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Hearris, MA , Owens, DJ, Strauss, JA, Shepherd, SO , Sharples, AP, Morton, JP and Louis, JB  (2020) Graded reductions in pre-exercise glycogen concentration do not augment exercise-induced nuclear AMPK and PGC-1 protein content in human muscle. *Experimental Physiology*, 105 (11). pp. 1882-1894. ISSN 0958-0670

**DOI:** <https://doi.org/10.1113/EP088866>

**Publisher:** Wiley

**Version:** Published Version

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## RESEARCH PAPER

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

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**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  $\gamma$  coactivator 1 $\alpha$  (PGC-1 $\alpha$ ) 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  $\times$  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<sup>-1</sup> (L-CHO), 6 g kg<sup>-1</sup> (M-CHO) or 14 g kg<sup>-1</sup> (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)<sup>-1</sup>: H-CHO, 531  $\pm$  83; M-CHO, 332  $\pm$  88; L-CHO, 208  $\pm$  79). Exercise depleted muscle glycogen to  $< 300$  mmol (kg dw)<sup>-1</sup> in all trials (mmol (kg dw)<sup>-1</sup>: H-CHO, 270  $\pm$  88; M-CHO, 173  $\pm$  74; L-CHO, 100  $\pm$  42) and induced comparable increases in nuclear AMPK protein content ( $\sim 2$ -fold) and PGC-1 $\alpha$  ( $\sim 5$ -fold), p53 ( $\sim 1.5$ -fold) and carnitine palmitoyltransferase 1 ( $\sim 2$ -fold) mRNA between trials (all  $P < 0.05$ ). The magnitude of increase in PGC-1 $\alpha$  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-1 $\alpha$  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

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