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A single field test evaluation for the assessment of the Record Power Profile in cycling

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Power meters

Fundamental and powerful tool providing instant valuable information about the amount of mechanical production (Vogt et al., 2006; Weber et al., 2005)

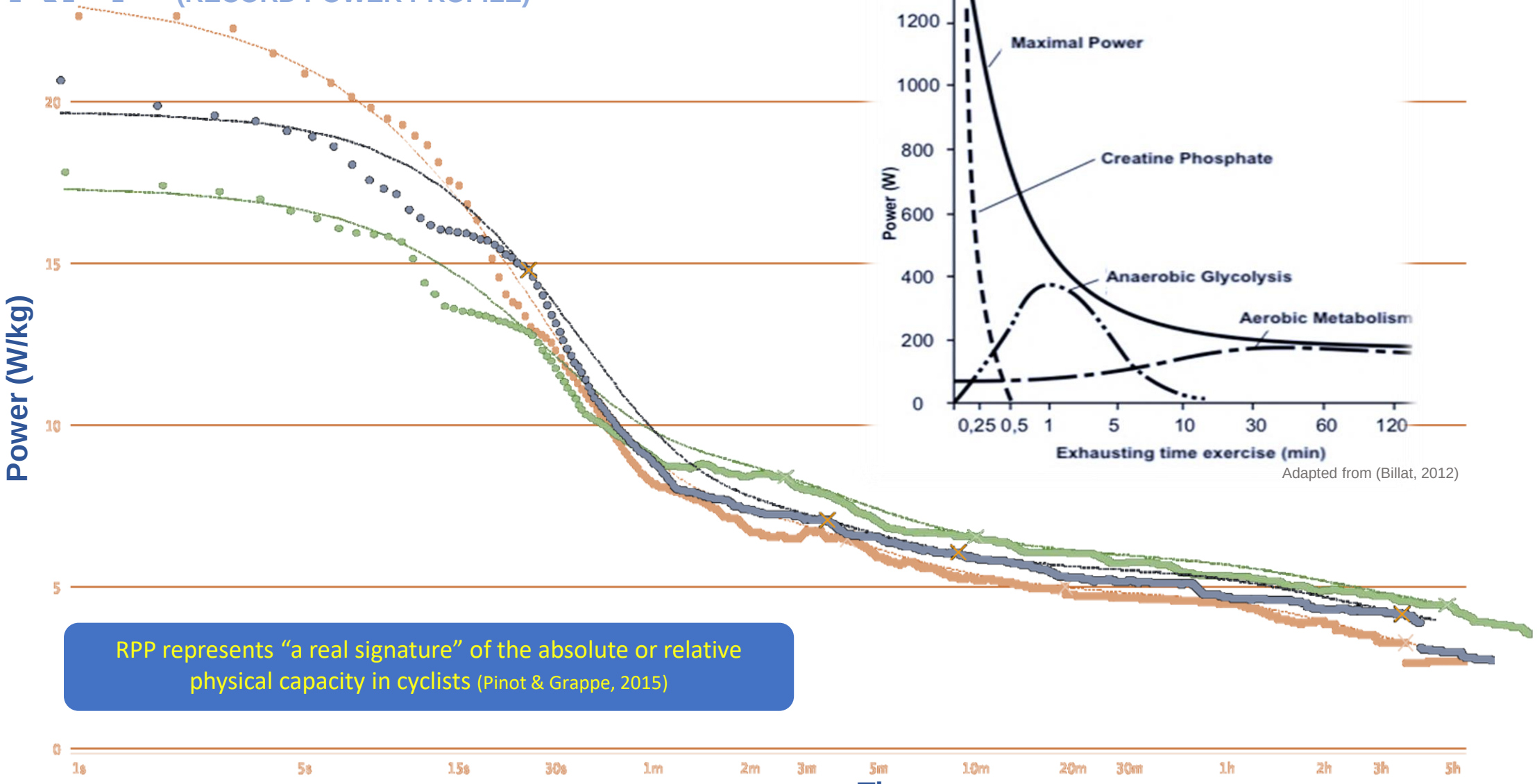
Measure Validity

Accuracy

· Maier et al., 2014, 2017

Picture: @GrahamWatson

RPP (RECORD POWER PROFILE)



Adapted from (Billat, 2012)

RPP represents “a real signature” of the absolute or relative physical capacity in cyclists (Pinot & Grappe, 2015)

CLIMBER 58kg

TT 76kg

SPRINTER 73kg

“Building” a PP (Power Profile)

Hyperbolic relationship between maximal PO sustained as a function of the effort duration (Allen & Coggan, 2010; Hill, 1993)

Lab

- Quod et al., (2010)
- Gonzalez Tablas et al., (2016)

Field

- Allen & Coggan (proposed in Cheung & Zabala, 2017)
- Deutsch et al., (2011) (unpublished data)

Preliminary RPP test

Both conditions

- Grappe, et al., (2012) (on development according the authors)
- Allen & Coggan (2010)

Hypothesis

A specific one single field test with successive efforts allowing to to obtain a reliable PP

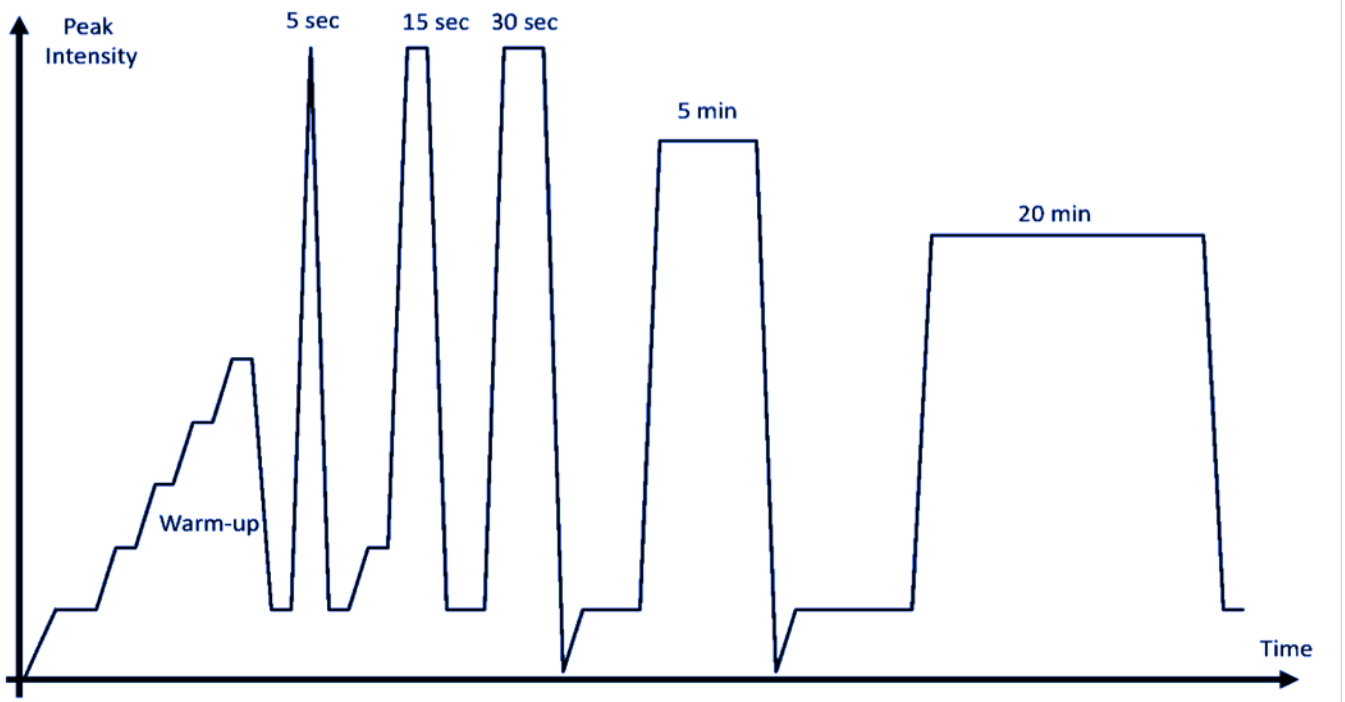
PP would match closely calculated from training and competition data

Aim of this study:

To test the validity of a single field test to establish a valid **record power profile** in elite cyclists

PPP-test

Peak Power Profile



5 successive bouts to define a hyperbolic profile of the maximal power sustained over 5, 15, 30, 300 and 1200 s

Performance determinants to reflect the different energetic metabolism pathways in cycling

Cyclists were **not** instructed about how to manage the efforts and recoveries of the PPP test.

Sunny day, in windless conditions and at an adequate temperature on quiet uphill roads

The average power output for each effort was recorded

Study Desigr

Methods

8 MALE ELITE CYCLISTS *

MAP estimated and extracted from RPP (Pinot & Grappe, 2014)

Age (years)	Mass (kg)	Height (cm)	MAP (W/kg^{-1}) MAP: Maximal Aerobic Power
23.8 ± 4	66.6 ± 5.8	180 ± 4.9	6.8 ± 0.4

Own bike & SRM (Professional Training Systems, Schoberer Rad Messtechnik, Jülich, Germany)

Training Peaks coach version (Peaksware, CO, USA) & GoldenCheetah v.3.5

PPP-test effort management. Mean (SD)

Efforts	% Road gradient	Duration (s) between efforts	PO during recovery (W)
Warm-up	-	1648±470	201±19
5 s	1.2±1.7	363±82	186±32
12 s	1.0±0.8	470±81	190±45
30 s	2.7±0.9	872±101	156±36
5 min	7.5±0.6	1464±217	160±49
20 min	6.6±1.7	-	-

No significant difference for the duration and intensity of the recovery phases and the self-selected slope of the road. P<0.05

* UCI Elite International license in track cycling, mountain-bike and road cycling

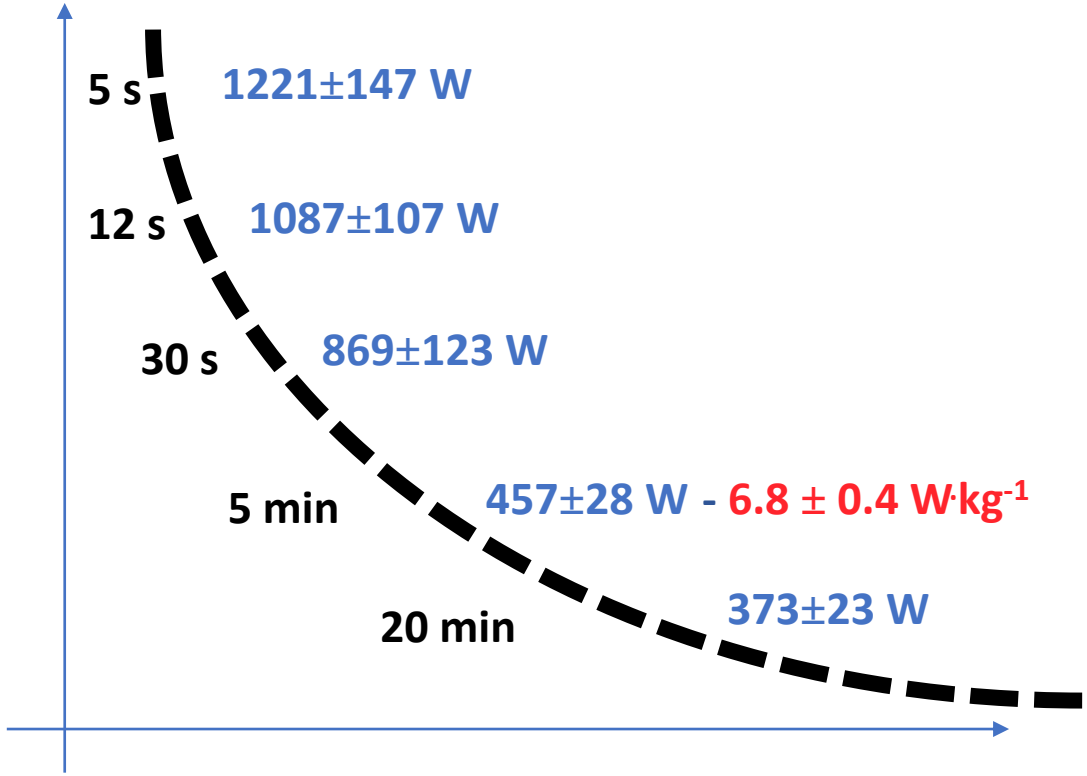
Results

2500 files/sessions

Positive correlation* between maximal PO obtained during the PPP-test and **training** (R^2= 0.97) and **competition** values (R^2= 0.91)

* **Pearson's correlation** coefficients were calculated to assess the **relationship between PPP test values with competition and training PO**

Maximal Power Outputs



Average record PO of PPP-test, training and competition.

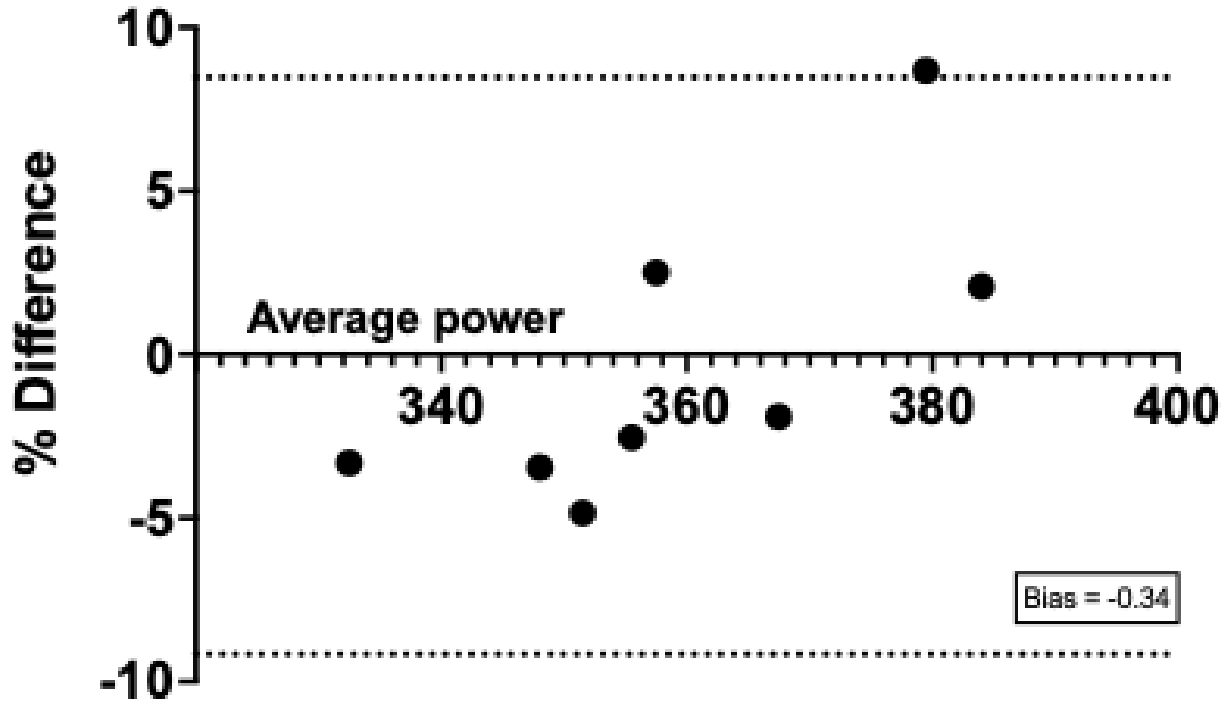
	Effort	PPP-test	Training	Competition	p< 0.05 PPP-test / Training	p< 0.05 PPP-test / Competition	p< 0.05 Training / Competition
PO (W) **POW·kg^{-1}**	5 s	1163±159 17.5±2	1221±147 18.3±1.5	1102±189 16.5±2	0.09	0.16	0.007 *
PO (W) **PO W·kg^{-1}**	12 s	1065±147 16±2	1087±107 16.3±0.9	955±14 14.3±1	0.46	0.04 *	0.008 *
PO (W) **PO W·kg^{-1}**	30 s	869±123 13±1	857±119 12.8±1	756±13 11.3±1	0.63	0.02 *	0.02 *
PO (W) **PO W·kg^{-1}**	5 min	439±2 6.6±0.4	457±28 6.8±0.4	433±30 6.5±0.3	0.03 *	0.54	0.03 *
PO (W) **PO W·kg^{-1}**	20 min	359±2 5.4±0.4	373±23 5.6±0.4	360±12 5.4±0.3	0.02 *	0.88	0.08

3.2 % lower during the PPP test compared to training

5.5 % higher during the PPP test compared to competitions

Differences between
(**Competition, Training, PPP-test**)
Paired design Student's t-test
Null hypothesis was rejected for P<0.05 (two tailed)

Difference between 20' efforts during the field test vs. in competition



Bland–Altman plots PPP-test vs. Competition.

Difference in % are represented as function of the average power recorded with the 95% limits of agreement (dotted lines)

Discussion

A single field test evaluation yields sufficiently high-power outputs to allow a valid peak power profile to be established

RPP match

Pinot & Grappe
Deutsch et. al (2011)

Ecological alternative

Ability to perform it their optimal conditions

May help to increase the performance
(Zeidenitz et al., 2007)

4% (14 W) difference PPP-test vs. Training

20 min maximal may alter the previous 5 min

de Koning et al., 1999
Hettinga et al., 2006

Competition 17.5 % vs. Training 55%

Role as teammate

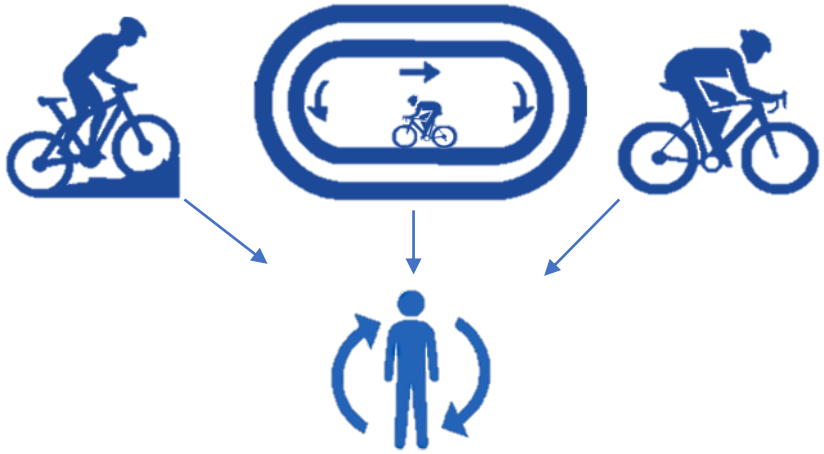
Impact on their aptitude to maximally perform
(Menaspà et al., 2015)

Practical Application

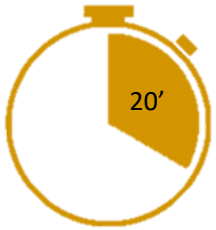
PPP-test as a reliable tool for cyclists and trainers to define training regimens and target power zones

PPP-test

To objectively assess if improvements occur with racing and training



Different metabolic profiles



PPP-test to predict sustainable power in competition when fatigue is accumulated

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Original Article

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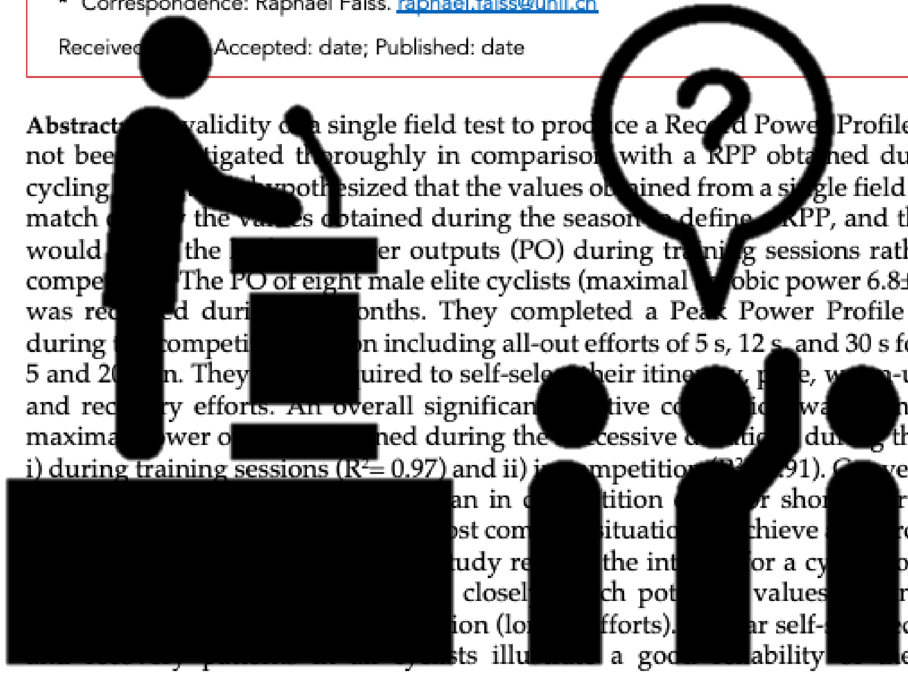

Abstract[illegible]validity [illegible]a single field test to pro[illegible]ce a Rec[illegible]d Powe[illegible]Profile (RPP) has not bee[illegible]tigated t[illegible]roughly in compariso[illegible] with a RPP obta[illegible]ned during a full cycling[illegible]othesized that the values o[illegible]ined from a si[illegible]gle field test would match [illegible] the va[illegible]s obtained during the season[illegible] define[illegible]RPP, and that cyclists would [illegible] the [illegible]er outputs (PO) during tr[illegible]ni[illegible]g sessions rather than in compe[illegible] The PO of eight male elite cyclists (maximal [illegible]obic power 6.8±0.4 W/kg) was re[illegible]d duri[illegible]onths. They completed a Pea[illegible] Power Profile test (PPP) during [illegible]ompeti[illegible]n including all-out efforts of 5 s, 12 s and 30 s followed by 5 and 2[illegible]n. They[illegible]uired to self-sele[illegible]heir itine[illegible], p[illegible]e, w[illegible]-up strategy and rec[illegible]y efforts. An overall significan[illegible]ive c[illegible]wa[illegible]nd between maxima[illegible]wer o[illegible]ned during the[illegible]cessive d[illegible]du[illegible]g the PPP and i) during training sessions (R^2= 0.97) and ii) i[illegible]mpetition[illegible]91). C[illegible]versely, peak [illegible]an in c[illegible]tition [illegible]r sho[illegible]rts (≤ 30 s). [illegible]st com[illegible]ituatio[illegible]chieve [illegible]d PO (55%) [illegible]udy re[illegible]the int[illegible]or a cy[illegible]o perform a [illegible]closel[illegible]ch pot[illegible]values[illegible]ned during [illegible]ion (lo[illegible]fforts).[illegible]r self-[illegible]d warm-up [illegible]ts illu[illegible] a go[illegible]ability[illegible]e test. The underpinning strong motivation needed to reach ones peak PO over successive durations during one single field test may limit its validity over longer durations so that the 20 min peak power output may ideally be obtained from a separate field test..

Keywords: Performance, Training, Elite, Cyclist

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Statistical Analysis

Differences were assessed using a one-way general linear model repeated-measures ANOVA with all pairwise comparison (Holm-Sidak method)

The null hypothesis was rejected for $P<0.05$ (two-tailed)

Pearson's correlation coefficients were calculated to assess the relationship between PPP test values with competition and training PO

XLSTAT data analysis (XLSTAT, 2017 Paris, France) add-on for the Excel software (Microsoft, Richmond, USA)