Effect of acute intermittent hypoxia on the systemic vascular response to sympathetic activation in healthy men and women

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BACKGROUND

- Activation of the sympathetic nervous system causes vasoconstriction of peripheral blood vessels.
- Acute intermittent hypoxia (AIH) elicits persistent increases in sympathetic nervous system activity.
- Previous data from our group found the persistent increase in sympathetic activity following AIH occurs simultaneously with blood pressure increases in men, but not women.

AIM

Examine vascular responsiveness to sympathetic activation before and after acute intermittent hypoxia (AIH) in healthy young men and women.

HYPOTHESES

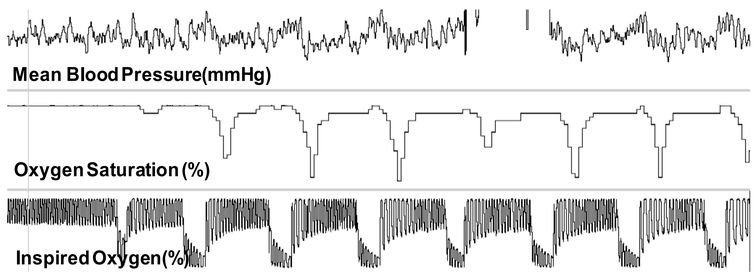
The vascular response to sympathetic activation would be preserved following AIH in men, and the vascular response to sympathetic activation would be attenuated in women following AIH.

METHODS

- **Participants:** 13 men, 13 naturally cycling (NC) women, and 11 women taking oral contraceptives (OCP). Women were studied during the late follicular or active pill phase.
- **Instrumentation:** Mean arterial blood pressure (MBP, finger photoplethysomography) was measured. Cardiac output (CO) and total vascular conductance (TVC) were calculated.
- **Protocol:** Data were collected twice (Pre-IH, Post-IH), where participants completed a 2-min cold pressor test [CPT, foot submerged in ice water].

Fig 1: Experimental set-up. Participants wore a mask connected to a non-rebreathing valve and were instrumented for measures of MBP.

METHODS



Acute Intermittent Hypoxia (AIH): Individuals alternated between hypercapnic hypoxia (3% CO_2, 5% O_2) and room air (21% O_2) to target 15 hypoxic events over 30-min.

Analysis: A relative (%) change from baseline in MBP, CO, and TVC during the CPT were calculated [(Baseline – CPT)/Baseline x 100].

DEMOGRAPHICS

	Men	Naturally Cycling (Late Follicular)	Oral Contraceptive (Active Pill)	*P*-value
Count	13	13	11	
Age (yrs)	26±1	25±1	24±1	0.41
Height (cm)	175±2	165±1*	165±2*	<0.01
Weight (kg)	81±2	61±1*	57±2*	<0.01
BMI (kg/m²)	26.2±0.5	22.5±0.5*	21.0±0.7*	<0.01
Estradiol (pg/mL)	34±3	186±44	17±1*†	<0.01
Progesterone (pg/mL)	0.6±0.1	1.1±0.2	0.5±0.0	0.058
Testosterone (pg/mL)	665±31	42±4*	29±4*	<0.01

Table 1: Participant Demographics. Data are reported as Mean±SEM. *p<0.05 vs Men. †p<0.05 vs Naturally cycling.

RESULTS

	Men		Naturally Cycling (Late Follicular)		Oral Contraceptives (Active Pill)	
	Pre IH	Post IH	Pre IH	Post IH	Pre IH	Post IH
Mean blood pressure (mmHg)	87±2	90±2*	81±2	83±2	82±1	82±2
Heart rate (beats/min)	65±3	67±3	71±3	72±3	76±2	78±2
Stroke volume (mL/beat)	84±8	79±7	70±5	69±4	82±4	78±4
Cardiac output (L/min)	5.8±0.3	5.4±0.3	4.7±0.3	4.7±0.3	6.1±0.4	6.0±0.3
Total peripheral resistance (mmHg.s/mL)	0.91±0.04	1.01±0.04*	1.12±0.12	1.11±0.09	0.84±0.05	0.86±0.05
Total vascular conductance (mL/mmHg.min)	67±3	60±2*	58±4	57±3	74±4	72±4

Table 2: Participant Demographics. Data are reported as Mean±SEM. *p<0.05 vs Men.

RESULTS

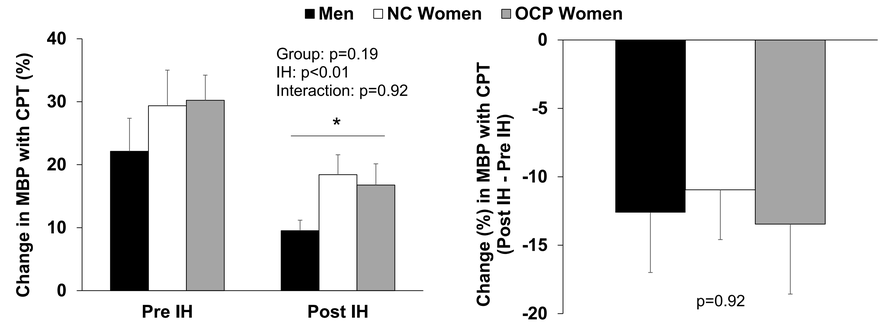


Figure 3: After AIH, mean blood pressure (MBP) increases less in response to sympathetic activation - independent of sex or hormone(s). *p<0.05 vs Pre IH

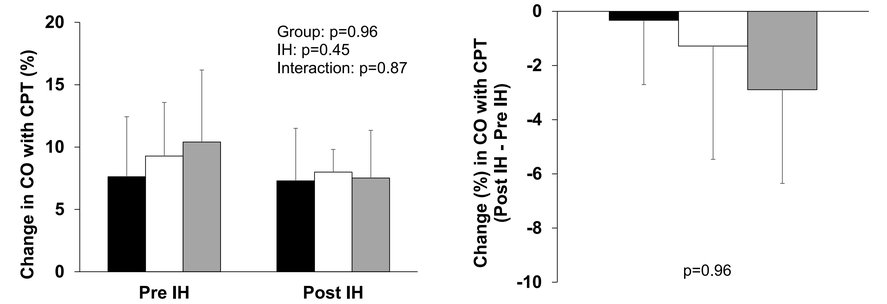


Figure 4: There is no effect of AIH on the cardiac output (CO) response to sympathetic activation.

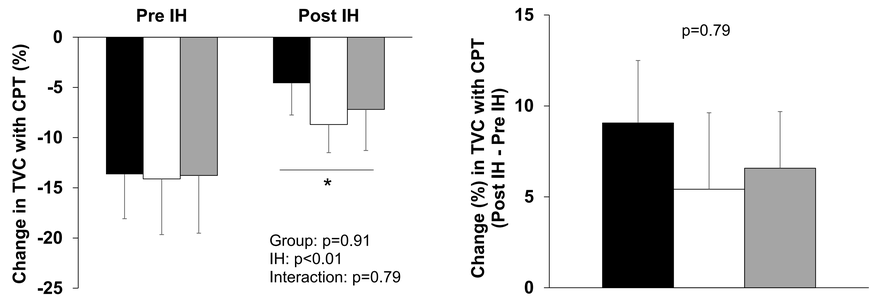


Figure 5: After AIH, there is less peripheral vasoconstriction in response to sympathetic activation - independent of sex or hormone(s). *p<0.05 vs Pre IH

CONCLUSIONS

- The MBP (**Fig 3**) and TVC (**Fig 5**) responses to sympathetic activation are attenuated following AIH in both men and women. However, the rise in cardiac output (**Fig 4**) is preserved across groups.
- Acute adaptive responses to sympathetic activation following AIH in healthy adults are independent of sex or hormone(s).

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