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Strength gain at little cost? Feasibility of 'low load' eccentric cycling as a tool for strength gain in sedentary men

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Abstract

Symptomatic reporting is a common issue in exercise rehabilitation. When traditional concentric aerobic exercise is used as an exercise stimulus, dyspnoea and fatigue are often reported by elderly⁵ and by cohorts with cardiorespiratory pathology³. Among the unique attributes of eccentric aerobic exercise is lower metabolic and cardiovascular demand for a given workload ^{1,2}. This makes eccentric aerobic exercise more suitable for long-term adherence in rehabilitation. Although, extremely 'high load' eccentric cycling interventions have shown improvements in strength measurements⁴, no 'low load' eccentric cycling studies have been performed to determine if strength adaptations are feasible. Therefore, this study determined if 'low load' eccentric cycling can stimulate strength adaptations.

Keywords

tool, cost, cycling, gain, strength, little, eccentric, feasibility, men, low, sedentary, load

Disciplines

Medicine and Health Sciences | Social and Behavioral Sciences

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Strength gain at little cost? Feasibility of 'low load' eccentric cycling as a tool for strength gain in sedentary men

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Introduction: Symptomatic reporting is a common issue in exercise rehabilitation. When traditional concentric aerobic exercise is used as an exercise stimulus, dyspnoea and fatigue are often reported by elderly⁵ and by cohorts with cardiorespiratory pathology³. Among the unique attributes of eccentric aerobic exercise is lower metabolic and cardiovascular demand for a given workload^{1,2}. This makes eccentric aerobic exercise more suitable for long-term adherence in rehabilitation. Although, extremely 'high load' eccentric cycling interventions have shown improvements in strength measurements⁴, no 'low load' eccentric cycling studies have been performed to determine if strength adaptations are feasible. Therefore, this study determined if 'low load' eccentric cycling can stimulate strength adaptations.

Methods: Seventeen sedentary males [42.7 ± 8.3 years, BMI 28.6 ± 5.2, O₂ peak 30.5 ± 5.8 ml·kg⁻¹·min⁻¹] completed an 8-week concentric (Con, n=8) or eccentric (Ecc, n=9) training program. Subjects were matched for baseline peak isometric quadriceps strength. In addition, a 6 repetition max protocol on a 450 leg press was performed as a measure of functional strength. Training workloads were set at 60% of individual peak concentric workload and heart rate, as well as ratings of perceived exertion (RPE) were continuously recorded during sessions. Isometric strength was tested at weeks 3, 5, 7 and one week post-training, along with functional strength. Prior to participation, all subjects provided written informed consent and all procedures were approved by the University of Wollongong Human Ethics Committee.

Results: During the 8 weeks of training, both groups achieved the prescribed 180 W workload, with the mean power achieved by the Ecc group within 5% of the target. Lower cardiovascular work in eccentric cycling was confirmed (Con = 154 beats·min⁻¹, Ecc 95 = beats·min⁻¹), with lower ratings of perceived exertion (Con = 14.9, Ecc = 9.5). There was no difference in isometric or functional strength between the groups at baseline. Following training, both Con and Ecc groups significantly improved isometric and functional strength. The Con group improved isometric and functional strength by 14.7% and 10.0% and the Ecc group by 12.7% and 10.7% respectively (Table 1).

Table 1: Strength measurements

Strength	Group	Pre (N·m ¹)	Week 3 (N·m ¹)	Week 5 (N·m ¹)	Week 7 (N·m ¹)	Post (N·m ¹)
Isometric	Con	1345 ± 158	1432 ± 146	1533 ± 134	1550 ± 122	1543 ± 139 [#]
	Ecc	1333 ± 106	1359 ± 87	1408 ± 128	1457 ± 105 [#]	1500 ± 103 [#]
Functional	Con	176 ± 21				196 ± 21 [#]
	Ecc	192 ± 11				213 ± 15 [#]

Data presented as mean ± SEM. # indicates significant within group difference. Alpha set at 0.05

Discussion/Conclusion: The current investigation has demonstrated that in sedentary males, low load eccentric cycling can achieve isometric and functional strength gains. This was achieved with a 38% lower heart rate and 36% lower RPE compared to concentric cycle training. The implications are that even at low loads, strength adaptations are possible which highlights the usefulness of Ecc aerobic exercise as a training modality to improve muscular strength and maintain activities of daily living in individuals with exercise intolerance.

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