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Non-hypothermic cold stress methodology for psychological research

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Non-hypothermic Cold Stress Methodology for Psychological and Physiological Research

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Introduction

- Cold environments are a natural stressor and negatively impact human cognitive and physical performance.[1]
- Thermal stress can be measured directly from human homeostatic response or indirectly from perceptual response.
- Common methods of studying cold stress use expensive climate chambers and are out of reach of traditional labs.[2]
- To safely study the effects of cold in a traditional lab setting, affordable methods of producing non-hypothermic cold stress should be explored.

The purpose of the current study is to test an affordable method of manipulating cold stress by using ice packs and measuring human psychological and physiological response.

Methods

- Forty-four participants (24 Females, Age=19.97±2.9)
- Two conditions
  - Thermal Neutral
  - Cold
- Cooling Apparatus
  - Ice vest and ice packs
  - Fan
- 30 Minute experimental period
- Measures of cold stress
  - Subjective thermal comfort (1-5)
  - Subjective thermal sensation (1-9)
  - Mean skin temperature (four locations)
  - Estimates of core temperature (two locations)
- Participants were monitored for excessive discomfort and cooling

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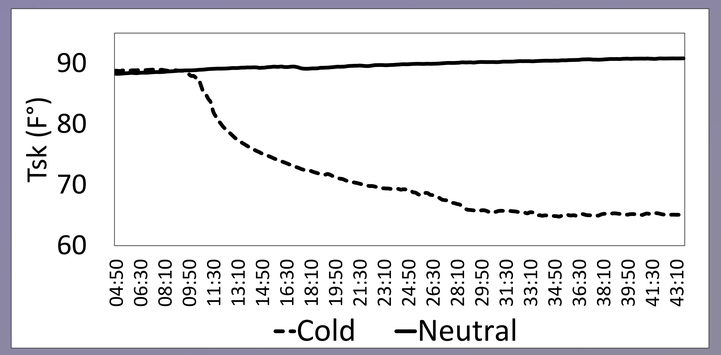

Figure 1: Average skin temperature throughout the session

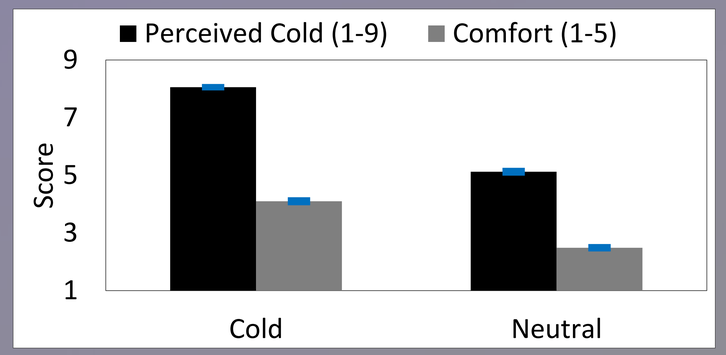

Figure 2: Subjective perception and comfort of thermal stress

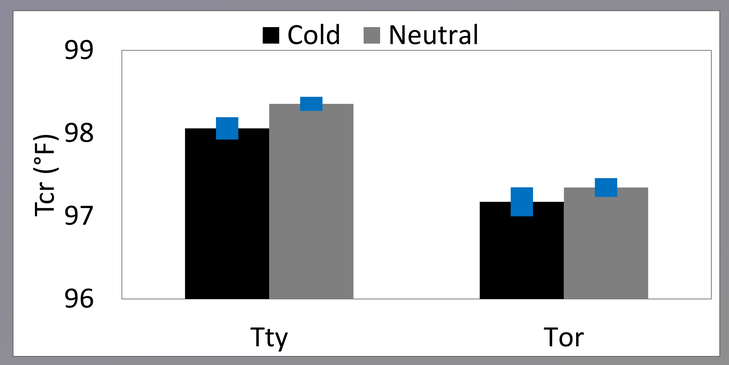

Figure 3: Estimates of core temperature from Ear (Tty) and Mouth (Tor)

Results

- Mean skin temperature taken continuously from three locations was significantly lower in the cold condition ($t(39)=11.58$, $p<.001$) *Figure 1*
- The method significantly lowered subjective feelings of comfort and raised perceptions of cold ($t(42)=16.64$,$p<.001$; $t(42)=8.47$, $p<.001$) *Figure 2*
- Measures of vasoconstriction showed that the method trended towards some physiological cold stress response in the cold condition ($t(39)=1.76$, $p=.087$)
- Measures of vasoconstriction showed that cold perception correlated with physiological cold stress response ($r(41)=-.38$, $p=.014$)
- Core temperature taken from the mouth and ear was not significantly impacted by the method ($p>.05$) *Figure 3*

Conclusions

- The affordable method successfully produced a cold stress response without hypothermia
- Participants qualitatively reported feeling cold and uncomfortable due to the stressor
- Skin temperature was significantly cooled
- Vasoconstriction was evident in a non cooled location
- The new method is a viable stressor for non-specialized lab spaces

References

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2. Cheung, S., Westwood, D., & Knox, M. (2007). Mild body cooling impairs attention via distraction from skin cooling. *Ergonomics, 50*(2), 275-288.