Received: 22 June 2020 | Accepted: 21 August 2020

DOI: 10.1113/EP088866

Experimental Physiology WILEY

RESEARCH PAPER

Graded reductions in pre-exercise glycogen concentration do not augment exercise-induced nuclear AMPK and PGC-1α protein content in human muscle

Mark A. Hearris[1] | Daniel J. Owens[1] | Juliette A. Strauss[1] | Sam O. Shepherd[1] | Adam P. Sharples[2] | James P. Morton[1] | Julien B. Louis[1]

[1] Research Institute for Sport and Exercise Sciences, Liverpool John Moores University, Liverpool, UK

[2] Institute of Physical Performance, Norwegian School of Sport Sciences, Oslo, Norway

Correspondence
Julien Louis, Research Institute for Sport and Exercise Sciences, Liverpool John Moores University, Tom Reilly Building, Byrom St. Campus, Liverpool L3 3AF, UK
Email: J.B.Louis@ljmu.ac.uk

Funding information
Faculty of Science at Liverpool John Moores University

Edited by: Daniel Wilkinson

Abstract

We examined the effects of graded muscle glycogen on the subcellular location and protein content of AMP-activated protein kinase (AMPK) and peroxisome proliferator-activated receptor γ coactivator 1α (PGC-1α) and mRNA expression of genes associated with the regulation of mitochondrial biogenesis and substrate utilisation in human skeletal muscle. In a repeated measures design, eight trained male cyclists completed acute high-intensity interval (HIT) cycling (8 × 5 min at 80% peak power output) with graded concentrations of pre-exercise muscle glycogen. Following initial glycogen-depleting exercise, subjects ingested 2 g kg^{-1} (L-CHO), 6 g kg^{-1} (M-CHO) or 14 g kg^{-1} (H-CHO) of carbohydrate during a 36 h period, such that exercise was commenced with graded ($P < 0.05$) muscle glycogen concentrations (mmol (kg dw)$^{-1}$: H-CHO, 531 ± 83; M-CHO, 332 ± 88; L-CHO, 208 ± 79). Exercise depleted muscle glycogen to <300 mmol (kg dw)$^{-1}$ in all trials (mmol (kg dw)$^{-1}$: H-CHO, 270 ± 88; M-CHO, 173 ± 74; L-CHO, 100 ± 42) and induced comparable increases in nuclear AMPK protein content (~2-fold) and PGC-1α (~5-fold), p53 (~1.5-fold) and carnitine palmitoyltransferase 1 (~2-fold) mRNA between trials (all $P < 0.05$). The magnitude of increase in PGC-1α mRNA was also positively correlated with post-exercise glycogen concentration ($P < 0.05$). In contrast, neither exercise nor carbohydrate availability affected the subcellular location of PGC-1α protein or PPAR, SCO2, SIRT1, DRP1, MFN2 or CD36 mRNA. Using a sleep-low, train-low model with a high-intensity endurance exercise stimulus, we conclude that pre-exercise muscle glycogen does not modulate skeletal muscle cell signalling.

KEYWORDS
CHO restriction, train-low, vastus lateralis