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A Novel Submaximal Field Test of Fatigue Resistance in Professional Cyclists

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IN MEMORIAM

PROFESSOR LOUIS PASSFIELD

A BIT ABOUT ME

BACKGROUND

Physical stimulus

Perceptual response

Rating	Descriptor
6	No exertion at all
7	Extremely light
8	
9	Very light
10	
11	Light
12	
13	Somewhat hard
14	
15	Hard (heavy)
16	
17	Very hard
18	
19	Extremely hard
20	Maximal exertion

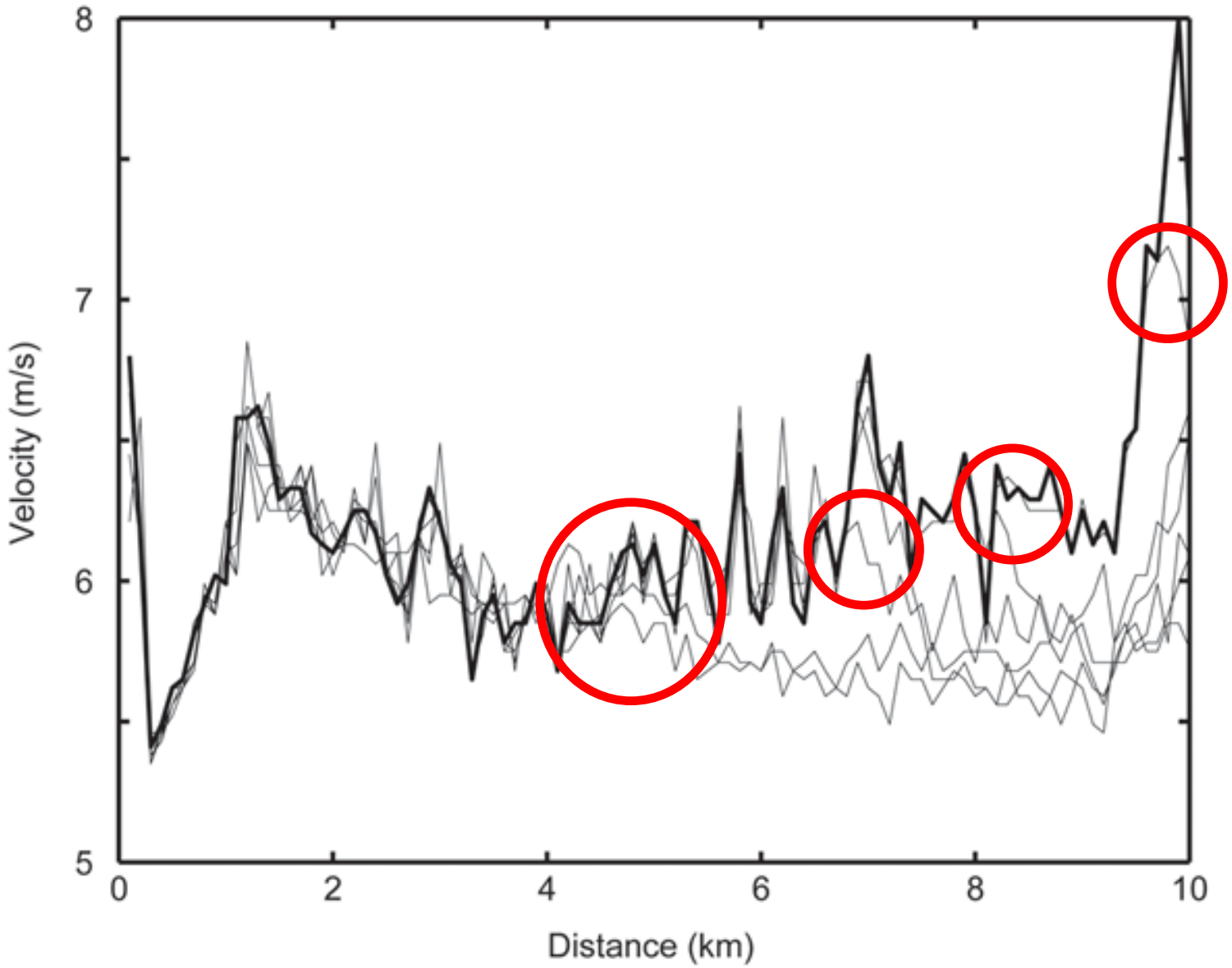
BACKGROUND

Fatigue

Decrease in performance

Increase in perceived exertion

BACKGROUND



de Koning et al. (2011)

BACKGROUND

Perception of effort

Conscious sensation of how hard, heavy, and strenuous a physical task is

BACKGROUND

Journal of Science & Cycling
Breakthroughs in Cycling & Triathlon Sciences

Conference abstract

Predicting power outputs in a fatigued state: A pilot study

James Spragg [1], Peter Leo [2], Jeroen Swart[1]

Brief Communication

Peter Leo[1] · Andrea Giorgi[2,3] · James Spragg[4] · Borja Martinez Gonzalez[5] · Iñigo Mujika[6,7]

Impact of prior accumulated work and intensity on power output in elite/international level road cyclists —a pilot study

Ger J Exerc Sport Res 2022 · 52:673–677
https://doi.org/10.1007/s12662-022-00818-x

EUROPEAN JOURNAL OF SPORT SCIENCE
2023, VOL. 23, NO. 4, 489–498
https://doi.org/10.1080/17461391.2022.2049886

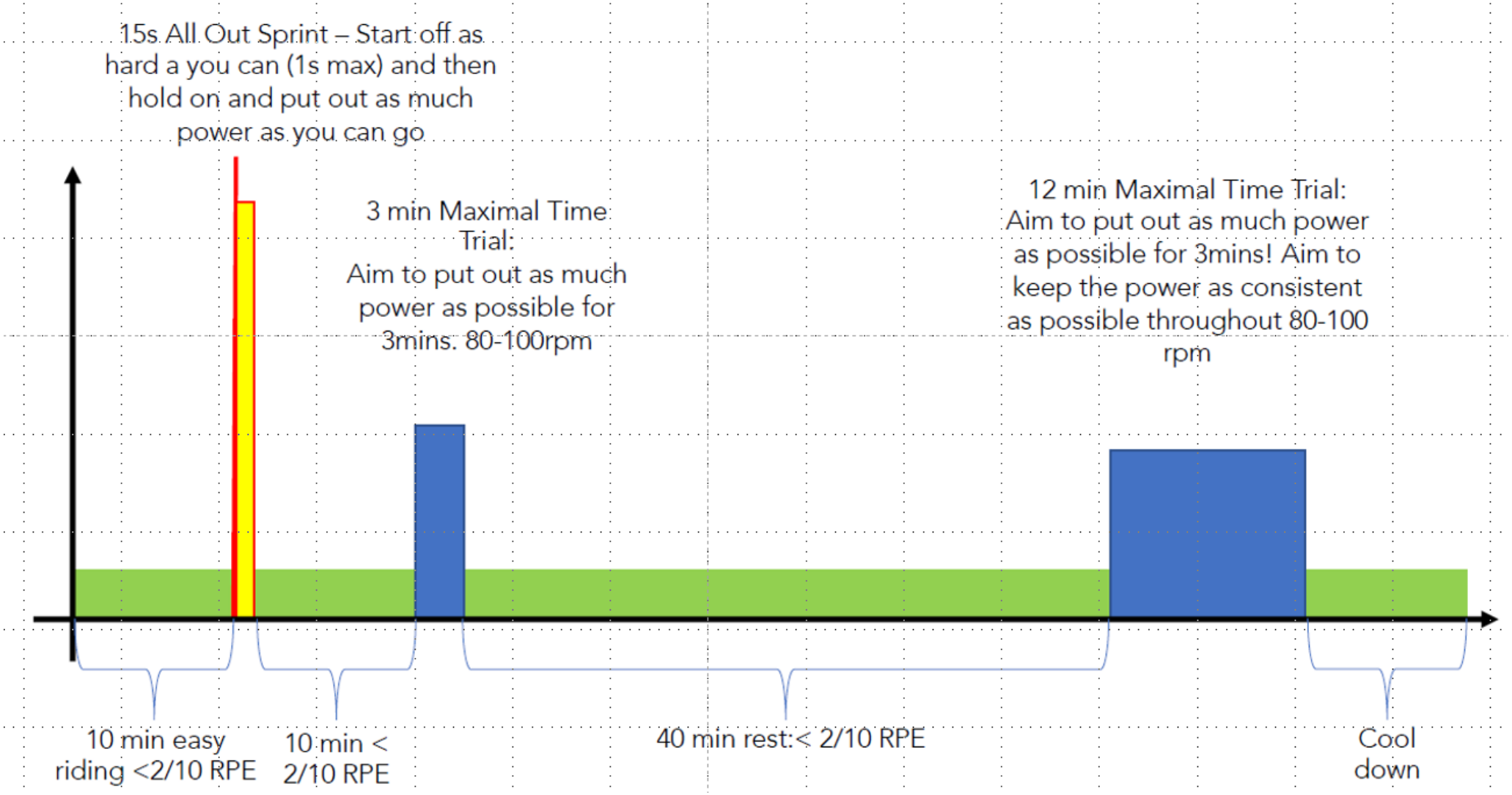
Routledge
Taylor & Francis Group

REVIEW

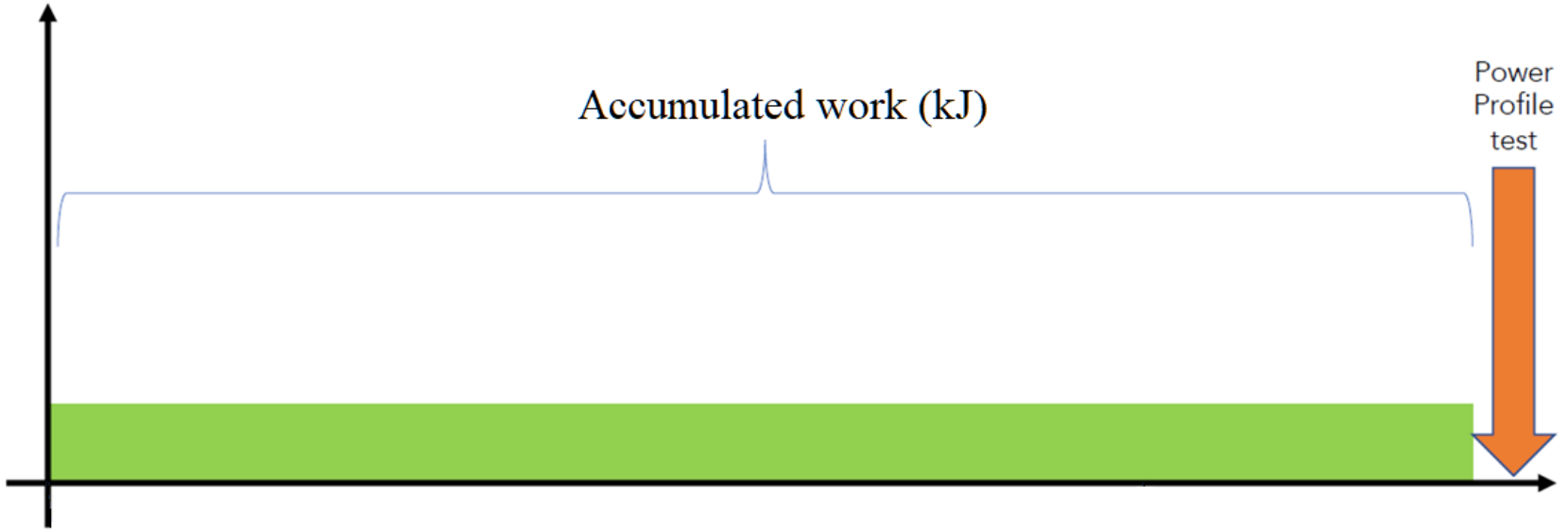
The relationship between training characteristics and durability in professional cyclists across a competitive season

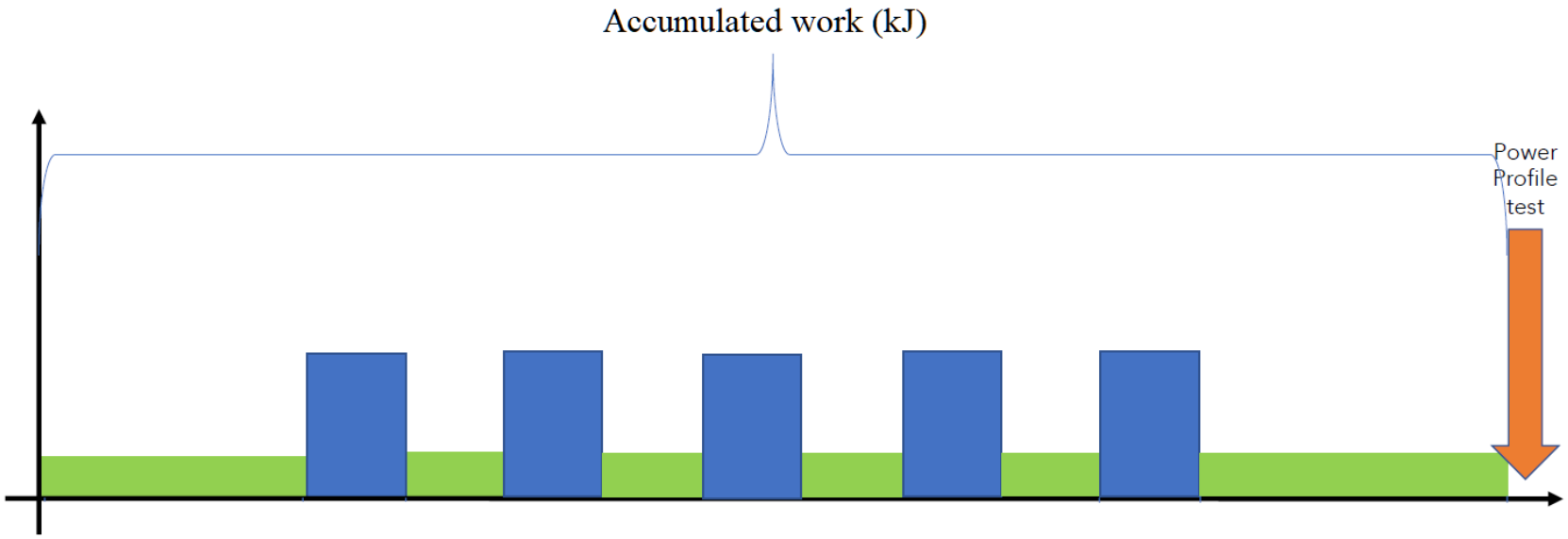
James Spragg[a], Peter Leo [b] and Jeroen Swart[a]

BACKGROUND


15s All Out Sprint – Start off as hard a you can (1s max) and then hold on and put out as much power as you can go
3 min Maximal Time Trial:
Aim to put out as much power as possible for 3mins. 80-100rpm
12 min Maximal Time Trial: Aim to put out as much power as possible for 3mins! Aim to keep the power as consistent as possible throughout 80-100 rpm
10 min easy riding <2/10 RPE
10 min < 2/10 RPE
40 min rest:< 2/10 RPE
Cool down

BACKGROUND

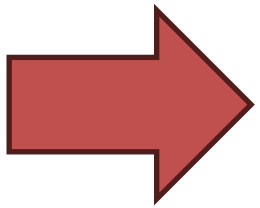

Accumulated work (kJ)
Power
Profile
test


Accumulated work (kJ)
Power
Profile
test

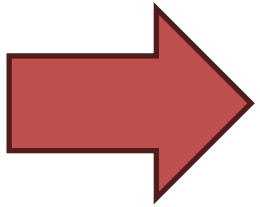
METHODOLOGY

<u>Aim of the study</u>: to investigate the impact of prior accumulated work on perceived exertion during submaximal exercise in professional cyclists

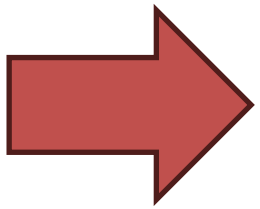
Lactate Threshold Test



P1 = 70% lactate turnpoint



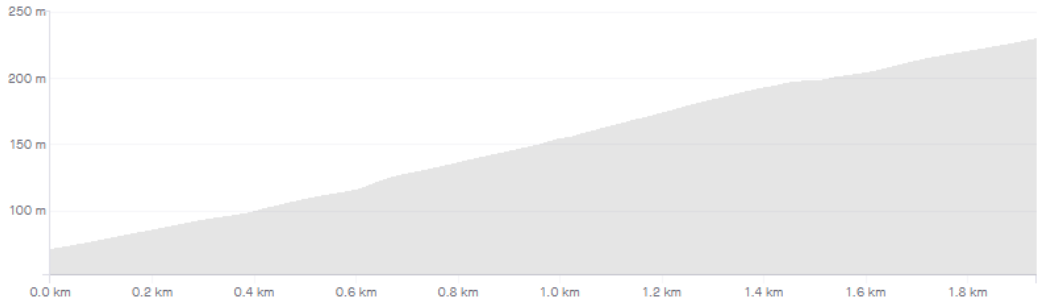
P2 = Lactate threshold



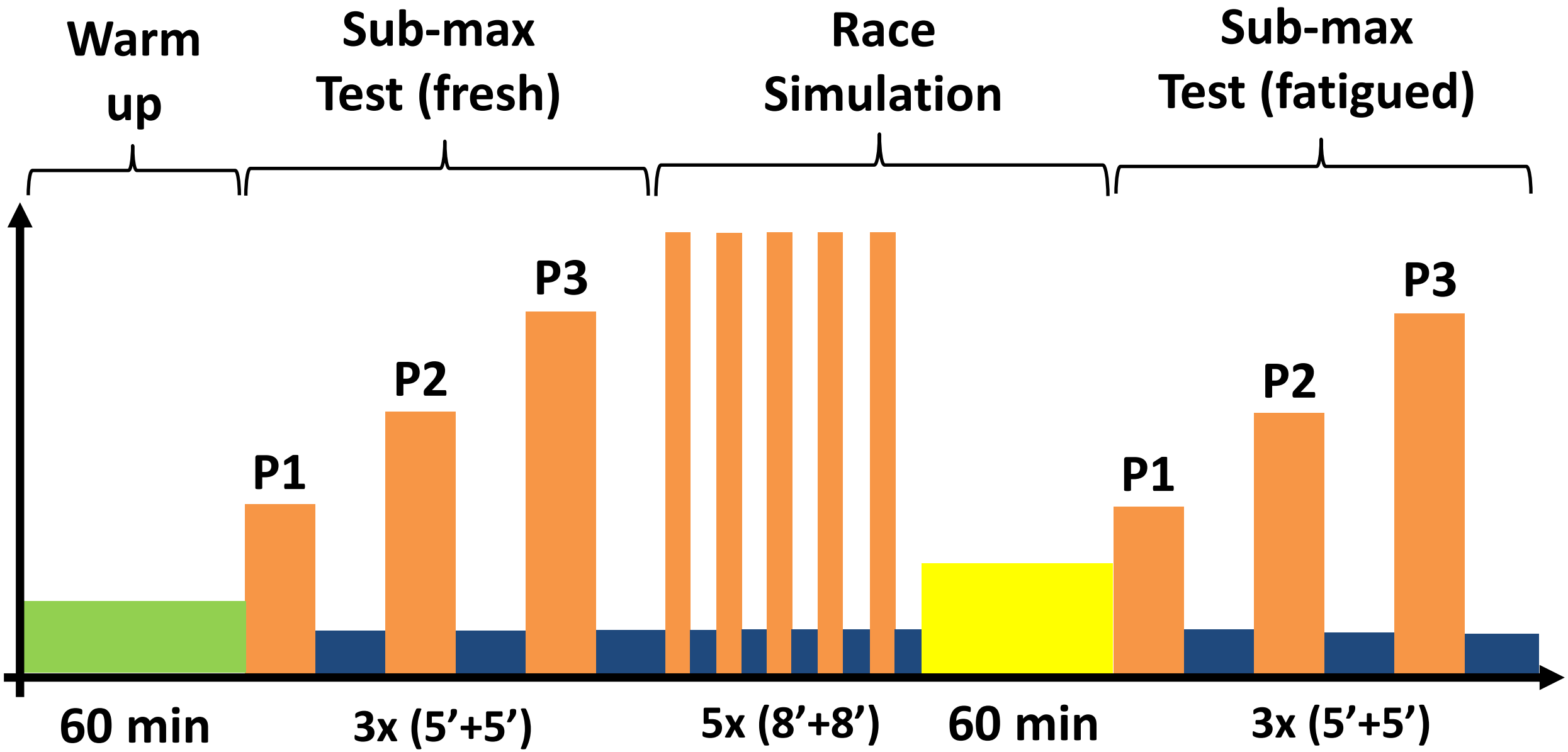
P3 = Lactate turnpoint

MATERIALS

Distance	Elevation Gain	Avg Grade	Lowest Elev	Highest Elev	Elev Difference	Climb Category
1.93km	159m	8.2%	71m	230m	159m	4



METHODOLOGY



PARTICIPANTS

Seven male professional cyclists

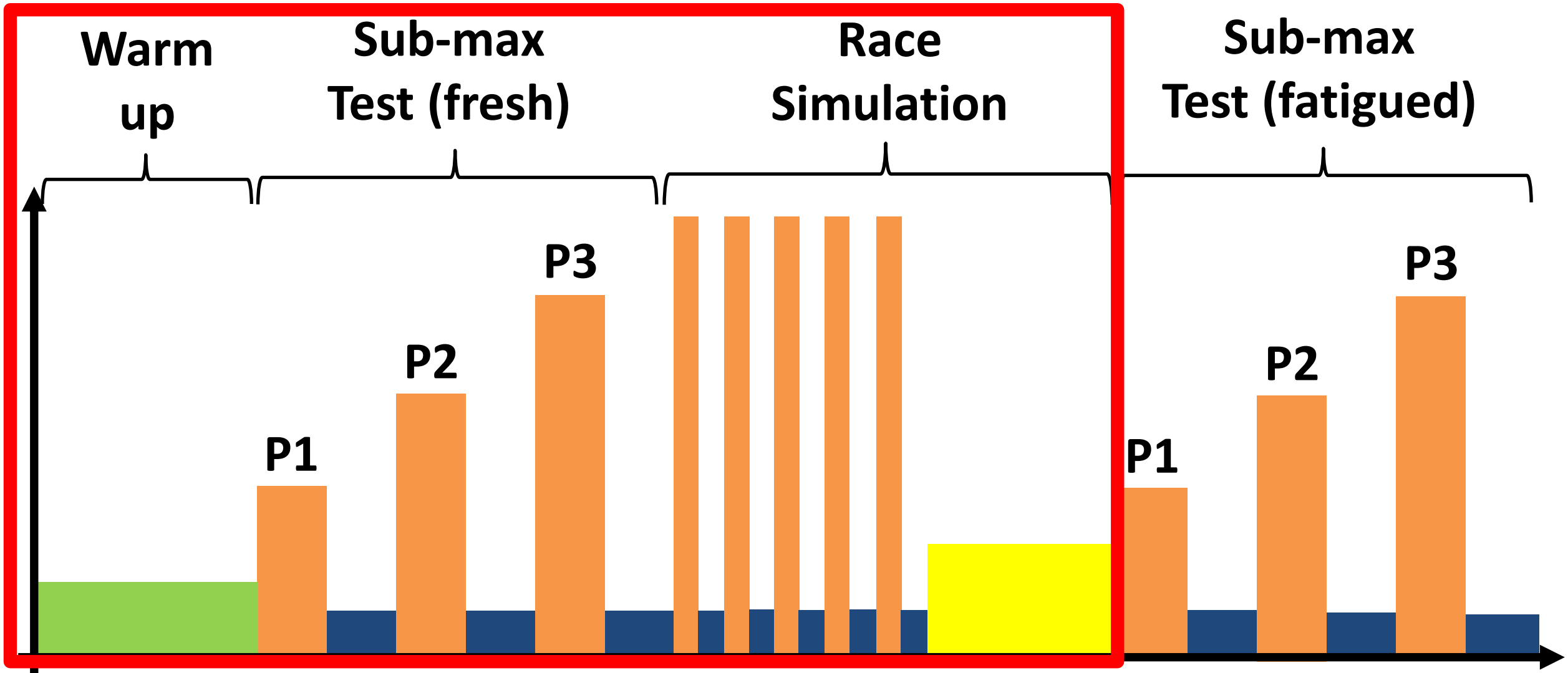
classified as Tier 4 (Elite/International Level) McKay et al., (2021)

Age (years)	Body mass (kg)	Stature (m)
19 ± 1	64.1 ± 4.3	1.75 ± 0.05

P1 (W)	P2 (W)	P3 (W)
267 ± 23	319 ± 29	376 ± 33

RESULTS

Total work done = 3244 ± 83 kJ (50.7 ± 2.3 kJ/kg)



RESULTS

P1 (267 ± 23 W)			
	Fresh	**Fatigued**	**p**
Power output (W)	274 ± 19	270 ± 24	0.279
Power output (W/kg)	4.28 ± 0.26	4.21 ± 0.30	0.281
Heart rate (bpm)	143 ± 7	150 ± 5*	0.012
0-10 RPE (A.U.)	2.4 ± 0.9	3.9 ± 1.4*	0.033

RESULTS

P2 (319 ± 29 W)			
	Fresh	**Fatigued**	**p**
Power output (W)	319 ± 30	316 ± 33	0.134
Power output (W/kg)	4.97 ± 0.39	4.92 ± 0.42	0.136
Heart rate (bpm)	155 ± 5	162 ± 4*	0.001
0-10 RPE (A.U.)	4.2 ± 0.7	5.7 ± 1.3*	0.001

RESULTS

P3 (376 ± 33 W)			
	Fresh	**Fatigued**	**p**
Power output (W)	377 ± 30	371 ± 23	0.115
Power output (W/kg)	5.89 ± 0.42	5.81 ± 0.39	0.093
Heart rate (bpm)	168 ± 7	172 ± 5*	0.008
0-10 RPE (A.U.)	7.0 ± 1.2	8.5 ± 1.0*	0.004

DISCUSSION

Main findings of the study → **RPE** and **heart rate** during submaximal exercise are **sensitive indicators** of the state of **fatigue** induced by more than 3000 kJ (~51 kJ/kg) of work done in professional cyclists

The proposed **test** was **feasible** and **well tolerated** by professional cyclists during a training camp

LIMITATIONS

Lack of a **performance measure** (e.g., a time trial) to investigate whether changes in perceived exertion during submaximal exercise are associated with changes in performance during a maximal exercise test

Lactate threshold Test

Weather

FUTURE RESEARCH

Validity and **Reliability**

Sensitivity to changes in fatigue resistance induced by training and other interventions

Updated **protocol** (RPE production, performance test)

Fatigue resistance: predicting and profiling athletes

TAKE HOME MESSAGES

A feasible and well tolerated submaximal cycling test

In professional cyclists, the state of fatigue induced by over 3000 kJ of work done can be effectively assessed by monitoring the RPE and heart rate during submaximal exercise

ACKNOWLEDGMENTS

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