

ADAPTATION IN CENTRAL THERMOSENSITIVITY OF METABOLIC HEAT PRODUCTION
 FOLLOWING FIVE COLD WATER EXPOSURES

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During immersion in cold water, metabolic heat production is elevated as a result of both peripheral and central (core) thermoreceptor stimulation. Previous studies have reported that short-term (5 days), repeated cold water exposures may reduce the magnitude of the transient elevation in ventilation (\dot{V}_E , "gasp response") and thus oxygen consumption ($\dot{V}O_2$), which result from cutaneous thermoreceptor stimulation during the initial phase of immersion. Although data from short-term cold air exposures have suggested a diminished thermogenic response along with a greater reduction in core temperature, these studies have not attempted to isolate the modification of central thermosensitivity of metabolic heat production to a given thermal stress.

In the present study head-out immersion in cold water (15°C) on 5 consecutive days was used to clamp skin temperature (T_{sk}) as the thermogenic response (HP, indirectly assessed from $\dot{V}O_2$) to an esophageal temperature (T_{es}) reduction was evaluated in 4 healthy, male subjects (24.7-33.8 yrs). Within each subject, the magnitude of the decrease in T_{es} and rate of esophageal temperature cooling (\dot{T}_{es}) were controlled by utilizing the pressure cuff occlusion (10 minutes) and subsequent release of blood within the cooled limbs. Subjects were immersed for one hour or until T_{es} reached 35°C.

Comparative data (mean \pm SD) for day 1 and day 5 values are shown in the following table: (ΔT_{es} = decrease in T_{es} following release of occluded blood, \dot{T}_{es} = rate of T_{es} cooling corresponding to ΔT_{es} , AHP = increase in heat production following release of occluded blood, and β = slope of HP vs. T_{es} following release of occluded blood)

| | T_{sk} (°C) | ΔT_{es} (°C) | \dot{T}_{es} (°C·min ⁻¹) | AHP (W·kg ⁻¹) | β (W·kg ⁻¹ ·°C ⁻¹) |
|-------|--------------------|-------------------------|-------------------------------------------|------------------------------|----------------------------------------------------|
| Day 1 | 17.67 \pm .93 | -.54 \pm .24 | -.20 \pm .09 | 3.40 \pm 1.40 | -5.49 \pm .87 |
| Day 5 | 17.68 \pm .98 | -.66 \pm .33 | -.17 \pm .07 | 2.40 \pm 1.26 | -2.48 \pm 1.95 |

Both Δ HP and β were significantly reduced during the 5th immersion when compared with the initial immersion response. Although the thermogenic response was diminished for all subjects by day 5, only one subject showed a continuous decrease across the daily immersions.

These results indicate that central thermal drive to metabolic heat production is reduced following short-term (5 day) cold water exposure. Individual variability in the pattern of adaptation was observed which is in agreement with previous acclimation studies.

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