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The effect of plasma volume on changes in markers of muscle damage, inflammation and oxidative stress following a 42.2 km trail run, and the efficacy of recovery interventions

Plasma Volume changes following exhaustive exercise: Does this affect the magnitude of change induced by exercise and/or the interaction effect of recovery interventions?

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Introduction

The use of cold water immersion and/or the consumption of a Montmorency cherry juice to facilitate exercise recovery are becoming increasingly popular. The efficiency of these exercise recovery interventions has been examined by measuring specific circulating biomarkers. However, exercise, can produce a transient fluid shift out of the intravascular space, resulting in haemoconcentration (Alis et al, 2015). The aim of this study was to examine whether plasma volume affects a) the magnitude of change over time in biomarkers and b) the outcomes of these recovery strategies following a 42.2 km trail run.

Methods

Twenty seven endurance trained males (mean age 40 ± 8 years; height 1.77 ± 0.08 m; mass 75.9 ± 10.3 kg) completed a 42.2 km trail run. Participants were randomly assigned to one of 3 recovery interventions (placebo (PL); cherry juice (CJ); or cold water immersion (CWI)). Markers of inflammation (C-reactive protein (CRP); Interleukin-6 (IL-6)), muscle damage (Creatine Kinase (CK)) and oxidative stress (Protein carbonyls (PC); Thiobarbituric acid reactive substances (TBARS); Superoxide dismutase (SOD)) and full blood count were measured before and immediately, 24h and 48h following the run. All biomarkers were adjusted for any plasma volume (PV) changes using the Dill and Costill (1974) equation. The interaction effect between recovery intervention and time at each level of plasma volume (uncorrected (U) and corrected (C)) were analysed using a $3 \times 4 \times 2$ mixed model analyses of variance. Simple main effects analyses were calculated for significant interaction effects between treatment and time by PV. The level of significance was set at $P < 0.05$.

Results

Analysis revealed significant interaction effects of time x PV ($P < 0.05$) for all variables except TNF- α ($P > 0.05$). For CRP and TBARS post-hoc tests revealed significant changes over time for U and C data. There was no significant change over time for SOD U or C. U IL-6 and PC analysis revealed no significant change over time, however there was a significant change over time for C values. Similarly, CK analysis demonstrated significant changes over time for U values but no significant change over time for C values. There were no significant interaction effects of time x PV x group ($P > 0.05$).

Conclusion

A marathon results in significant changes in markers of inflammation (CRP; IL-6), muscle damage (CK) and oxidative stress (PC; TBARS) over 48 hours. Plasma volume affects the magnitude of

change over time in these markers. However, plasma volume did not affect the outcomes of these recovery interventions.

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