Role of pre-exercise alkalosis on the expression of sarcolemmal proteins involved in muscle pH regulation following a single bout of high-intensity exercise

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The removal of hydrogen ions (H+) during intense skeletal muscle contractions occurs via transport proteins and muscle buffering (Juel, 1997; Bishop *et al.*, 2008). Despite limited research, it appears that some of these proteins can be rapidly affected by a single bout of exercise (Thomas *et al.*, 2012). Furthermore, research suggests that pH may affect the exercise-induced expression of these proteins (Thomas *et al.*, 2007). We therefore hypothesised that there would be an altered expression of proteins involved in muscle pH regulation during the 24 h following a single bout of high-intensity exercise, and that minimizing the decrease in muscle pH during exercise may promote greater exercise-induced changes in genes and proteins associated with skeletal muscle pH regulation. Eight active men performed a 3 × 30s cycling test following either placebo (PLA) or sodium bicarbonate (BIC) supplementation. Blood samples were analysed for pH, bicarbonate ([HCO_3^-]) and lactate ([La−]) concentration before and after exercise. Muscle samples were obtained from the *vastus lateralis* at rest, as well as immediately, 6 h and 24 h after exercise. The protein content of CD147, MCT1 and MCT4, NBCe1, NHE1, as well as protein carbonylation and lipid peroxidation, were measured by Western blotting. Real-time PCR was used to quantify changes in the mRNA content of both MCT1 and MCT4 (normalized to EEF1α). Compared to PLA, there was a higher blood pH and [HCO_3^-] in BIC ($P < 0.05$), with no differences for [La-]. BIC also attenuated the post-exercise increase in protein carbonylation ($P < 0.05$). While PLA was associated with a post-exercise decrease in MCT1, CD147 and NHE1 content, these proteins were increased in BIC ($P < 0.05$). MCT1 mRNA was 24.5% and 35.2 % greater in BIC compared to PLA 6 h and 24 h after exercise, respectively ($P > 0.05$); no significant change was noted for MCT4 mRNA content. There were no differences for NBCe1 and MCT4 protein content, or lipid peroxidation ($P > 0.05$), at all the time points. In summary, we report dynamic alterations in the content of proteins involved in pH regulation (*i.e.*, MCT1, CD147 and NHE1) following a single bout of high-intensity exercise, and that the extent of these changes was influenced by the pre-exercise ingestion of BIC. This up-regulation could result from the lower blood pH values and/or lower exercise-induced oxidative stress observed in the BIC condition, but did not seem to be affected by AMPK activation. MCT4, NBCe1 and CAII protein expression was not significantly sensitive to these stimuli.

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