Learning from field data of professional cyclists; from winning bunch sprints to the effect of accumulating fatigue on performance

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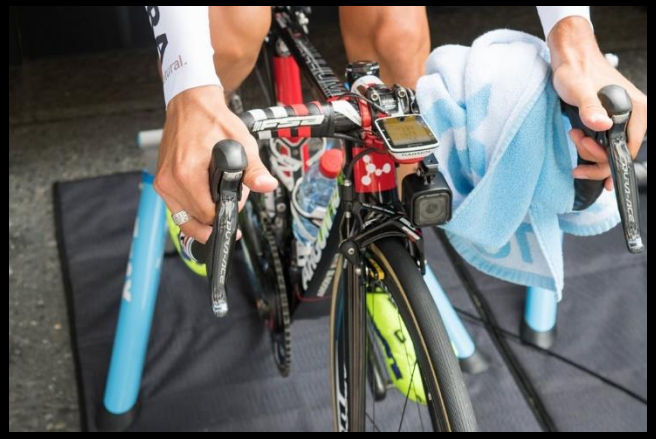
Introduction



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Introduction

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Introduction

Laboratory data

Field data

WHAT CAN WE LEARN FROM FIELD DATA IN ELITE CYCLISTS

Sprint tactics in the TDF

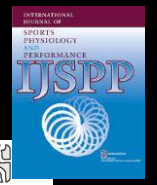
Case-study of a world-class sprinter

Power Profile of Top 5 Results in World Tour Cycling Races

Effects of different stage type

Changes in Power output with accumulating level of work completed

Sprint tactics in the Tour de France



International Journal of Sports Physiology and Performance, (Ahead of Print)
https://doi.org/10.1123/ijspp.2020-0700

Human Kinetics

BRIEF REPORT

Demands of the Tour de France: A Case Study of a World-Class Sprinter (Part I)

Teun van Erp, Marcel Kittel, and Robert P. Lamberts

International Journal of Sports Physiology and Performance, (Ahead of Print)
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Human Kinetics

BRIEF REPORT

Sprint Tactics in the Tour de France: A Case Study of a World-Class Sprinter (Part II)

Teun van Erp, Marcel Kittel, and Robert P. Lamberts

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Sprinting tactics and characteristics

Highly successful sprinter shared his PO data from 4 TDF editions (2013, 2014, 2016 and 2017)

Riding for 2 teams, namely:

Giant-Shimano (2013, 2014)

and

Etixx-Quick step (2016,2017)

	All sprints		Min		Max
Duration (s)	13 ± 3		7		17
PO (W)	1411 ± 117		1026		1576
Speed (km/h)	66 ± 6		52		73
Cadence (rpm)	112 ± 5		103		121

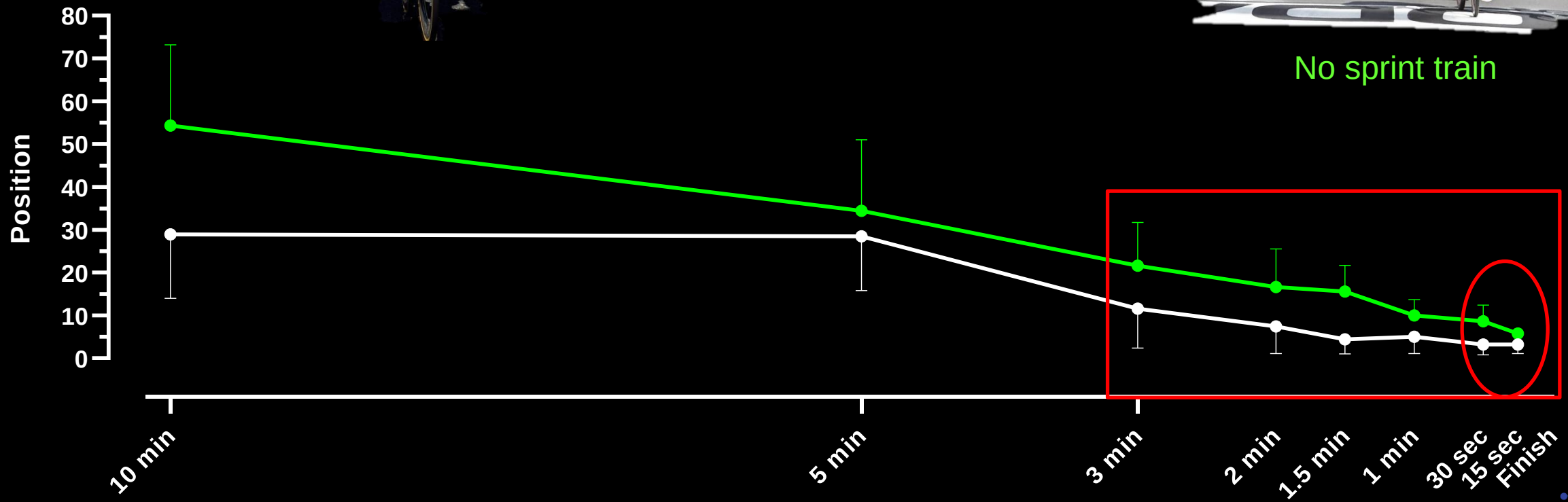
Sprint tactics

Sprint train

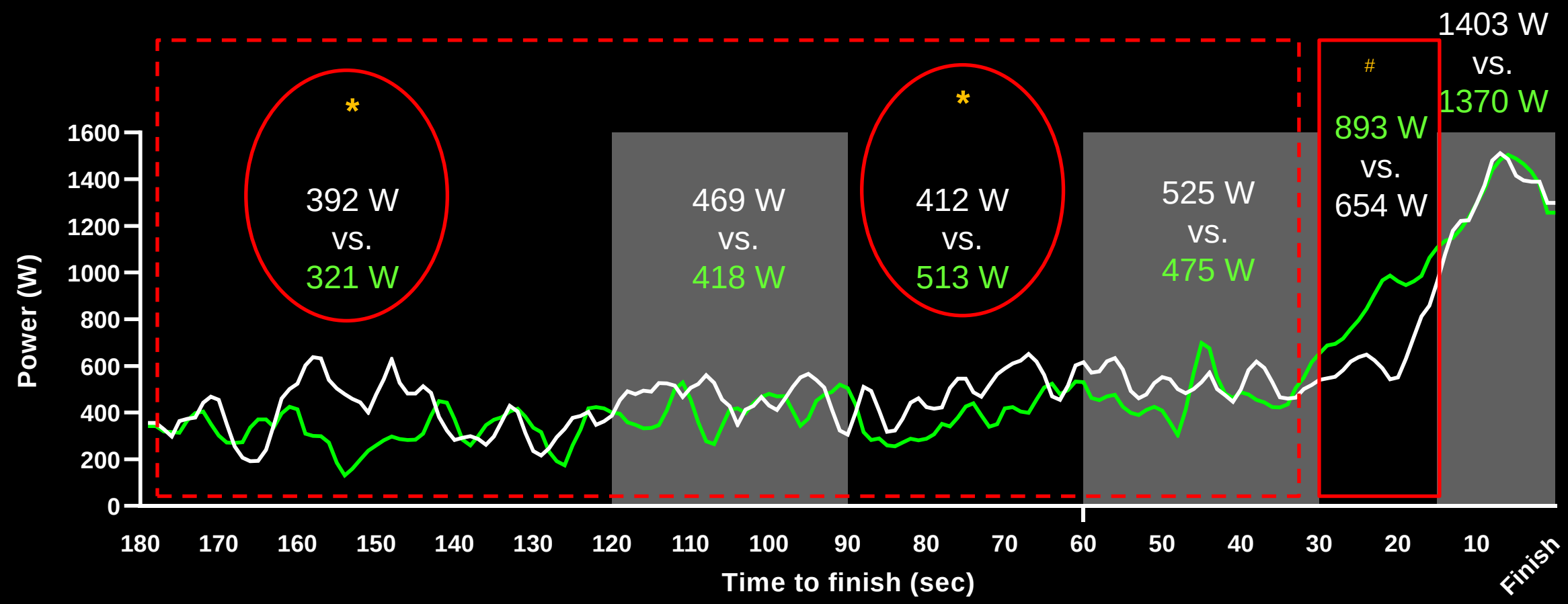
team Quick-step

team Shimano

No sprint train



Sprinting tactics – last 3 minutes



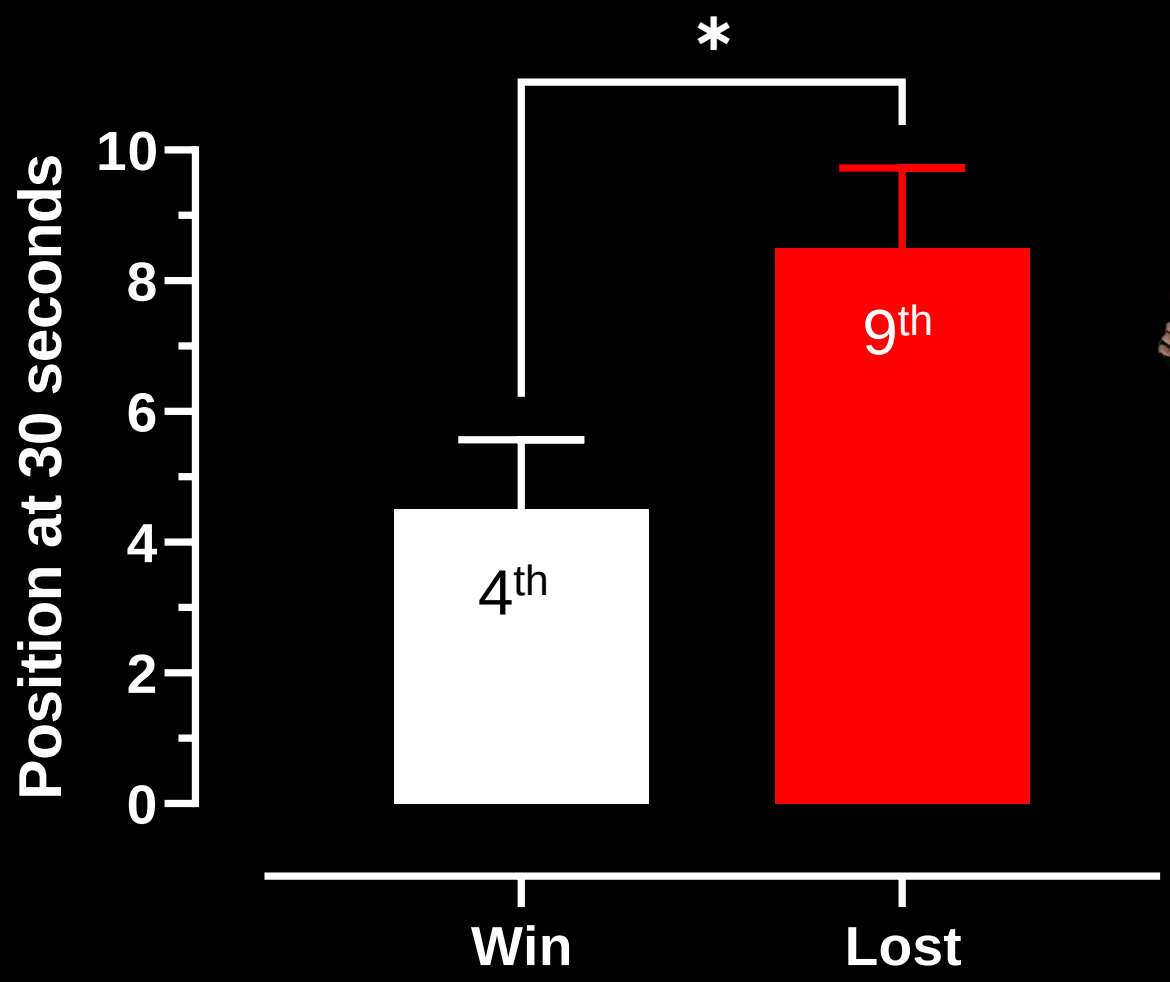
8 out of 10 sprint resulted in a win

6 out of 11 sprint resulted in a win

team Quick-step

team Shimano

Won versus lost



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Sprinting tactics and characteristics

Take home messages

High-power outputs are needed to win sprint stages in the TDF

Sprint tactics and demands differ based on team tactics

Sprint tactics have pro's and con's at different time points

Position at 30 seconds before the finish is important to win a sprint

Based team tactics - sprint training might need to differ

Power Profile of Top 5 Results in World Tour Cycling Races

International Journal of Sports Physiology and Performance, (Ahead of Print)
https://doi.org/10.1123/ijspp.2021-0081

Human Kinetics
ORIGINAL INVESTIGATION

Power Profile of Top 5 Results in World Tour Cycling Races

Teun van Erp, Robert P. Lamberts, and Dajo Sanders

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Power Profile of Top 5 Results in World Tour Cycling Races

Top 5 results of 18 WT cyclists during 177 races (2012-2019)

Flat:	n=84
Sm_{sprint}	n=49
Sm_{uphill}	n=19
Mountain	n=25

	FLAT	SM sprint	SM mountain	Mountain
Body mass (kg)	80 ± 7	76 ± 10	66 ± 5	65 ± 5
10 sec MMP	1611 ± 182	1376 ± 258	1048 ± 90	1038 ± 74
60 sec MMP	785 ± 67	762 ± 99	666 ± 39	670 ± 30
5 min MMP	494 ± 47	490 ± 35	461 ± 25	466 ± 28
20 min MMP	423 ± 27	427 ± 31	408 ± 25	409 ± 32
CP (W)	399 ± 25	405 ± 32	389 ± 25	389 ± 33
W' (kJ)	30 ± 8	26 ± 4	23 ± 2	24 ± 3

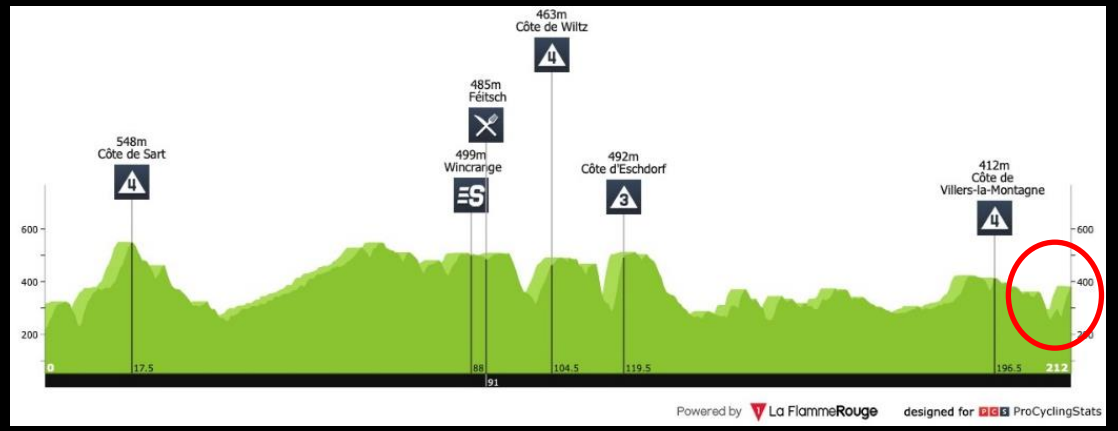
CP and W' calculated from linear work time model using MMP – 3,5,10 and 20 min MMP

van Erp, Lamberts, Sanders. IJSPP 2021 – Accepted for publication

Power Profile of Top 5 Results in World Tour Cycling Races

Flat

Semi-mountain – uphill finish



Semi-mountain – flat finish

Mountain

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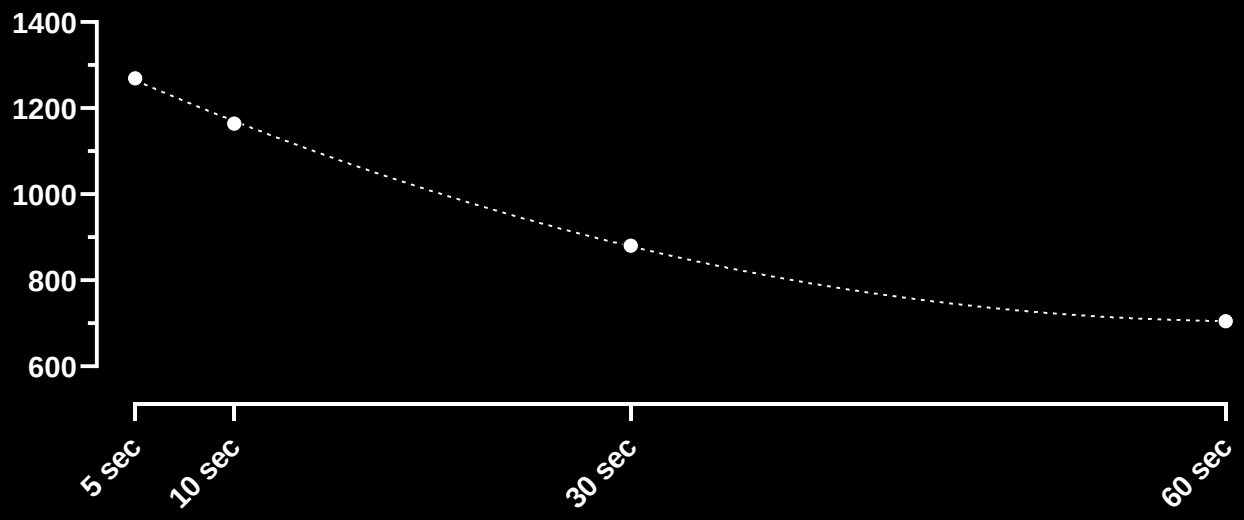
Power Profile of Top 5 Results in World Tour Cycling Races

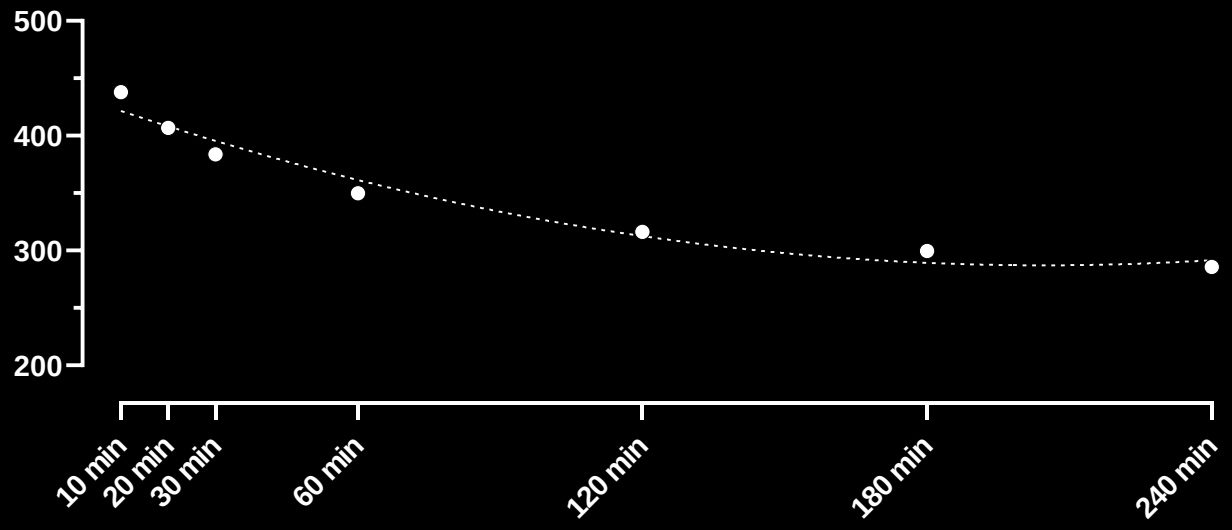
Power profile

Mean Maximum Power output (MMP) over different time frames

Short duration



Long duration



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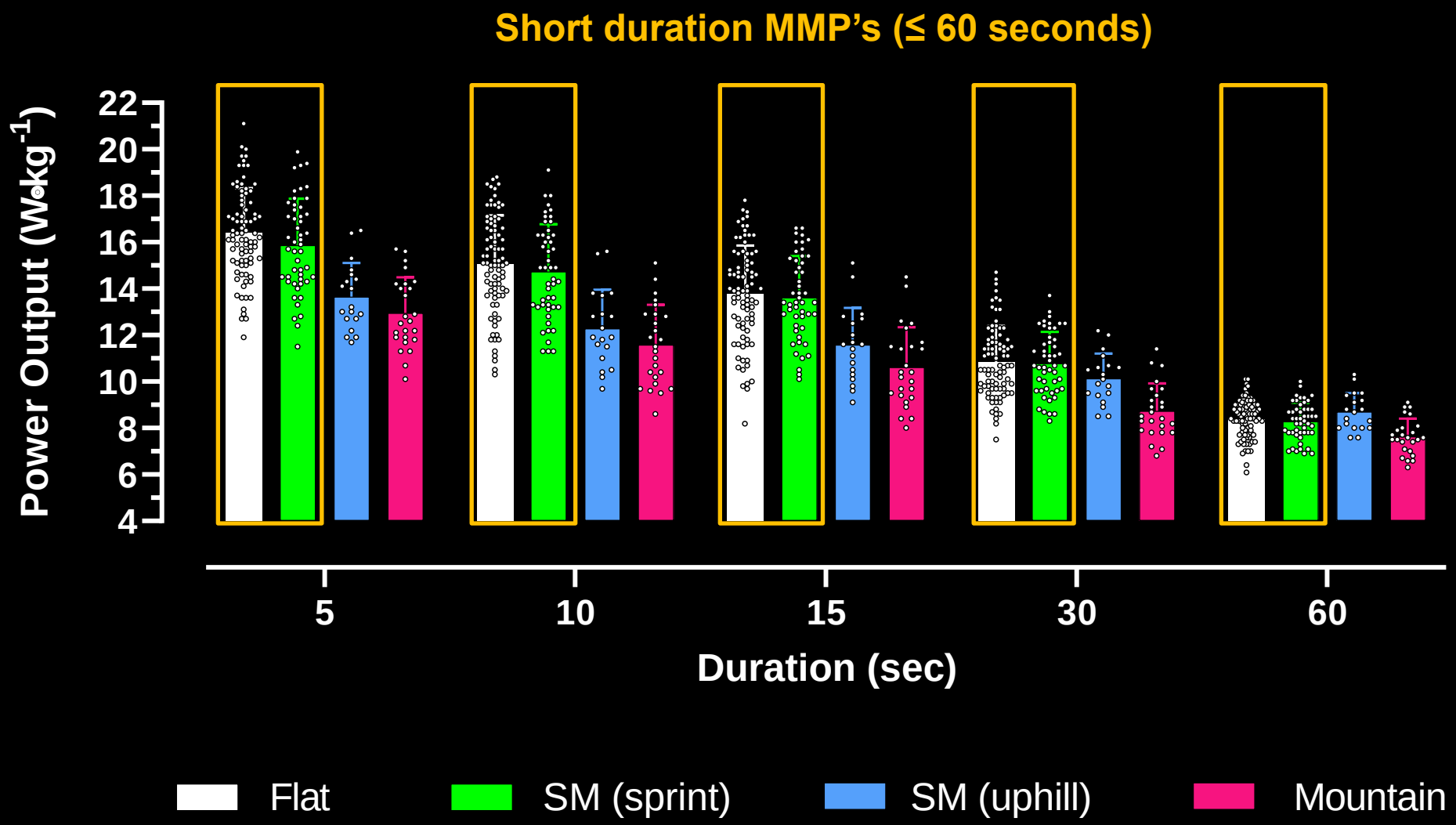

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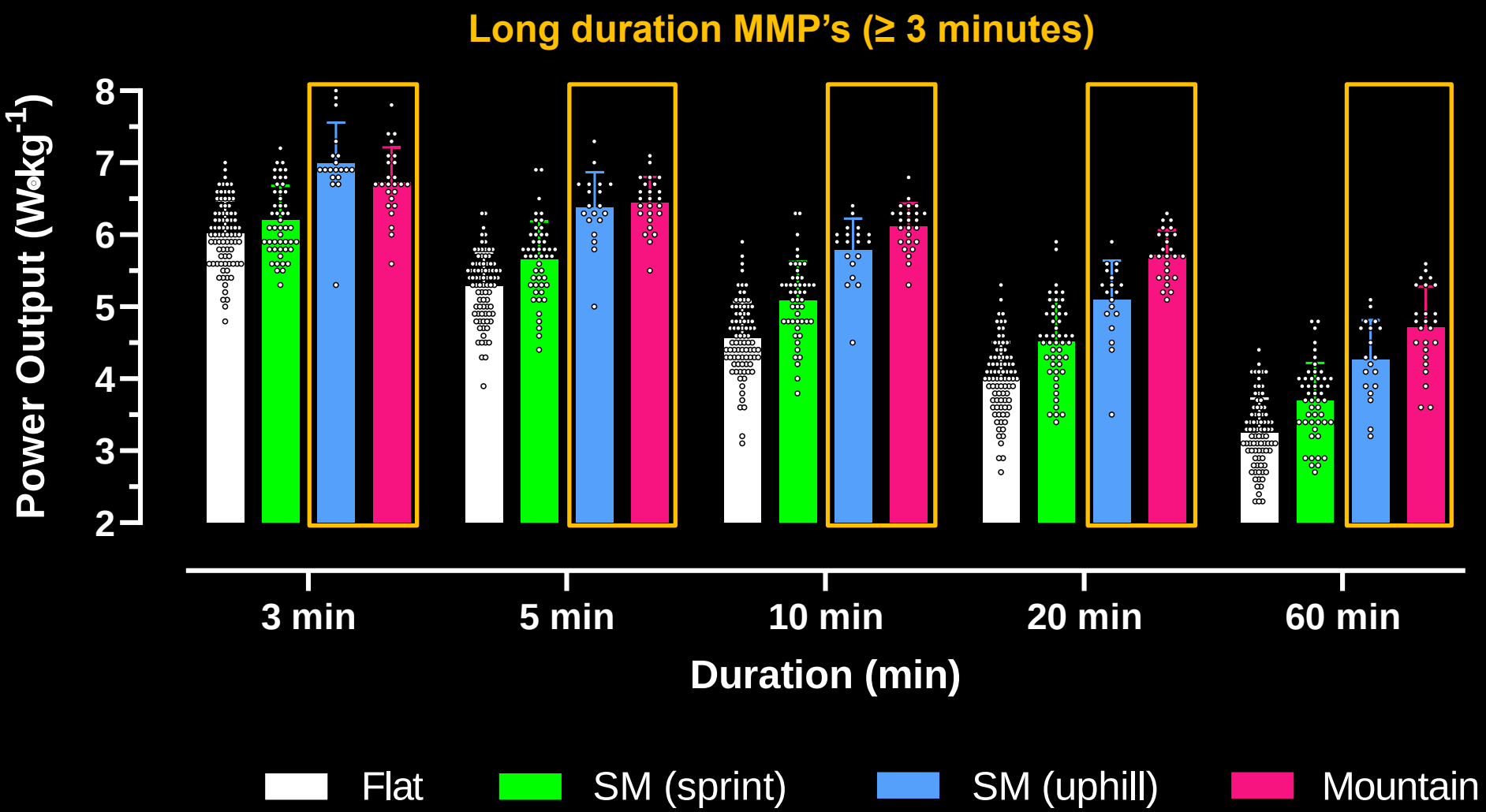

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Power Profile of Top 5 Results in World Tour Cycling Races

Take home messages:

Top-5 Flat and SM_{sprint} : short duration MMP's (especially 5, 10 and 15 sec) are important

Reference values for successful sprints:

	Flat	SM_{sprint}
5 sec	1370 ± 211	1238 ± 205
10 sec	1259 ± 216	1152 ± 2206
15 sec	1150 ± 209	1064 ± 181
30 sec	906 ± 154	841 ± 130
60 sec	701 ± 80	646 ± 80

Top-5 SM_{uphill} and MT races : long duration MMP's (especially ≥10 min) are important

Reference values for successful sprints:

	Flat	SM_{sprint}
3 min	7.0 ± 0.6	6.7 ± 0.5
5 min	6.4 ± 0.5	6.4 ± 0.4
10 min	5.8 ± 0.4	6.1 ± 0.3
20 min	5.1 ± 0.5	5.7 ± 0.3
60 min	4.3 ± 0.5	4.7 ± 0.6

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Changes in Power output with accumulating level of work completed

Maintaining Power Output with Accumulating Levels of Work Done Is a Key Determinant for Success in Professional Cycling

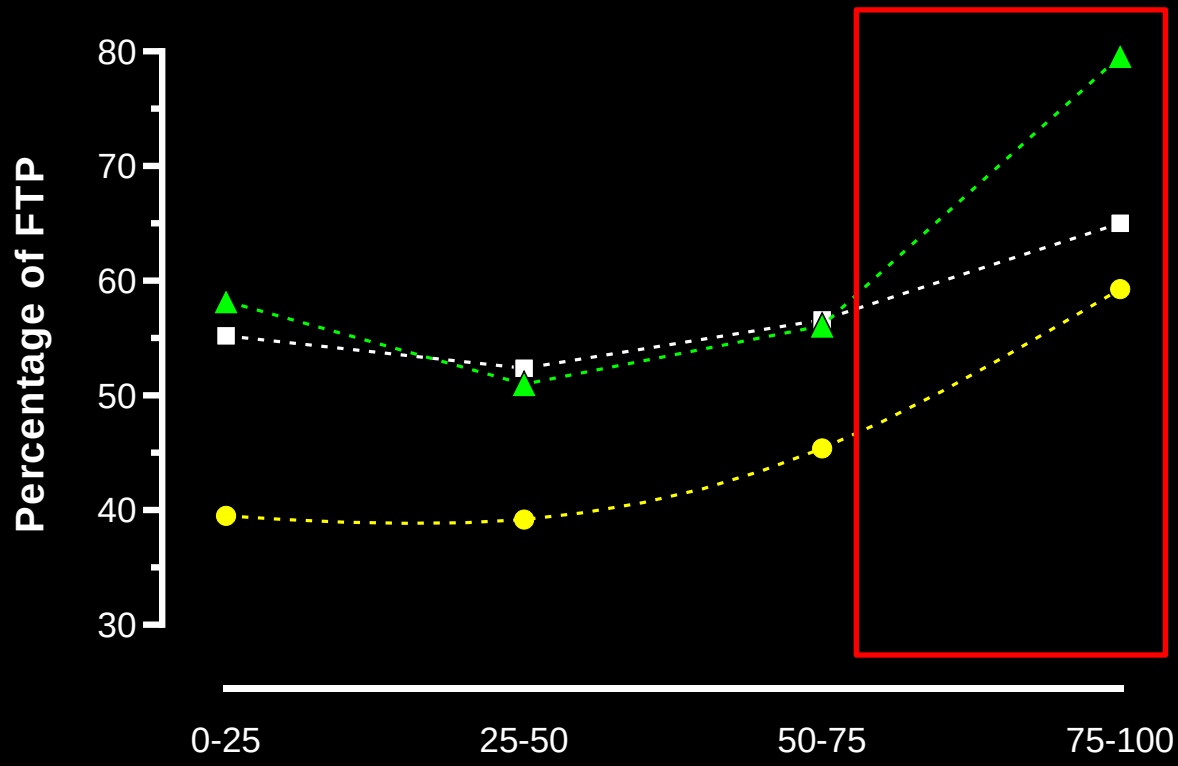
TEUN VAN ERP[1], DAJO SANDERS[2], and ROBERT P. LAMBERTS[1]

Van Erp, Sanders, Lamberts. MSSE 2021 – Epub ahead of print

Changes in Power output with accumulating level of work completed

Professional cycling races in male cyclists

Duration: 4 to 7 hours
Energy expenditures: ~3700 kJ (up to > 5700 kJ)



Mountain stages
Semi Mountain TD
Flat stages

Lamberts and van Erp – submitted paper

Changes in Power output with accumulating level of work completed

26 professional cyclists
17,900 power files
85 seasons

	Climbers		Sprinters	
	Highly successful	Less successful	Highly successful	Less successful
Seasons	15	30	16	24
Riders	5	13	7	8
PCS points	949 ± 477	154 ±98	936 ± 480	173 ± 54
Top-10 classifications	9 ± 2	2 ± 2	19 ± 2	7 ± 4

** >400 PCS – highly successful*

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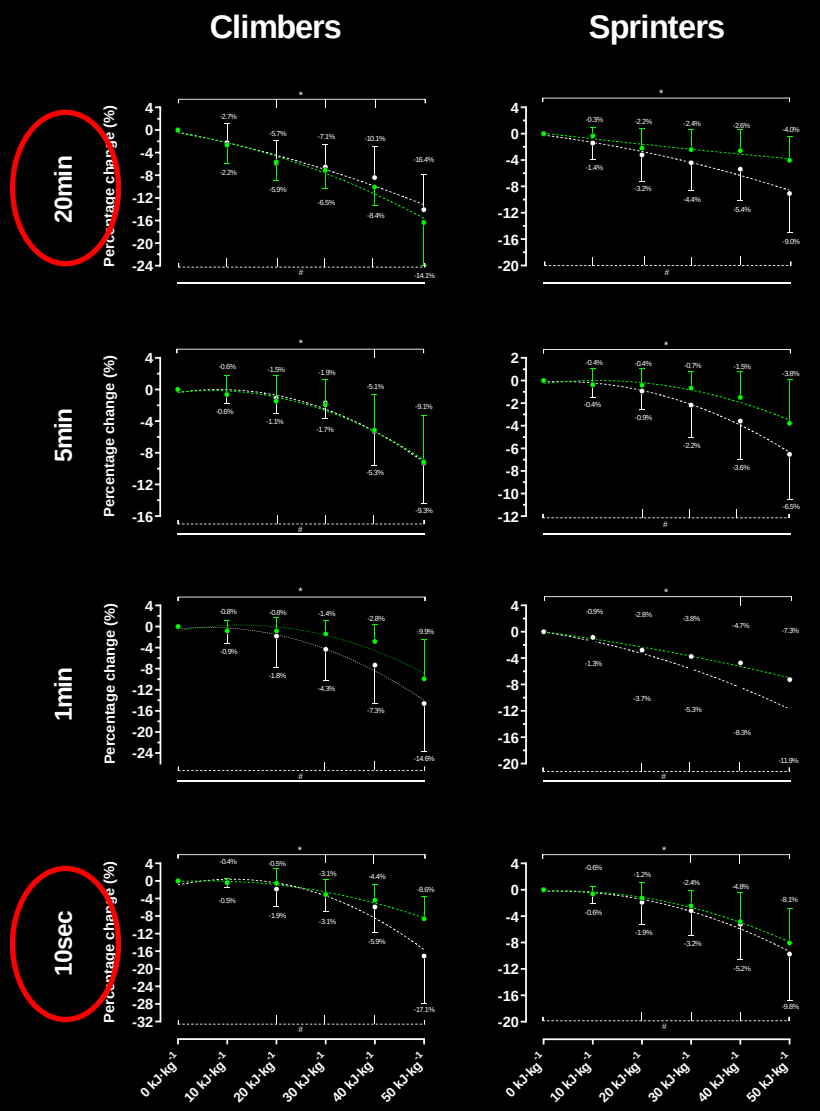
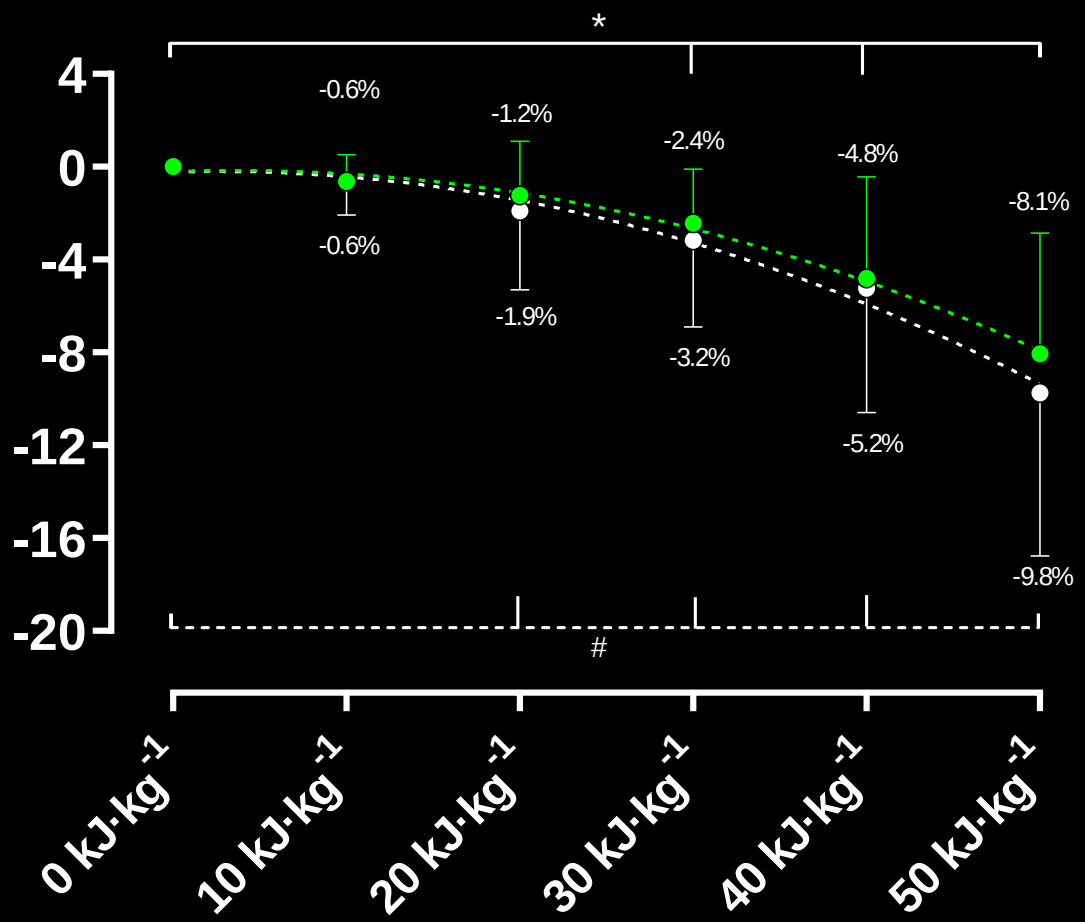
Changes in Power output with accumulating level of work completed

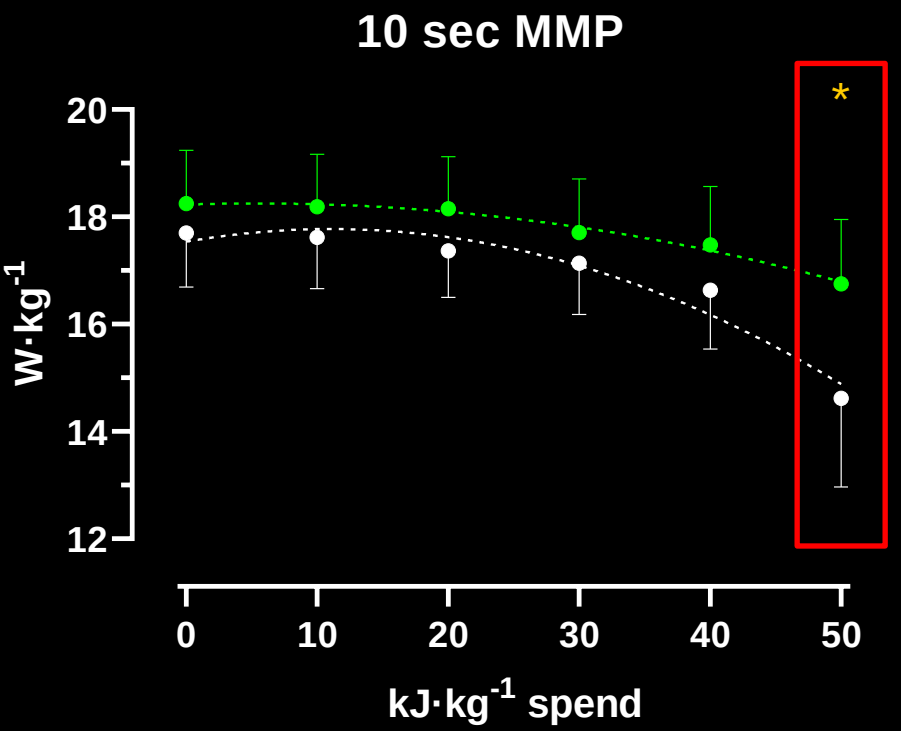


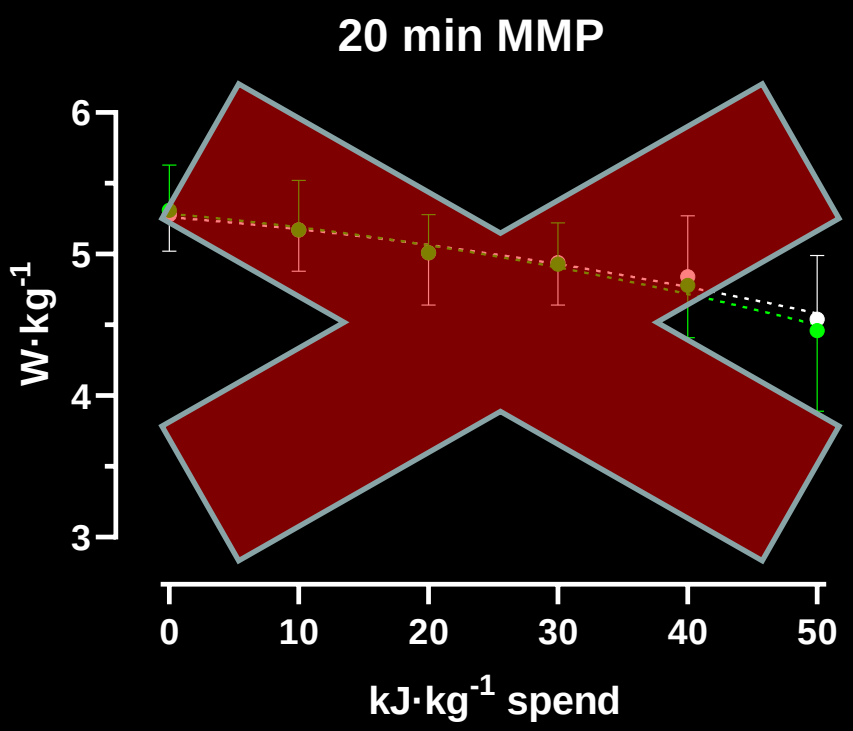


Changes in Power output with accumulating level of work completed

MMP profiles with accumulating levels of work completed

ABSOLUTE CHANGES IN PO





Sprinters

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MMP profiles with accumulating levels of work completed

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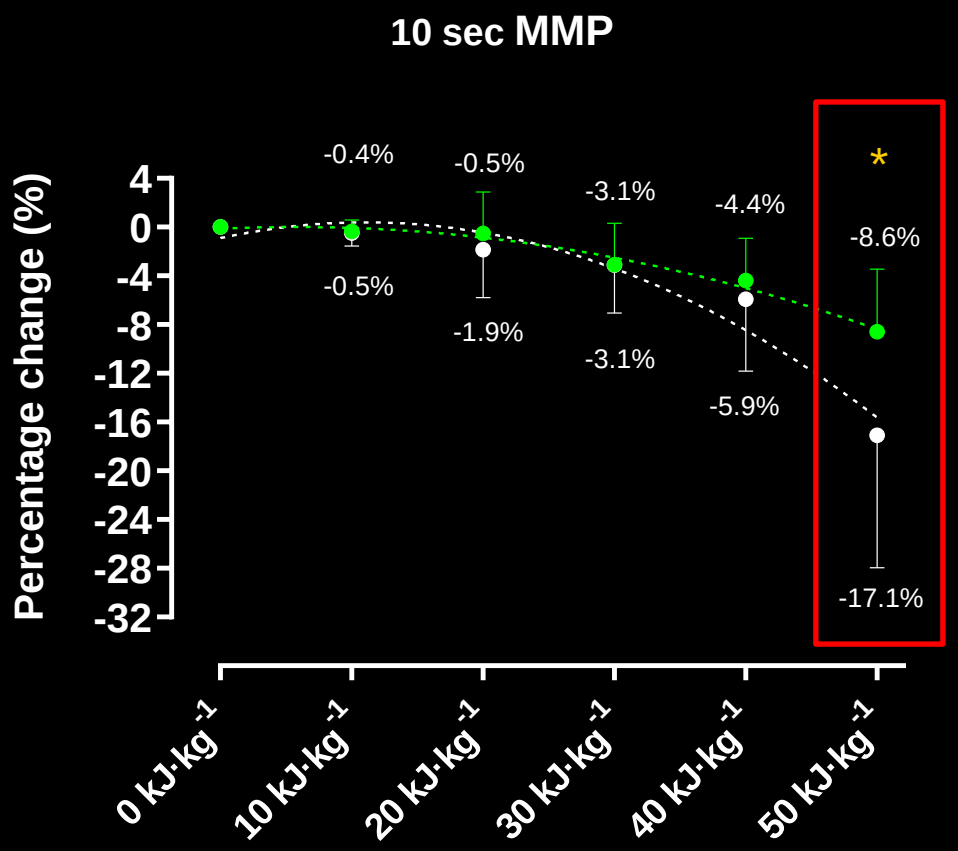

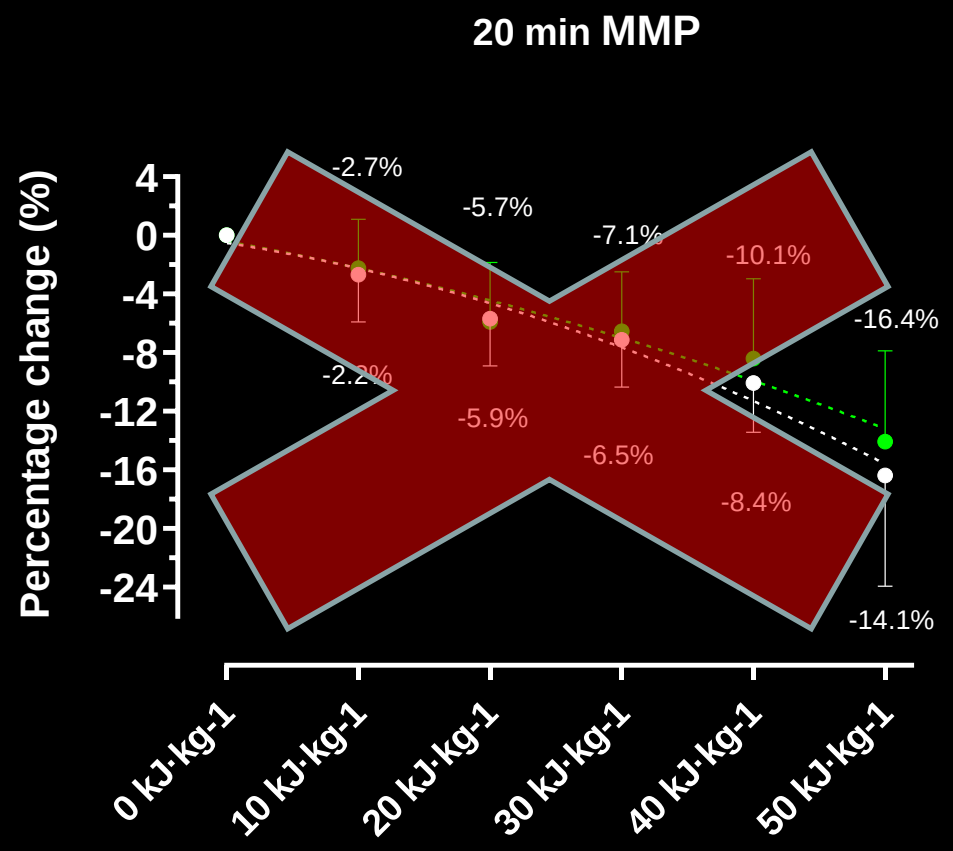

Sprinters

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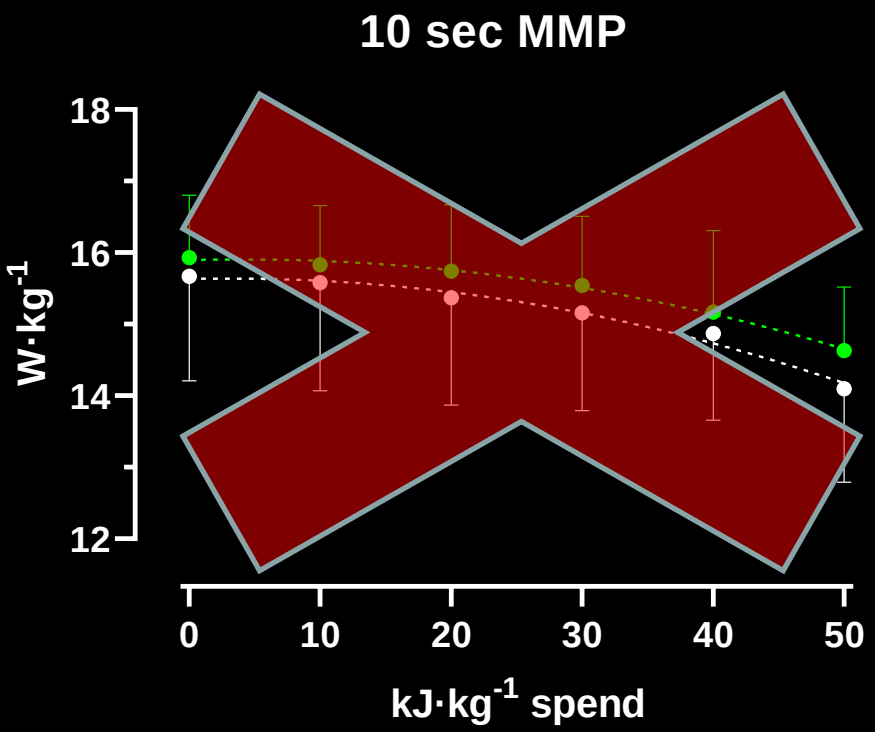

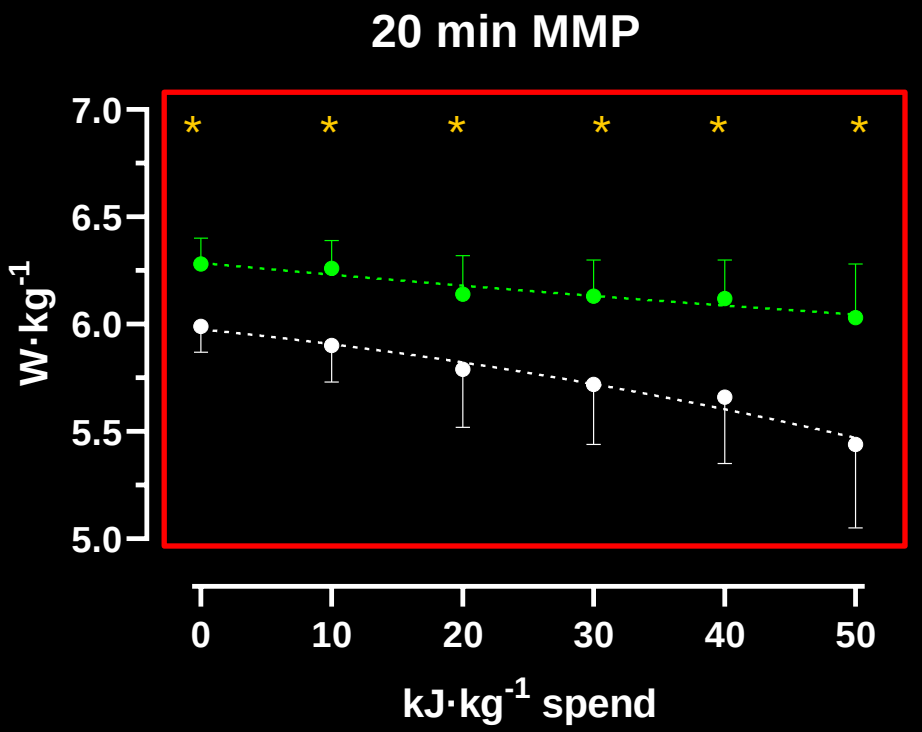

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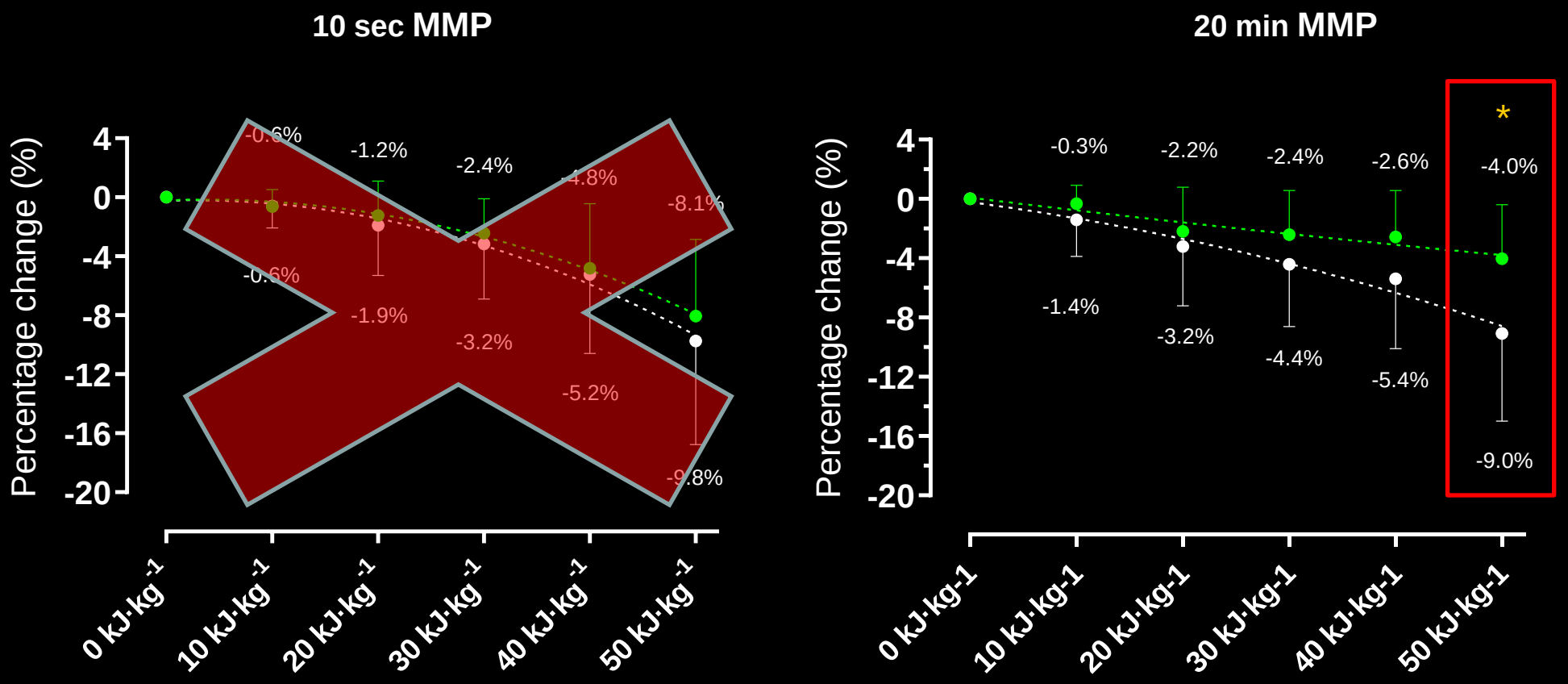

CLIMBERS

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Changes in Power output with accumulating level of work completed

Take home messages:

Successful sprinters can maintain short duration MMP's (esp. 10 sec) better with accumulating level of kJ burnt

Changes in 10 sec MMP's

	Highly successful	Less successful
10 kJ/kg	- 0.4	- 0.5
20 kJ/kg	- 0.5	- 1.9
30 kJ/kg	- 3.1	- 3.1
40 kJ/kg	- 4.4	- 5.9
50 kJ/kg	- 8.6	- 17.1

Successful climbers can maintain long duration MMP's (esp. 20 min) better with accumulating level of kJ burnt.

Changes in 20 min MMP's

	Highly successful	Less successful
10 kJ/kg	- 0.3	- 1.4
20 kJ/kg	- 2.2	- 3.2
30 kJ/kg	- 2.4	- 4.4
40 kJ/kg	- 2.6	- 5.4
50 kJ/kg	- 4.0	- 9.0

Learning from field data in professional cyclists

Provide novel insight into cycling demands in the field (specific races / team tactics)

Field data can assist with assessing ‘strength’ and ‘weaknesses’ of a rider

Field data can assist with monitoring & optimizing training programs

Field data allows to gain insights into changes in performance with accumulating levels of work done (‘fatigue’).

Field data can provide insights into the best role for a cyclist within a team.

Field data can play a role in talent identification and development (specialisation)

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