

Abstract

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

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1. Introduction

Power output represents a pertinent metric to assess the performance level in cyclists. In this context, the Record Power Profile (RPP) reflects the best power output spectrum of an athlete recorded during training and competitions (Pinot & Grappe, 2011). To date, several laboratory or field tests separately allow to determine the successive points necessary to build a cyclists RPP. To the best of our knowledge, the overall validity of a single field test evaluation to produce a RPP has not been investigated thoroughly in comparison with a more robust RPP obtained during a whole cycling season.

2. Materials and Methods

This study was conducted with 8 elite cyclists and proposes a single field test evaluation (Peak Power Profile test (PPP)) to establish a preliminary RPP and to compare the latter with a RPP calculated over the time course of an entire cycling season. We first investigated if RPP values were obtained mostly during training sessions or during competitions. We hypothesized that cyclists would reach the highest power outputs during the more

specific training sessions rather than during racing. Second, cyclists had to perform a PPP including successive bouts of all-out efforts of several duration (from 5 s to 20 min) with self-paced warm-up and individual recovery phases to allow to reach peak power outputs for each duration on an adequate terrain. We hypothesized that the values obtained from a single PPP would match closely the values obtained during the season to define a RPP.

For the purpose of the study, we recruited eight male elite cyclists (23.8±4 y, 66.6±5.8 kg, maximal aerobic power 6.8±0.4 W/kg) competing at an international level (UCI Elite International license) in track cycling, mountain-bike and road cycling. Their power output was recorded during 12 months from October to September to determine their RPP. The cyclists completed a single PPP during the competitive season (between June and August) following the protocol illustrated in Table 1. Briefly, subjects performed all-out efforts of 5 s, 12 s, and 30 s followed by efforts of 5 min and 20 min. The cyclists were required to self-select their itinerary and pace their own warm-up and recovery efforts to allow for their best power output on the most adequate terrain. Power



data were recorded at 1 Hz with the cyclists' own power meter (SRM) and HR belt at 1 Hz and computed in a dedicated software (Golden Cheetah) to allow for the quantification of their training load and automated determination of their RPP.

3. Results

The cyclists covered an average yearly cycling distance of 16021 ± 4575 km during the season. A significant positive correlation was found between the overall peak power outputs obtained during the single PPP-test and i) during training sessions during the season ($R^2 = 0.97$, $P = 0.05$) (Fig. 1) and ii) competition ($R^2 = 0.91$, $P = 0.05$) (Fig. 2). However, when analyzed individually, peak powers recorded during the PPP-test were higher than in competition for short efforts of 12 s ($P = 0.05$) and 30 s ($P = 0.05$) (Table 2). Conversely, the best 20 min power output tended to be higher in competition than during the PPP-test ($P = 0.05$) (Table 2). The individual distribution of the peak PO in different conditions illustrated that specific training sessions represented the most common situation to achieve a record PO (55% of the cases) followed by the PPP-test (27.5%) (Fig. 3). The pattern of intensity and duration during the warm-up and recovery phases was similar in all cyclists without any precise external recommendations (Table 3).

4. Discussion

This study reports the interest for a cyclist to perform a single PPP to establish a RPP that would closely match potential values obtained during the rest of the season during training (for shorter efforts) or competition (for longer efforts). However, short all-out eff

orts may alter the power output of a subsequent 20 min maximal effort. The similar warm-up and recovery patterns illustrate a good reliability of the test when utilized to compare the objective level of cyclists at a given time point.

5. Conclusions

Our study highlights the utility of a single field test to establish a valid Record Power Profile in elite cyclists. The very high-power outputs obtained during the single Peak Power Profile test make it a reliable tool for cyclists and trainers to define training regimens and target power zones. The underpinning strong motivation needed to reach one's peak power output over successive durations during the test may limit its validity over longer duration. It may be recommended to extrapolate peak power for longer efforts or use competition data to be included in a profile.

References

1. Pinot, J., & Grappe, F. (2011). The record power profile to assess performance in elite cyclists. *International Journal of Sports Medicine*, 32(11), 839- 844. doi:10.1055/s-0031-1279773.

Phase	Time / Effort	Description
Warm-Up	Self-management of duration and intensity	Select your own terrain according to your cyclist characteristics.
	5 seconds	Free start velocity - All-out effort
Main set	Recovery	Self-management
	15 seconds	Free start velocity - All-out effort
	Recovery	Self-management
	30 seconds	Free start velocity-Go as hard as you can
	Recovery	Self-management
	5 minutes	Free start velocity - Maximal capacity
	Recovery	Self-management
	20 minutes	Free start velocity - Maximal capacity
Cool-down	Free	Easy Ride

Table 1: Peak Power Profile test protocol

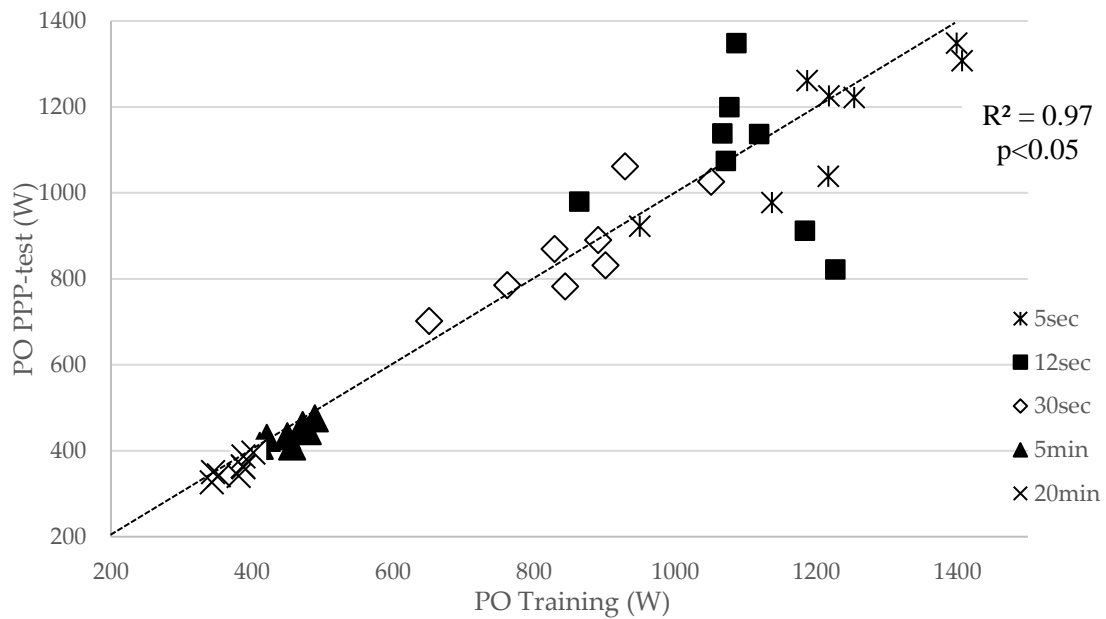


Figure 1: Correlation between the maximal power output (PO) reached during the Peak Power Profile (PPP) test and during training sessions

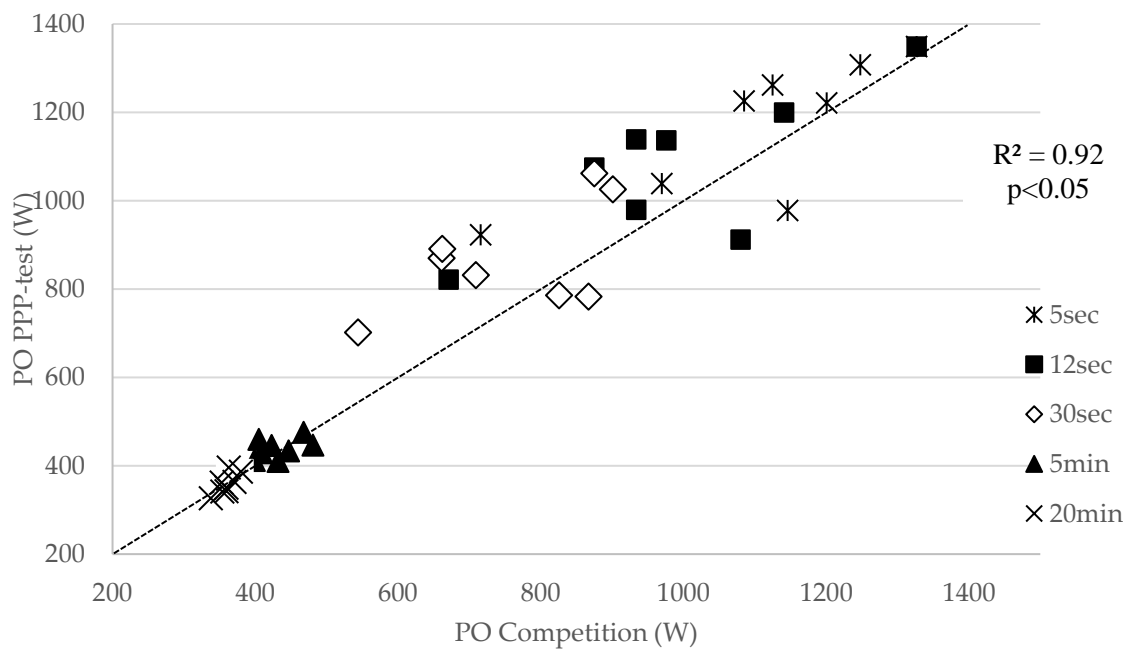


Figure 2: Correlation between the maximal power output (PO) reached during the Peak Power Profile (PPP) test and during competitions

Absolute (W) and Relative ($W \cdot kg^{-1}$) Power Output (W)	Efforts	Power Output (W)			PPP-test vs. Training	PPP-test vs. Competition	Training vs. Competition
		PPP-test	Training	Competition			
N=8	5 s	1163±159	1221±147	1102±189	0.09	0.16	0.007
		17.5±2	18.3±1.5	16.5±2			
	12 s	1065±147	1087±107	955±14	0.46	0.04	0.008
		16±2	16.3±0.9	14.3±1			
	30 s	869±123	857±119	756±13	0.63	0.02	0.02
		13±1	12.8±1	11.3±1			
	5 min	439±2	457±28	433±30	0.03	0.54	0.03
		6.6±0.4	6.8±0.4	6.5±0.3			
	20 min	359±2	373±23	360±12	0.02	0.88	0.08
		5.4±0.4	5.6±0.4	5.4±0.3			

Table 2: Average maximal power output (PO) reached during the specific peak power profile (PPP) test, and during training and competition with all-pairwise comparisons.

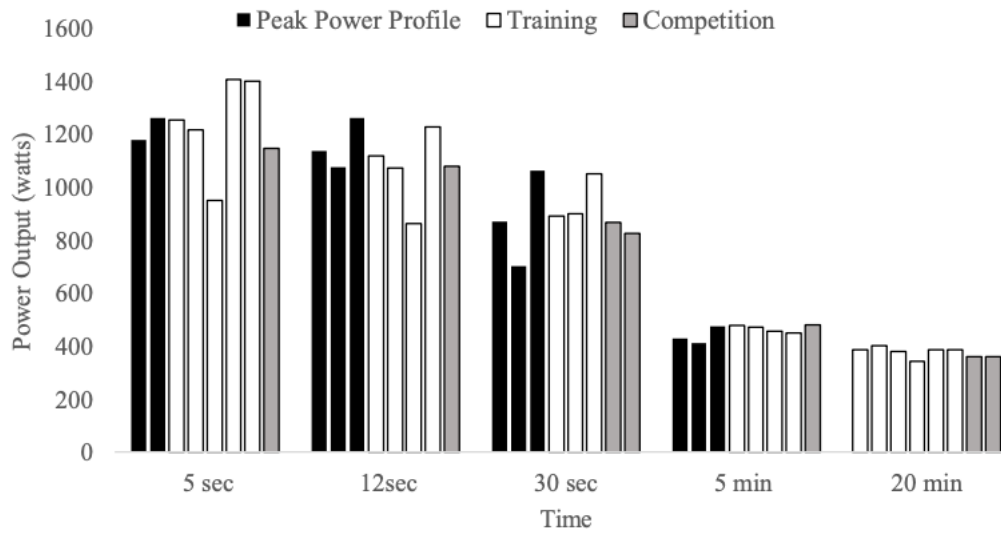


Figure 3: Peak Power Output (W) and its distribution on the different conditions for the subjects

Efforts	% Road gradient	Time (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	-	-

Table 3: Duration and intensity of the warm-up and recovery phases during the PPP test with self-selected slope for the successive efforts