Can the increase in mitochondrial biogenesis in skeletal muscle following acute exercise be prevented by antioxidant supplementation?

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Introduction. Endurance exercise potently stimulates increases in skeletal muscle mitochondrial volume and the increased mitochondrial biogenesis (synthesis) following exercise training is largely attributed to the cumulative effects of each acute bout of exercise (Hood, 2001). Recent evidence suggests that small physiological increases in skeletal muscle reactive oxygen species (ROS) play a role in the regulation of exercise-induced mitochondrial biogenesis. Vitamin C supplementation (a non-specific antioxidant; 0.5g/kg body weight/day) during 6 wk of exercise training in rats prevents improved exercise capacity and completely abolishes increases in several markers of exercise-induced mitochondrial biogenesis in skeletal muscle (Gomez-Cabrera *et al.*, 2008). Therefore, to understand the molecular mechanisms that are regulating the longer term increases in mitochondrial biogenesis following training, the aim of this project was to determine if vitamin C supplementation attenuates mitochondrial biogenesis signalling pathways following acute exercise in skeletal muscle of rats.

Methods. Thirty-two male Sprague Dawley rats (227 ± 2 g) were familiarized to treadmill running 1 wk prior to experimentation. Half the rats were given vitamin C (0.5g/kg body weight/day) in their drinking water for 7 days prior to the experiment as this dose of vitamin C has previously been shown to block increases in ROS levels during exercise (Sastre *et al.*, 1992). Animals were further assigned rest (Rest), or exercise (Ex) groups (8 rats in each group). The exercise groups ran on a motor driven treadmill at 25m/min on a 5% incline for 60 min. Rats were killed immediately after exercise with an intraperitoneal injection of Pentobarbital sodium (170 mg/kg) and the gastrocnemius (Gomez-Cabrera *et al.*, 2008) was rapidly frozen in liquid nitrogen. Mitochondrial biogenesis signalling proteins were examined (phosphorylated p38 MAPK, AMPKα Thr172 and ATF-2) *via* immunoblotting with commercially available antibodies.

Results. Treadmill running significantly (main effect for exercise; $p < 0.05$) increased phosphorylation of p38MAPK AMPKα Thr172 and ATF-2. Vitamin C supplementation did not significantly alter the phosphorylation or protein abundance of p38 MAPK, AMPKα or ATF-2.

Conclusions. Antioxidant treatment *via* vitamin C supplementation does not attenuate the phosphorylation of the mitochondrial signalling proteins, p38 MAPK, AMPKα and ATF-2 following acute exercise. The attenuation of exercise training-induced mitochondrial biogenesis by vitamin C supplementation previously observed in rats (Gomez-Cabrera *et al.*, 2008) does not appear to be due to an altered mitochondrial biogenesis signalling pathway involving p38 MAPK or AMPK.

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