Validity and reliability of the CycleOps Hammer direct drive trainer during sprint tests when compared with an SRM powermeter – a preliminary study

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Abstract

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Background: Coaches and cyclists often use direct drive home-trainers for measuring power output (PO) during testing and training. Several devices like the Tacx Fortius (Peiffer et al., 2011: International Journal of Sports Medicine, 32, 353-356) and the Velotron trainer (Abbiss et al., 2009: International Journal of Sports Medicine, 30, 107-112) have been scientifically validated when compared to an SRM powermeter which is considered as the gold standard (Gardner et al., 2004: Medicine Science in Sports and Exercise, 36, 1252-1258). Contrarywise, others such as the Axiom Elite (Bertucci et al., 2005: International Journal of Sports Medicine, 26, 59-65) or the Kickr Power trainer (Zadow et al., 2016: International Journal of Sport Physiology and Performance, 11, 1115-1117) are less accurate and reliable. A recent study reported that the CycleOps Hammer provides valid and reliable PO measurements during graded exercise tests (100-500W). This validation procedure is nevertheless uncompleted as no comparison in maximal PO during all-out sprints have been done.

Purpose: The purpose of this study was to assess the validity and reliability of PO measurement of three Cycleops Hammer trainer devices during maximal sprint tests when compared to an SRM powermeter.

Methods: Three cyclists voluntarily participated in this study (Mean ± SD: 28 ± 9 years old; 1.81 ± 0.02 m; 72 ± 5 kg). Each subject performed three one-day laboratory test sessions separated by at least 48 h, that comprised successively: 1) one maximal graded exercise test (100-425 W) performed at a constant pedalling cadence (~90 rpm) ; 2) three 10-s all-out sprint tests against three different slope resistance (0.5%, 3%, 7%) ; 3) one 30-s all-out Wingate test (slope resistance of 3 %) ; and 4) a 20 min constant power test to study the potential power drift. All the tests were performed on the same road bike (Roubaix Tarmac, Specialized, USA) that was mounted on to a Hammer direct drive trainer (CycleOps, Madison, USA) and fitted with a SRM professional powermeter (SRM FSA K-Force Light, SRM GmbH, Jülich, Germany; accuracy ± 1 %). Prior to the study, the slope of the SRM powermeter was calibrated with set of weights. The zero offset of each device was performed according to the manufacturer's recommendations before each test session. Power output (PO) and pedalling cadence (PC) were measured continuously by the two devices every second and stored in a GPS bike computer (Edge 520, Garmin, USA). The PO differences between the two devices was assessed by non-parametric Wilcoxon tests. To study the accuracy of each Hammer trainer, the relative bias of the PO differences between the SRM and the Hammer trainer and its 95% limits of agreement was defined using the Bland-Altman method. The 95% confidence interval (95%CI) for the relative bias was also calculated. All significant differences were set at $p < 0.05$. Only the data obtained during sprints and Wingate tests are presented in this abstract.

Results: Significant differences in 1-s peak PO (sprints) and in 30-s mean PO (Wingate) were observed between the three Hammer devices and the SRM powermeter. When compared to the SRM powermeter, mean ± SD of bias for 1-s peak PO was 11.3 ± 10.3 % for Hammer 1, 13.2 ± 12.7% for Hammer 2 and 21.1 ± 9.5% for Hammer 3. Mean ± SD of bias for 30-s mean PO was 4.3 ± 3.0% for Hammer 1, 1.7 ± 2.4% for Hammer 2 and 5.5 ± 1.0% for Hammer 3. No significant differences were found in maximal (sprint) and mean pedalling cadence (Wingate) whatever the Hammer device used.

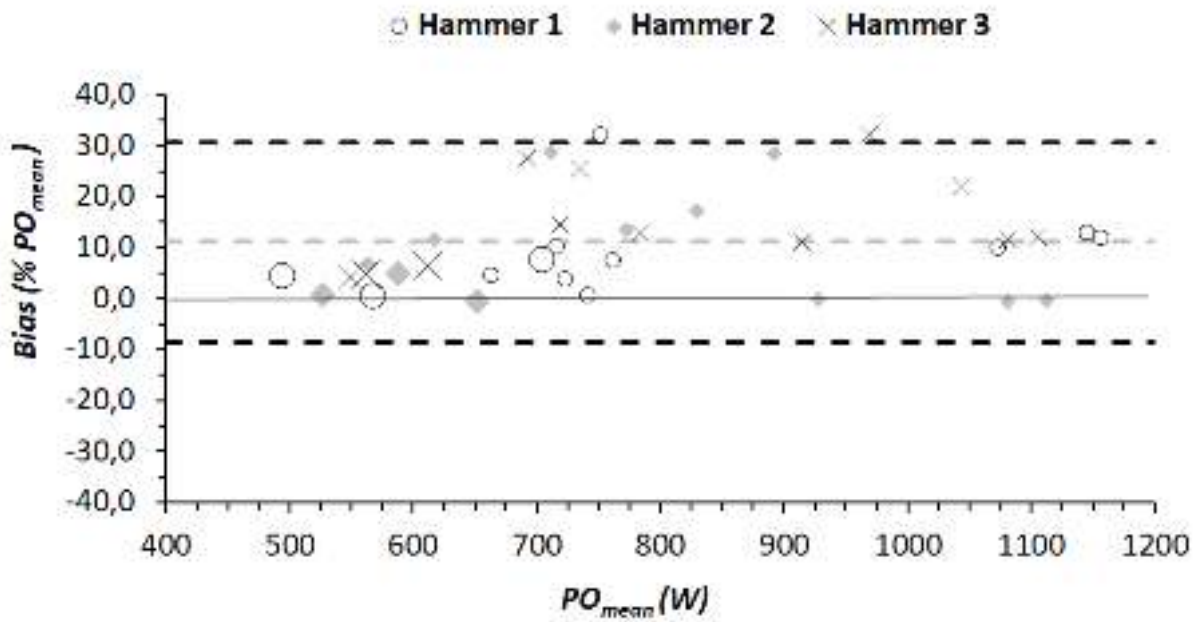

Figure 1. Bland-Altman plot of the three Hammer devices assessed during the 10-s sprint test (small symbol) and the 30-s Wingate test (large symbol) compared to the SRM powermeter. The dashed grey line represents the mean biais of the three devices whilst the dashed black lines showed the limits of agreement.

Discussion and conclusion: These preliminary results seems to suggest that the CycleOps Hammer is not a valid device to measure PO with a high accuracy during all-out exercises as sprints. Nevertheless, according the lowest bias observed in 30-s mean PO during Wingate test, the overestimation of PO tends to decrease with increasing averaging time. Future studies should confirm it by increasing the sample size.

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