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The Effects of Acute Thermoneutral and Hot Water Immersion on Cerebrovascular Reactivity

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Repetitive hot head-out water immersion increases non-immersion cerebral blood flow and peripheral vascular function. However, it is not known if an acute bout of hot head out water immersion (HOWI) improves cerebrovascular reactivity versus thermoneutral HOWI. **PURPOSE:** We tested the hypothesis that cerebrovascular reactivity is greater during and following hot (HOT) vs. thermoneutral (TN) HOWI. **METHODS:** Six healthy participants (age: 23±3 y, 2 females) completed two randomized trials consisting of 30 min of HOT (39°C) or TN (35°C) HOWI. Beat-to-beat blood pressure (MAP; photoplethysmography), middle cerebral artery blood velocity (MCAv; transcranial Doppler), and end-tidal partial pressure of CO_2 ($PETCO_2$; capnograph) were recorded continuously. After 5 min of resting baseline, participants breathed hypercapnic gas (3, 5, and 7% CO_2 for 3 min each) in a stepwise fashion. Cerebrovascular reactivity (CVR) testing was completed pre, 25 min into immersion (during), and immediately post-HOWI. The slope of the linear regression line for MCAv versus $PETCO_2$ was calculated to represent CVR. **RESULTS:** MAP (HOT: 84±5 vs TN: 80±12 mmHg; P=0.14), MCAv (HOT: 65.1±7.3 vs TN: 64.2±17.0 cm/s; P=0.44), and CVR (HOT: 1.58±0.40 vs TN: 1.54±0.43 cm/s/mmHg; P=0.87) were not different between HOT and TN at baseline. $PETCO_2$ was different between HOT and TN at baseline (HOT: 43±2 vs TN: 45±3 mmHg; P=0.04). MAP was different between HOT and TN during (HOT: 80±9 vs TN: 89±12 mmHg; P=0.03) but was not different post (HOT: 84±8 vs TN: 90±17 mmHg; P=0.10). MCAv was not different between HOT and TN during (HOT: 65.0±12.5 vs TN: 70.1±17.1 cm/s; P=0.16) or post (HOT: 66.5±12.1 vs TN: 67.5±16.8 cm/s; P=0.41). $PETCO_2$ was not different between HOT and TN during (HOT: 44±2 vs TN: 46±3 mmHg; P=0.11) or post (HOT: 43±3 vs TN: 44±3 mmHg; P=0.17). CVR was not different between HOT and TN during (HOT: 1.65±0.28 vs TN: 1.77±0.76 cm/s/mmHg; P=0.36) or post (HOT: 1.23±0.81 vs TN: 1.64±0.86 cm/s/mmHg; P=0.15) and did not differ across timepoints within trials (P=0.08). **CONCLUSION:** These preliminary data indicate that an acute bout of hot or thermoneutral head-out water immersion does not improve cerebrovascular reactivity during or after immersion in healthy participants.

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