

# Development of a methodology to assess comfort and thermal tolerance of children exercising at sub-zero temperatures



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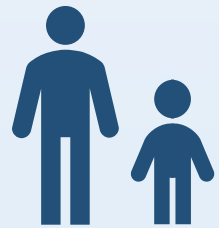


## Introduction



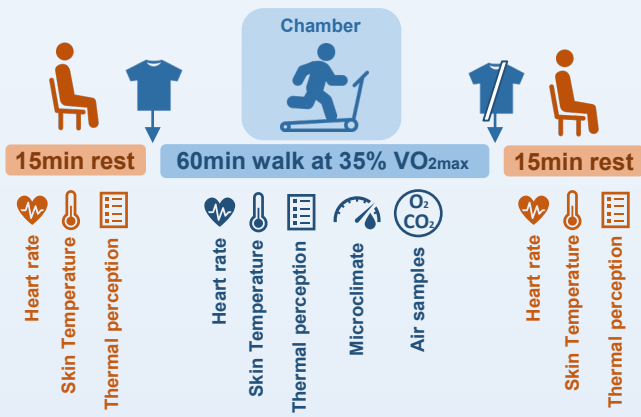
### 3 Children's thermoregulation is different to adults

- Children have a:
- ↑ BSA/M ratio
  - ↑ Metabolic cost per kg
  - Faster vasodilation/ vasoconstriction
  - ↓ Sweat rates
  - ↓ Behavioral responses



AIM  
 Can you use adult-based models to predict children's thermal comfort?  
 Methodology used with adults adapted for children and tested

Twenty-one **7-9-year-old boys & girls** took part. Anthropometrics were taken and a submaximal cardiorespiratory treadmill test was performed to set exercise intensities relative to 35% VO<sub>2</sub>max during the experimental protocol:



Therefore, **thermal comfort criteria** were set to determine children's thermal comfort limits. A participant was considered to be in thermal comfort if the following conditions all applied:

- They completed the full 60-min experimental protocol
- They ended the protocol with a thermal sensation between +1 (a bit warm) and -1 (a bit cool)
- They ended the protocol with a thermal preference between +1 (a bit warmer) and -1 (a bit colder)
- They ended the protocol without any comments of feeling too hot or too cold

## Experimental Set-up

Three clothing ensembles were tested at a set of temperatures in counterbalanced order (wind speed <0.3m·s<sup>-1</sup>, relative humidity <50%):



## Results

Thermal comfort in adults has been previously determined by looking at the relationship between thermal sensation and skin temperature (Gagge, 1967).

However, there was **no correlation** between children's thermal sensation and skin temperature (example in Fig 1).

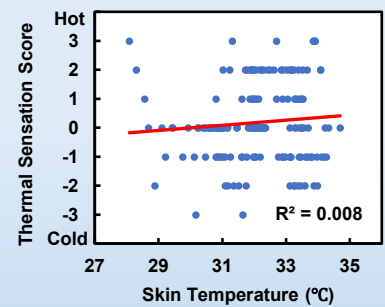


Fig 1. Whole-body thermal sensation vs skin temperatures recorded during all four experimental conditions for each participant in the heavily insulating clothing.

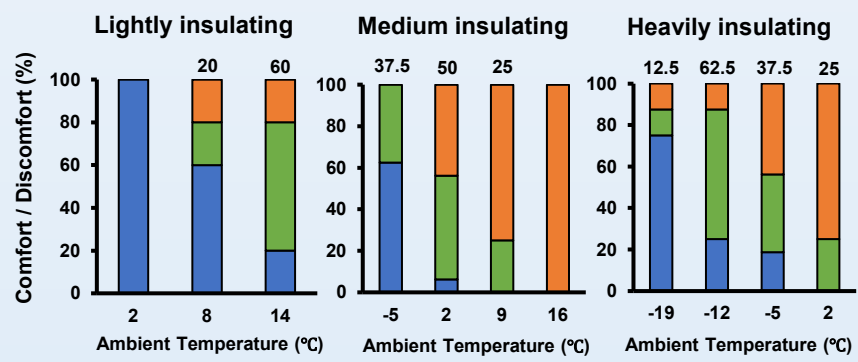


Fig 3. The percentage of children who were in cold discomfort (blue), comfort (green) and hot discomfort (orange) during each experimental condition in each clothing group. Percentage of comfort is highlighted in bold.

## Future Analysis

Can adult-based models be used to predict children's thermal comfort or does a child-based model need to be designed?

