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The Relationship Between Durability and Simulated Cycling Performance

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Science & Cycling

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Background

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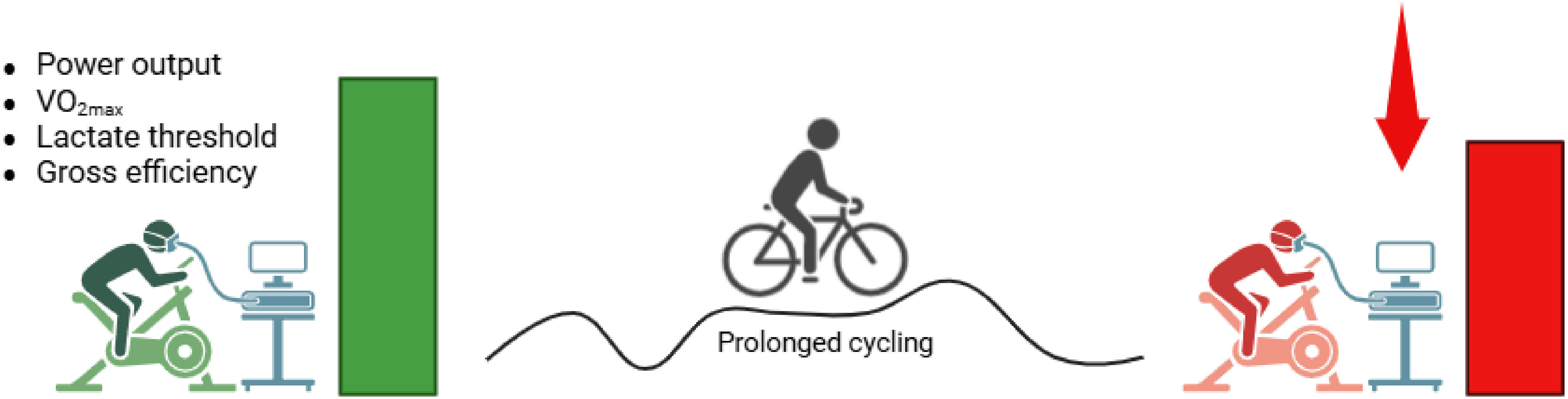
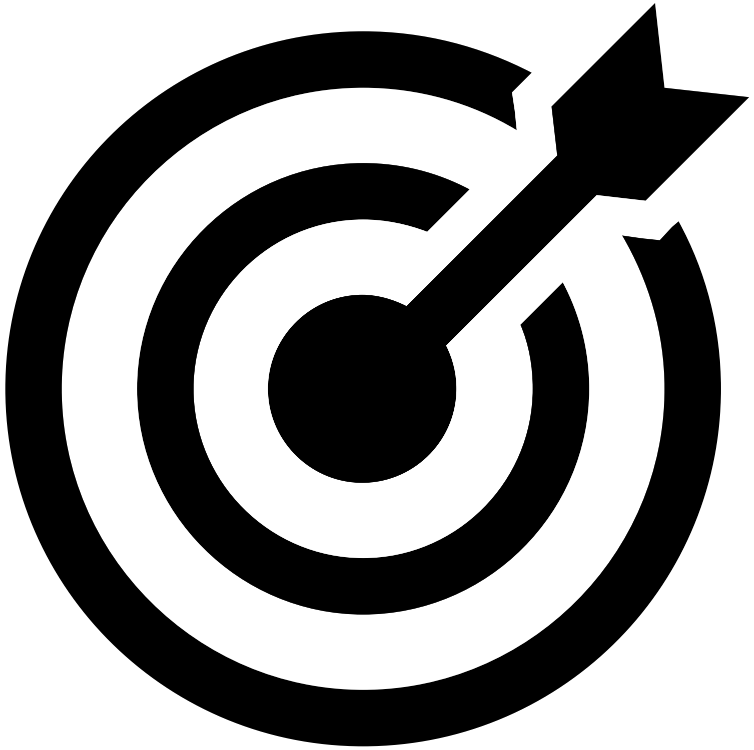
- Most endurance tests assess markers of performance in a 'fresh' (non-fatigued) state.
- Prolonged exercise induces significant drops in key performance markers (Clark et al., 2018; Stevenson et al., 2022).
- Durability - the capacity to resist these declines is emerging as a core determinant of endurance success (Jones, 2023; Maunder et al., 2021) however, data about its direct relationship with cycling performance is limited.
- Durability seems to be protocol, or intensity dependant (Mateo-March,, 2024; Spragg et al., 2024).



Aims

a) To determine whether the type of fatiguing protocol (continuous or intermittent) influences the relationship between durability and cycling performance.

b) To determine whether the relationship between the markers of endurance performance and cycling time trial (TT) and road race (RR) performance is improved when durability is considered.



Participants *n = 8 (aiming for 14)

Inclusion criteria:

- 18-50 Y/O
- "Trained" in cycling (tier 2 or better: training ~ 3x per week with the purpose to compete) - participant classification framework by McKay et al. (2021).

Characteristic	Mean ± SD
Age (years)	31 ± 9
Stature (cm)	180 ± 6
Mass (kg)	79 ± 6
$\dot{V}O_{2max}$ (ml•kg•min^{-1})	59 ± 4
Critical power (W)	322 ± 42

Methods

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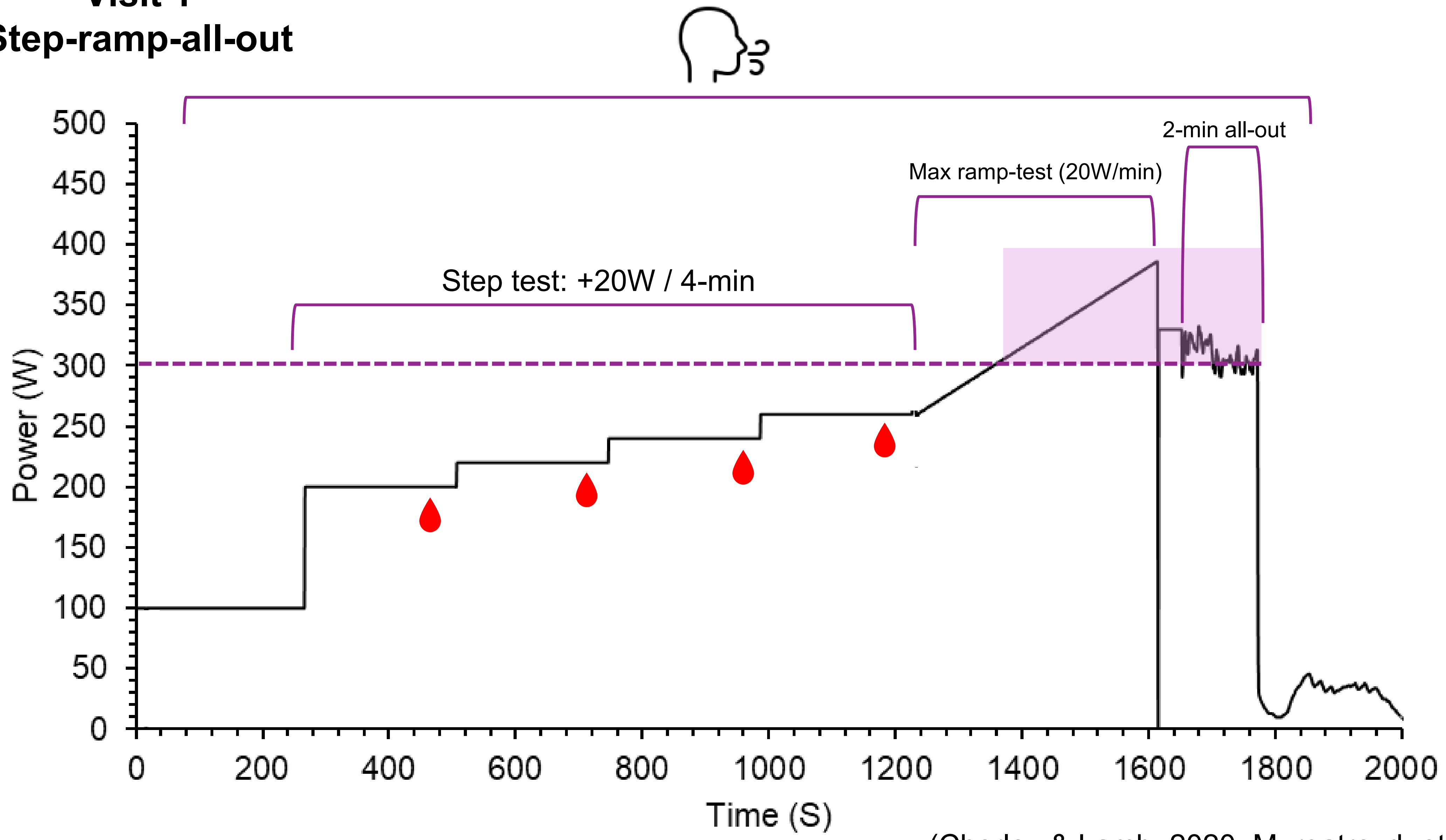
Visit 1
Step-ramp-all-out



(Chorley & Lamb, 2020; Murgatroyd, et al., 2014)

Methods

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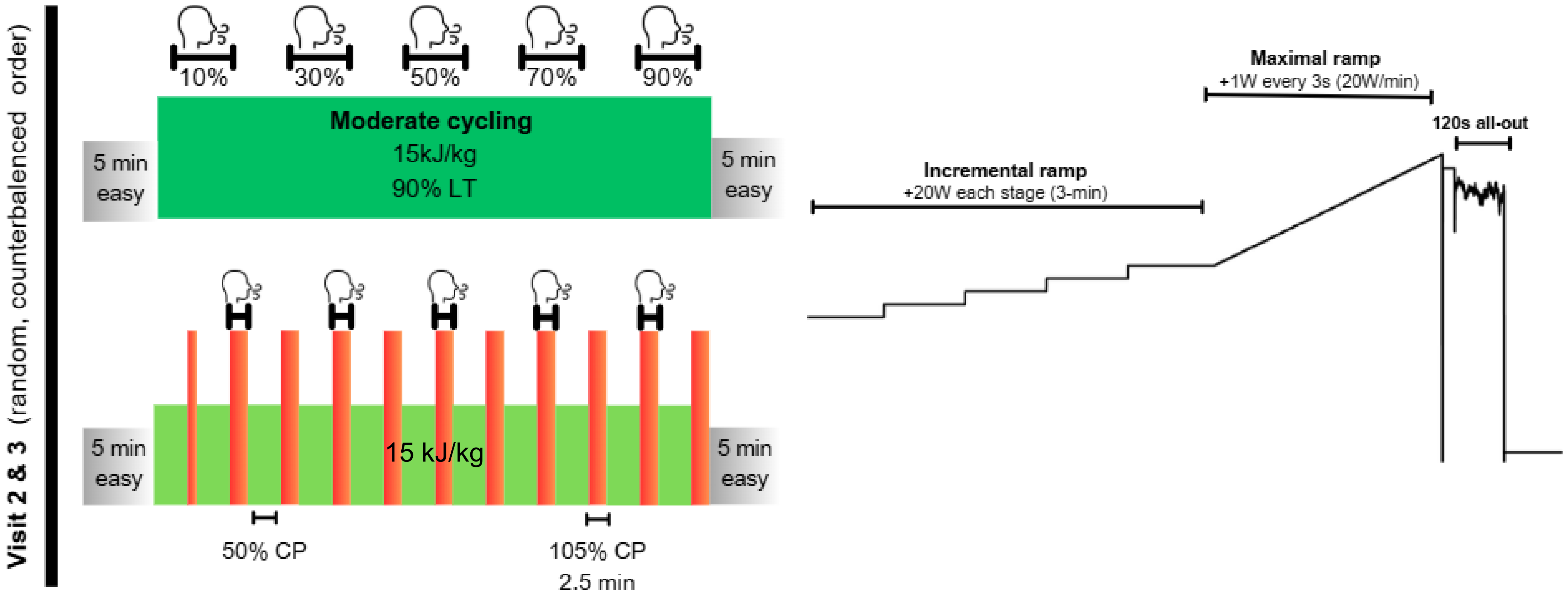
Visit 2 & 3
15 kJ•kg + step-ramp-all-out



*Both fatiguing protocols took ~ 95 mins on average

Methods

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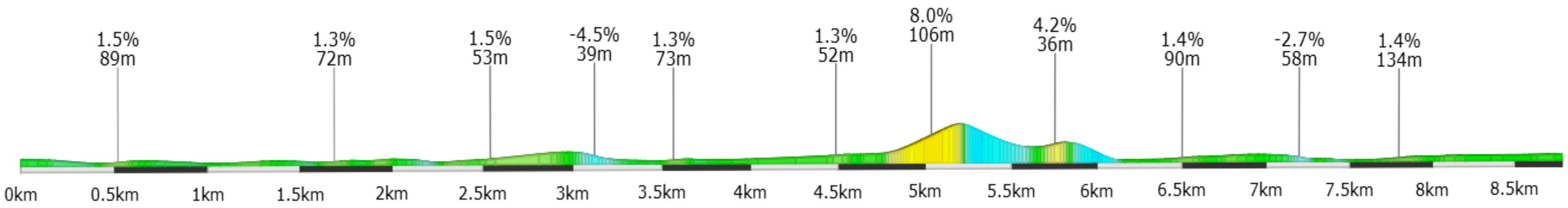
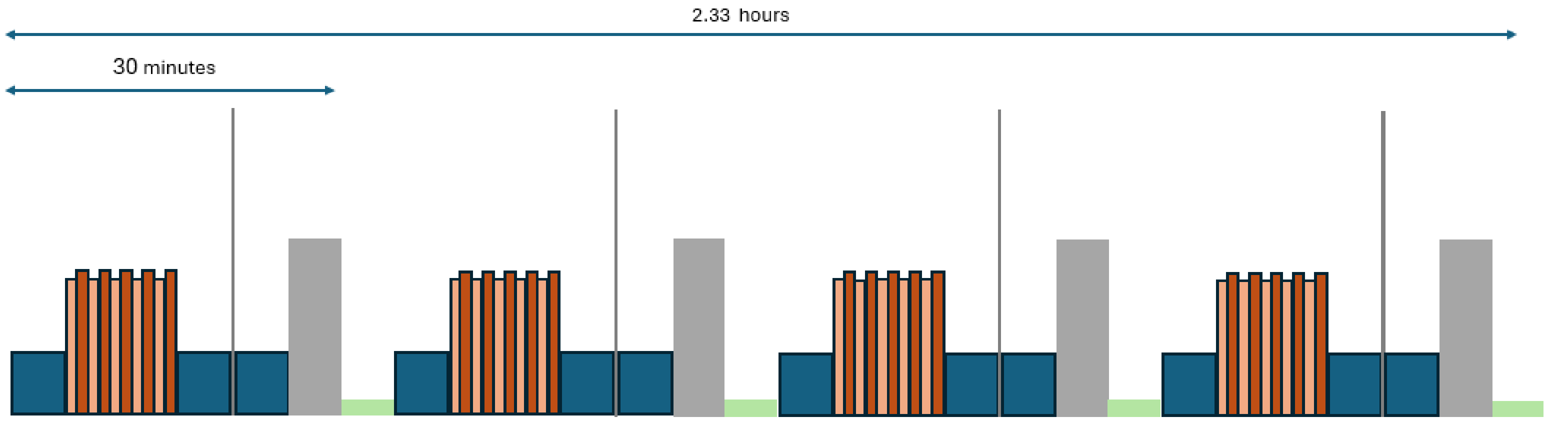
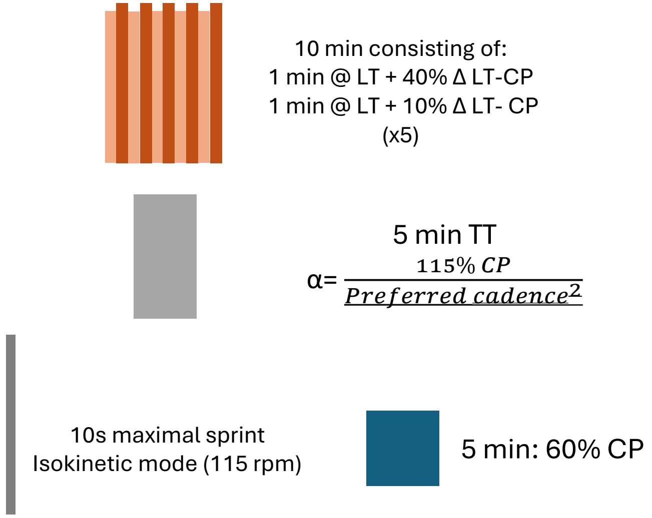
Visit 4 & 5 - simulated road race & time trial

26.8 km Zwift time trial (TT)



2.3 hour simulated road race





Results – changes in markers of endurance performance

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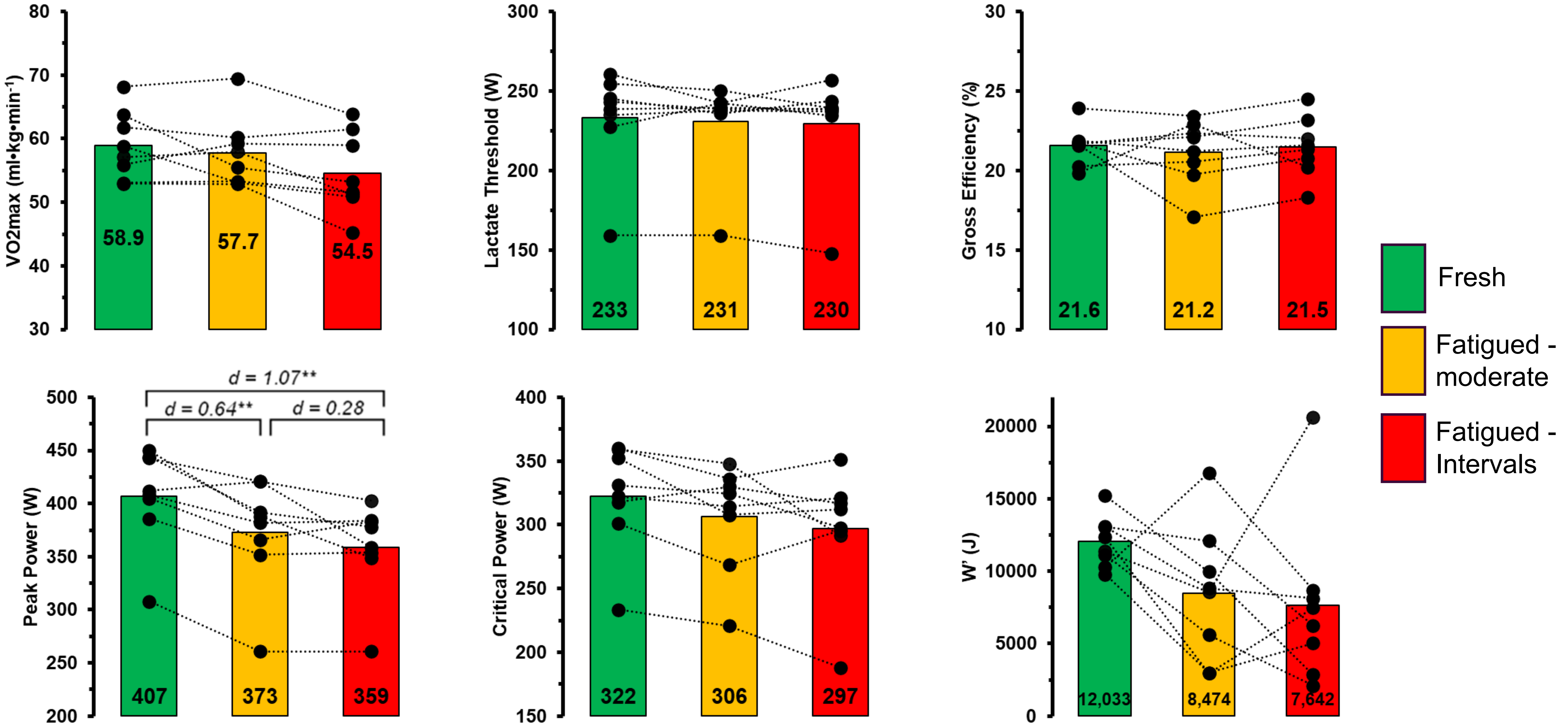

Results – relationship with TT performance

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Table 2. Correlation matrix between the time taken to complete the 26.8 km time trial and markers of endurance performance, determined in a fresh state and after 15 $kJ \times kg^{-1}$ work accomplished via moderate and interval cycling. Pearsons's correlation coefficient (R) is annotated with $P < 0.05$, $P < 0.01$, & $P<0.001$ denoted by *, ** & *** respectively.

	Fresh	Fatigued: Moderate intensity		Fatigued: Intervals	
	Absolute	Absolute	Percentage of value obtained in Fresh	Absolute	Percentage of value obtained in Fresh
$\dot{V}O_{2max}$ ($L \cdot min^{-1}$)	**-.95*** **	**-.77***	.35	**-.80***	-.03
$\dot{V}O_{2max}$ ($ml \cdot kg \cdot min^{-1}$)	-.57	-.30	.35	-.45	-.03
Peak Power (W)	**-.98*** **	**-.94*** **	-.38	**-.84** **	-.09
Gross Efficiency (%)	-.15	**-.92** **	**-.78***	**-.81***	**-.88** **
Lactate Threshold (W)	**-.91** **	**-.95*** **	.09	**-.92** **	-.55
Critical Power (W)	**-.98*** **	**-.88** **	.13	**-.89** **	-.36
W' (J)	-.45	-.46	-.37	-.15	-.10

Results – relationship with RR performance

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Table 3. *Correlation matrix between power output during the simulated road race and markers of endurance performance, determined in a fresh state and after 15 kJ·kg^{-1} work accomplished via moderate and interval cycling. Pearsons's correlation coefficient (R) is annotated with P < 0.05, P < 0.01, & P<0.001 denoted by *, ** & *** respectively.*

	Fresh	Fatigued: Moderate intensity		Fatigued: Intervals	
	Absolute	Absolute	Percentage of value obtained in Fresh	Absolute	Percentage of value obtained in Fresh
$\dot{V}O_{2max}$ (L•min^{-1})	**.83***	**.95*****	.09	**.77***	.10
$\dot{V}O_{2max}$ (ml•kg•min^{-1})	**.76***	**.80***	.09	.66	.10
Peak Power (W)	.65	**.89***	**0.83***	.64	.06
Gross Efficiency (%)	-.38	**.78***	**.95*****	.26	.64
Lactate Threshold (W)	.47	.67	.52	.60	**.82***
Critical Power (W)	.69	**.76***	.24	.50	.01
W' (J)	-.07	.69	**.75***	.46	.48

Discussion

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- Endurance markers start to shift after 15 $kJ \cdot kg^{-1}$, as previously shown (Clark et al., 2018; Mateo-March et al., 2022; Stevenson et al., 2022).
- Intensity doesn’t seem to alter decline*- contrary to Mateo-March (2024) and Spragg et al. (2024). *May currently underpowered, to detect those differences.
- In fatigued states, more markers of performance are related with TT & RR performance.
- The durability of GE seems to drive both TT and RR outcomes.
- Durability of ramp-test peak power, LT, GE and W′ may be important for RR success.
- Include fresh and fatigued measures in endurance testing for cyclists to achieve a fuller performance profile.

Thank you

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