. Perhaps the $\dot{V}o_2$ would respond similarly to the HR, i.e., remain stable, or modestly increase or decrease, depending on the relative exercise intensity and duration. In their Point, Ferri Marini et al. noted that they conducted a relevant study on a small, homogeneous population sample that is currently under review. However, they do not address whether $\dot{V}o_2$ varied during these sessions, stating only, "the 1:1 relationship [of %HRR to %$\dot{V}o_2$R] was not present during longer exercise bouts." Following this study's potential publication, and that of other studies using a wider range and number of subjects, a clearer picture of this response should emerge.

Ferri Marini et al. also suggested using the ventilatory threshold (VT) as an adjunctive intensity modulator for

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aerobic exercise prescription. One of us (BF) was an author of the 1998 ACSM Position Stand (1), both of us were authors on the 2011 update (4), and we considered this possibility. One drawback in using the VT is that it requires specialized cardiopulmonary measuring equipment, such as a metabolic cart, to establish the VT, whereas prescriptions employing HR do not. Most clients, including those with and without heart disease, rarely have exercise metabolic testing that would allow the measurement of VT. Of course, the same is true of $\dot{V}o_2$max and thus $\dot{V}o_2$R, but $\dot{V}o_2$max can be reasonably estimated from maximal treadmill performance (e.g., Ref. (5)). Another drawback to the use of VT is the wide range of methodologies for calculating it from cardiopulmonary data (e.g., nonlinear increase in ventilation [V_E] versus workload or $\dot{V}o_2$; breakpoint in $\dot{V}co_2$ versus $\dot{V}o_2$; rise in $V_E/\dot{V}o_2$ before rise in $V_E/\dot{V}co_2$), and an even wider range for estimating it from blood lactate concentration [L] (e.g., first increase in [L] versus workload or $\dot{V}o_2$; rise of [L] by 1 mM above baseline; rise of [L] to 4 mM). Accordingly, the ACSM has suggested that HR is a more practical method for prescribing exercise intensity for most people.

Clearly, additional population-specific research on the effects of cardiovascular drift and other potential confounders on exercise prescription is warranted. We look forward to Ferri Marini et al. and others pursuing these lines of research and leading us into the future.

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