TACSM Abstract

Exercise Cerebral Blood Flow Hemodynamics Differ in Hot Dry and Humid Conditions

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ABSTRACT

Passive and exercise-heat stress have been reported to cause reductions in cerebral blood flow (CBF); however, it is unknown if CBF velocity is different under hot dry and humid conditions. **PURPOSE:** This project tested the hypothesis that upright rest and exercise-heat stress in hot dry and humid conditions result in similar CBF reductions. **METHODS:** Seven healthy active (7 day activity: 9887±3564 steps/day; VO_2max: 52±10 mL/kg/min) subjects (5M/2F, 24±9y, 171±6cm, 68±7kg) completed a 30 min baseline rest followed by 60 min of exercise at a rate of perceived exertion (RPE) of 12 (between light and somewhat hard) on a 20-point rating scale. Subjects were blinded to the ergometer (Watt) in a hot dry to humid (42.3±0.3°C; initial 10.4±0.4% relative humidity [R*h*] that increased to 62.2±5.3%R*h*) and control neutral dry (22.9±1.0°C; 11.5±1.9%R*h*) condition in random order separated by at least 7 days. Heart rate (HR), intestinal temperature (Ti), absolute (cm/s) and relative (% of rest) middle cerebral artery (MCA) blood flow (CBF) velocity during systole, diastole and mean (MCA Vsys, MCA Vdia, MCA Vmean) were analyzed utilizing a 2-way repeated measures analysis of variance for interaction and main effects for condition x time. **RESULTS:** CBF or Ti at rest was not different between conditions (P>0.05). HR (Δ14±11bpm) was elevated at rest and further increased (Δ26±28 bpm) during exercise in hot compared to the neutral condition (Interaction: Condition x Time; P<0.0001). Exercise Ti was similar between neutral and hot dry 10-20% R*h* conditions; however, increased (Δ1.2±0.8°C) to a greater during the hot humid >30-60% R*h* condition (Interaction: Condition x Time; P<0.0001). Exercise heat-stress caused an initial increase in CBF for MCA Vsys (Δ30±15% cm/s) and MCA Vmean (Δ17±15% cm/s) in hot dry (10-30%R*h*) conditions compared to neutral dry (Interaction: Condition x Time; P<0.0001). During the hot humid (40-50%R*h*) condition, CBF was reduced to similar velocities as in the neutral dry condition; however, it was reduced to a greater extent (Δ-16±9%cm/s) during hot humid (>60%R*h*) compared to the neutral condition (Δ0±19% cm/s). Exercise intensity was slightly greater (54±1 vs 48±3%VO_2max, P<0.003) in neutral than hot conditions at an RPE of 12. **CONCLUSION:** Exercise heat-stress during hot dry conditions increase MCA Vmean, which is primarily due to a rise in blood flow velocity during systole. However, exercising in hot and high humidity attenuates MCA Vmean, due to reduced diastole blood flow velocity.