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

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Carbon dioxide (CO\textsubscript{2}) retention occurs during water immersion and increases the risk of CO\textsubscript{2} 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/m\textsuperscript{2}, 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 CO\textsubscript{2} (PETCO\textsubscript{2}; capnograph) and ventilation (pneumotachometer) were recorded continuously. Central chemosensitivity was evaluated via the Read rebreathing test. Briefly, subjects rebreathed 7% CO\textsubscript{2} and 93% O\textsubscript{2} from a 10 L bag for 3.5 min. Central chemosensitivity was calculated as the slope of the linear regression line of ventilation vs. PETCO\textsubscript{2} every 30 s throughout the test. Central chemosensitivity is reported as a change from baseline. **RESULTS:** PETCO\textsubscript{2} 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/PETCO\textsubscript{2}, p<0.01), 60 min (0.7±0.7 vs. 0.1±0.3 L/min/PETCO\textsubscript{2}, p<0.01), 90 min (0.7±0.9 vs. 0.0±0.3 L/min/PETCO\textsubscript{2}, p<0.01), and 120 min (0.8±1.1 vs. 0.4±0.5 L/min/PETCO\textsubscript{2}, 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 CO\textsubscript{2} retention during water immersion.

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