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Past attempts to identify a single physiological parameter as the main indicator of success in the tour de France seem to have failed

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Abstract

Background: Past attempts to identify a single physiological parameter as the main indicator of success in the tour de France seem to have failed.

Purpose: To evaluate the validity of the critical power model for the analysis of exhaustive power-time curves of grand tour winners.

Methods: The climbing time and the corresponding average climbing power for final and non-final climbs in the tour de France, The Giro and the Vuelta are obtained. From the final climbs exhaustive (P-t) relations are constructed and analyzed with the Monod-Scherrer critical power model. For each rider we obtained his critical power CP and his anaerobic work capacity AEC.

Results and Discussion: We found vast individual variations in CP and AEC. Neither of these single parameters, nor the pairs could identify the necessary quality for success. Winning CP was between minimum 4.82 W/kg (Hesjedal in 2011) and maximum 5.81 W/kg (Indurain in 1994-95). Winning AEC was between minimum 0.75 kJ/kg (Indurain in 1994-95) and 1.81 kJ/kg (Contador in 2009). Figure 1 shows the variation in CP and AEC, where the values obtained by Froome in 2012-13 were taken as reference values. Although in 2013 Froome and Contador had almost identical aerobic power, Contador fell short in AEC. This was quite different in his winning Tour 2009, when Contador had superior values both for CP and AEC. The highest historical CP-value is probably for Indurain in 1994, although he combined this with the lowest AEC-value. Hesjedal achieved sub-Froome parameters although he had an almost identical ratio of aerobic to anaerobic components. We see also that Horner's performance in his Vuelta 2013 is almost identical to Indurain in 1994. Also remarkable is the fact (not shown in fig 1) that the average climbing power of Froome in 14 non-exhaustive climbs of (5.05 ± 0.34) is barely lower than his CP of (5.16 ± 0.02) W/kg. This clearly indicates that modern strategy of the dominant teams is the one of "least controlling power" i.e. riding at a pace just below the leaders CP in order to bring him fresh to the foot of the final climb, but at a pace high enough to exhaust the other contenders.

Conclusion: Within the climbing time interval 15 – 60 minutes the Monod-Scherrer critical power model adequately describes the exhausting climbing performances of grand tour champions.
In modern cycling the anaerobic component is more important than generally accepted and the practice of estimating the functional threshold power and critical power with a single maximal test over 20 minutes could be invalid. The maximal oxygen uptake for all considered winners is below 90 $\frac{\text{ml}}{\text{min.kg}}$, with the exception of Indurain in the uncontrolled EPO-years 1994-1995.
More investigation of the 2-parameter CP model of the grand tours is necessary and might lead to a performance passport as a supplement to the existing biological passport. Future studies could be facilitated and could gain in public acceptance and credibility with the creation of a public database containing the power data files (SRM, Powertap and others) of all top riders.

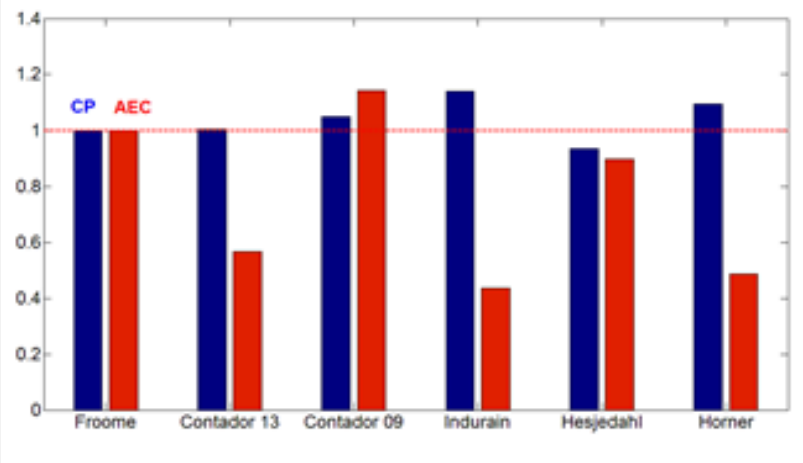

Figure 1. Critical Power (left bars) and anaerobic work capacity (right bars), referenced to Froome.

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Received: 1 May 2014. Accepted: 1 June 2014.