Hot Head-Out Water Immersion Acutely Impairs Cerebral Autoregulation in Healthy Participants

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Recurring hot head-out water immersion enhances peripheral vascular function and cerebral blood flow during non-immersion conditions. However, it is not known if an acute bout of hot head out water immersion (HOWI) improves cerebral autoregulation versus thermoneutral HOWI. PURPOSE: We tested the hypothesis that dynamic cerebral autoregulation is greater during and following an acute bout of hot (HOT) vs. thermoneutral (TN) HOWI. METHODS: Seven healthy participants (age: 23±2 y, 2 females) completed two randomized trials consisting of 30 min HOT (39°C) or TN (35°C) HOWI. Beat-to-beat blood pressure (MAP), middle cerebral artery blood velocity (MCAv), and end-tidal partial pressure of CO₂ (PETCO₂) were recorded continuously. After 5 min of resting baseline, participants breathed through a respiratory impedance device for 5 min to assess cerebral autoregulation using Fourier transformation. Cerebral autoregulation testing was completed pre, 25 min into immersion (during), and immediately post HOWI. RESULTS: MAP, MCAv, PETCO₂, gain, and phase were not different between HOT and TN at pre (P>0.14 for all). MAP was different between HOT and TN during (77±6 vs 91±9 mmHg; P<0.01) and post (81±9 vs 92±12 mmHg; P=0.03). MCAv was not different between HOT and TN during (63±8 vs 65±11 cm/s; P=0.28) or post (58±10 vs 62±11 cm/s; P=0.22). PETCO₂ was different between HOT and TN during (42±2 vs 44±4 mmHg; P=0.04) but was not different at post (39±3 vs 40±4 mmHg; P=0.13). Gain was different between HOT and TN during (1.0±0.2 vs 0.9±0.2 cm/s/mmHg; P=0.04) but was not different post (1.0±0.2 vs 0.9±0.2 cm/s/mmHg; P=0.15). Gain increased from pre in HOT during (P=0.03) but was not elevated post (P=0.15). Gain was not different from pre in TN during (P=0.95) or post (P=0.95). Phase was not different between HOT and TN during (12±7 vs 12±5°; P=0.48) or post (8±12 vs 11±7°; P=0.30). Phase was not different from pre in HOT or TN during (HOT: P=0.79 or TN: P=0.70) or post (HOT: P=0.70 or TN: P=0.74). CONCLUSION: These preliminary data indicate that the ability of the cerebral vasculature to buffer changes in blood pressure during hot HOWI is impaired compared to non-immersion conditions and thermoneutral HOWI in healthy participants. Supported by Office of Naval Research Award N00014-17-1-2665