SYSTEMIC BUT NOT LOCAL REHYDRATION RESTORES DEHYDRATION-INDUCED ALTERATIONS IN LUNG FUNCTION IN HEALTHY ADULTS

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INTRODUCTION: Water transport and airway hydration are vital for the normal physiological functioning of the lungs. Water supply to the airways stems primarily from the bronchial circulation which, in turn, arises from the systemic circulation. Information on the effects of systemic water loss on lung function is limited and contradictory(1,2,3). Thus, our primary aim was to clarify the impact of systemic dehy- dration on lung function in healthy adults. To gain mechanistic insight, we compared two modes of dehydration (fluid restriction vs exer- cise) and two modes of rehydration (systemic vs local).

METHODS: Ten participants (2 females; age 29 ± 8 y; mass 62.8 ± 8.5 kg; height 173 ± 10 cm) with normal baseline lung function per- formed four experimental visits in a randomised order. Two visits involved 28 h of fluid restriction (FR) and two visits required participants to exercise for 2 h in the heat (EX). Lung function was assessed using spirometry and body plethysmography in a euhydrated (EUHY), dehydrated (DEHY), and rehydrated (REHY) state. Rehydration occurred over 1 h, either as oral fluid (systemic) or as nebulised isotonic saline inhalation (local). Hydration status was quantified via changes in body mass and plasma osmolality (Posm). Differences were assessed using repeated-measures ANOVA. Values are means ± SD.

RESULTS: Both FR and EX induced a similar state of mild dehydration, with a reduction in body mass (2.5 ± 0.4% and 2.6 ± 0.7%, respec- tively; both $p<0.001$) and an increase in Posm (292 ± 5 to 300 ± 4 mOsm·kg-1 and 293 ± 6 to 300 ± 4 mOsm·kg-1, respectively; both $p<0.001$). Following FR and EX, lung function was impaired with no differences between dehydration methods. After DEHY, forced vital capacity (FVC) decreased by 153 ± 126 ml, residual volume (RV) increased by 208 ± 173 ml and functional residual capacity (FRC) in- creased by 119 ± 191 ml (all $p<0.01$ vs EUHY). Total lung capacity and forced expiratory volume in 1 s did not change ($p>0.05$ vs EUHY). Systemic rehydration fully restored body mass, Posm and FRC, and partially restored FVC and RV to EUHY values (29 ± 190 ml and -45 ± 137 ml vs EUHY, respectively). Local rehydration did not restore hydration status or lung function.

CONCLUSION: Mild systemic dehydration, induced by exercise or fluid restriction, resulted in impaired small airway function in healthy adults. In this state, systemic rehydration restored lung function; however, local rehydration had no effect, thus suggesting that an in- crease in plasma osmolality may contribute to small airways dysfunction.

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