UMC St Radboud

Effects of wearing a cooling vest on exercise performance, thermoregulation and comfort in highly trained athletes during a 5-km time trial

Thijs Eijsvogels PhD, Coen Bongers BsC, Maria Hopman PhD MD

Radboud University Nijmegen Medical Centre
Department of Physiology
The Netherlands

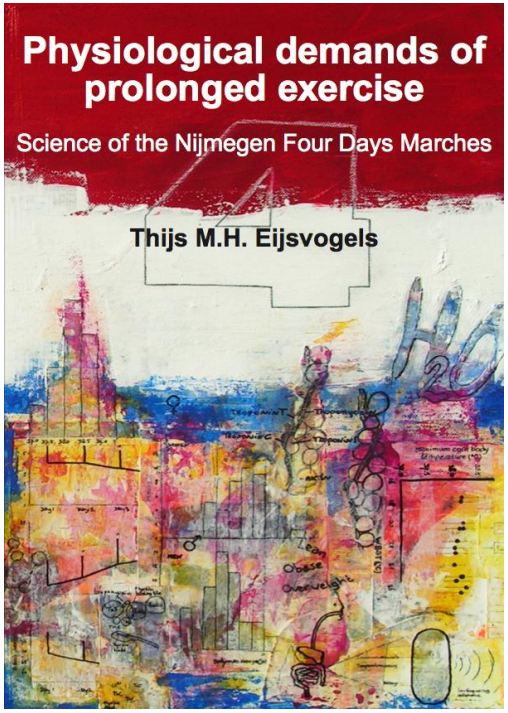
Physiomics
next level

INTRODUCTION

2005 BSc - Biomedical sciences

2007 MSc - Human movement sciences

2011 PhD - Medical sciences



Expertise:

- Exercise physiology
- Thermoregulation
- Fluid- and electrolyte balance
- Exercise cardiology

Physiomics
next level

INTRODUCTION

- Core body temperature (T_{core}): 36.5 – 38.5 °C [1]
- Exercise → heat production →↑ T_{core}
- T_{core} > 40°C → exertional hyperthermia
  → + physical complaints = heat stroke [2,3]

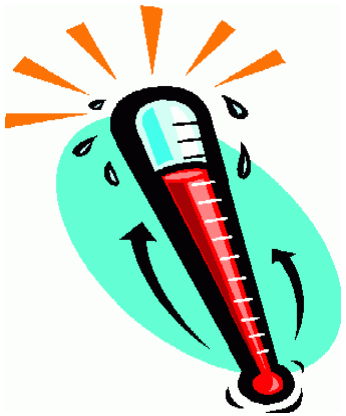
Impaired exercise performance

1. Critical core body temperature (40 °C) [4,5]
2. Anticipatory theory [4,6]

[1]Moran 2002, [2]Armstrong 2007, [3]Bouchama 2002 [4]Quoud 2006, [5]Siegel 2011, [6]Tucker 2004

INTRODUCTION

- Cooling: limit the increase in T_{core}



- Precooling studies:
  - Limiting the increase in core temperature [1]
  - Heat storage capacity ↑ [2]
  - Time to voluntary termination ↑ [3]
  - Exercise performance ↑ [1,3]

- Cooling during exercise: limited knowledge

[1]Arngrimmson 2004, [2]Stannard 2011, [3]Tyler 2011

RESEARCH QUESTION

What are the effects of wearing a Hyperkewl cooling vest during a 5-km time trial in highly trained athletes on:

I) Thermoregulation

II) Performance

III) Comfort

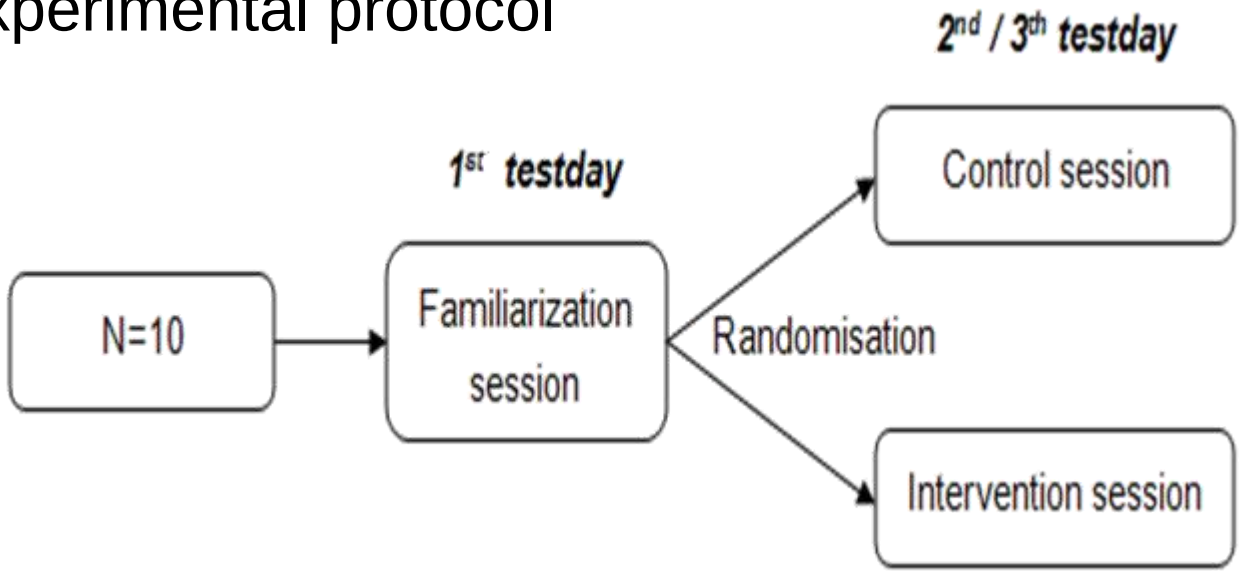
Hypothesis

- Tcore and Tskin ↓
- Performance levels ↑
- Comfort ↑

METHODS

- 10 male subjects:
  - > 18 years
  - PR at 5-km < 20 minutes

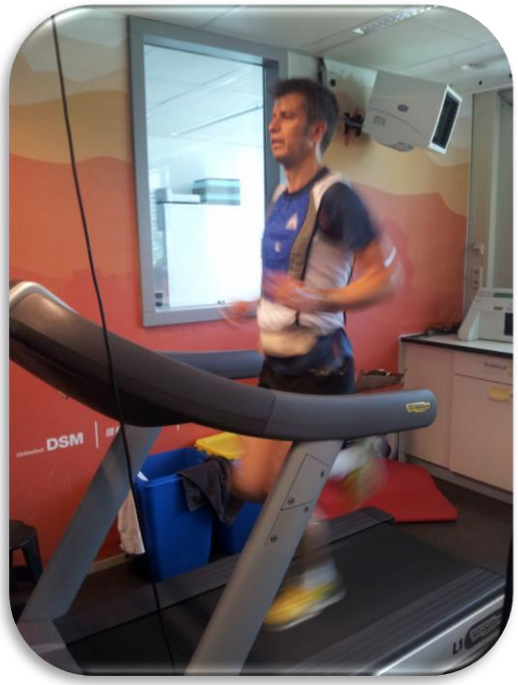
- Experimental protocol



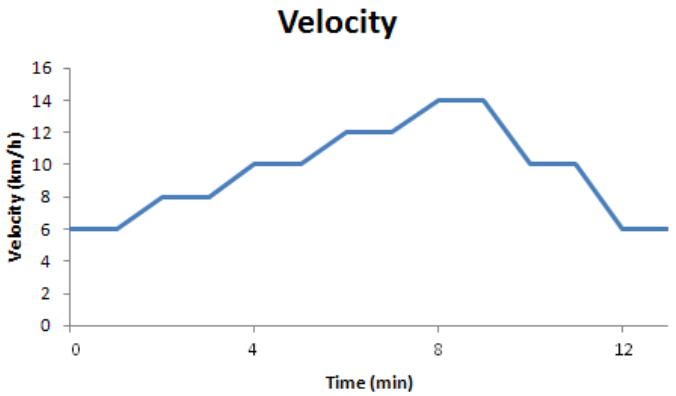
METHODS

Climate chamber

- 25 °C
- 55% humidity
- Wind velocity 3 m/s



Standardized warm-up

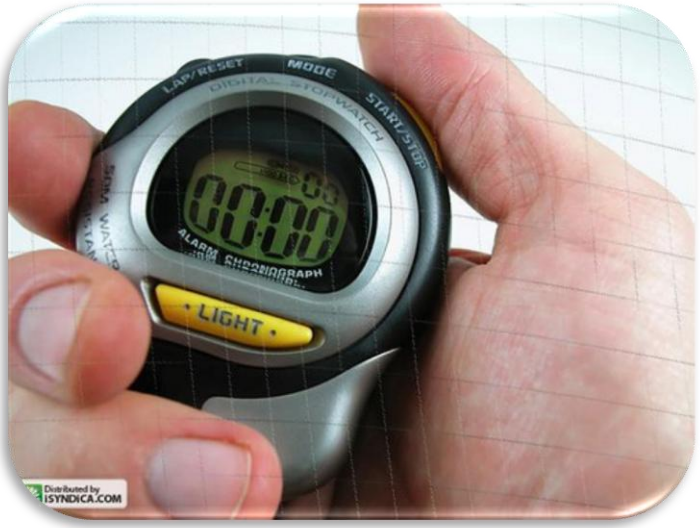


METHODS

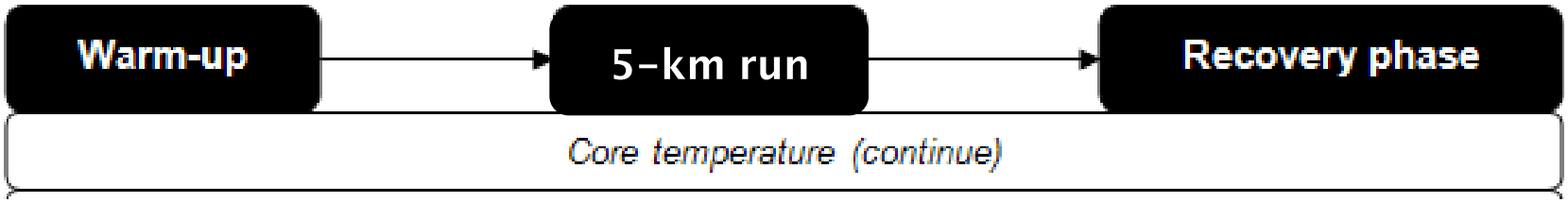
Warm-up → 5-km run → Recovery phase

Exercise performance

- Split times (500 m)
- Finish time



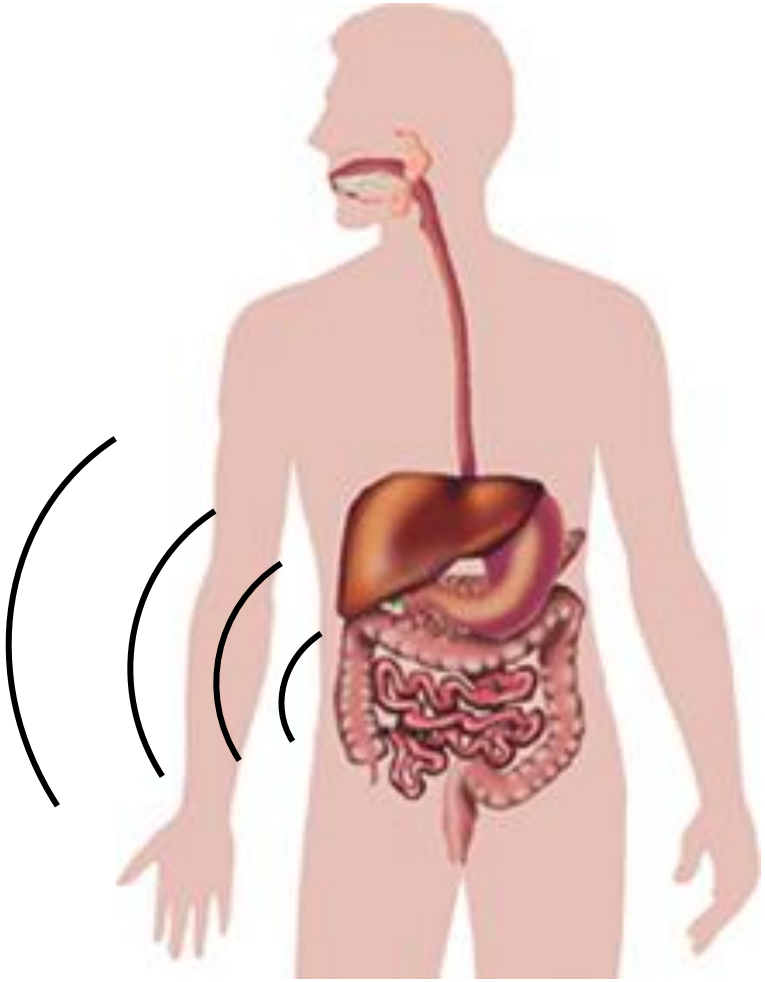
METHODS



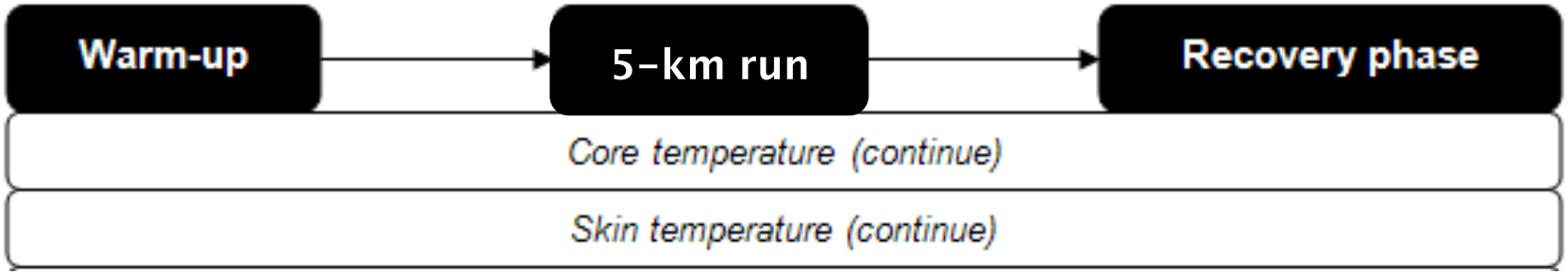
Core body temperature

- Intake 5-hours pre-measurement
- Continuously measured

METHODS

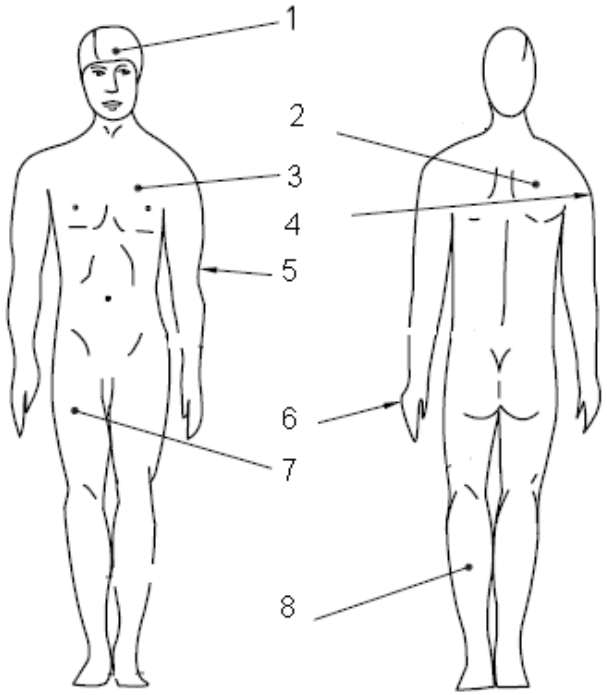


METHODS



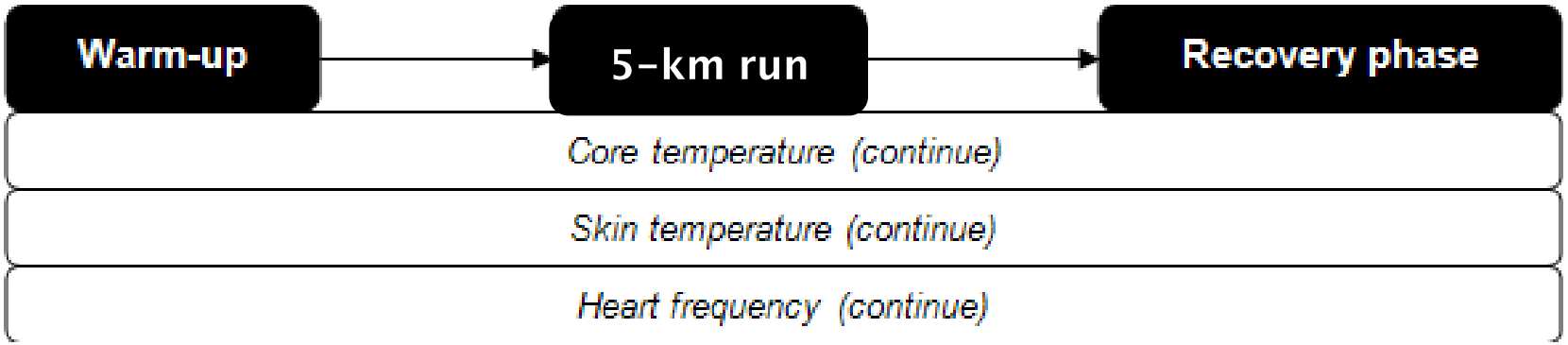
Skin temperature

- I-Buttons (8 points model)
- Continuously measured



1= Forehead
2= Right scapula
3= Left upper chest
4= Right arm in upper position
5= Left arm in lower position
6= Left hand
7= Right anterior thigh
8= Left calf

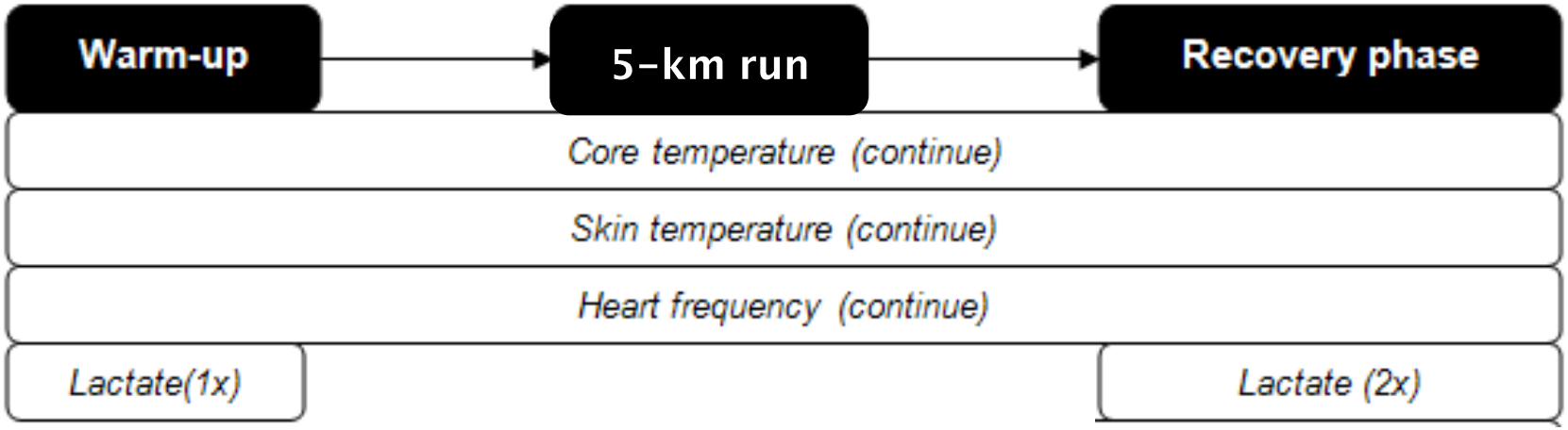
METHODS



Heart rate

- Polar system
- Continuously measured
- Relative exercise intensity

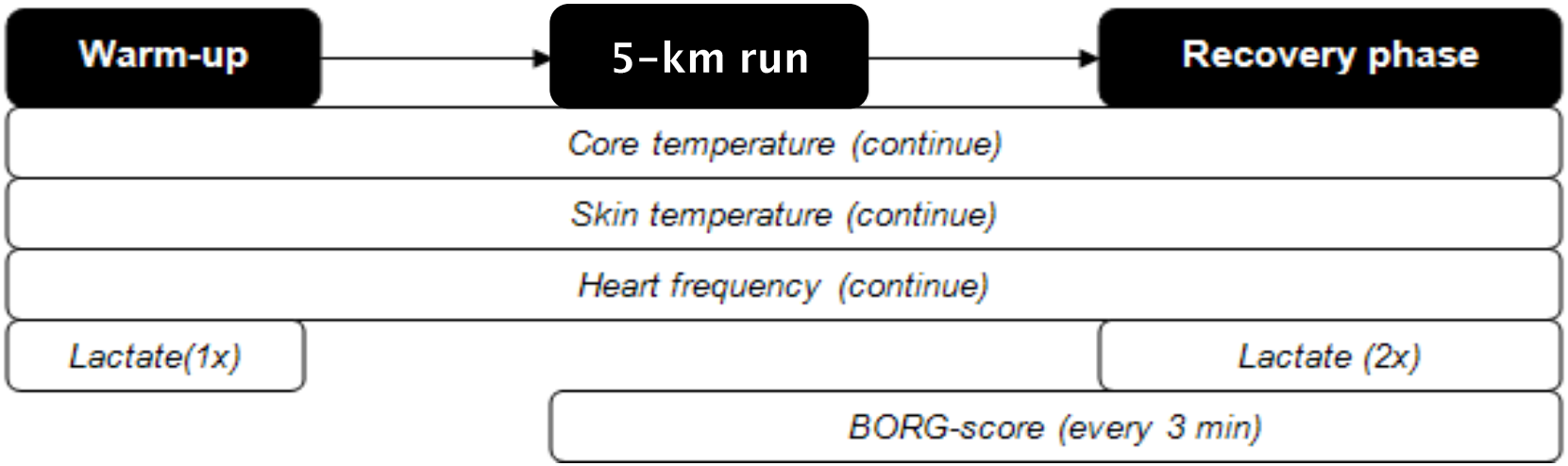
METHODS



Lactate

- Baseline
- Post exercise
- After recovery

METHODS

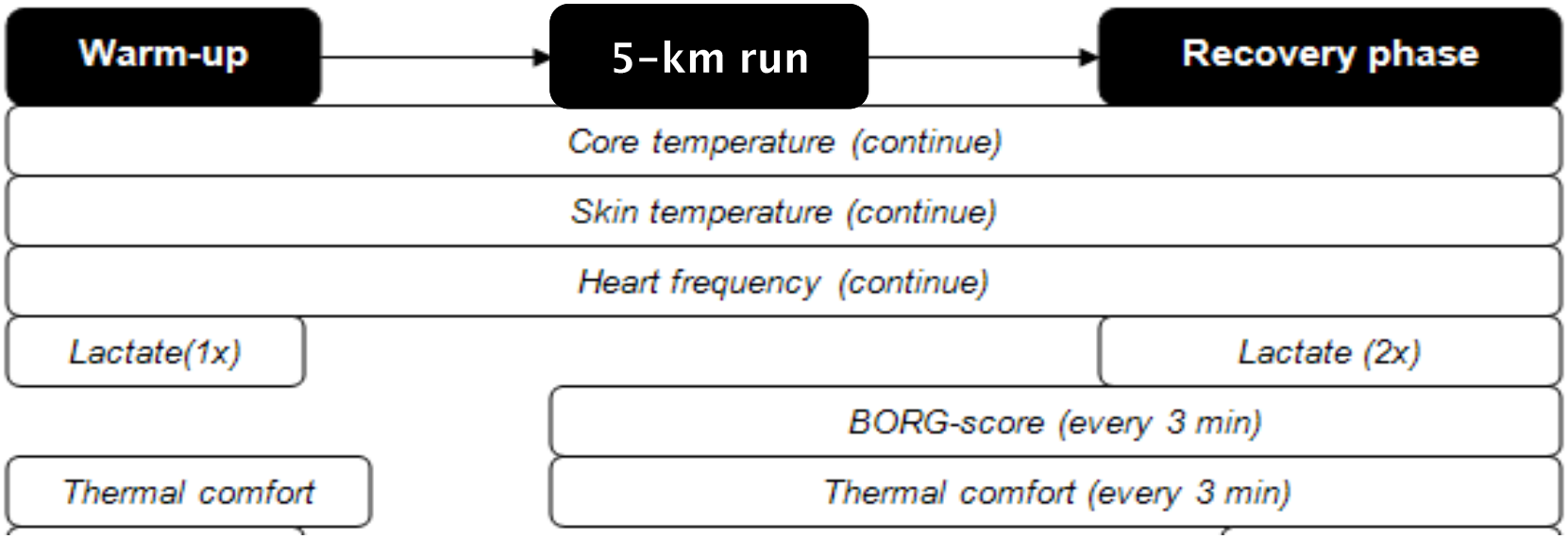


BORG-score

- Rate of perceived exertion
- Subjective parameter

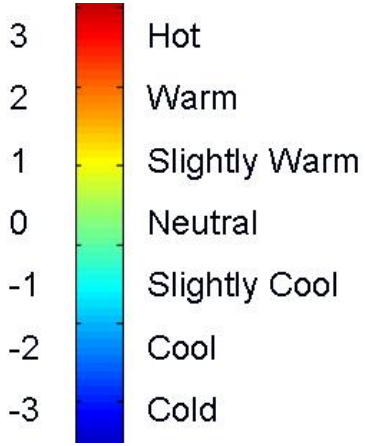
1 - 10 Borg Rating of Perceived Exertion Scale	
0	Rest
1	Really Easy
2	Easy
3	Moderate
4	Sort of Hard
5	Hard
6	
7	Really Hard
8	
9	Really, Really, Hard
10	Maximal: Just like my hardest race

METHODS

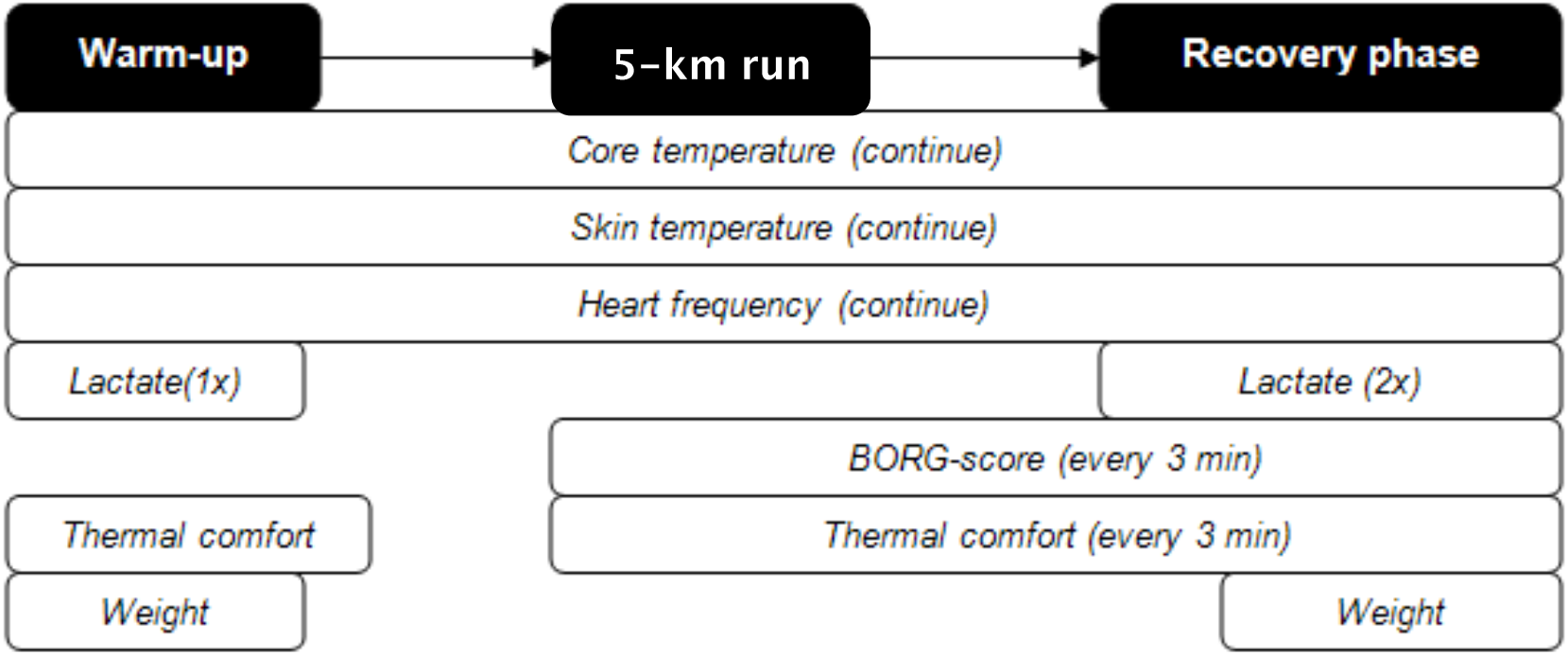


Thermal comfort

- Perception by athlete
- Subjective parameter



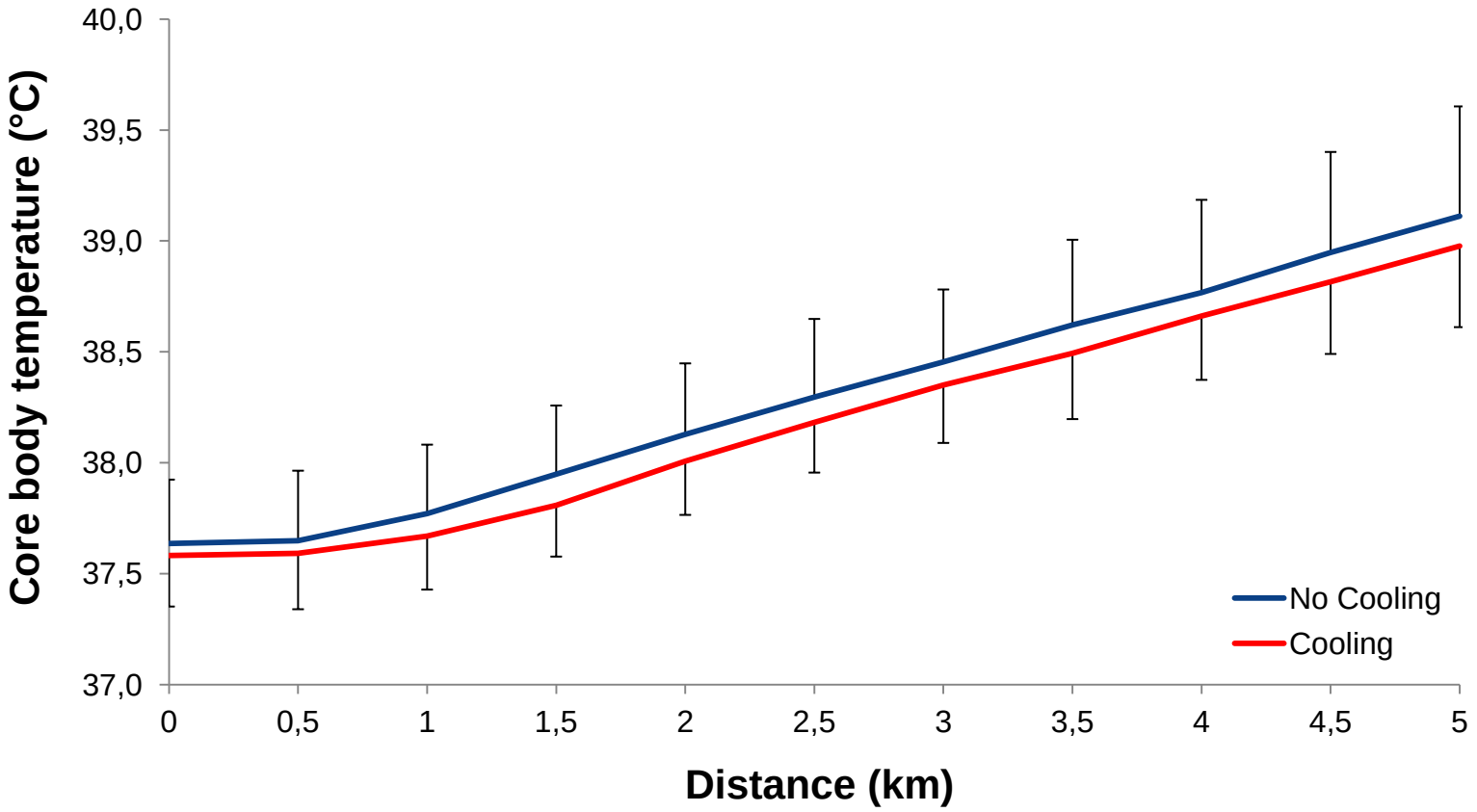
METHODS



Fluid balance

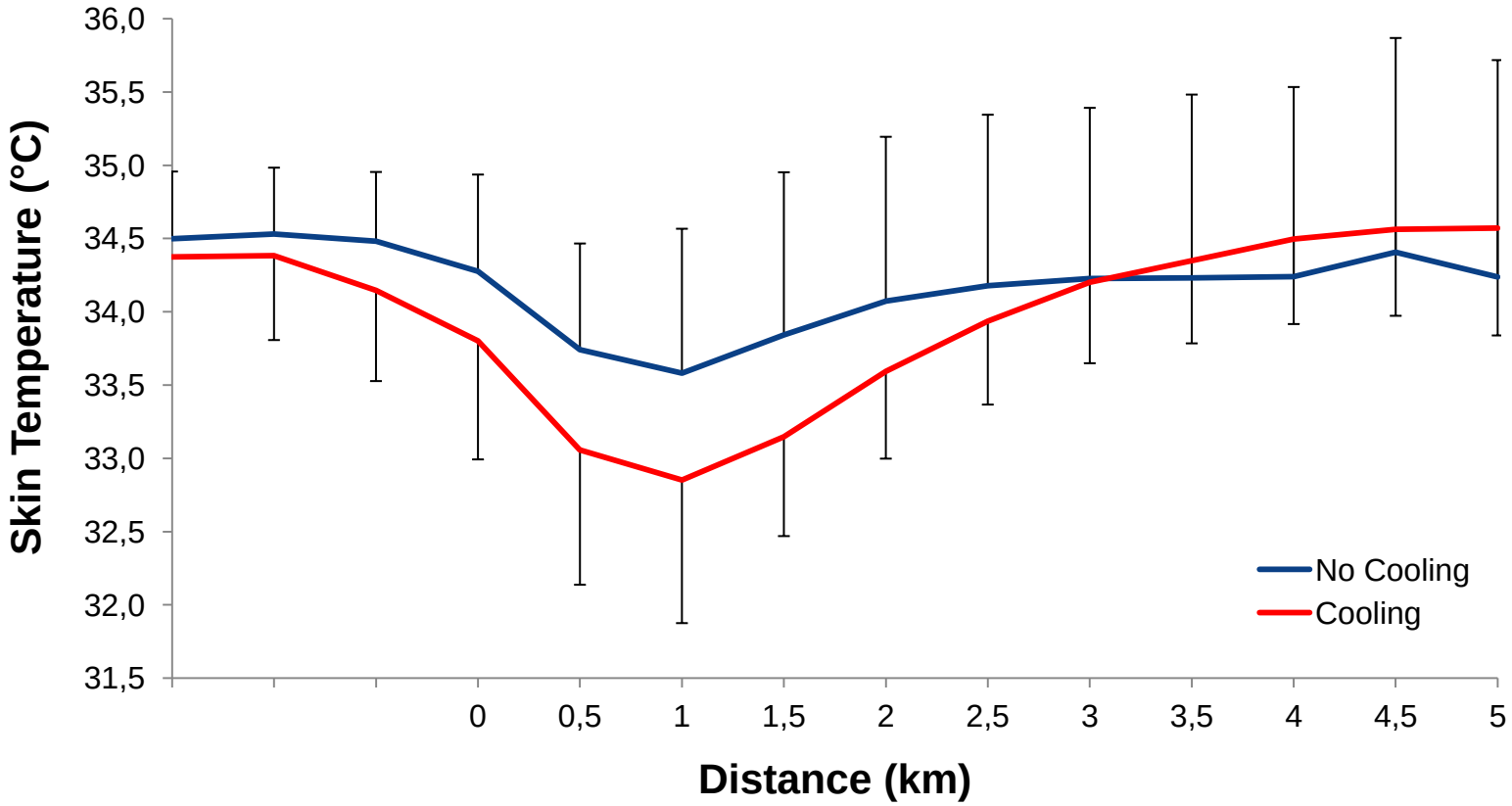
- Sweat loss
- Dehydration (> 2% body mass loss)

RESULTS – Core body temperature



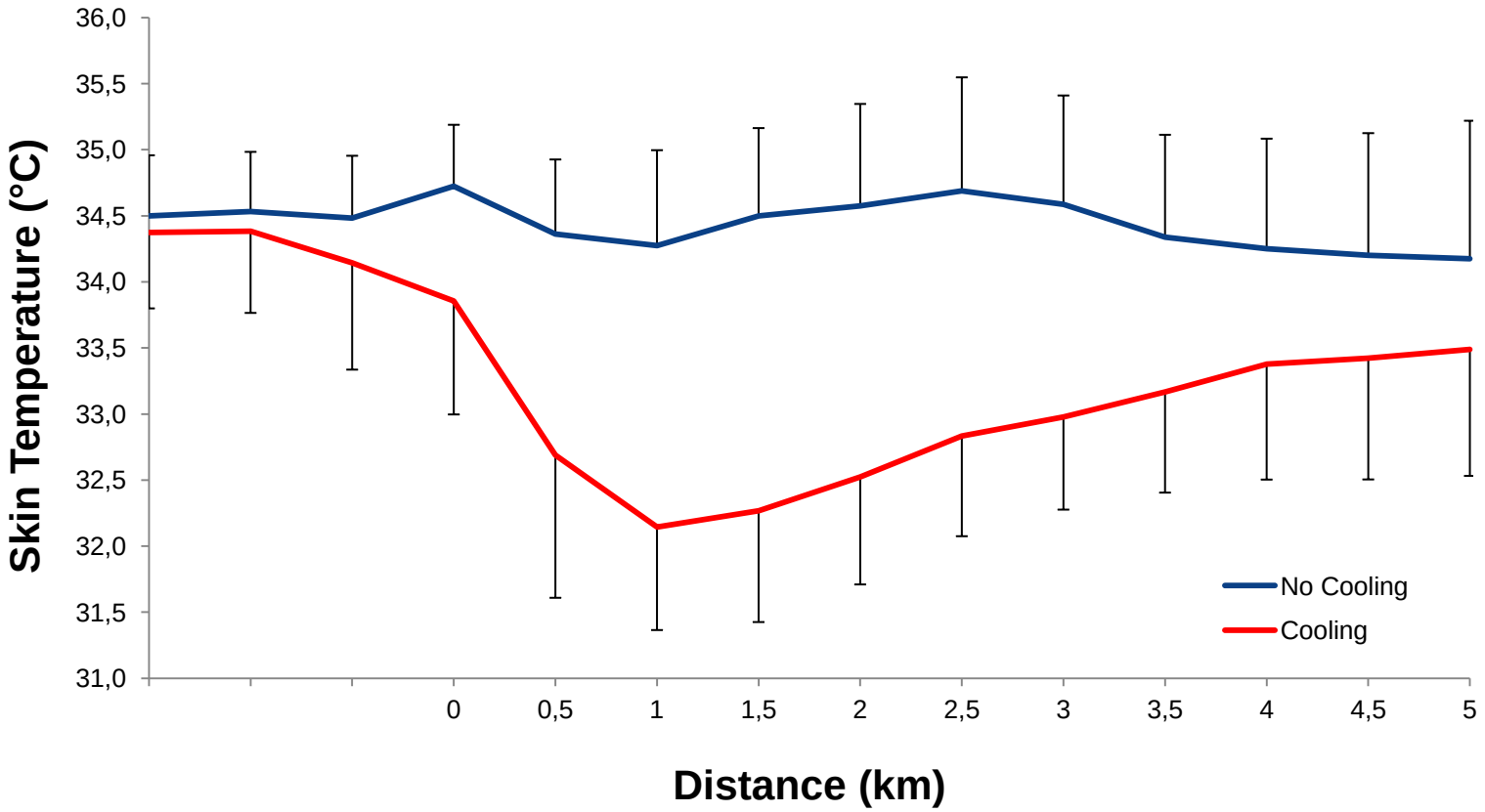
Thermoregulatory responses were comparable across conditions

RESULTS – Skin temperature



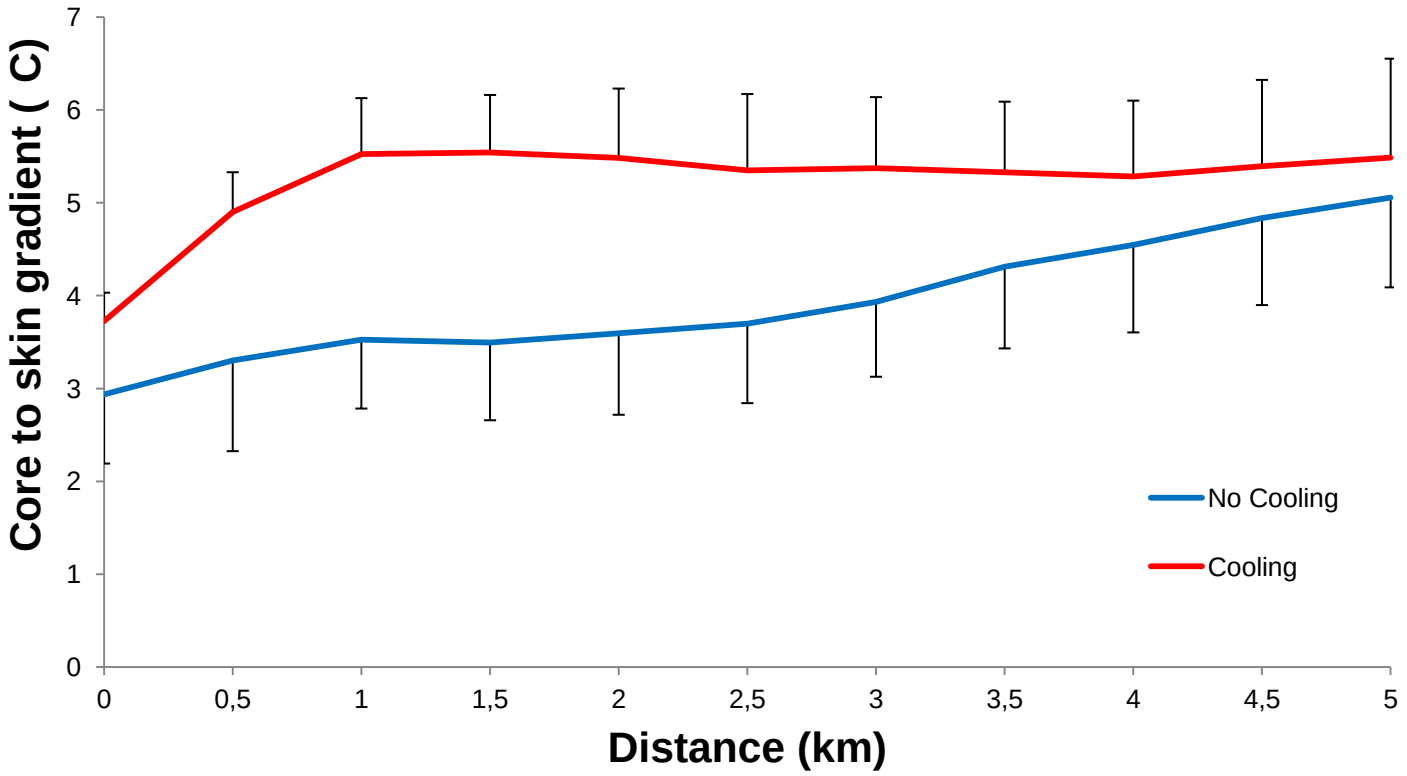
The cooling vest resulted in a temporary decrease of the skin temperature

RESULTS – Skin temperature (upper body)



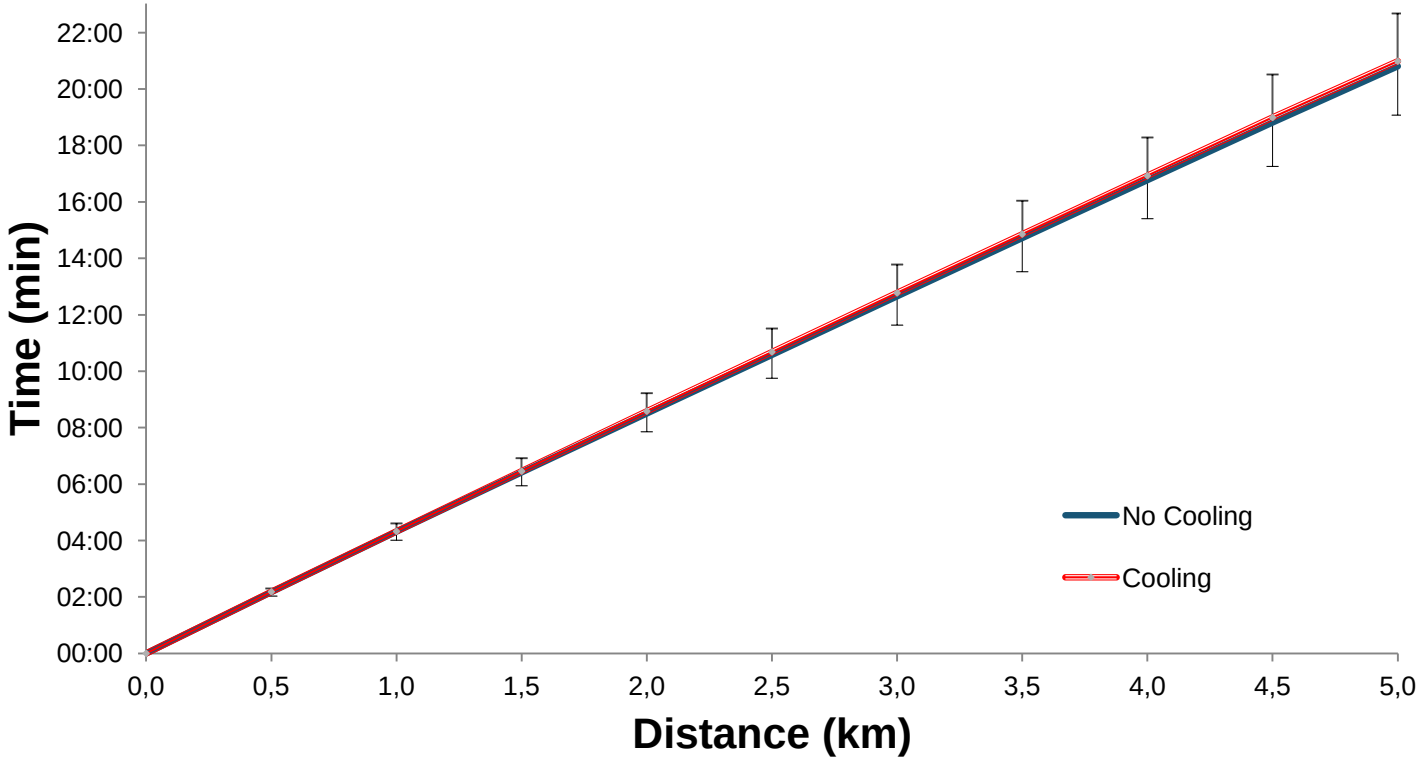
The cooling vest resulted in a significant decrease of the upper body skin temperature

RESULTS – Core to skin temperature gradient



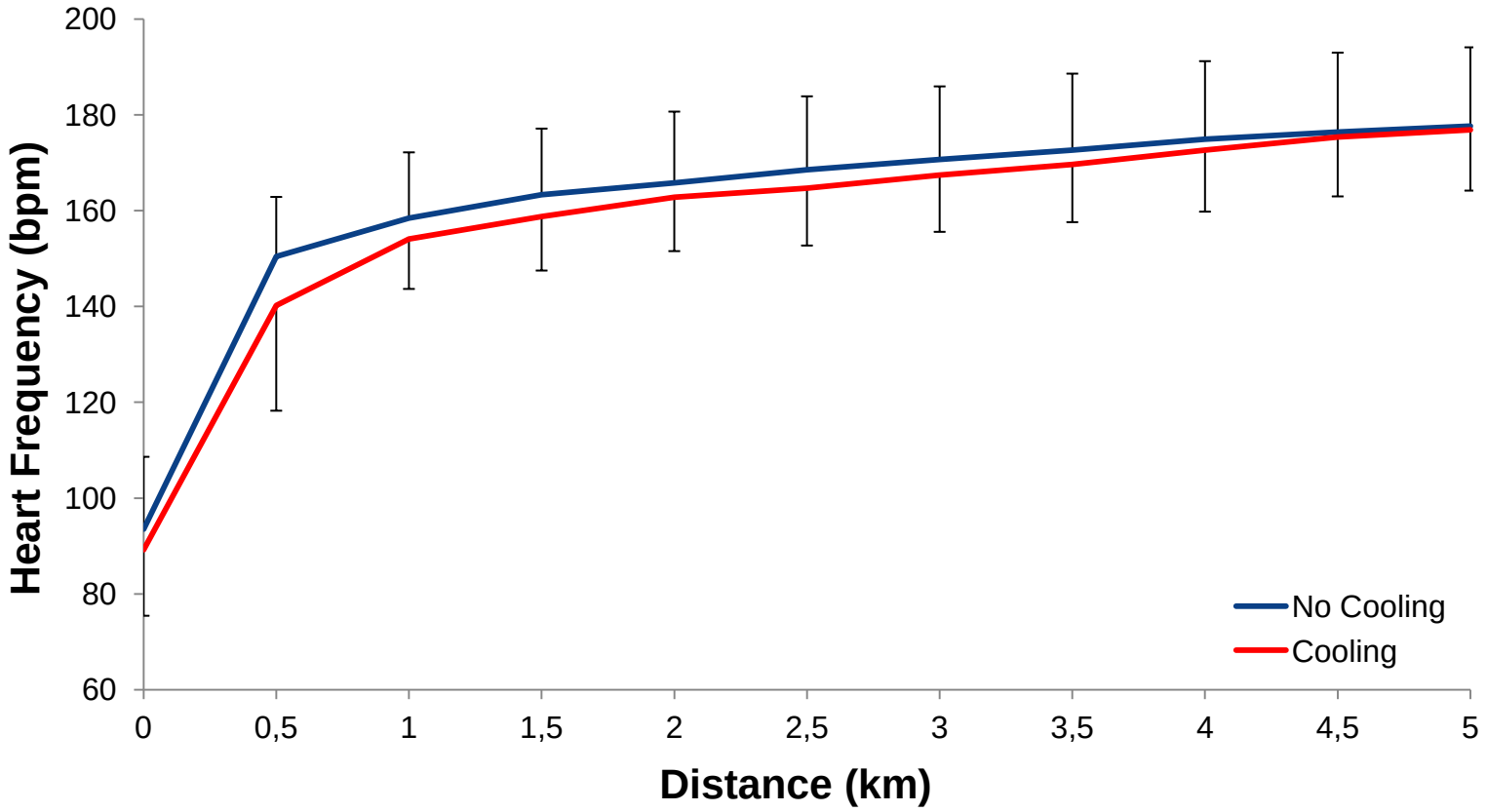
The cooling vest significantly increased the core to skin temperature gradient

RESULTS –Performance



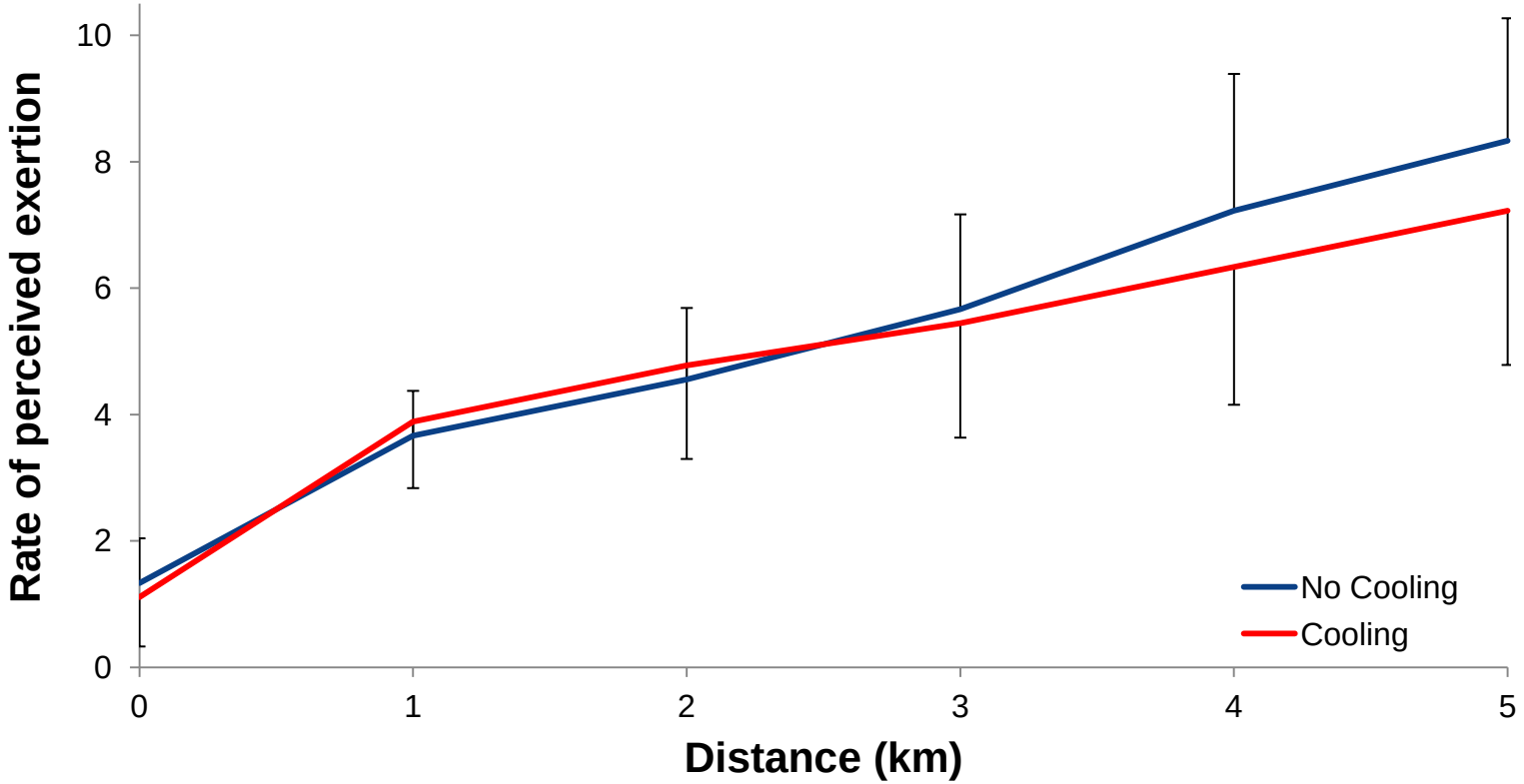
The cooling vest did not impact split and finish times

RESULTS – Heart rate



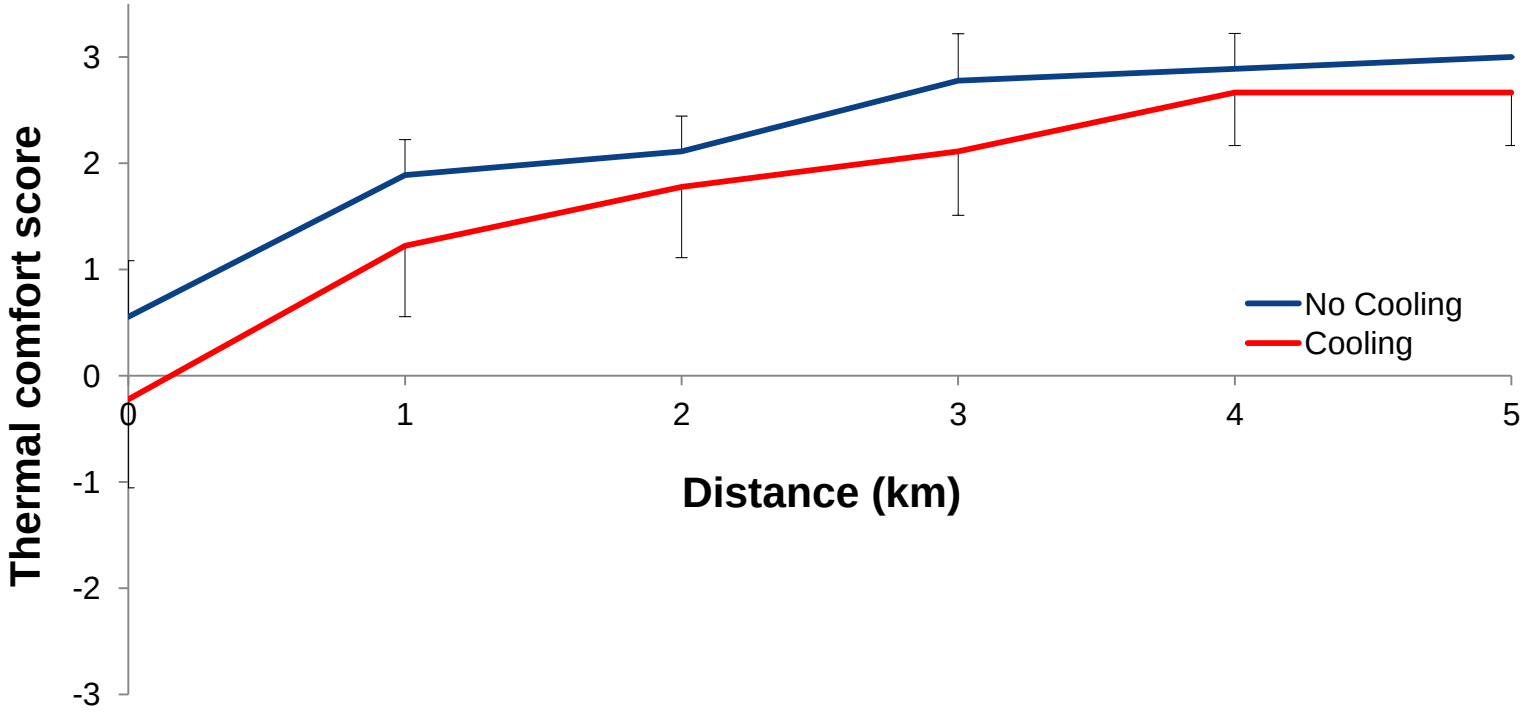
Heart rate responses did not differ across conditions

RESULTS - RPE



Subject reported a comparable level perceived exertion

RESULTS - Comfort



Subjects rated the cooling vest condition as cooler compared to the control condition

DISCUSSION

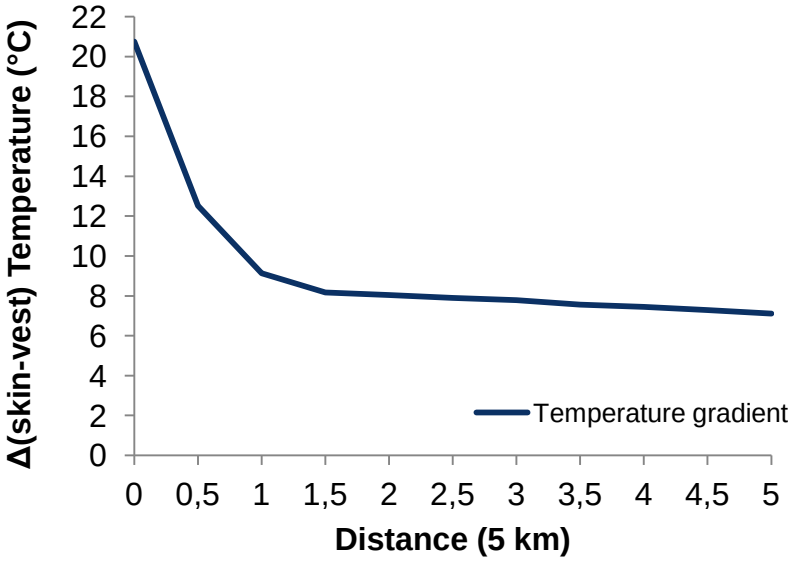
- Cooling improved thermal comfort
  - In agreement with previous studies
  - In agreement with feedback participants

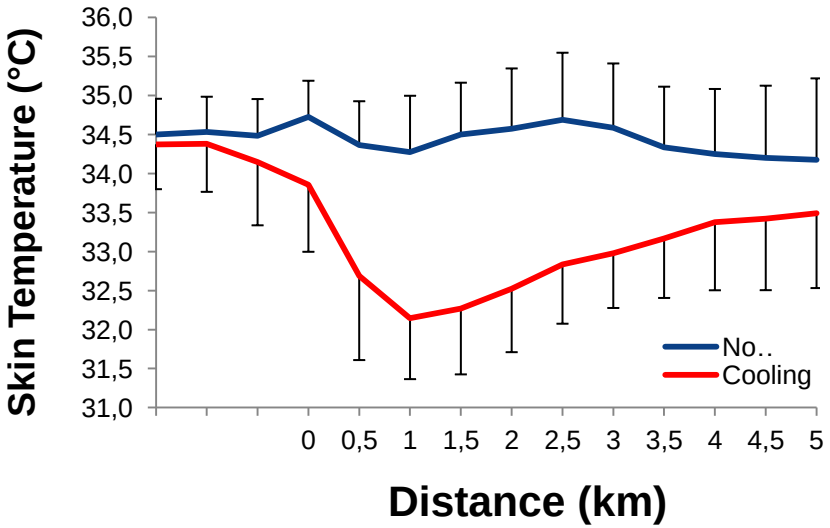
- The cooling vest partially impacted on thermoregulation
  - No effect on core body temperature
  - Lower skin temperature
  - Higher core to skin temperature gradient

Increased possibilities for heat dissipation!

DISCUSSION

- Cooling did not affect performance levels
  - Vest to skin temperature gradient decreased rapidly
  - Skin temperature increased after 3 km





CONCLUSION

1. Skin temperature decreased significantly, while the cooling vest did not affect core body temperature responses

2. The cooling vest did not (negatively or positively) impact performance levels

3. The cooling vest significantly improved the thermal comfort of the athletes during the 5 km time trial

CONTACT

T.Eijsvogels@fysiol.umcn.nl

Thijs Eijsvogels

@ThijsEijsvogels

Physiomics
next level

www.physiomics.eu

UMC St Radboud

Effects of wearing a cooling vest on exercise performance, thermoregulation and comfort in highly trained athletes during a 5-km time trial

Thijs Eijsvogels PhD, Coen Bongers BsC, Maria Hopman PhD MD

Radboud University Nijmegen Medical Centre
Department of Physiology
The Netherlands

Physiomics
next level