

The 'Power Profile' for determining the physical capacities of a cyclist

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1. Introduction

Monod and Scherrer have determined the concept of critical power (CP) by establishing a linear relation between the time to exhaustion (T_{ex}) and (1) the total work performed (Monod and Scherrer 1965) and (2) the distance covered (Scherrer 1958). To improve this concept, Peronnet and Thibault (1987) have suggested a more elaborate model that describes the relationship between the percentage of maximal aerobic velocity and the time of exercise from 7 min to 2 h. This model allows the evaluation of three physical capacities of an athlete: T_{ex} , CP and endurance. It is possible to ameliorate this model by determining the 'Power Profile' (PP) of a cyclist. The PP can assess more physical capacities (Figure 1) from the relationship between the maximum power output (PO_{max}) sustained (during trainings and competitions) and the time between 1 s and 4 h (Larrazabal et al. 2006; Villerius et al. 2007). PO developed by a cyclist becomes a biomechanical variable of performance which is currently measured in routine directly on the bicycle during training and competition. For that, it is necessary to fix a powermeter on the bike (SRM training system or Powertap). The simplicity of use of these systems pushes the coaches and the cyclists to use PO for the training follow-up. As the level of PO is dependent on the exercise intensity, the analysis of PO during all the trainings and competitions permits the determination of the PP of the cyclist. From there, it is possible to make PP comparisons between (1) different cyclists according to the age and race category and (2) during a season for a cyclist.

The aim of this study was (1) to determine the PP during a competitive season for five cyclists of different fitness levels and (2) to analyse the inter- and intra-individual PP changes that can occur during 1 year.

2. Methods

During a cycling competitive season (February–September), five cyclists (22 ± 5 years old, 180 ± 3 cm and 66 ± 4 kg) of different levels (second category, first category, first category; member of the U23 French National team, professional in a Continental Pro Team; professional in a Pro Tour Team: top 5 in Giro and Vuelta) carried out their training and competitions with a powermeter (SRM or Powertap) on their bike. Twelve durations of the PO_{max} –time relationship were determined to emphasise the five physical capacities specific in cycling: explosiveness (1, 5 s), lactic tolerance (30 s), maximal aerobic power ~ 5 min, anaerobic threshold (20, 30, 45 and 60 min) and endurance (2, 3, 4 and 5 h) (Figure 1). The highest maintained PO value for each duration during the season was retained to determine the PP of each cyclist (PO was expressed in W/kg in order to make comparisons between the cyclists).

3. Results and discussion

The most important findings of this study are that (1) the PP allows the assessment of changes in the different physical capacities during a season for a cyclist (Figure 2) and (2) the higher the level of practice, the more the PO increases for an exercise duration (Figure 3). The level of PO is dependent on the cyclist's category. For example, at the anaerobic threshold (20–60 min), there is a mean difference of 1 W/kg between the cyclists in Pro Tour and second categories. Thus, it is possible to assess the different physical capacities for a cyclist from the PO_{max} –time relationship. The combination between the different physical capacities determines a standard PP for each athlete. This suggests that PP can represent a signature of the physical potential of the cyclist. The PP is a concept that appears very interesting for the longitudinal follow-up

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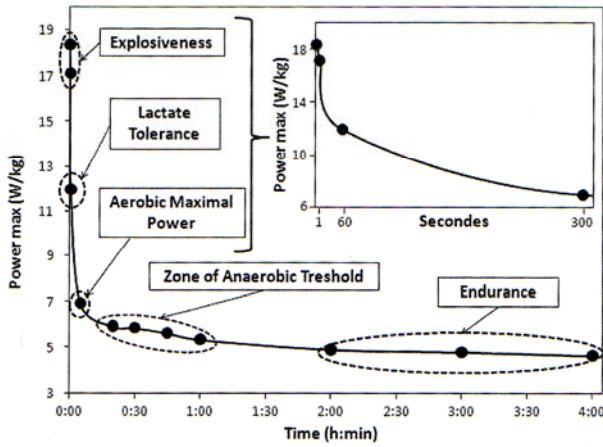


Figure 1. Determination of the different physical capacities of a cyclist from the PP.

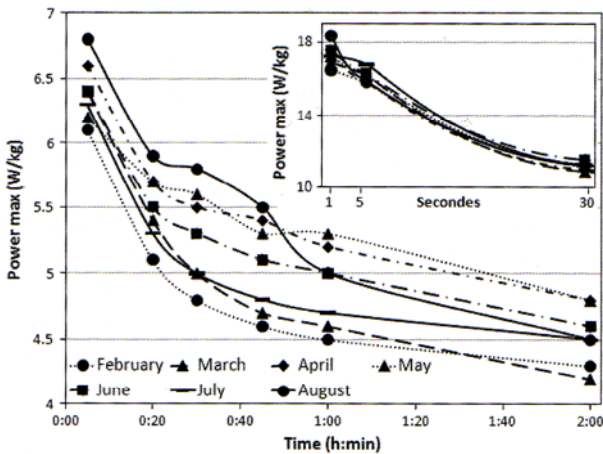


Figure 2. PO longitudinal follow-up per month for a cyclist from 1 s to 2 h durations.

of the athlete's fitness. The changes during the training follow-up allow the trainer to optimise the training process. One can follow the changes in the different physical aptitudes from the varying training loads and different kinds of races (flat, mountain, etc.). The work of the coach becomes more accurate with the possibility of making weekly/daily adjustments in the training process of the cyclist. With such training follow-up, the cyclist can

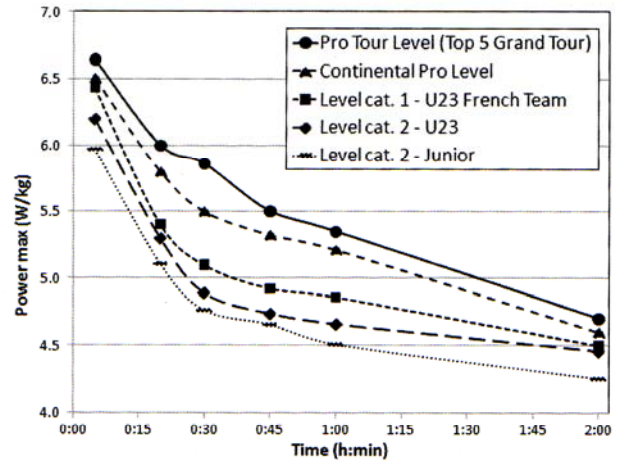


Figure 3. Changes in PP for five cyclists of different categories between 5 min and 2 h durations.

work with an overtraining prevention model and can optimise his performance capacity.

4. Conclusion

The training load longitudinal follow-up of a cyclist allows to determine his PP according to the PO_{max} -time relationship. One can observe the fitness changes of the athlete during the season. The PP can give a signature of the athlete's capacities.

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