Acute physiological impact of electrical support during cycling in patients with systolic heart failure

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INTRODUCTION

Because patients with heart failure and reduced ejection fraction (HFREF) often experience a significantly reduced exercise performance, electrical assisted bicycles (EAB's) could be used to overcome limitations to cycling and thus assist in achieving a sufficient physical activity level.

However, it is unknown whether sufficient exercise intensities and volumes could be elicited during cycling on EAB's in HFREF patients.

AIM

To examine, for the first time, the acute physiological impact of electrical support during cycling in HFREF patients.

METHODS

In this randomized cross-over study, 16 HFREF patients (13 males, aged 68±7 years) executed a maximal cardiopulmonary exercise test and afterwards cycled a predefined route of 10.2 km on an ergometer, in three different conditions: cycling without support (EABno), EAB with low support (EABlow) and high support (EABhigh).

Oxygen uptake (VO2), expiratory volume (VE) and carbon dioxide output (VCO2) was measured continuously by a gas-analyzing system. Cycling time was recorded, caloric expenditure was calculated and ratings of perceived exertion (RPE) was assessed at completion of the route.

RESULTS

Four patients failed to complete one of the three cycling routes and were excluded prior to data analysis.

Mean VO2 was not different between conditions (EABno: 1040±233 ml/min, EABlow: 1040±207 ml/min, EABhigh: 1036±264 ml/min, p=0.78), as well as elicited exercise intensity (EABno: 66±15 %VO2peak, EABlow: 66±16 %VO2peak, EABhigh: 65±15 %VO2peak, p=0.78) (see Table 1).

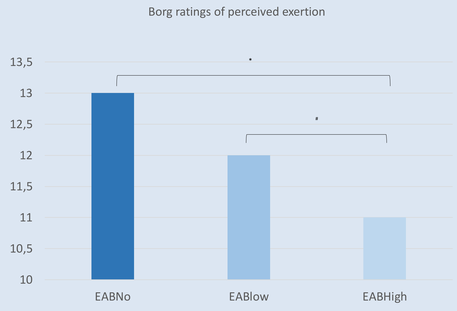
Total energy expenditure (EABno: 166±17 kcal, EABlow: 162±21 kcal, EABhigh: 155±18 kcal) and Borg RPE (EABno: 13.2±1.8, EABlow: 12.5±2.3, EABhigh: 11.2±1.7) were significantly different (p<0.05) between conditions (See Figure 1).

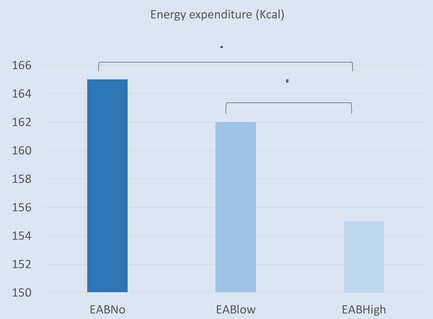
Table 1 Exercise response to cycling with or without electrical support

	EAB_{no}		EAB_{low}		EAB_{high}					
	Average	SD	Average	SD	Average	SD	P between conditions	*P* No vs Low	*P* No vs High	*P* Low vs High
$VO2_{abs}$ (ml/min)	1040	233	1040	207	1036	264	0.779	-	-	-
MET	3.44	0.81	3.42	0.57	3.42	0.89	0.779	-	-	-
VE (l/min)	34	9	33	7	33	11	0.779	-	-	-
%VO2peak	66	15	66	16	65	15	0.779	-	-	-
RER	0.96	0.05	0.94	0.04	0.95	0.05	0.039	0.028*	0.530	0.388
Kcal	166	17	162	21	155	18	0.039	0.583	0.041*	0.050*
Cycling time (sec) (min)	2056 34	300 5	2007 33.45	213 3.55	1957 32.62	305 5.08	0.083	-	-	-
Speed (km/u)	18	2.6	19	1.9	19	3.2	0.083	-	-	-
Borg RPE	13.2	1.8	12.5	2.3	11.2	1.7	0.000	0.065	0.003*	0.031*

VO2, oxygen uptake; MET, metabolic equivalent; VE, expiratory volume; RER, gas exchange ratio; RPE, ratings of perceived exertion

Figure 1 Energy expenditure and Borg RPE during cycling with or without electrical support





* indicates a significant difference between conditions (p<0.05)

CONCLUSION

Outdoor cycling with electrical support leads to similar exercise intensities in HFREF patients with reductions in the perception of effort, but also lowers exercise volumes, especially when providing high electrical support.

Declaration of interest

The authors declare that there is no conflict of interest associated with this publication

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