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Short and Long Individual Time-Trials Involve Intermittent Exercise Intensity Regulation

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Abstract

Pacing strategies during endurance performance is becoming one of the main topics in sport sciences. Tucker et *al*. (2006) reported that Power Output (PO) recordings during an individual time trial (ITT) exhibit non-random fluctuations which can be determinant for the intensity regulation by the central nervous system. Recently, Abbiss et *al*. (2010) proposed the "Exposure Variation Analysis" (EVA) method to study the PO variations during races. This new method expresses PO as a tridimensional distribution which allows to identify both intensity and duration of each effort realised by the cyclist. During self-paced ITT, this method offers valuable and relevant possibilities to analyse the pacing strategies and PO variations in elite cyclists to optimise their performances. Therefore, the aim of this study was to analyse the PO variations during a short and a long ITT in professional road cyclists.

Methods: Three UCI World Tour road cyclists took part in this study (1 ITT specialist, 1 world class climber and 1 domestic climber). PO data were recorded during the short initial ITT of 2015 Tour de France (13.8km) and the long ITT of 2013 Tour de France (33km). PO variations were analysed from the EVA method that quantifies both the time spend within 7 predefined intensity levels and the"acute" time for which PO was maintained within each intensity zone without changing to another level. Intensity zones were expressed in percentage of the mean PO of the ITT (<90%; 90 to 94%; 94 to 98%; 98 to 102%; 102 to 106%; 106 to 110%; >110%). Acute times were ranged from <2s; 2 to 5s; 5 to 10s; 10 to 30s; >30s.

Results: Both short and long ITT present a lot of PO variations, with a majority of time spent in <2s acute time zone (59.6 ± 7.2% of total ITT time for the long ITT and 53.3 ± 7.4% for the short ITT). Furthermore, there is no acute effort longer than 10s for 90 to 110% PO zones.

Most of the efforts were made inside extreme <90% and >110% intensity zones (respectively 31.7 ± 6.0% and 20.8 ± 3.8% of total time) for both short and long ITT but with different acute times repartition inside these two PO zones: short ITT exhibits only acute times shorter than 30s whereas long ITT exhibits several constant efforts lasting for more than 30s (3.6 ± 1.5%; figure 1).

Discussion: The main finding of this study is that both short and long ITT exhibit variable PO with most of constant efforts lasting for less than 2s. These results are consistent with the hypothesis of St Clair Gibson et *al*. (2006) which explain that self-paced efforts are composed of alternating periods of certainty and uncertainty (that come from both right and left lower limbs) during which the brain expects feedbacks from physiological systems in order to regulate the metabolic rate. Thus, during the ITT the brain doesn't regulate the exercise intensity linearly but with a multitude of little PO adjustments of 16W for a mean PO of 400W. The short ITT appears to be even more inconstant than the long ITT with more short efforts at intensities higher than the mean PO. These results can be related to the short ITT course which exhibits many corners where the cyclists must produce a strong acceleration to regain speed as quickly as possible.

Conclusion: Both short and long ITT present the same intermittent exercise intensity regulation with mainly inconstant efforts lasting for less than 2s and only a few longer constant efforts at intensities lower at 90% of the mean PO and higher at 110% of the latter.

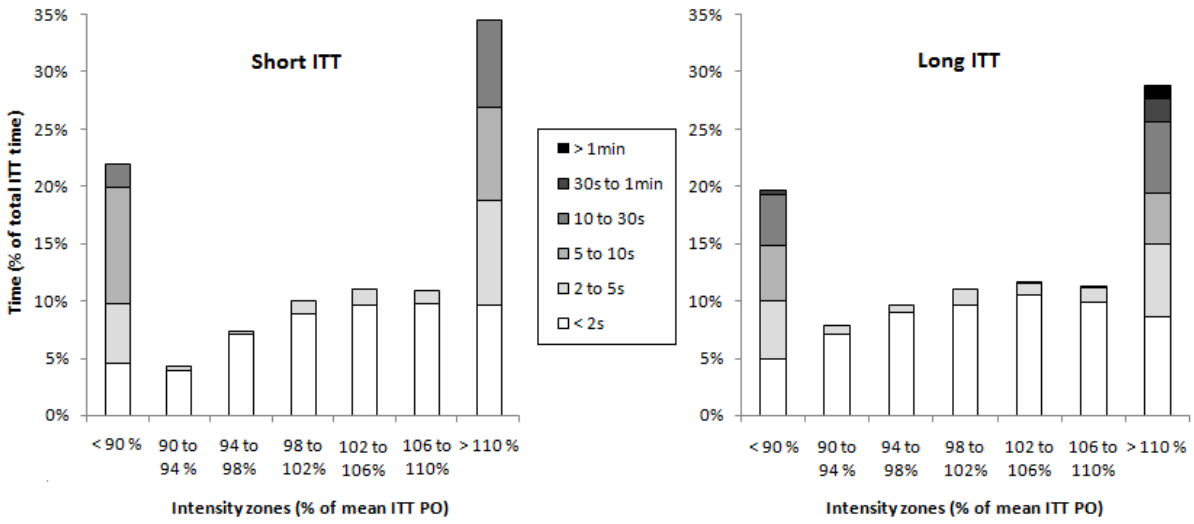

Figure 1: EVA analysis averaged for 3 professional cyclists on the same short and long Tour de France ITT

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