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Comparison of physiological and perceptual responses to a maximal exhaustive test performed on the SRM and the Cyclus2 ergometer

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Abstract

Background: No cycle ergometer perfectly replicates the physiological demands and movement patterns associated with real world cycling (Abbiss et al., 2009: International Journal of Sports Medicine, 30(2), 107-112). The purpose of this research was to compare physiological and perceptual responses during a standardized exercise test using the classical SRM ergometer (Schoberer Rad Messtechnik, GmbH, Jülich, Germany) and the Cyclus2 ergometer (RBM elektronik-automation GmbH, Leipzig, Germany) which allows the use of personal bikes and allows lateral movement.

Methods: 13 moderately trained cyclists (mean ± SD: age 35 ± 7 years, body mass 74.1 ± 9.6 kg) performed two graded cycling tests to volitional exhaustion in a randomized order on the SRM and the Cyclus2 ergometer. Maximal aerobic capacity (VO_{2max}), maximal aerobic power (MAP), blood lactate concentrations and heart rate responses were compared using a paired t-test. Participants were also required to fill in the NASA Task Load Index (TLX) questionnaire (Hart, 2006: NASA-Task Load Index, 50th Human Factors and Ergonomics Society Meeting, Santa Monica, USA) after each test to assess the perceived workload in an effort to understand if one ergometer is perceived to be more or less of a workload than its counterpart. In order to analyse the workload from each participant, individual TXL factors were summed for each ergometer TLX administration creating an overall workload score per ergometer. After conclusion of the experiment participants were asked to state their preference in ergometers. Lastly, a correlation was performed on the level of performance within the ergometer testing and the perceived performance.

Results: Compared physiological responses and MAP (321 ± 44 W; SRM and 326 ± 41 W; Cyclus2) did not find any significant differences. A constructed ANOVA model which examined the difference of the overall workload scores between the two ergometers did not show any significant difference ($F(1,12)$ = .025, p = .876). In order to examine if there were individual factor differences between the six TLX factors of each ergometer, a constructed repeated measure MANOVA did not reveal any significant differences between ergometers and within individual TLX scores ($F(5,8)$ = .995, p = .477). Interestingly, the absolute VO_{2max} performance score was significantly correlated on the Cyclus2 ergometer with the self-reported performance TLX factor (r = .560, p = .047) while the same score was not significant for the SRM ergometer (r = .247, p = .415). However, participants were highly positively correlated between perceived performance on each ergometer (r = .736, p = .004). Participants were asked to name which ergometer they felt they performed better on. Eight participants named the SRM Ergometer, while 5 named the Cyclus2. When asked which ergometer they preferred to use, 4 named the SRM Ergometer, while 9 named the Cyclus2. When asked which ergometer the participant would prefer to use if the test were to be run again, 5 named the SRM Ergometer, while 8 named the Cyclus2. Participants were lastly asked to think of how comfortable they were for each of the ergometers. A paired t-test examined the differences between the comfort ratings of revealed a significant difference (t = -2.803, p = .016), with this being driven by the higher favourable ratings of the Cyclus2 compared to the SRM (Figure 1). These differences can be accounted for by 6 participants stating that they preferred the Cyclus2 and increased comfort owning to the usage of their own bike. Those that preferred the SRM stated it was more solid and stable (n = 4).

Discussion: Biomechanical factors can influence physiological responses, perception of exercise and efficiency of an individual riding a bicycle or ergometer at a given power output (Patterson and Moreno, 1990: Medicine & Science in Sports & Exercise, 22(4), 512-516. Whilst not demonstrating any differences in physiological variables and MAP, participants generally felt more comfortable on the ergometer, which allows the use of personal bikes and which appears to replicate real world cycling more closely.

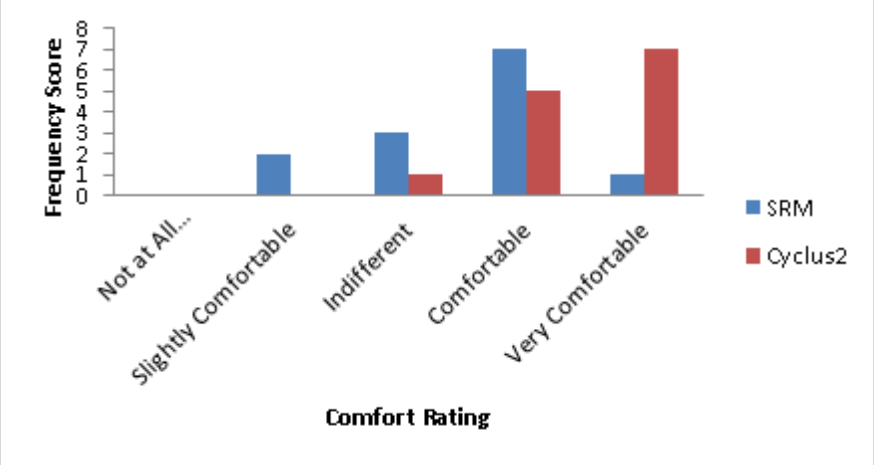

Figure 1. Comfort by Ergometer

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