Females Have an Increased Sensitivity to Thermal Stress during Matched Exercise Metabolic Heat Production

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ABSTRACT

Females report greater sensitivity in pain and cold exposures. PURPOSE: It is unclear how thermal sensitivity is affected when the change for internal temperature (ΔTin) and metabolic heat production (MHprod) are matched during exposure to hot conditions. This project tested the hypothesis that females have enhanced sensitivity to thermal stress during exercise hyperthermia when ΔTin and MHprod is matched. METHODS: Twenty-two healthy active (7 day activity: 8620±3008 steps/day; VO2max: 49±10 mL/kg/min) adults (11M/11F, 22.4±4.9y, 169±7.6cm, 68.3±13kg) exercised at similar MHprod (M: 7.1±1.5 W/kg, F: 6.9±1.4 W/kg; P=0.32) for 60 min (cycle ergometer) in cool (24.0±0.0°C; 14.4±3.6%Rh) and hot (42.3±0.2°C; 27.9±5.5%Rh) conditions in random order separated by at least 7 days. The ΔTin, heart rate (ΔHR), and thermal stress indices for comfort (TC, -4 very cold to +4 very hot), sensation (TS, -4 very cold to +4 very hot), perception (TP, 1 so cold I am helpless to 13 so hot I am sick), feeling (TF, +5 very good to -5 very bad), and focus (F, 0 internal focus [bodily sensations] to 100 external focus [external environment]) were measured every 10 minutes. A 2-way repeated-measures analysis of variance on area under the curve was used to examine Interaction (I) and Main Effect (ME) for condition × sex. Values are expressed as means ±SD with significance set at P<0.05. RESULTS: Males and females had similar increase in hot compared to cool for ΔTin (Cool: Δ0.5±0.1°C, Hot: Δ1.5±0.6°C; ME: condition; P<0.0001) and ΔHR (Cool: 58±15 b/min, Hot: 71±15 b/min; ME: condition; P<0.01). Females reported that TC and TS felt hotter in both conditions (ME: sex; P<0.0001) and both groups increased in hot compared to cool (ME: condition; P≤0.04). Females reported that TS was elevated compared to males in cool compared to hot (I: condition × sex; P<0.005). TP felt hotter in the cool but similar increase in hot for females compared to males (I: condition × sex; P<0.02). Females reported TF was more positive compared to males in hot (I: condition × sex; P<0.0001). Females reported greater external focus in cool compared to males (ME: sex; P<0.0002). CONCLUSION: These data indicate that sex differences exist for thermal stress. Females perceive thermal stress in hot and cool conditions to a greater extent than males exercising at similar metabolic heat production.