BOOK OF ABSTRACTS **Open Access**

No differences in gross efficiency between dominant and non-dominant legs during one-legged counterweighted cycling.

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Abstract

Background: Recently, the use of a counterweight during one-legged cycling has been advocated as a training methodology to enhance the metabolic and oxidative potential of skeletal muscle. However, to date, no study has investigated whether training using either the dominant or the non-dominant leg affects the physiological response to a bout of exercise. Thus, the aim of this study was to assess whether cycling gross efficiency was affected by using either the dominant or the non-dominant leg during counterweighted cycling.

Methods: The experiment was performed on 7 occasions, separated by at least 48 h, with 11 competitive cyclists (mean ± SD; age: 31.0 ± 7.7 years; body mass: 70.6 ± 10.8 kg; height: 175.8 ± 8.1 cm; VO2peak: 64.0 ± 9.0 ml.kg-1.min-1). At the first occasion, cyclists' anthropometry and lateral preference (Waterloo Footedness Questionnaire) were assessed. Then, participants performed a graded exercise test to exhaustion (25 W.min-1). In the following sessions, one-legged cycling exercise was performed with dominant and non-dominant legs, in different workloads (60 or 100 W), cadences (60, 75 or 90 rev.min-1) and counterweights (non-counterweighted, 2.5 or 5 kg) — 2 cycling bouts per session (one for each limb) with a 40-min passive recovery between them. Bouts consisted of 18 min at a constant workload with each target cadence for 6 min. Workloads, cadences and counterweights were randomly assigned. All tests were performed on a standard road bike fitted with a powermeter crank (Professional, SRM, Jülich, Germany) and attached to a Computrainer (ProLab, RacerMate, Seattle, USA). Twenty-second gas exchanges were recorded thoroughly by open-circuit indirect calorimetry (VO2000, Medgraphics, St. Paul, USA). The average of the last 3 min of each condition was used for gross efficiency calculations as the ratio of the power output to the power input, multiplied by 100. Data normality was confirmed with a Shapiro-Wilk test. A repeated-measures three-way ANOVA was used for each workload to compare gross efficiency within conditions, followed by Bonferroni pairwise comparisons if $P \leq 0.05$.

Results: Results are summarized in table 1. One participant did not complete all conditions and his data were therefore included only at 60 W. No significant main effect of the leg was found at 60 ($F=0.024$; $P=0.879$) or 100 W ($F=3.617$; $P=0.086$). However, a significant main effect of the cadence was found at 60 ($F=40.213$; $P<0.001$) and 100 W ($F=54.509$; $P<0.001$). A main effect of the counterweight was found at 100 ($F=3.879$; $P=0.038$), but not at 60 W ($F=2.439$; $P=0.115$). No significant interactions were found, except for counterweight versus cadence at 60 W ($F=2.843$; $P=0.038$). Bonferroni pairwise comparisons showed significant differences between 60 and 90 ($P<0.001$) and between 75 and 90 rev.min-1 ($P<0.001$) at both 60 and 100 W, but not between other conditions.

Discussion: The results of this study demonstrate that the use of either the dominant or the non-dominant leg during one-legged cycling does not affect cycling gross efficiency. As shown in bilateral cycling studies, higher cadences decrease gross efficiency. In addition, as work rate increased from 60 to 100 W a main effect of the counterweight on gross efficiency was found, possibly reflecting biomechanical advantages of the counterweighted-cycling model. However, due to high between-subject variability in gross efficiency, a bigger sample is required to confirm this assumption. A significant interaction of counterweight versus cadence at 60 W suggests that the optimal counterweight for one-legged cycling might vary across conditions, warranting further investigation.

Conclusion: No difference in gross efficiency was found between dominant and non-dominant legs when adopting a counterweighted-cycling model.

Table 1: Gross efficiency calculated from each condition. Data are presented as mean ± SD.

		60 W		100 W	
Conditions	**rev.min-1**	**D**	**ND**	**D**	**ND**
NC	60	13.2 ± 1.7	12.5 ± 1.9	15.1 ± 1.8	15.2 ± 1.9
	75	12.5 ± 2.0	12.0 ± 1.8	14.0 ± 1.7	15.0 ± 2.9
	90	11.2 ± 2.0	11.1 ± 2.1	12.4 ± 1.5	13.1 ± 1.7
2.5 kg	60	13.6 ± 2.2	14.1 ± 2.5	16.3 ± 1.0	16.2 ± 1.0
	75	13.2 ± 2.3	14.0 ± 3.2	15.8 ± 1.6	16.0 ± 1.7
	90	12.5 ± 2.6	13.2 ± 3.2	14.7 ± 1.7	14.7 ± 1.9
5 kg	60	13.8 ± 1.8	14.0 ± 2.2	15.9 ± 1.8	16.2 ± 2.2
	75	14.0 ± 1.9	13.6 ± 1.9	15.7 ± 2.8	15.9 ± 2.2
	90	13.2 ± 1.7	12.9 ± 2.1	14.7 ± 1.8	15.0 ± 2.7

NC: non-counterweighted; D: dominant leg; ND: non-dominant leg.

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