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Conference Abstract

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Optimizing Cycling Time Trial Performance in Zwift: Validation of the PACE Model for Pacing Strategy

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Abstract

The application of the critical power (CP) model to intermittent exercise allows to gain valuable insights into the dynamic balance between *W'* depletion and *W'* recovery, thereby offering a potential tool for designing and optimizing pacing strategies in cycling. This study aimed to assess whether a pacing plan based on the PACE model - a novel model for real-time monitoring of *W'* during exercise - could improve time trial (TT) performance on the Zwift indoor cycling platform. Additionally, we investigated the impact of prior heavy-intensity exercise on TT performance. Twelve recreationally trained cyclists (29 ± 7 years; 75.2 ± 5.2 kg; 180 ± 3 cm; 54.1 ± 5.2 mL·min^{-1}·kg^{-1}) completed 9 to 11 laboratory testing sessions on separate days. Following an initial maximal ramp test, critical power (CP) and *W'* were determined through 3 to 5 constant power output (PO) tests to exhaustion. Participants then completed four 23.5 km TTs on Zwift (The Muckle Yin): two TTs with self-selected pacing (TT_1 + TT_2), one TT following a 120-minute constant work rate effort with 60 g/h carbohydrate intake (TT_{CWR}), and one TT with model-imposed pacing (TT_{PACE}). Differences in finish time and PO between the TTs were analysed using Repeated Measures ANOVA. IntraClass Correlation (ICC) was calculated between TT_1 and TT_2 to evaluate day-to-day variation. Critical power and *W'* were 281 ± 14 W and 22.8 ± 3.8 kJ, respectively. No significant differences in finish time were observed between TT_1 and TT_2 ($p = 1.000$, ICC = 0.974). Finish time was 77 ± 57 s faster in TT_{PACE} (2315 ± 80 s) compared to TT_1 (2359 ± 91 s, $p < 0.001$), TT_2 (2361 ± 102 s, $p = 0.031$), and TT_{CWR} (2458 ± 146 s, $p = 0.002$). Average PO was significantly higher in TT_{PACE} (278 ± 15 W) compared to all other conditions (TT_1 = 265 ± 18 W, $p < 0.001$; TT_2 = 264 ± 22 W, $p = 0.029$, TT_{CWR} = 243 ± 27 W, $p < 0.001$). In conclusion, the present study results demonstrate the effectiveness of a novel predictive *W'* model to improve TT performance in recreational cyclists, by optimizing *W'* expenditure and recovery.

Keywords

critical power concept; *W'* balance; PACE model; Zwift