EFFECTS OF HIGH-INTENSITY ECCENTRIC CYCLING ON AEROBIC AND FUNCTIONAL CAPACITIES AND HEALTH IN SEDENTARY PEOPLE.

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Introduction: Elderly individuals are prone to physical deconditioning, affecting functional capacities and quality of life, often associated with higher risks of chronic pathologies. High intensity interval training (HIIT) is effective in generating muscular improvements, but this requires a high metabolic demand. However, eccentric training is emerging as an efficient training method because of its capacity to develop high forces for a low metabolic cost. Therefore, the aim of our study was to assess and compare the effects of an eccentric based HIIT with a concentric based HIIT and with an eccentric based continuous cycling training in deconditioned people. We assumed that eccentric intervals (EI) would induce comparable improvements to concentric intervals (CI) regarding functional parameters, and similar to greater improvements than continuous eccentric (EC) training.

Methods: 43 healthy deconditioned adults (VO2 = 23mL/min/kg; 61yrs) were assigned to EI (n=15), EC (n=15) or CI (n=13) groups and trained twice-a-week for 12 weeks. The intensity ranged from 120% to 135% of the concentric maximal aerobic power (cMAP) for EI and from 80% to 90% of the cMAP for EC and CI. Maximal oxygen consumption (VO2max), MAP, quadriceps maximal isometric force (MIF), balance error scoring system (BESS), ten times sit to stand test (TTSST), time up and go (TUAG), 6 minutes walking test (6MWT), and health parameters were evaluated before and after each protocol. The rate of perceived exertion (RPE), heart rate (HR), cognitive demand and muscle soreness were monitored during the training period.

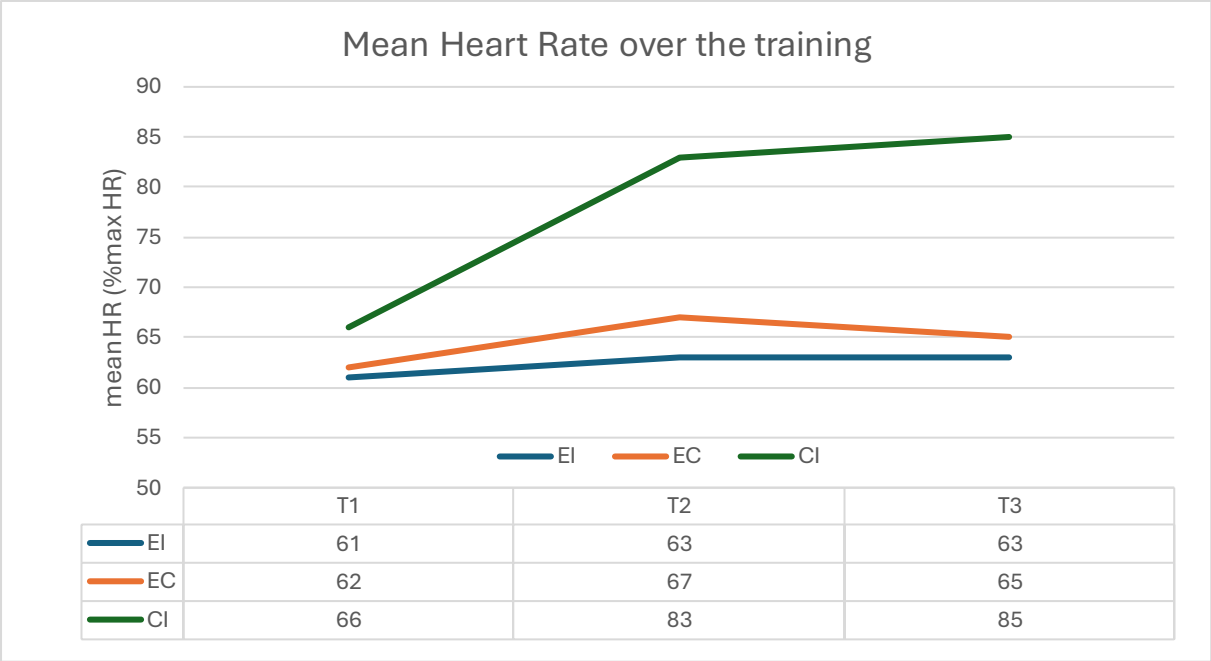
Results: EI and EC showed lower mean HR (expressed in % of maximal HR) and RPE than CI (HR : 63%; 65%; 85% and RPE : 12; 11; 14, respectively), without onset of soreness in any group. EI, EC and CI induced functional gains regarding the MIF (+13%; +17; +23%), TTSST (+14%; +16%; +10%), and 6MWT (+5%; +5%; +4%), without any difference between the different trainings. BESS scores were improved in EI and CI (+22.5%; +34.5%), and TUAG in EC and CI (+2.9%; +9.3%). However, only CI provided a sufficient stimulus for MAP and VO2max improvements (MAP : +17.8% and VO2 max : +14%, for CI).

Conclusion: Our results demonstrate the effectiveness of eccentric training in improving muscle and functional capacities. Its low metabolic cost makes it an efficient modality to counteract deconditioning and sarcopenia. This study also shows that eccentric intervals is a feasible and efficient method enabling frail people to train at high intensity.

Table 1: Differences for functional and aerobic parameters in each group

Parameter	EI	EC	CI
MIF	**+13% (86 – 115 Nm)**	**+17% (85 – 95 Nm)**	**+23% (77 – 105 Nm)**
TTSST	**+14% (11.4 – 9.9 s)**	**+16% (12.4 – 10.7 s)**	**+10% ((10.5 – 9.3 s)**
6MWT	**+5% (672 – 684 m)**	**+5% (676 – 687 m)**	**+4% (653 – 681 m)**
BESS	**+22.5% (24 – 18 UI)**	+19.4% (21 – 19 UI)	**+34.5% (19 – 13 UI)**
TUAG	-0.2% (5 – 4.7 s)	**+2.9% (5 – 4.8 s)**	**+9.3% (5 – 4.6 s)**
MAP	+3% (182 – 184 W)	+1% (165 – 165 W)	**+17.8% (182 – 210 W)**
VO2 max	+1% (24.6 – 24.6 mL/min/kg)	-0.9% (21.4 – 21.4 mL/min/kg)	**+14% (23.4 – 26.7 mL/min/kg)**

EI = Eccentric Intervals; EC = Eccentric Continuous; CI = Concentric Intervals ; MIF = Maximal isometric force; TTSST = Ten time sit to stand test; MWT = Six minutes walking test; BESS = Balance error scoring system; TUAG = Time up and go; MAP = Maximal aerobic power; VO2 max = Maximal oxygen consumption



	T1	T2	T3
EI	61	63	63
EC	62	67	65
CI	66	83	85

Figure 1: Heart Rate evolution during the training (EI = Eccentric Intervals; EC = Eccentric Continuous; CI = Concentric Intervals; HR = Heart Rate)

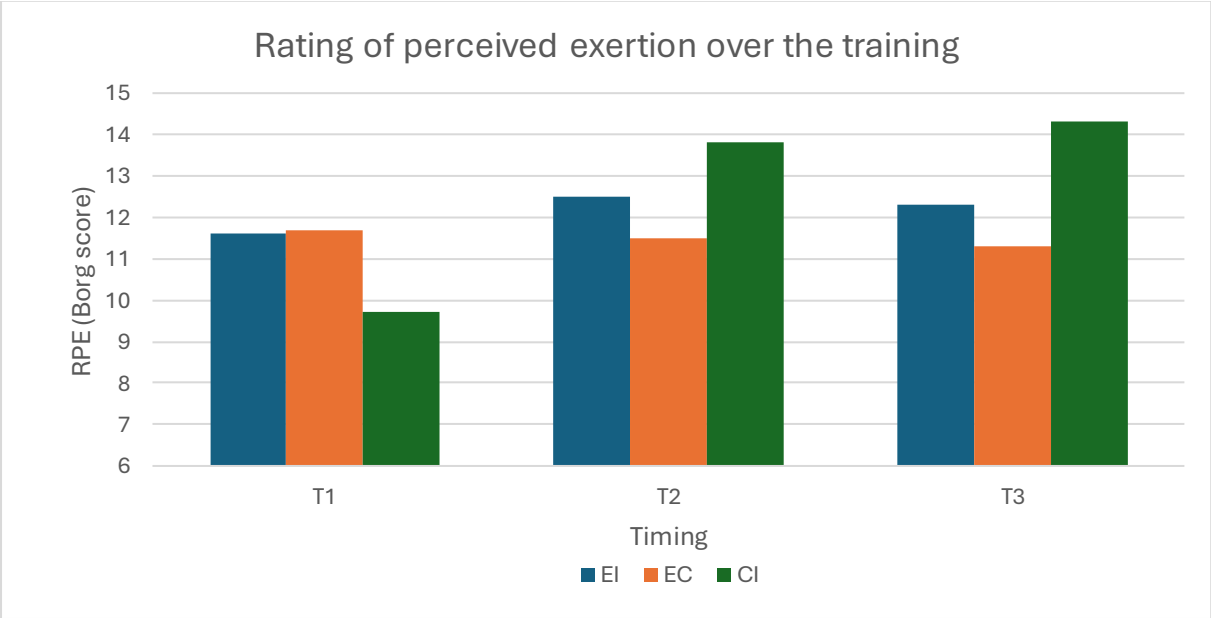


Figure 2 : Evolution of the rating of perceived exertion over the training (EI = Eccentric Intervals; EC = Eccentric Continuous; CI = Concentric Intervals; RPE = Rating of perceived exertion)