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Accuracy of the new Elite Drivo ergometer.

Vaeck, J.1.[1]✉, Bouillod, A.[1, 2, 3], Bouzigon, R.[1, 4], Pinot, J.[5], Grappe, F.[1, 5]

Introduction

The need to record power output (PO) of riders during training and competition is well accepted in modern cycling. Accuracy of PO needs to be high in order to measure differences in performance (Gardner et al. 2004; Hurst and Atkins 2006). Further ergometers are often used for training or testing, which demands good accuracy in PO (Guiraud et al. 2010). PO can be measured by different systems, with static or mobile ergometers (Paton and Hopkins 2001). The Elite Drivo is a new static ergometer (Elite, Fontaniva, Italy). This ergometer uses two optical torque sensors, which measures the time delay between a set of teeth. The advantage of such a system is, that it is not influenced by temperature. SRM (Trainingsystems, Schoberer Rad Messtechnik, Jülich, Germany) is a power-meter that measures PO accurately at the spider crank. SRM has been validated previously and is considered as a gold standard (Gardner et al. 2004; Hurst and Atkins 2006; Jones and Passfield 1998). The aim of this study was to assess the accuracy of the Elite Drivo ergometer in comparison with the SRM device. We hypothesised that the Elite Drivo underestimate PO compared to the SRM, due to mechanical losses, as the Drivo measures PO at the rear wheel and SRM at the spider crank.

Methods

6 cyclists (age: 24.1 ± 1.8 years, height: 1.79 ± 0.07 m, body mass: 71.7 ± 7.5 kg) performed all testing sessions on a bicycle fitted with a SRM power-meter and fixed on an Elite Drivo ergometer. At the start of the study, the SRM was calibrated whereas the zero-offset was reset before each testing session. The accuracy was investigated in the laboratory during 1) a sub-maximal incremental test and 2) a sprint test. A seventh cyclist performed only the sprint test. The sub-maximal incremental test was performed with six 3-min duration PO (100, 150, 200, 250, 300 and 350 W) and three 1-min duration pedalling cadences (60, 80 and 100 rpm) for each PO. Only the last 30 s of each step were analysed. The sprint test consisted of three 7 s sprints to determine maximal PO over 1 s ($PO_{1\text{-}sec}$) and 3 s ($PO_{3\text{-}sec}$) for the analysis.

Results

There was a significant difference between the PO_{SRM} and the PO_{Drivo}. ($p < 0.001$), whereas a strong correlation was measured between both power-meters ($R^2 = 0.999$, $p < 0.001$) (Figure 1A). Moreover, there was no effect of cadence ($p = 0.96$). Bland-Altman analysis showed that PO_{Drivo} was 16W lower than PO_{SRM} (Figure 1B) with a 95% confidence interval between -66W and 34W. This underestimation increased for higher PO, from -1.6% in the incremental test to -4.1% in the sprint test. For the incremental test, difference between PO_{Drivo} and PO_{SRM} increase with higher absolute PO, but relative (%) variation stayed the same, as for the sprint test, absolute and relative (%) variation increased with higher PO.

Conclusions

The main finding of this study shows that Elite Drivo ergometer underestimate PO compared to SRM, but PO_{Drivo} correlates well with PO_{SRM}. The underestimation increases with higher PO, but there is no influence of cadence. Average underestimation was -2.3%, which is higher than stated by the manufacturer.
A reason for this underestimation is the design of the power-meters, as the SRM record PO at the spider crank and the Drivo at the rear wheel. Some PO is lost due to chain friction, which is higher in sprint than in constant incremental tests (Hurst and Atkins 2006; Paton and Hopkins 2001). Also, the two power-meters have different measurement processes, which can explain the higher differences in PO at sprints.

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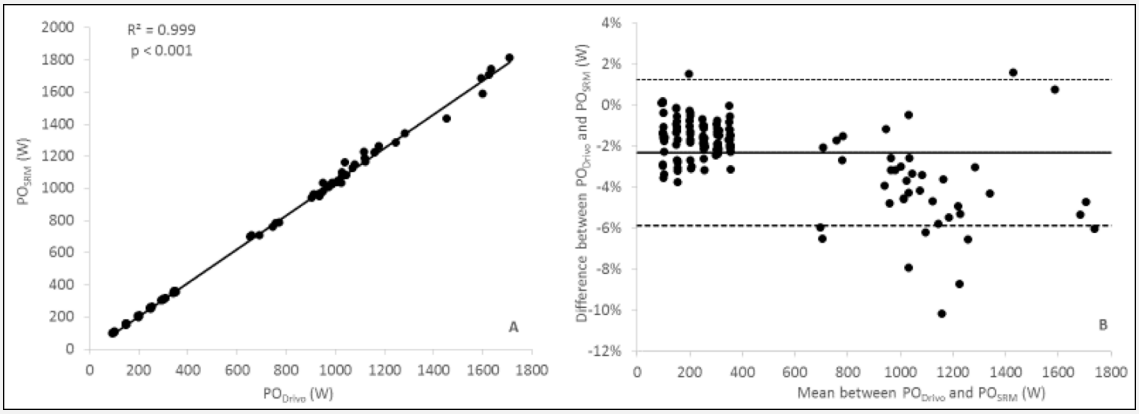

Figure 1. A: correlation between POSRM and PODrivo, B: Bland-Altman for the difference between PODrivo and POSRM during the sub-maximal incremental test and the sprint tests. The solid line represents the bias, whereas the dashed lines represent the high and low 95% confidence interval (CI).

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Key words: Power output, power-meters, ergometers

✉**Contact email:** jaspervaeck@hotmail.com (J Vaeck)

[1] *EA4660, C3S Health - Sport Department, Sports University, Besancon, France*
[2] *French Cycling Federation, Saint Quentin en Yvelines, France*
[3] *LAAS-CNRS, Université de Toulouse, CNRS, Toulouse, France*
[4] *Inside the athletes 3.0, Besançon, France*
[5] *Professional Cycling Team FDJ, Moussy le Vieux, France*