

Online Resource 1

Supplementary methods for:

Steinarsson, A., Jakobsdóttir, G., Benediktsson, S. S., & Jóhannsson, E. (2026). *Aerobic endurance and physiological thresholds estimated from submaximal heart-rate kinetics: Comparison with cardiopulmonary exercise and sprint testing* [Unpublished manuscript]. Faculty of Health Promotion, Sport and Leisure Studies, University of Iceland.

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Ventilatory breakpoint identification

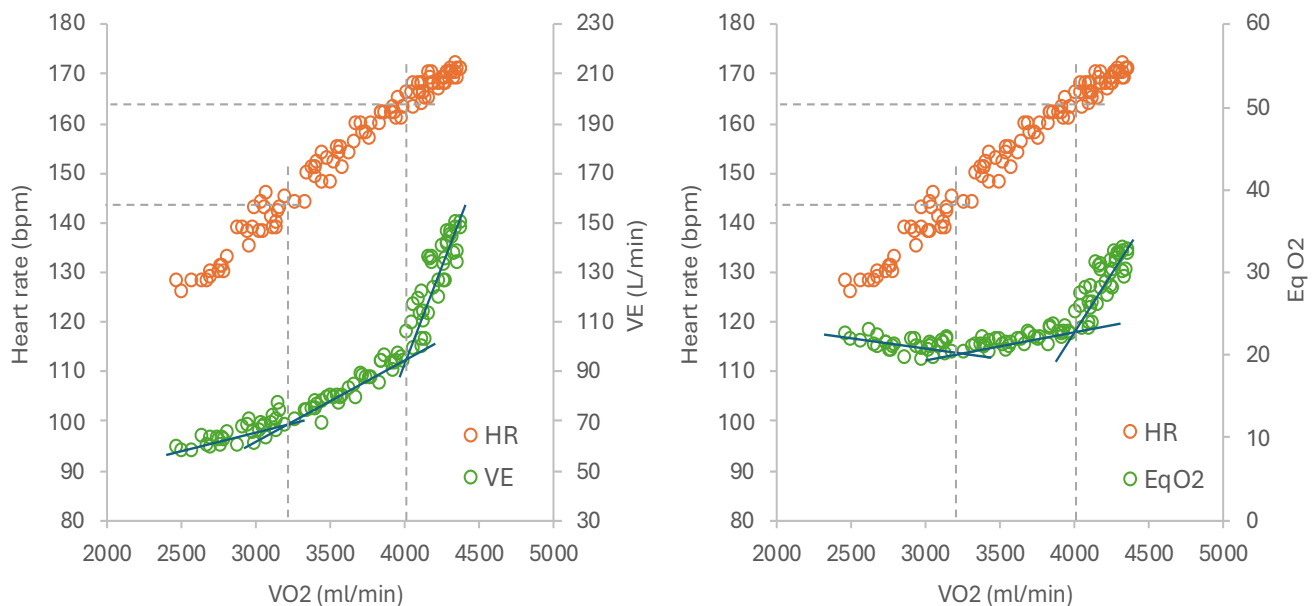


Fig. S1 Breakpoint (ventilatory threshold) detection illustrated for a representative participant's CPET. A) Heart rate (orange) and minute ventilation (VE, green) plotted against VO_2 ; the first dashed line marks the VT_1 breakpoint (the initial disproportionate rise in VE relative to VO_2) and the second marks the VT_2 breakpoint (a second, steeper inflection). B) Heart rate (orange) and the ventilatory equivalent for oxygen (EqO_2 , green) plotted against the same VO_2 axis; VT_1 corresponds to the point where EqO_2 stops declining and begins to rise, and VT_2 to the subsequent accelerated rise in EqO_2 .

Ventilatory thresholds were identified using a multi-signal approach (Fig. S1), combining ventilatory equivalents (EqO_2 and EqCO_2), end-tidal oxygen pressure (PETO_2), and the conventional VE/VO_2 and VE/VCO_2 relationships, rather than relying on a single criterion (Jamnick et al. 2020). VT_1 was identified from the first systematic disproportionate increase in ventilation relative to VO_2 , supported by the nadir and subsequent rise in EqO_2 and associated PETO_2 responses. VT_2 was identified from the onset of respiratory compensation and disproportionate hyperventilation (Keir et al. 2024). Corresponding heart rates and incline-corrected running speeds were recorded as VT_1HR , VT_2HR , VT_1v , and VT_2v for comparison with the model-derived

thresholds. Breath-by-breath gas-exchange data were smoothed using an eight-breath moving average and processed in SentrySuite (Vyntus CPX 2019), which provided automated slope calculations and initial breakpoint estimates. Where automated identification was ambiguous, the exported breath-by-breath data were reviewed post hoc using the combined criteria described above.

Treadmill Speed Correction

Treadmill speed (v_t) was corrected to an equivalent overground running speed (v) to account for the fixed 1% incline used throughout testing and for the absence of self-generated air resistance on the treadmill. The incline correction used the metabolic cost of running as a function of gradient (i), $C_r(i) = 155.4i^5 - 30.4i^4 - 43.3i^3 + 46.3i^2 + 19.5i + 3.6$ (in $\text{J} \cdot \text{kg}^{-1} \cdot \text{m}^{-1}$; Minetti et al., 2002), with treadmill speed scaled by the ratio $C_r(i)/C_r(0)$ to hold metabolic cost constant relative to level running. The air resistance correction estimated running resistance power, $P_r = c \cdot m \cdot v$ (in W, where $c = 0.98 \text{ kJ} \cdot \text{kg}^{-1} \cdot \text{km}^{-1}$ is the specific cost of overground running, m is body mass in kg, and v is velocity in m/s), and air resistance power, $P_a = 0.5 \cdot \rho \cdot C_d A \cdot v^3$ (in W, where $\rho = 1.205 \text{ kg/m}^3$ is air density, $C_d A = 0.24 \text{ m}^2$ is the runner's drag area, and no wind is assumed), then adjusted treadmill speed so that overground running power ($P_r + P_a$) matched treadmill running power (P_r alone), reflecting the absence of self-generated air resistance on the treadmill (Van Dijk & Van Megen, 2017).