The Compound Score in elite road cycling

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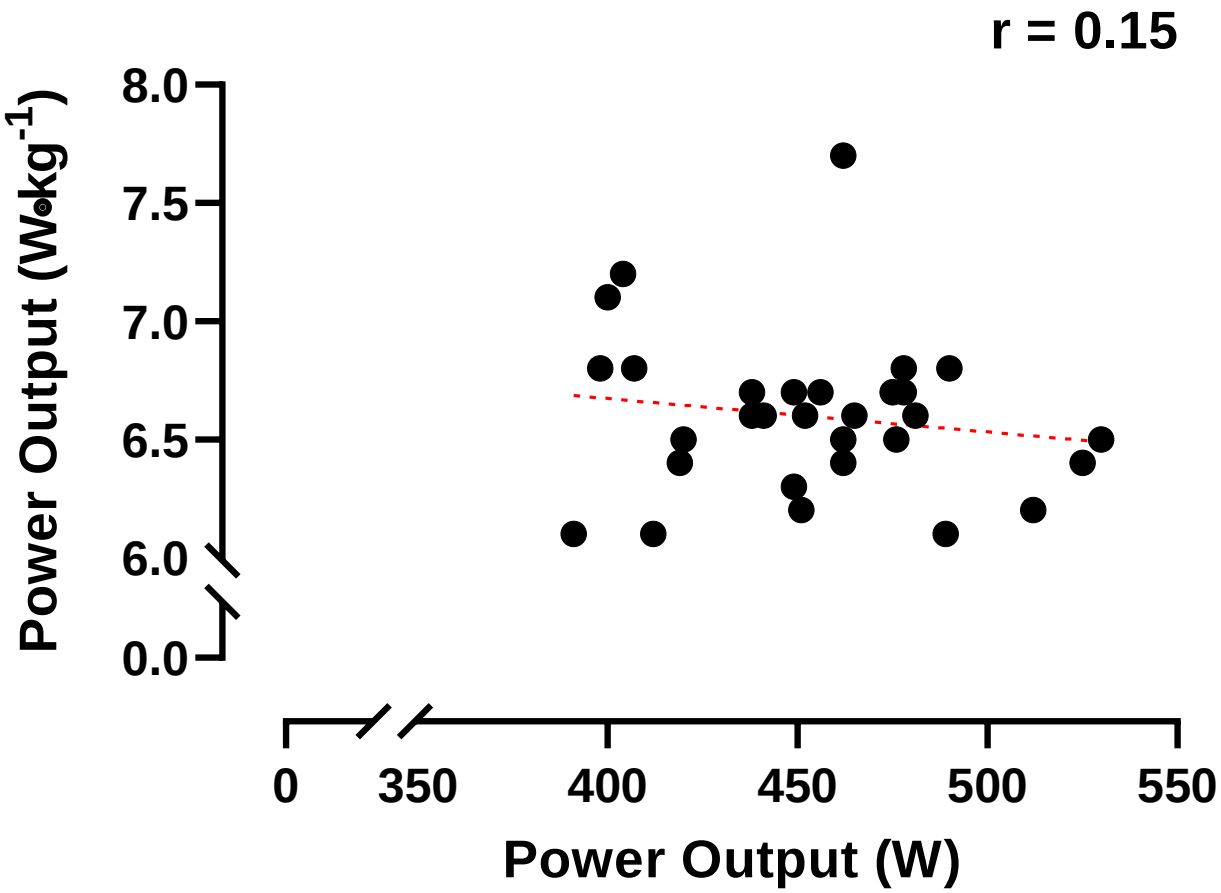
Background

- Elite road cycling is characterized by racing over varied terrain
- Quantification of performance characteristics (internal and external)
- Power output data to predict race performance
- Which power output data to choose?
  - Absolute power (W)
  - Power to mass ratio ($W.kg^{-1}$)
  - Allometric Scaling ($W.kg^{-0.32}$ or $W.kg^{-0.78}$)
  - Power per CdA ($W.CdA^{-1}$)

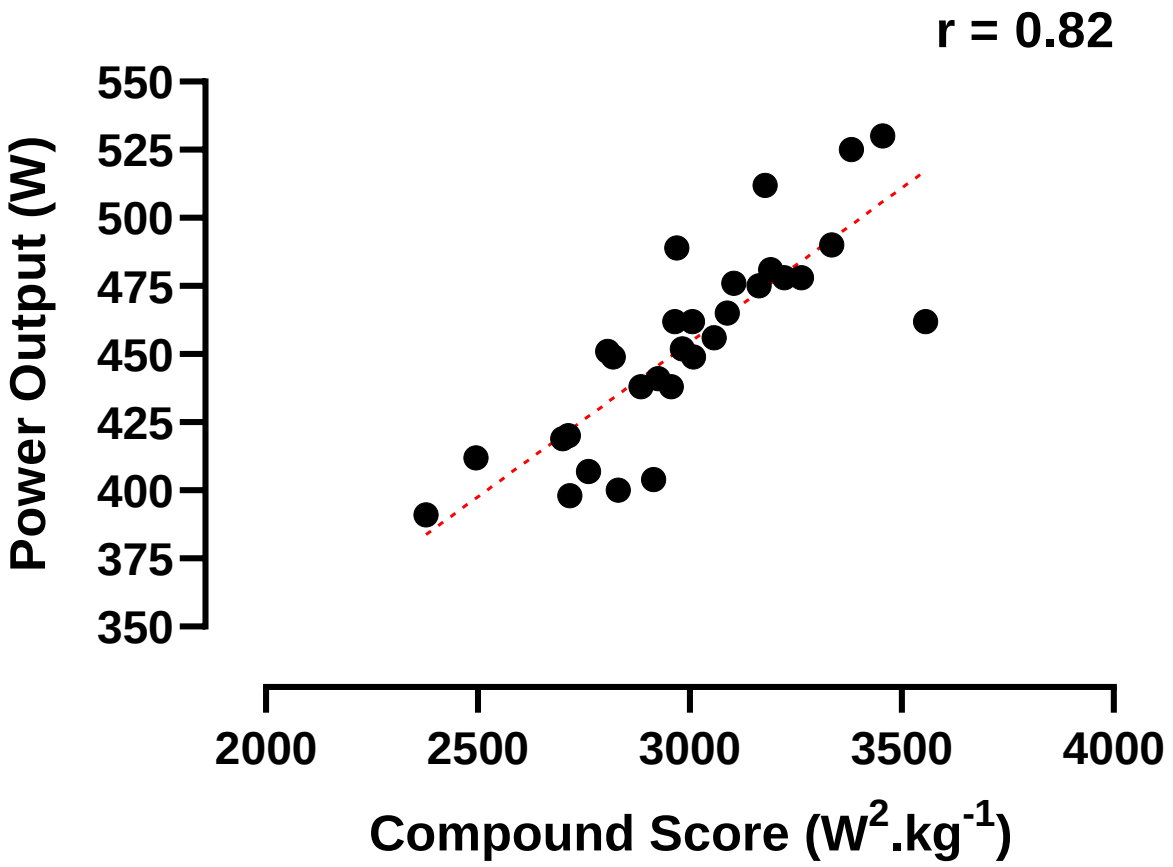
Padilla et al. (1999), Jobson et al. (2009), Sanders et al. (2021)

The Compound Score

- Compound – *noun* - */ˈkɒm.paʊnd/:* something consisting of two or more different parts
- Compound Score [$W^2.kg^{-1}$] = absolute power output [W] × relative power output [$W.kg^{-1}$]



The Compound Score



Race Performance Score

Cat	Weighting
Ncup l'Avenir	
Class 1	
Ncup	
Class 2	
1.2 U	

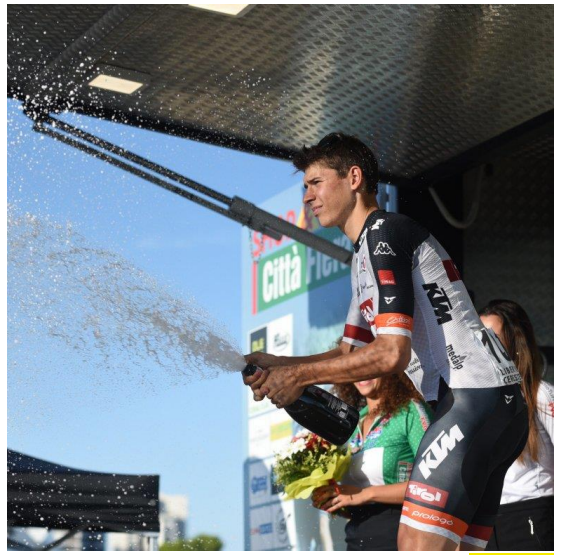
$$\bar{P} = \frac{1}{100} \times \sum_{n=1}^{10} P_n \qquad \bar{P} = \frac{1}{100} \times \sum_{n=1}^{10} 546$$

Position	UCI ProSeries	Class 1	Class 2	1.2U et 2.2U	Ncup Tour de l'Avenir	Ncup
1	200	125	40	30	140	70
2	150	85	30	25	110	55
3	125	70	25	20	80	40
4	100	60	20	15	60	30
5	85	50	15	10	50	25
6	70	40	10	5	40	20
7	60	35	5	3	30	15
8	50	30	3	1	20	10
9	40	25	3	1	10	5
10	35	20	3	1	6	3

Source: UCI Cycling Regulations Part 2 Road Races – Version 01.04.2022

Participants

- Thirty male U23 cyclists (age, 20.1±1.1, body mass 69 ± 6.9 kg, height 182.6 ± 6.2cm)
- 2019-21 Racing Season
- 123 races analyzed

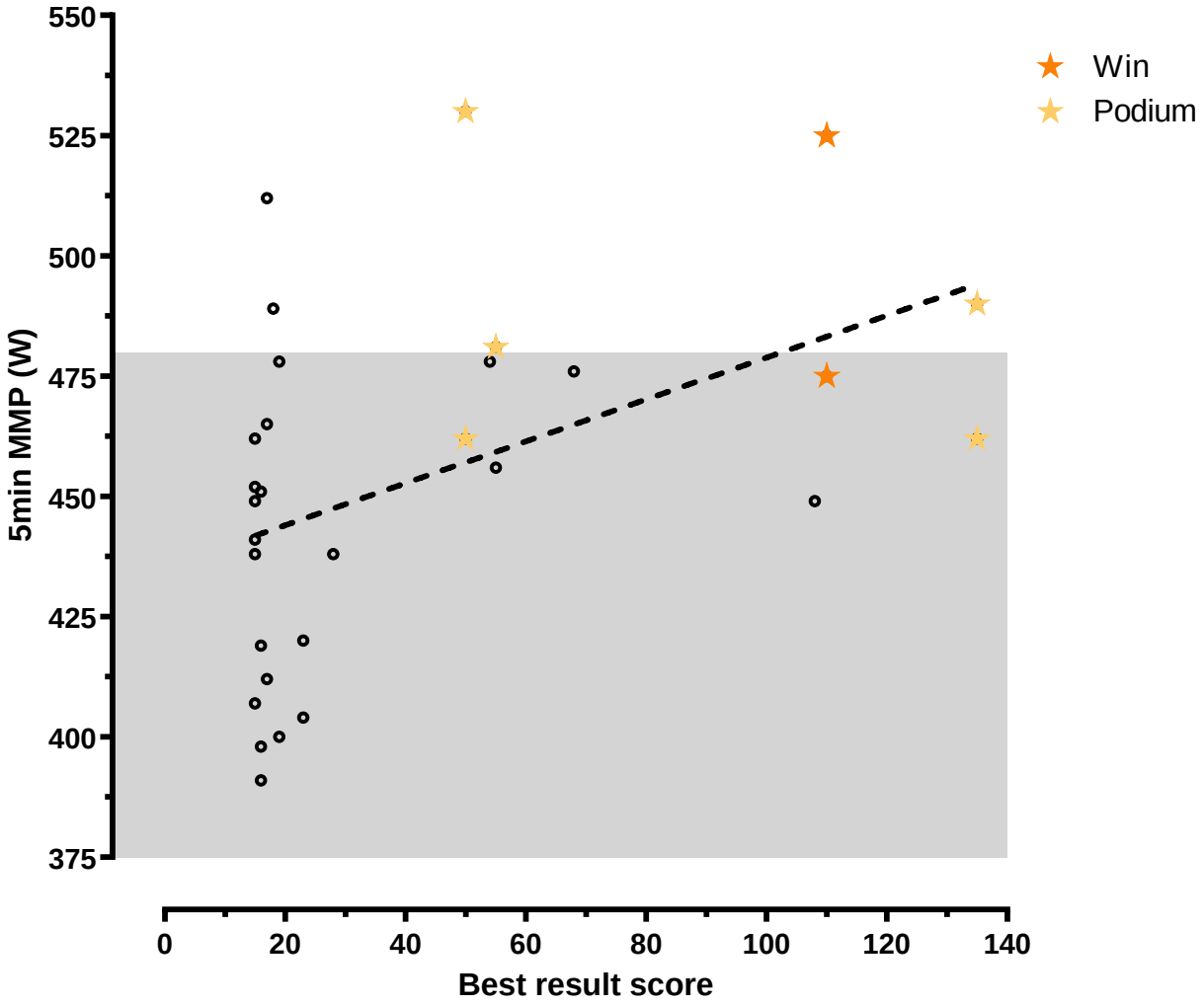


Results

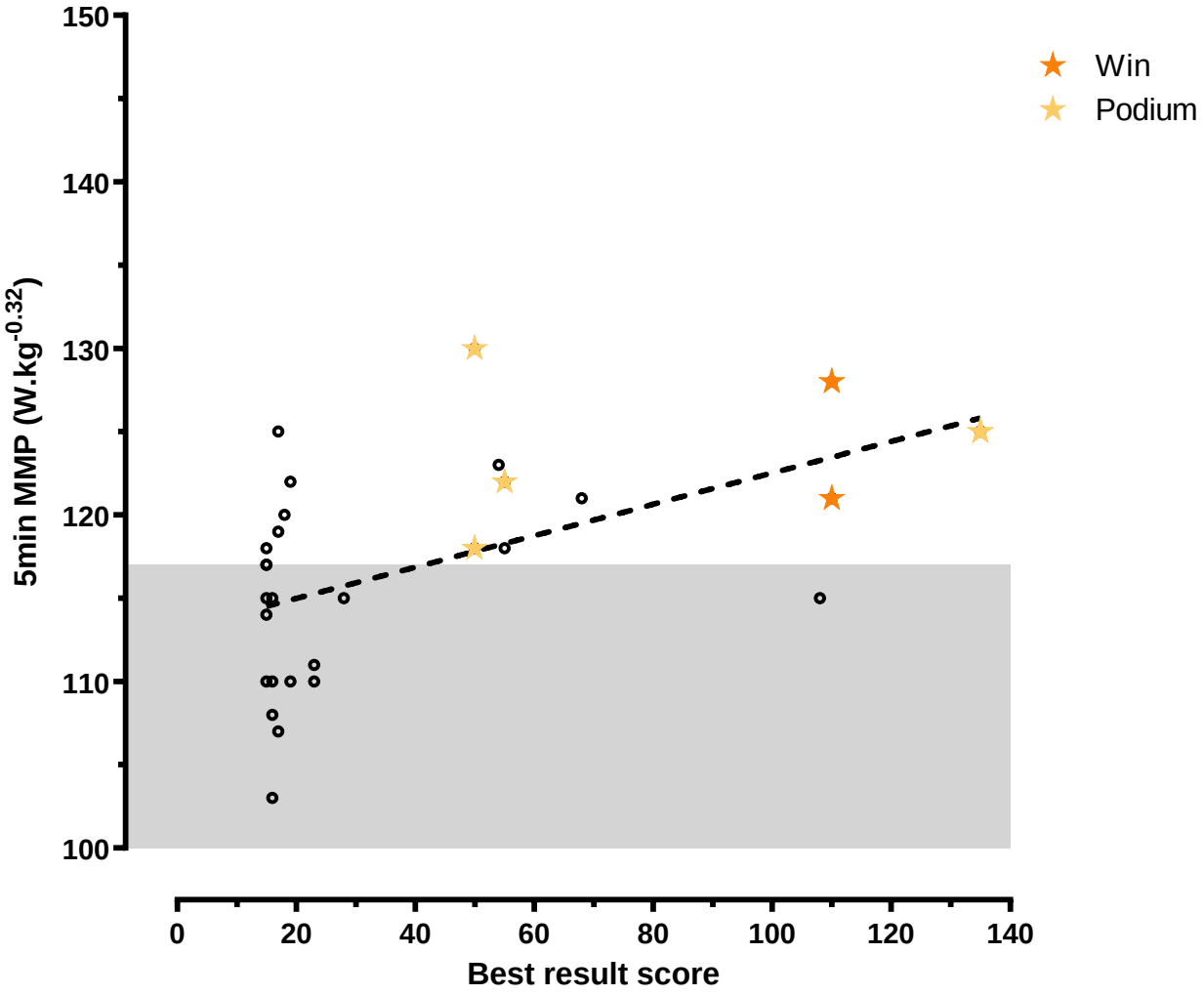
	5-min MMP (W)	5-min MMP ($W.kg^{-1}$)	5-min MMP ($W.kg^{-0.32}$)	5-min MMP ($W.kg^{-0.78}$)	Compound Score ($W^2.kg^{-1}$)
Mean					
SD					
95% CI					

MMP – mean maximum power, SD – standard deviation, CI – confidence interval

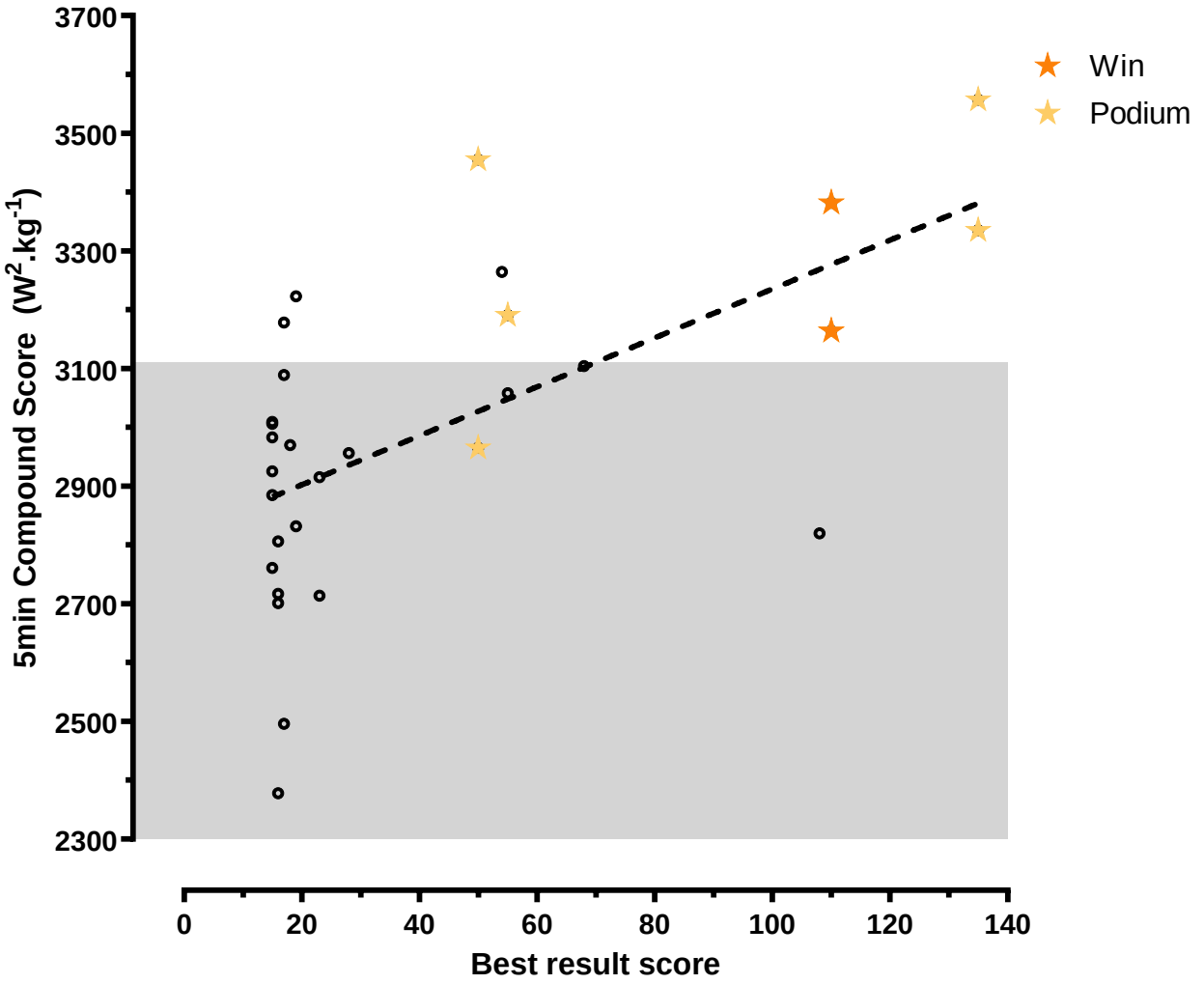
Results


550
525
500
475
450
425
400
375
5min MMP (W)
0
20
40
60
80
100
120
140
Best result score
Win
Podium

Results


Win
Podium
150
140
130
120
110
100
5min MMP (W.kg-0.32)
0
20
40
60
80
100
120
140
Best result score

Results


3700
3500
3300
3100
2900
2700
2500
2300
5min Compound Score (W².kg⁻¹)
0
20
40
60
80
100
120
140
Best result score
Win
Podium

Results

performance variable	threshold value	positive predictive capacity	negative predictive capacity	average predictive capacity	correlation coefficient (r)	p-value	effect size
5-min MMP (W)							
5-min MMP ($W.kg^{-1}$)							
5-min MMP ($W.kg^{-0.32}$)							
5-min MMP ($W.kg^{-0.78}$)							
5-min Compound Score ($W^2.kg^{-1}$)							

Discussion

- The two greatest forces a cyclist is required to overcome are gravitational force and drag.
- As relative power output scales inversely to mass and absolute power output scales proportionally with mass, these two variables represent a diverging set of performance characteristics
- The compound score seeks to provide a variable with which the balance of these diverging performance variables can be measured.

Take home messages

- A compound score of >3110 $W^2.kg^{-1}$ has a 80.0% positive predictive capacity for a podium or race win in U23 category
- A compound score of <3110 $W^2.kg^{-1}$ has a 85.0% negative predictive capacity of not achieving a podium or race win in U23 category
- A compound score above or below these thresholds is associated with only 20% or 15% likelihood, respectively, for making a podium/win or not

Thanks Team!

James Spragg

John Wakefield

Jeroen Swart

Questions?

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