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 CO₂ (PETCO₂; capnograph) were recorded continuously. After 5 min of resting baseline, participants breathed hypercapnic gas (3, 5, and 7% CO₂ 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 PETCO₂ 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. PETCO₂ 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). PETCO₂ 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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