BOOK OF ABSTRACTS Open Access

Exposure Variation Analysis (EVA) method to monitor ability to optimally regulate exercise intensity of professional cyclists during time-trial competitions

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Introduction

Pacing strategies during endurance performance is becoming one of the main topics in sport sciences. Several studies proved that a constant pacing strategy, adjusted from course main difficulties, is optimal for individual time-trial (ITT) performance. However, the regulation mechanisms that allow athletes to maintain a constant power output (PO) remain poorly studied (Abbiss and Laursen 2008). The "Exposure Variation Analysis" (EVA) was recently proposed as a new innovative method to quantify short-time PO fluctuations during ITT (Abbiss et al. 2010; Peiffer and Abbiss 2011). This method appears to offer an interesting way to investigate the athlete ability to optimally regulate exercise intensity during ITT in order to maintain a constant optimal pacing strategy. The aim of this study was to assess the relationship between the exercise intensity regulation mechanisms quantified thanks to the EVA method and the evolutions of performance of Word-Tour cyclists during an official competitive ITT performed on the same course during two consecutive years.

Methods

Six UCI World-Tour road cyclists took part in this study. Their PO were recorded during the same World-Tour ITT race performed on the exact same course (10 km) for two consecutive years. PO fluctuations were analysed from the EVA method to quantify time spent at an accurate PO for optimal constant pacing strategy (APO, PO between 95 and 105 % of mean ITT PO), time spent at an inaccurate PO for optimal constant pacing strategy (IPO, PO lower than 95 % or higher than 105 % of mean PO for more than 10 s) and short-time regulations of inaccurate PO (REG, PO lower than 95 % or higher than 105 % of mean PO for less than 10 s). Relationships between evolutions of times spent at APO, IPO or REG and evolution of performance (mean speed, kph) between the two ITT were assessed thanks to Pearson correlation coefficients.

Results

Final ranking ranged from 6th to 107th. Mean PO weren't significantly different between the two ITT (428 ± 17 and 425 ± 12 W respectively), and their variations weren't significantly related to the evolutions of performance between the two ITT. However, a significant relationship was identified between the evolution of performance and the difference of time spent at APO between the two ITT ($r = 0.88$, $p < 0.05$; figure 1). A trend of a decrease of performance with the increase of time spent at IPO was also identified ($r = -0.65$, $p = 0.15$; figure 2).

Discussion

It has been demonstrated that cycling ITT performance is mainly related to the mean PO / Effective frontal area ratio (Peterman et al. 2015). However, our results suggest that mean PO variations are insufficient to predict the performance changes between two World-Tour ITT performed by a same cyclist. At this elite level, cyclists must also provide an optimal use of their mean PO to achieve a good performance. This optimal use of the mean PO implies a good regulation of exercise intensity during the entire ITT, with an

increasing time spent at a constant optimal PO (APO) and reduced irregular efforts at a too high or too low PO (APO).

Conclusion

For a same ITT, mean PO of a professional cyclist remain extremely stable over years. Accordingly, he will be more able to improve his performance thanks to a better effort regulation than by increasing his mean PO. EVA method appears to be an innovative tool to evaluate cyclists' ability to optimally regulate exercise intensity during ITT.

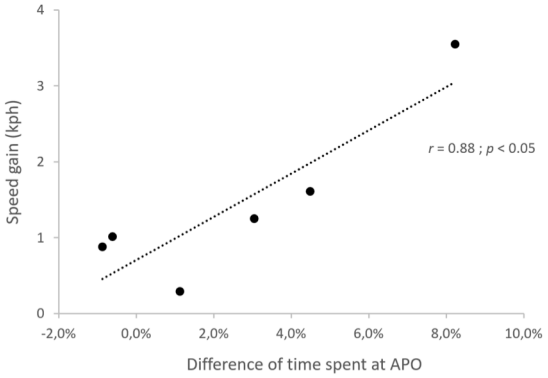

Figure 1: Relationship between variation of performance and evolution of time spent at optimal constant power output (APO) between two ITT on the same course

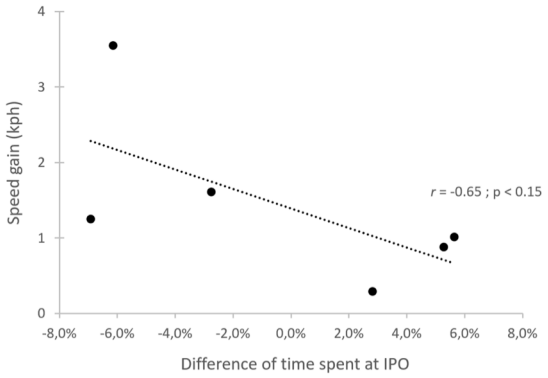

Figure 2: Relationship between variation of performance and evolution of time spent at inaccurate power output for optimal constant regulation (IPO) between two ITT on the same course

References

1. Abbiss CR, Laursen PB (2008) Describing and understanding pacing strategies during athletic competition. Sports Med 38: 239-252
2. Abbiss CR, Straker L, Quod MJ, Martin DT, Laursen PB (2010) Examining pacing profiles in elite female road cyclists using exposure variation analysis. Br J Sports Med 44: 437-442
3. Peiffer JJ, Abbiss CR (2011) Influence of environmental temperature on 40 km cycling time-trial performance. Int J Sports Physiol Perf 6: 208-220
4. Peterman JE, Lim AC, Ignatz RI, Edwards AG, Byrnes WC (2015) Field-measured drag area is a key correlate of level cycling time trial performance. PeerJ 3: e1144

Key words: Brain control, Pacing strategy, Power Output distribution, Time Trial Performance, Record Power Profile

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