

Impact of Different Sprint Pedal Resistances Within Heat-Based Sprint Interval Training on Repeated Sprint Ability, Time Trial Exercise and Recovery

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INTRODUCTION

- Previously, we demonstrated that heat-based sprint interval training (SIT) at 38°C and 30% RH led to a greater time till exhaustion and a lighter sprint pedal resistance (7.5% bodyweight; BW) delayed blood lactate accumulation by ~95 s compared with a heavier resistance (8.5% BW) (1).
- These findings indicate pedal resistance can impact metabolic responses during SIT in heat.
- Pedal resistance as a SIT variable is overlooked with 79% of SIT use 7.5% BW (2).
- Early SIT research shows 8.5-8.7% BW pedal resistances increase peak power and type II fibre recruitment which may require greater recovery (3). In turn, heavier resistances >7.5% BW may lead to greater power and recovery adaptations.
- Determining the optimal sprint pedal resistance during heat-based SIT may therefore be critical for maximising training adaptations.

AIM & HYPOTHESES

- Aim: to compare the impact of 7.5% BW and 8.5% BW cycle sprint pedal resistances on repeated sprint ability, cycling time trial (TT) performance, muscle oxygen use and muscle oxygen recovery within a 3-week heat-based SIT protocol.
- Hypotheses: 1) both pedal resistances would see an improved 15-minute TT performance. 2) greater sprint power and recovery capacity would be observed with 8.5% BW pedal resistance.

METHODS

- 10-week total study where a 3-week heat-based SIT protocol was completed in 38°C and 30% RH. 14 participants were allocated to a sprint pedal resistance training group (TG): 7.5% BW (7.5TG) or 8.5% BW (8.5TG). See figure 1.
- Data analysis: sprint SmO₂ components - time delay (TD) = time till fast desaturation, fast desaturation (FD) = rapid decline in SmO₂ and equilibrium (Eq) = new steady state is established (4). Change-point detection was used to divide the 15-minute time trial and 30-minute cycle into four components (C1–C4). See figure 2. Significance was set to P ≤ 0.05.

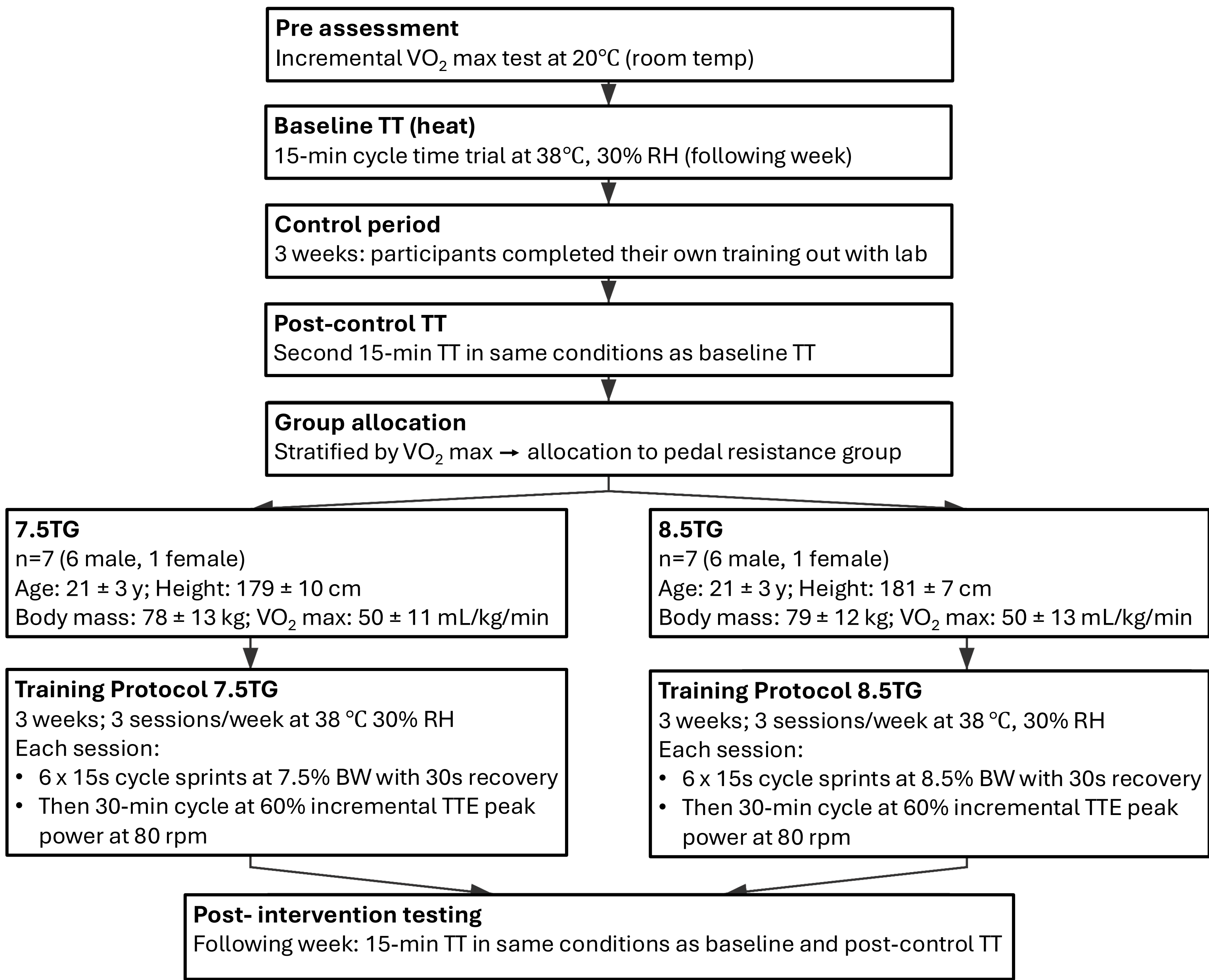


Figure 1. Flow diagram of study. TT time trial, TG training group, TTE time till exhaustion.

MUSCLE OXYGEN SATURATION (SmO₂) ANALYSIS

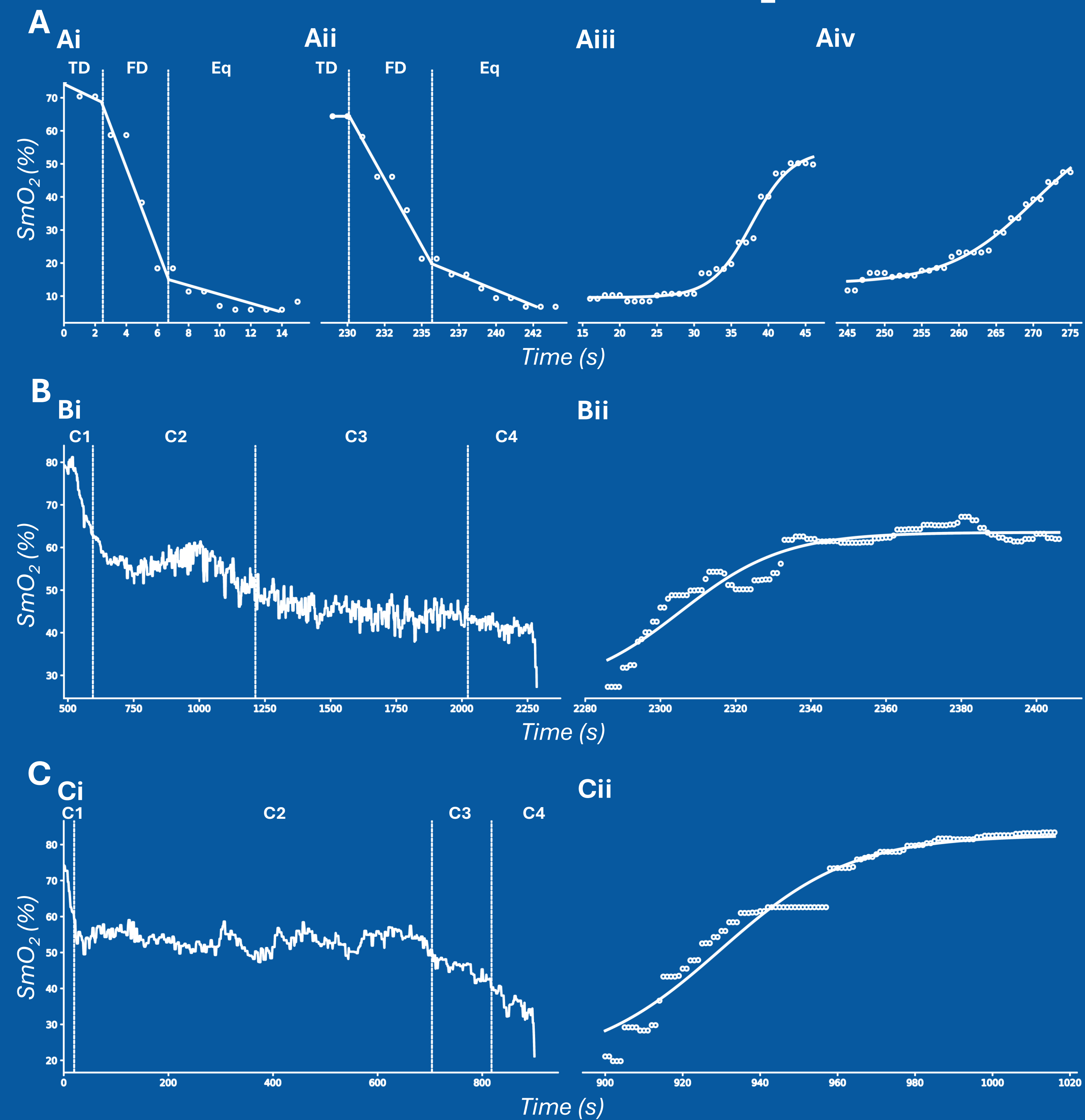


Figure 2. Muscle oxygenation analysis. (Ai) Sprint 1 with linear fit, (Aii) Sprint 6 with linear fit, (Aiii) 30s recovery post sprint 1 with sigmoidal fit, and (Aiv) 30s recovery post sprint 6 with sigmoidal fit. TD time delay, FD fast desaturation, and Eq equilibrium. (Bi) 30-min phase with change point detection and (Bii) 2-min recovery following 30-min phase with sigmoidal fit. (Ci) 15-min time trial with change point detection (Cii) 2-min recovery following 15-min time trial with sigmoidal fit. C1 component 1, C2 component 2, C3 component 3 and C4 component 4.

KEY RESULTS

Repeated sprints

- Exercise: FD SmO₂ average power increased in both groups from first-last training session (P = 0.05). FD rate decreased from sprint 1 to 6 (P < 0.01). In both groups, FD rate increased (P = 0.04) while FD duration decreased from first-last session (P = 0.01).
- Recovery: SmO₂ recovery rate decreased from sprint 1 to 6 (P = 0.03), SmO₂ capacity limit increased only in the 7.5TG from first-last session (P_{Adj} = 0.02)

30-minute phase post sprints

- There was a significant component × group interaction for ΔSmO₂ start–end (P = 0.03), with visual inspection suggesting a trend toward a metabolic disturbance during C1 in 8.5TG compared to 7.5TG during first and last training sessions.

15-minute time trial

- Distance covered (km) or exercising/recovery SmO₂ did not improve. This may reflect a self-selected pacing strategy adopted after baseline cycle TT in the heat (5). In turn this may have masked the training effects.

PRACTICAL APPLICATIONS

- Light and heavy pedal resistances improved repeated sprint power and muscle oxygen use.
- To maximise power and recovery adaptations 7.5% BW pedal resistance is recommended.
- TT performance did not improve. Consider using fixed pacing during TT for future studies.

