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

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Carbon dioxide (CO$_2$) retention occurs during water immersion and increases the risk of CO$_2$ 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: $22\pm1$ y, BMI: $25\pm2$ kg/m$^2$, 8 women) during a thermoneutral ($35\pm0^\circ$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$_2$ (PETCO$_2$; capnograph) and ventilation (pneumotachometer) were recorded continuously. Central chemosensitivity was evaluated via the Read rebreathing test. Briefly, subjects rebreathed 7% CO$_2$ and 93% O$_2$ 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$_2$ every 30 s throughout the test. Central chemosensitivity is reported as a change from baseline. **RESULTS:** PETCO$_2$ 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 ($45\pm2$ vs. $44\pm2$ mmHg, $p=0.02$), 60 min ($46\pm1$ vs. $44\pm2$ mmHg, $p\leq0.01$), 90 min ($46\pm1$ vs. $44\pm2$ mmHg, $p\leq0.01$), and 120 min ($46\pm1$ vs. $44\pm2$ mmHg, $p\leq0.01$). 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 ($9.3\pm2.5$ vs. $8.4\pm1.7$ L/min, $p=0.05$). Change in central chemosensitivity was greater during HOWI vs. control at 10 min ($0.7\pm0.5$ vs. $0.0\pm0.4$ L/min/PETCO$_2$, $p<0.01$), 60 min ($0.7\pm0.7$ vs. $0.1\pm0.3$ L/min/PETCO$_2$, $p<0.01$), 90 min ($0.7\pm0.9$ vs. $0.0\pm0.3$ L/min/PETCO$_2$, $p<0.01$), and 120 min ($0.8\pm1.1$ vs. $0.4\pm0.5$ L/min/PETCO$_2$, $p<0.01$) 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$_2$ retention during water immersion.

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