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Central Chemosensitivity is Augmented During Thermoneutral Head Out Water Immersion in Healthy Adults

James R. Sackett, Zachary J. Schlader, Christopher L. Chapman, Blair D. Johnson. University at Buffalo, Buffalo, NY

Carbon dioxide (CO₂) retention occurs during water immersion and increases the risk of CO₂ toxicity. The central chemoreceptors primarily mediate the rise in ventilation during hypercapnia. However, it is unknown if two hours of head out water immersion (HOWI) alters central chemosensitivity. **PURPOSE:** We tested the hypothesis that central chemosensitivity is blunted during two hours of HOWI. **METHODS:** We assessed central chemosensitivity in 18 subjects (age: 22±1 y, BMI: 25±2 kg/m², 8 women) during a thermoneutral (35±0°C) HOWI trial and a time-control dry trial at baseline, 10 min, 60 min, 90 min, 120 min, and post. The partial pressure of end tidal CO₂ (PETCO₂; capnograph) and ventilation (pneumotachometer) were recorded continuously. Central chemosensitivity was evaluated via the Read rebreathing test. Briefly, subjects rebreathed 7% CO₂ and 93% O₂ from a 10 L bag for 3.5 min. Central chemosensitivity was calculated as the slope of the linear regression line of ventilation vs. PETCO₂ every 30 s throughout the test. Central chemosensitivity is reported as a change from baseline. **RESULTS:** PETCO₂ was not statistically different during HOWI vs. control at baseline (p=0.90) or post (p=0.27) but was greater during HOWI vs. control at 10 min (45±2 vs. 44±2 mmHg, p=0.02), 60 min (46±1 vs. 44±2 mmHg, p≤0.01), 90 min (46±1 vs. 44±2 mmHg, p≤0.01), and 120 min (46±1 vs. 44±2 mmHg, p≤0.01). Ventilation was not statistically different during HOWI vs. control at baseline (p=0.66), 60 min (p=0.12), 90 min (p=0.12), 120 min (p=0.27), or post (p=0.12) but was greater during HOWI vs. control at 10 min (9.3±2.5 vs. 8.4±1.7 L/min, p=0.05). Change in central chemosensitivity was greater during HOWI vs. control at 10 min (0.7±0.5 vs. 0.0±0.4 L/min/PETCO₂, p<0.01), 60 min (0.7±0.7 vs. 0.1±0.3 L/min/PETCO₂, p<0.01), 90 min (0.7±0.9 vs. 0.0±0.3 L/min/PETCO₂, p<0.01), and 120 min (0.8±1.1 vs. 0.4±0.5 L/min/PETCO₂, p<0.01) but was not statistically different during HOWI vs. control at post (p=0.90). **CONCLUSIONS:** These findings indicate that central chemosensitivity is augmented during two hours of thermoneutral HOWI. Thus, it is unlikely that changes in central chemosensitivity contribute to CO₂ retention during water immersion.

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