4th Science & Cycling Conference, 28-29 June 2017, Düsseldorf, Germany **J Sci Cycling.** Vol. 6(3), 66-67

BOOK OF ABSTRACTS **Open Access**

Reliability of W´ using time-trials under laboratory conditions

Triska.[1]✉

Introduction

Critical power (CP) and the maximum work above CP (*W´*) serve as important parameters to characterize high intensity exercise (Jones et al. 2010). However, recent research reported poor reproducibility of *W´* (Galbraith et al. 2011; Karsten et al. 2015; Triska et al. 2015) and it was suggested that differences in the environmental conditions (e.g. terrain, seating position) or exhaustive durations might have influenced *W´* between tests.

Therefore, the aim of this study was to determine *W´* under controlled laboratory conditions using time-trials (TT). We hypothesized non-significant differences and a high reliability for *W´*.

Methods

Ten well-trained cyclists (MAP: 329±41 W) participated in this study. Reliability was assessed across three tests comprising three exhaustive TT each. These TT were 12, 7, and 3 min in duration and interspersed by 30 min passive rest. Tests were separated by at least 72 h. TTs were performed on a Cyclus2 ergometer (RBM Elektronik GmbH, Leipzig, Germany) where the participants' personal bikes were mounted on. To replicate real-world TT cycling, participants consequently utilised a self-pacing strategy were gearing was adjusted throughout efforts using the virtual gear changer mounted to the handlebars. *W´* was estimated using a linear regression where power is plotted against the inverse of time ($1.s^{-1}$):

$P = W´.t^{-1} + CP$

where P is the power output (W) and t is the time (s). The standard error (SE) for *W´* was calculated in absolute and relative values for each test.

A repeated measures ANOVA assessed the differences between the trials and significant main effects were followed-up by Bonferroni post-hoc procedures. Reliability was analysed using the intra-class correlation coefficient (ICC) and the coefficient of variation (CoV) (Hopkins 2000). Statistical significance was set at $P<.050$.

Results

Table 1 illustrates the results of the tests. Non-significant differences between repeated tests were revealed for *W´* ($F_{1.513,9.935} = 2.951$; $P = .115$). However, significant differences were found for the absolute and relative SE ($F_{2,18} = 10.865$; $P = .001$; and $F_{2,18} = 5.428$; $P = .014$, respectively). Using Bonferroni post-hoc procedures, absolute SE of *Test I* was significantly higher compared to *Test II* and *Test III* (P = .008-.042).

Discussion and Conclusions

Using TT efforts in trained cyclists, a learning effect for *W´* between *Test I-Test II* was identified. Furthermore, the ICC was low between *Test I-Test II*, but high for *Test II-Test III*. This is supported by CoV values for *Test I-Test II* which were notably above the recommended upper limit of 10% (Atkinson and Nevill 1998), however, improved to acceptable values in the following tests. The relative SE of the first test was slightly above the accepted upper limit of 10% (Ferguson et al. 2013), but well below that in the two following tests. Furthermore, absolute SE was significantly lower in *Test II* and *Test III*. To accurately determine *W´* our findings suggest a familiarisation trial even when testing trained cyclists.

Table 1: Results of the three tests to determine *W´*

	Test I	*Test II*	*Test III*
W´ (J)	17316 ± 6340	14972 ± 3052	14710 ± 3368
SE (J)	2012 ± 963	1060 ± 896*	868 ± 825*
SE (%)	12.6 ± 7.4	7.3 ± 6.5	6.0 ± 6.0
ICC (95%CL) *Test I-Test II*	0.58 (-0.03 to 0.88)		
ICC (95%CL) *Test II-Test III*	0.95 (0.80 to 0.99)		
CoV (%) (95%CL) *Test I-Test II*	25.3 (16.8 to 50.9)		
CoV (%) (95%CL) *Test II-Test III*	8.2 (5.6 to 15.5)		

W´ = maximum work above CP; SE = standard error of the estimate; ICC = intra-class correlation coefficient; CL = confidence limits; CoV = coefficient of variation; *significantly different from *Test I* at P<.050.
and FTP_{60} values (Panel A) and the correlation between CP and FTP_{60} values (Panel B).

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Key words: time-trials, Cyclus2, power-duration relationship, familiarisation